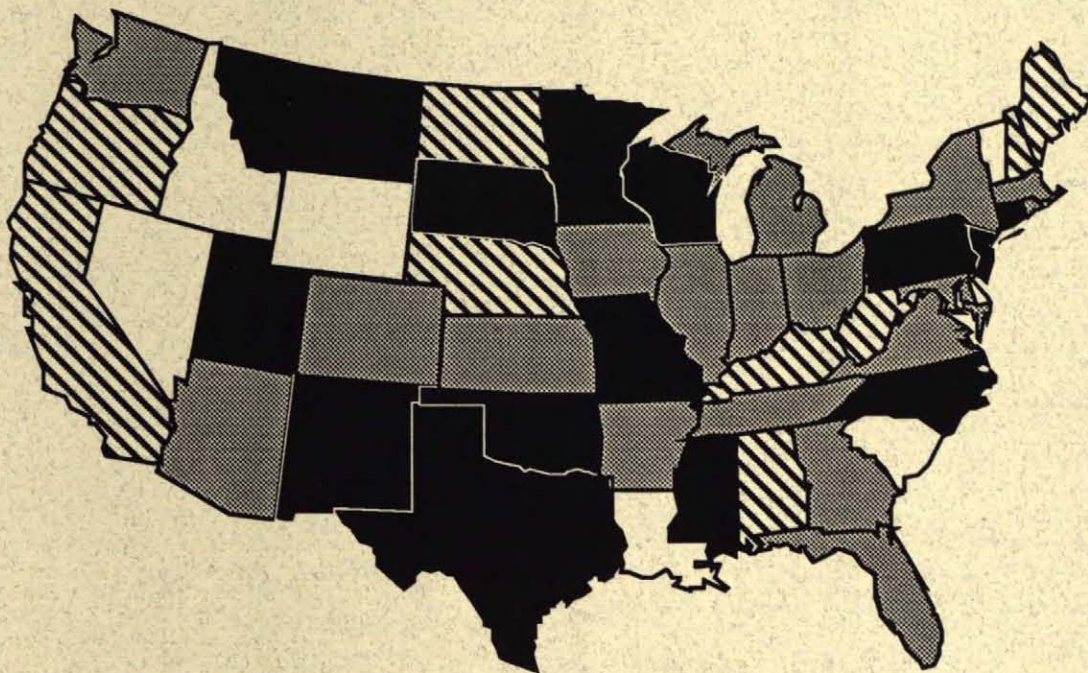


SRI International

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STATE AND LOCAL PROGRAMS SUPPORTING SCIENCE AND TECHNOLOGY FOR INDUSTRIAL INNOVATION IN THE UNITED STATES



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I. INTRODUCTION TO STATE AND LOCAL TECHNOLOGY PROGRAMS

Purpose and Perspectives

Government at the federal, state, and local level is becoming increasingly more aggressive in encouraging technological innovation to promote economic competitiveness. Industry, Science and Technology Canada (ISTC) commissioned SRI International to profile some of the more successful and innovative government science and technology programs in the U.S. to gain a better understanding of what is being done, where it is occurring, and how it is being accomplished. This report presents profiles of state and local programs in the 11 most-populous states in the U.S. Bound in a separate report are profiles of 23 federal programs designed to promote the research, development, and transfer of technology. Together, these two reports represent the most extensive examination to date, in terms of breadth and depth combined, of government activities supporting science and technology for industrial innovation in the U.S.

The programs presented in this study were selected by SRI and ISTC for their relative size, uniqueness, and efficacy. The format used was developed at ISTC and is structured to cover a broad range of key program characteristics.

This study is guided by both a definition of the term "science and technology program" and an understanding of the role these programs play in the comprehensive technology infrastructure of a nation, state, and local region. The technology infrastructure is the sum of all the public and private sources of R&D, human resources development, and financing that affect the technology innovation and adoption process. Federal, state, and local programs are only part of this public and private system.

For this analysis, SRI defines technology programs as government efforts to meet a need, provide a service, bring together new constituencies, or otherwise "fill a gap" in the technology infrastructure. SRI does not include traditional university funding or research appropriations, federal fundamental research funding, or similar efforts in the definition of technology programs used in this study because these activities are well known and primarily emphasize science research, not technology development.

Under SRI's definition, technology programs are efforts to fill new kinds of needs that have arisen as a result of the increasingly rapid rate of technological change and intensifying economic competition worldwide. These technology programs are often experimenting with new approaches to leveraging funds, to establishing relationships among and between universities, industry, and government, and to fostering entrepreneurship, with the overall objective that these efforts may ultimately diffuse throughout the technology infrastructure and make it more effective.

Organization of This Report

This report begins with a brief discussion of the method used to select and profile these programs, followed by a summary of state and local efforts. The bulk of the report, Chapters III through XIII, contains the program profiles. Three to five state-sponsored science and technology programs in each of the 11 states are profiled, along with profiles of local programs in three to four metropolitan regions within each state. Each chapter is composed of four parts:

- A summary of the state's approach to technology policy is presented, including a description of the level of commitment, types of programs supported, and the areas in which state efforts are concentrated. Major changes that have occurred in both the type and level of support for technology programs are described, as well as the motivation behind these changes.
- A comprehensive organizational chart of the state's technology programs, illustrating the state's overall approach and where profiled programs fit.
- Three to five state-level programs, followed by three to four local programs or local applications of state programs.
- A list of contacts for each program profiled and any other major state agencies.

Federal program profiles are presented in a separate report, titled *Federal Programs Supporting Science and Technology for Industrial Innovation in the United States*.

Method

To collect the information needed for the program profiles, a variety of resources were utilized, beginning with SRI's large data base on federal, state, and local technology programs. For each program covered, SRI then collected information through a combination of telephone interviews with program administrators, through written correspondence, and from legislative reports. In addition, supplemental information on some of the programs described in this report were gathered from the following sources:

- American Association of State Colleges and Universities

- Center for Utilization of Federal Technology, National Technical Information Service, U.S. Department of Commerce
- Machinery and Allied Products Institute
- National Governors' Association
- National Institute of Standards and Technology
- National Science Foundation
- Office of Science and Technology, Department of Trade and Economic Development, State of Minnesota
- U.S. Small Business Administration

A close working relationship was established with at least one government office in each state to confirm our findings and to develop the organizational charts of each state's technology programs.

Criteria for Choosing State Programs

The selection of state-sponsored science and technology programs presented in this report was based on criteria outlined in the Interim Report, and agreed to by ISTC. All state-sponsored programs that are profiled focus on research, development, or the commercialization of technology and involve state government either through initiation, administration, or funding. Furthermore, all profiled programs satisfy at least one of the following criteria:

- *The Centerpiece of their State's Technology Strategy*—Some states (e.g., Pennsylvania, Ohio, Virginia) have a single, multipurpose program that they have established as the centerpiece of their technology development strategy. These programs were selected for further study because they are simply the most important cross-cutting initiatives in their states.
- *Large in Relative Size or Impact*—Some state technology programs are much larger and their presumed impact more extensive than other technology programs in the state. These programs were selected because, although they are not necessarily the centerpiece, they are major components of their state's technology strategy.
- *Unique in Approach, Target, or Service*—Some state technology programs employ a funding, organizational, or staffing approach seldom used elsewhere, target a unique beneficiary, provide a unique service, or assemble unique public-private teams that help improve the technology innovation and adoption process. Examples of these programs have been selected because they provide insights into technology program innovation in the United States.
- *An Effective Magnet for Private or Federal Support*—Some state programs are designed to generate or "leverage" significant funds or in-kind support from other sources, such as corporations, private foundations, and the federal government. These programs have been

included because they often produce more impact per dollar invested than other programs, making them attractive options for state governments with especially limited resources.

Criteria for Choosing Locally-Focused Programs

The local programs, while in general less oriented toward science and technology, all emphasize technology-based economic development in a sub-state region and receive some form of public support. In selecting specific local programs to profile, SRI first looked within the recommended metropolitan region, and, if no eligible programs existed, qualified programs from neighboring regions were selected. Both locally-generated programs and noteworthy local implementations of state programs are included in this study.

Each program at the state and local level was profiled using the following standard format developed by Industry, Science and Technology Canada:

PROFILE FORMAT

State

Program

Name of Program and Government Agency

Program Purpose and Objectives

Industrial Sector

Where possible, the targeted industrial sector or technology field is identified.

Classification of Objectives

Program objectives are classified as one or more of the following:

- Research and development
- Sectoral/industrial development
- Regional development
- Adjustment to competition
- Social development
- Income maintenance
- Small/medium business assistance
- Export promotion
- Environmental protection
- Infrastructure development
- Other.

Ranking of Objectives

If a program has multiple objectives in addition to R&D these objectives are ranked according to their importance to the program's mission.

Classification By R&D Type

R&D is classified as either:

- Basic research
- Applied research
- Development
- Proof of concept/prototype.

Level of R&D Focus

Programs are identified as targeting either:

- Existing R&D activities
- Expansion of existing R&D activities
- Establishment of new R&D activities.

Program Beneficiaries

Beneficiaries are listed along with any restrictions on the receipt of benefits. Assistance is classified as being available to foreign firms and/or service-industry firms as appropriate. Description of the assignment of rights to intellectual property and technology developed due to program.

Direct or Indirect Benefits

Direct and/or indirect beneficiaries, including downstream beneficiaries, are identified.

General or Targeted Benefits

Identification of whether the program is "generally available" or "targeted" to a specific sector, whether R&D results are made publicly available and easily accessible on a timely basis.

Program Duration and Permanence

State date of program and expected duration are noted, along with any significant changes in the program's mandate since inception.

Types of Potential Subsidy Intervention/Form of Funding

Each program intervention is classified as either:

- Loan or loan guarantee
- Equity
- Grant
- Tax credit/incentive
- Duty remission
- Provision of goods/services below market cost
- Other.

Description of How Program Is Funded/Amount of Funding

As available, financial information is presented on the source of funds and amount of funding.

Provisions for Cost Recovery

The nature of cost recovery, if attempted, is identified.

Discrimination/Conditionality

The following discriminations and conditionalities placed on beneficiaries are identified as appropriate:

- Formal restriction to a specific region
- Formal restriction to one or more specific firms (industries/sectors)
- Restriction on basis of access to knowledge (R&D).

Program's Administration and Operation

Description of program's administration, responsible department or agency, and fiscal transfer mechanisms.

Program Impact and Lessons

Identification of any information describing program's impact, including publicly-available third-party evaluations, legislative reports, or internal self-evaluations.

II. SUMMARY OF STATE AND LOCAL EFFORTS

The purpose of this chapter is to present an overview of science and technology programs encountered in this study, and as data permits, of what states are doing nationwide, to serve as background and context for the profiles that follow. Presented in this chapter is a review of:

- Technologies most frequently targeted
- The structure of state efforts
- Funding mechanisms and levels
- And policy trends.

The last part of this chapter summarizes the wide array of programs that are profiled in this study, and ends with a discussion of the challenges inherent in attempting to assess the effectiveness of these programs.

In the 11 states examined, SRI found a wide diversity in approaches to promoting technological innovation and development. Most programs are structured to respond to local economic and political conditions and to take advantage of existing industries or technologies in which the state or region has a competitive advantage and which hold potential for development. As a result, there is a great deal of variation among state programs in terms of structure, relationship to state government, clientele, and services. Table 1 offers a state-by-state breakdown of programs by type of intervention.

Many of these programs have developed out of the realization that the incentives that had promoted economic development in the past—abundant natural resources, cheap labor and land, low taxes—are not the primary attractions for firms striving to be innovative and responsive in the face of strong foreign competition and rapid technological change. The kinds of firms that will stay and grow in a state are firms looking for assets that will help them innovate, be responsive to markets, and attract and retain a high-quality workforce. For all these reasons many states, including all of the states in this study, have developed or are developing science and technology strategies as part of their overall economic development efforts.

Table 1
Science and Technology Programs by State

	Science and Technology Offices	Research Grants	Advanced Technology Centers	Research and Technology Parks	Tax Incentives	Technology Transfer	Capital Programs	Incubators	Technical and Managerial Assistance	Technical Training
California	*	*			*	*				
Florida	*	*				*			*	*
Illinois	*		*	*		*	*	*	*	*
Massachusetts	*	*	*	*	*		*			*
Michigan	*	*	*	*	*	*	*	*	*	*
New York	*	*	*			*	*		*	
North Carolina	*	*	*	*			*	*	*	
Ohio	*	*	*			*	*	*	*	*
Pennsylvania	*	*	*		*	*	*	*	*	*
Texas	*	*	*			*			*	
Virginia	*	*	*		*	*		*	*	*

Targeted Technologies

Many of the states that target specific industries, research fields, and technologies do so to complement existing research strengths, industry concentrations, and market demands. Targeted technologies range from optoelectronics and food processing in one state (Florida) to superconductivity and "environmental enhancement" in another (California). Table 2 groups similar technologies into categories and ranks, on a percentage basis, the popularity of each technology category as targeted by state science and technology programs nationwide. Computers and computer related technologies, at 19%, are the most popular of the technologies targeted. 18% of the technologies targeted relate to advanced manufacturing process technologies, which include CAD/CAM, visual sensors, and robotics and biotechnology comes in a close third with 16%.

Table 2

Technologies Targeted by State Science and Technology Programs

Targeted Technology	Popularity (%)
Computers and Computer-Related Technologies	19.3
Advanced Manufacturing Technologies	18.2
Biotechnology	16.2
Miscellaneous Advanced Technologies	14.1
Natural Resources	9.9
Medical Technologies	8.6
Total	100.0

Source: National Association of State Development Agencies, 1988

Many of the states in this study target technologies that complement the state's existing economic base. Michigan targets advanced manufacturing process technologies, including robotics and flexible automation systems at both the Center for Research on Integrated Manufacturing and the Michigan Industrial Technology Institute. In Texas, the Energy Research and Applications Program has received over \$21 million to support existing and new R&D efforts in energy-related fields.

Organization of State Efforts

Each state examined has a relatively new organization or office that has a mission concerned with science and technology policy. Table 3 presents a listing of state science and technology offices nationwide. As products of their state's particular socio-political cultures, these agencies differ significantly from each other in terms of responsibilities and powers. For the most part, science and technology agencies have modest staffs and large boards to offer policy guidance. For example, the Florida High Technology and Industry Council has a staff of only three people, but accomplishes its objectives through coordinating with other agencies and relying on voluntary committees. North Carolina offers a unique case where the chairman of the Board of Science and Technology is the governor himself.

Other states, such as Massachusetts, while not developing formal umbrella technology development organizations, operate their programs either through quasi-public organizations or the state development agency. Often, in these states, overall direction for state policy is provided by an independent, quasi-public technology board.

Table 3
State Science and Technology Offices

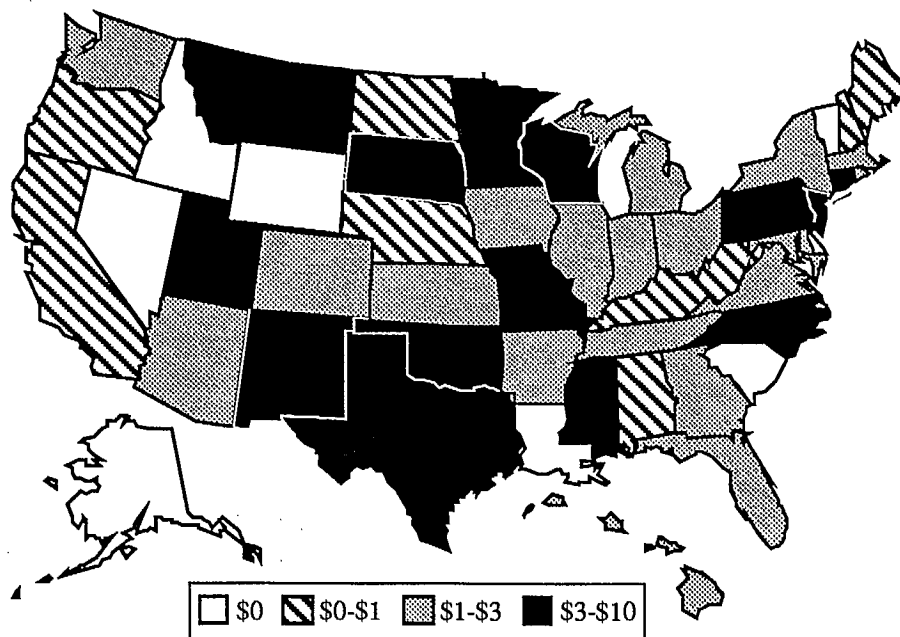
State	Office	Year Established
Arkansas	Arkansas Science and Technology Authority	1983
California	California Council on Science and Technology	1989
Florida	Florida High Technology and Industry Council	1984
Hawaii	Science and Technology Program Department of Business and Economic Development	1965
Idaho	Division of Science and Technology	1987
Illinois	Governor's Commission on Science and Technology	1983
Indiana	Corporation for Science and Technology	1982
Iowa	Research and Development Office Department of Economic Development	1982
Kansas	Kansas Technology Enterprise Corporation	1987
Kentucky	Office of Business and Technology	1985
Maine	Maine Science and Technology Board	1985
Massachusetts	Centers of Excellence Corporation	1985
Michigan	Michigan Strategic Fund	1985
Minnesota	Governor's Office of Science and Technology	1983
Missouri	Corporation for Science and Technology	1983
Montana	Montana Science and Technology Alliance Montana Department of Commerce	1985
Nebraska	Nebraska Research and Development Authority	1987
New Jersey	New Jersey Commission on Science and Technology	1985
New Mexico	Science and Technology Commission	1983
New York	New York State Science and Technology Foundation	1963
North Carolina	North Carolina Board of Science and Technology	1963
Ohio	Division of Technological Innovation Ohio Department of Development	1987
Oklahoma	Oklahoma Center for the Advancement of Science and Technology	1987
Pennsylvania	Office of Technology Development Pennsylvania Department of Commerce	1983
Rhode Island	Rhode Island Partnership for Science and Technology	1985
South Carolina	South Carolina Research Authority	1983
South Dakota	Office of Enterprise Initiation Governor's Office of Economic Development	1987
Tennessee	High Technology Development Department of Economic and Community Development	1982
Texas	Department of Commerce	1986
Virginia	Center for Innovative Technology	1984
Wyoming	Wyoming Science, Technology, and Energy Authority	1987

Source: National Governors' Association

Many states also rely on line item appropriations to fund specific R&D projects that are in addition to established science and technology programs. The State of Texas has spent roughly \$100 million a year for the last five years to support centers in agriculture, superconductivity, and cancer research, and to attract MCC, Sematech, and the Superconducting Super Collider.

Funding of Programs

According to a study by the Minnesota Office of Science and Technology in 1988, state expenditures from science and technology programs range from zero to \$76 million per state. In general, the states with the highest spending levels are manufacturing states of the Northeast and Midwest, while Western states tend to have lower spending levels (see Figure 1). Most science and technology programs receive their allocation from state general funds. Other sources include state employee pension funds, lottery earnings, and bond issues, as shown in Table 4.



Source: 1988 data from the Office of Science and Technology, Minnesota Department of Trade and Economic Development.

FIGURE1 STATE SCIENCE AND TECHNOLOGY FUNDING PER CAPITA

While state programs spend a considerable sum of money to support research and technological development, many state programs are designed to either leverage additional private investment or recoup costs through royalty payments or licensing of technology. For example, advanced technology centers at universities often require, at minimum, matching support from the private sector. In practice, however, private support often exceeds the amount requested. In one example, of the almost \$200 million that the Ohio Edison Centers have spent since 1984,

over 63 percent was from nonpublic sources. Of all the funds spent on the Ben Franklin Partnership Challenge Grants, over 78 percent were private matching funds.

Table 4
Funding for State Science and Technology Initiatives

<u>State</u>	<u>Total State Funding</u>	<u>State General Funds</u>	<u>Bond Issue</u>	<u>Miscellaneous Funding Source*</u>
Alabama	\$2,855,205	\$1,055,205		\$1,800,000 ¹
Alaska	30,000	30,000		
Arizona	7,000,000	7,000,000		
Arkansas	3,150,000	3,150,000		
California	5,900,000	5,900,000		
Colorado	3,700,000	3,700,000		
Connecticut	12,550,000	9,450,000	3,100,000	
Delaware	1,650,000	1,550,000	100,000	
Florida	27,958,000	27,958,000		
Georgia	11,094,430	11,094,430		
Hawaii	2,851,000	2,851,000		
Idaho	0	0		
Illinois	13,540,000	12,540,000	1,000,000	
Indiana	10,637,500	10,637,500		
Iowa	4,895,000	1,395,000		3,500,000 ²
Kansas	3,550,000	3,425,000		125,000 ³
Kentucky (FY89)	560,000	560,000		
Louisiana	0	0		
Maine	184,280	184,280		
Maryland	7,356,750	7,365,750		
Massachusetts	14,665,000	14,665,000		
Michigan	13,063,500	13,063,500		
Minnesota	39,439,200	39,439,200		
Mississippi	9,300,000	9,300,000		
Missouri	28,566,000	28,566,000		

¹State Trust Funds

²State Lottery

³State Gaming Funds

Source: 1988 data from the Office of Science and Technology, Minnesota Department of Trade and Economic Development.

Table 4 (concluded)

<u>State</u>	<u>Total State Funding</u>	<u>State General Funds</u>	<u>Bond Issue</u>	<u>Miscellaneous Funding Source*</u>
Montana	3,550,000	3,550,000		
Nebraska	858,500	858,500		
Nevada	0	0		
New Hampshire	200,000	200,000		
New Jersey	76,345,000	19,345,000	57,000,000	
New Mexico	7,654,000	7,654,000		
New York	22,129,300	22,129,300		
North Carolina	23,357,000	23,357,000		
North Dakota	207,000	207,000		
Ohio	18,000,000	18,000,000		
Oklahoma	12,046,375	12,046,375		
Oregon	2,215,000	0		2,215,000 ⁴
Pennsylvania	49,050,000	49,050,000		
Rhode Island	2,000,000	2,000,000		
South Carolina	0	0		
South Dakota	3,050,000	0		3,050,000 ⁵
Tennessee	13,109,400	13,109,400		
Texas	60,690,000	60,690,000		
Utah	5,187,000	5,187,000		
Vermont	0	0		
Virginia	9,400,000	9,400,000		
Washington	11,000,000	11,000,000		
West Virginia	150,000	150,000		
Wisconsin	18,978,000	18,978,000		
Wyoming	0	0		

⁴State Lottery⁵Future Fund

Source: 1988 data from the Office of Science and Technology, Minnesota Department of Trade and Economic Development.

Many of the programs that involve state money for equity investments or research grants strive not only to leverage private funds, but also attempt to recoup public investment through repayment or royalties. For example, Pennsylvania's five Seed Venture Capital Funds offer seed capital to small businesses for product conceptualization and development. The Funds require a 3:1 match from the private sector, but have been averaging a 6:1 ratio—a total of \$4.5 million in state appropriations has been matched with \$27 million in private funds.

Policy Trends

States are becoming increasingly aggressive in facilitating the technology commercialization process. Where traditionally states sponsored more passive programs and policies concerning physical infrastructure, taxes, and the promotion of the state as a good place to conduct business, state economic development initiatives now include long-term science and technology strategic plans, equity positions in private enterprises, targeted training in specific fields for specific industries, and active marketing both domestically and internationally of products and services of individual businesses. States and municipalities are discovering new ways to influence the market more directly and shape economic activities within their regions.

In order to achieve these goals, many of the state programs profiled in this study, as a matter of policy, incorporate a wide variety of education programs into their strategies, including research grants, industry-university partnerships, advanced technology research centers, training in targeted fields, university fellowships, and increased funding for science and engineering schools. While the program mix varies from state to state, education policy appears to be playing an increasingly larger role in the promotion of technology development in almost every state examined. As all states are facing similar challenges involving international competition, increasing rates of technological innovation, changes in the economic base, and the need to integrate the disadvantaged into the economic mainstream, so are many states considering education and technology development policies as inseparable.

Several states have targeted the training of scientists and technicians. Ohio's Edison Fellows Program provides post-graduate training fellowships for graduates of Ohio universities. The fellows receive two-year appointments with an Edison Technology Center, a company in an Edison Incubator, or a company receiving Edison Seed Development funds. The state provides each student with a stipend to be matched by the Edison company or Center. Thus the program not only provides hands-on experience for graduates, it also provides technology-based firms with subsidized technical employment.

A few states have created training programs to help firms train employees in the use of new technologies. The Michigan Modernization Service's Workforce Development Service provides skill training as an integral part of its program to help firms adopt new production technologies and computer-integrated manufacturing systems.

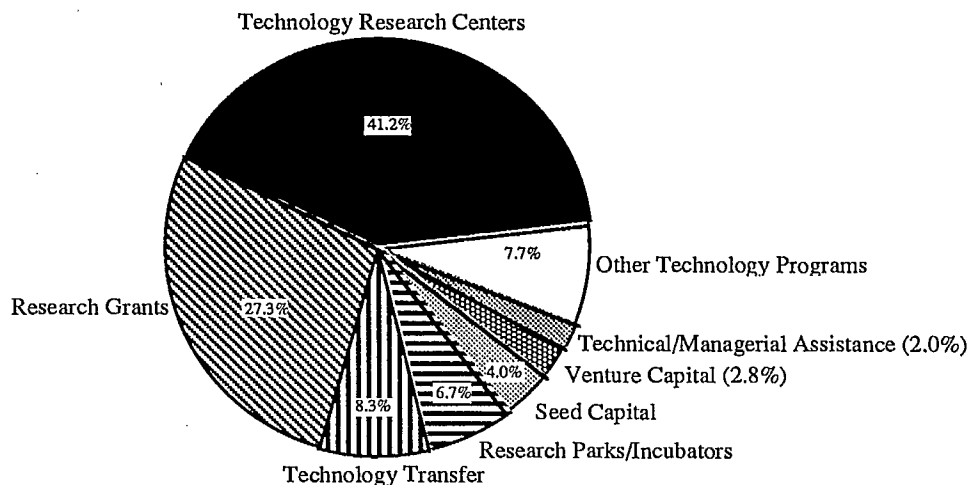
Another science and technology trend is the increasing emphasis of on diffusing best-practice technology to existing manufacturing firms. Several states in this study have developed programs to help existing manufacturers become more competitive by adopting existing state-of-the-art manufacturing technology. Michigan's Technology Deployment Service actively seeks out and helps small and medium-sized manufacturers adopt new technology. Similarly, New York has recently initiated several programs to assist its resident small and medium-sized manufacturers in adopting new technology. One program, the Industrial Effectiveness Program, provides funds for firms to hire engineering consultants to advise them on the best types of process technology to buy and how new technology can best be integrated into existing production processes.

Types of Programs

Profiled in this study are a wide array of programs that use a variety of tools to stimulate technological innovation. These programs include:

- Research grants
- Advanced technology centers
- Research parks
- Tax incentives
- Technology transfer programs
- Capital programs
- Incubators
- Technical assistance programs
- Technical training programs

A breakdown, using nationwide data, of the percentage of total state funding these programs receive is shown in Figure 2.



Source: 1988 data from the Office of Science and Technology, Minnesota Department of Trade and Economic Development.

FIGURE 2 STATE SCIENCE AND TECHNOLOGY PROGRAMS: DISTRIBUTION OF EXPENDITURES

University Research Grants

In general, university research grant programs direct money to individual researchers working on scientific and engineering research considered to be potentially important to the state's economy. The Texas Higher Education Coordinating Board administers two programs that provide grants that support basic and applied research at the state's universities in selected fields. The Advanced Research Program allocates \$20 million biennially for basic research, and the Advanced Technology Program distributes \$40 million biennially to fund applied research in designated science and engineering fields.

Many state grant programs place less of an emphasis on "supporting" research than "targeting" potential technologies. In general, each state has surveyed a range of technologies for possible investment, and then selected the fields in which it believes it has a comparative advantage vis-a-vis other states. The 11 states of this study sponsor the following research grant programs:

- California: Microelectronics Innovation and Computer Research Opportunities
- Florida: Applied Research Grants Program
- Massachusetts: Massachusetts Centers of Excellence Corporation
- Michigan: Research Excellence Fund Michigan Strategic Fund
- New York: Research and Development Grant Program
- North Carolina: North Carolina Biotechnology Center
- Ohio: Research Challenge Program
- Pennsylvania: Challenge Grant Program
- Texas: Applied Research Program Advanced Technology Program
- Virginia: Center for Innovative Technology

Advanced Technology Centers

Through industry involvement as either financial supporters and recipients of the research or as coresearchers, advanced technology centers conduct basic or applied research that has potential for being transformed into marketable products and processes. While science and technology agencies often use universities as their primary base for advanced technology centers, these centers may vary in form and function. In Massachusetts, a "center" frequently embraces two or more universities. North Carolina's Biotechnology Center is not affiliated with any university, but provides support to university researchers through its statewide competitive programs. Pennsylvania's Advanced Technology Centers involve alliances not only with industry, but also with labor and economic development groups.

"Where" to locate is often a more important factor than "what" to fund. States, like Illinois, that can afford a number of centers often spread them around geographically, so that spin-offs can accrue to the less developed parts of the state. Massachusetts' Centers of Excellence are, for

the same reasons, located outside of the Route 128 area. The 11 states in this study sponsor the following advanced technology centers:

- Illinois: Illinois Technology Commercialization Centers
Center for Advanced Manufacturing and Production
- Massachusetts: Massachusetts Centers of Excellence Corporation
- Michigan: Michigan Industrial Technology Institute Michigan Biotechnology
Institute
- New York: Supercomputer Program Centers for Advanced Technology
- North Carolina: Microelectronics Center of North Carolina
North Carolina Biotechnology Center
North Carolina Science and Technology Research Center
- Ohio: Edison Technology Centers
Ohio Advanced Technology Center
- Pennsylvania: Advanced Technology Centers
Industrial Resource Centers
- Texas: Institute of Biosciences and Technology
- Virginia: Center for Innovative Technology

Research and Technology Parks

An increasing number of states are developing research and technology parks, often located contiguous to research universities, with the intention of both attracting firms to the state or area and to help link university and industry research efforts. North Carolina's Research Triangle Park is one of the first examples of a state using a research park as a strategy for science- and technology-based economic development. The following states in this study have either established their own research parks or assisted localities or universities to establish their own:

- Illinois: Chicago Technology Park
- Massachusetts: Massachusetts Technology Park Corporation
- Michigan: Technology Park Development Act
- North Carolina: North Carolina Research Triangle Park

Tax Incentives

Some of the states in this study—California, Massachusetts, Pennsylvania, and Virginia—provide tax credits to encourage technological innovation. Tax credits range from investment in private venture capital funds, donation of equipment to universities, and R&D related expenses. Pennsylvania, for example, allows certain businesses to convert operating losses into tax credits for new Pennsylvania plant and equipment investments. Pennsylvania's tax credit program is unique in the respect that it is under the purview of the state's science and technology agency.

Because of the difficulty in determining revenue foregone due to tax credits, these "expenditures" are not included in state overall expenditure totals.

Technology Transfer

Technology transfer programs are designed to stimulate and speed up the transfer of technology from either universities or government laboratories to private industry. Many advanced technology centers, as part of their mission, transfer new technology to member firms of the research consortium. However, some states have established separate programs that focus solely on the transfer of technology. An increasing number of states are establishing data bases of descriptions of research expertise at universities and, sometimes, private firms. One of the most well-known of these is New York's Education and Research Network—a high-speed communications network linking the Cornell University supercomputer with New York's leading research institutions, laboratories, and industrial firms. The 11 states in this study sponsor the following programs that focus on technology transfer:

- California: California Competitive Technology Program
- Florida: Southern Technology Applications Center
- Illinois: Technology Commercialization Centers
Illinois Resource Network
Illinois Technology Development Program (I-TEC)
- Michigan: Technology Transfer Network
- New York: New York State Education and Research Network
Industrial Innovation Extension Service
- Ohio: Ohio Technology Transfer Organization
- Texas: Texas Innovation Information Network System
- Virginia: CIT Technology Transfer Program

Capital Programs

Many states have established different types of equity and royalty programs to provide innovative firms with patient, higher-risk capital. To encourage entrepreneurship and risk-taking, states most frequently will:

- Establish state-operated and state-funded venture programs
- Support a designated private venture capital firm by providing the firm with a tax credit for donations received or by allocating money directly to the firm
- Commit a portion of the state's employee pension fund to be used as equity support to technology-based firms in the state.

In Illinois, the Governor's Commission on Science and Technology has a Business Innovation Fund aimed at businesses that are working with a university or research institution. One-to-one leveraging with private funds is required, and a royalty repayment agreement reimburses the State of Illinois when the product is developed and sold in the marketplace.

Ohio's Edison Seed Development Fund, like the Illinois program, favors university-industry partnerships aimed at moving technology-based concepts to commercialization. Participating businesses must operate in Ohio or agree to locate an R&D or manufacturing facility in the state. This programs has received \$7.5 million in state financing, which was matched by \$11 million in private sector money. The 11 states in this study support the following capital programs:

- Illinois: Technology Venture Investment Program
- Massachusetts: Massachusetts Technology Development Corporation
- Michigan: Capital Access Program
Michigan Product Development Corporation
Michigan Seed Capital Program
Michigan Venture Capital Fund
- New York: Corporation for Innovation Development
New York State Business Venture Partnership
- North Carolina: Technology Development Authority
- Ohio: Pension Fund Venture Set-Aside
- Pennsylvania: Ben Franklin Seed Venture Capital Fund
Venture Capital Pension Fund

Incubators

Incubators provide physical space, laboratory equipment, and clerical assistance on an inexpensive and shared basis to inventors who wish to turn their work into marketable products. While many states have established incubators to nurture the growth of new firms, several states have developed incubators targeting technology-based start-ups. Often these incubators are affiliated with research universities in order to capitalize on close links between university applied research and activities. The 11 states in this study have created the following incubator programs:

- Illinois: Small Business Incubator Program
Chicago Technology Park
- Michigan: Metropolitan Center for High Technology
- North Carolina: Incubator Facilities Program
- Ohio: Edison Incubators
- Pennsylvania: Small Business Incubator Program
- Virginia: CIT Business Incubators

Technical Assistance Programs

Technical assistance programs help businesses find, evaluate, develop, and implement technologies suited for their needs. Services can include providing information on new technologies, evaluating the feasibility of new ideas, product testing, referrals, and patent searches. States are beginning to realize that employment growth in advanced technology sectors will be limited, but employment opportunities generated by technological innovation in traditional manufacturing and services are substantial. As a result, technical assistance programs are becoming increasingly more popular as a means to help mature firms adopt existing technology and best-practices that are new to the firm. Because of the technical expertise often required, many programs are administered by universities.

The 11 states in this study support the following technical assistance activities:

- Florida: Southern Technologies Applications Center
- Illinois: Center for Advanced Manufacturing and Production
- Michigan: Michigan Modernization Service
Technology Transfer Network
- New York: Industrial Innovation Extension Service
Economic Development and Technical Assistance Center
- North Carolina: Business Innovation & Technology Advancement Center
Science and Technology Research Center
Industrial Extension Service
- Ohio: Ohio Technology Transfer Organization
- Pennsylvania: Industrial Resource Centers
Challenge Grant Program for Technological Innovation
Pennsylvania Technical Assistance Program
- Texas: Technical Assistance Centers
- Virginia: Commonwealth Technology Information Service

Technical Training

An increasing number of states have created programs to train technicians and engineers in new technologies. For example, Michigan has established a satellite-based telecommunications system that links the state's four main research universities directly to participating automotive industry firms. The program enables engineers to take courses for degree or skills upgrading directly from the schools while still remaining at work. Ohio's Thomas Edison Program complements other programs administered through the state university system by providing funds for selected students completing advanced degrees in science and technology. These students are expected to work two years with companies participating in the Edison program who donated

matching funds. The intent is that students will stay with sponsoring companies, and thus in Ohio. The 11 states in this study support the following technical training programs:

- Florida: Centers of Electronic Specialization
 Centers of Electronic Emphasis
- Illinois: Center for Advanced Manufacturing and Production
- Massachusetts: Bay State Skills Corporation
- Michigan: Workforce Development Service
- Ohio: Edison Fellows Program
- Pennsylvania: Customized Job Training Program
- Virginia: CIT Engineering Clinic

Analysis and Assessment

In its interviews, SRI found a strong interest among program directors and policy makers to determine appropriate measures to assess and evaluate science and technology programs. Some administrators suggest that, since science and technology programs have long-term goals, progress should not be evaluated in terms of short-term measures. Job creation and retention rates and industry attraction, creation, and retention rates are seldom accurate and are measures that do not reflect what these programs are really setting out to accomplish. Under this view, firms and universities are not looking for R&D dollar leveraging or short-term job creation, but instead have less-measurable more fundamental objectives that involve the technology "infrastructure," such as:

- Promoting basic research
- Training graduate students
- Supporting the economic revitalization of an area
- Developing new industrial processes
- Improving the transfer of knowledge and expertise into commercial applications.

Often the value of a program lies with its ability to create new partnerships among and between universities, state government, and industry, which, in turn, can serve to improve the human resource base of an area, and increase the rate of technological innovation. Job creation/retention rates and other self-reported program assessments, aside from the difficulty in establishing causality, may not be the best guide to policy making, since these evaluation techniques do not emphasize the important long-term impacts these programs may have on a state or region's economic foundations.

Clearly, the challenge exists to develop an improved framework in which to evaluate science and technology programs that will take into account their long-term focus and emphasis on constituency-building.

III. CALIFORNIA

California does not have a designated office to coordinate and oversee state science and technology initiatives. However, the state provides over \$35 million each year in research funds to the University of California system where research is conducted at the various campuses. At present, state efforts are being directed toward increasing industry participation in the transfer and commercialization of university research.

In 1989, the California Legislature established the California Council on Science & Technology to serve as an alliance of the state's major public and private research universities and industry leaders to address issues that significantly affect science, technology, and competitiveness in California. The Council is charged with providing analysis and policy recommendations as well as developing and supporting policy initiatives at the request of the Governor, the Legislature, and government agencies.

The Council studies issues affecting all levels and fields of research, but emphasizes research in selected areas: K-12 science education, S&T and economic competitiveness, environmental enhancement, S&T indicators for the state, and earthquake research. The Council also studies how to attract federal laboratories, international projects, federal research funding, and how to develop large, multiinstitutional science and technology research consortia in the state.

One of California's most significant technology initiatives, the Competitive Technology Program (CompTech), was established in 1988 and operates within the Department of Commerce. The Program, through funding public-private collaborative technology transfer projects, is designed to make the resources of California's national laboratories, nonprofit institutions, and universities more available to private industry. In 1990, CompTech awarded \$6 million in grants to fund 28 projects involving public-private research teams. Over \$4.8 million in private sector matching funds were committed to CompTech projects.

The MICRO program (Microelectronics Innovation and Computer Research Opportunities) was established in 1981 to spearhead a UC system-wide effort to join with industry in the research of microelectronics. The objective of MICRO is to encourage collaboration between industry and university researchers for the purposes of enhancing technology transfer, exposing

faculty to cutting-edge technology and practices, and bringing graduate students together with potential future employers.

The operation of the MICRO program is based on a more "bottom-up" approach than most other research grant programs. The philosophy behind MICRO is grounded in entrepreneurialism and decentralization. Individual faculty members must find industry sponsors themselves before submitting proposals, thus ensuring that projects reflect market demands and focus on topics that are ripe for investigation. Please see Figure 3 for organizational chart of state activities.

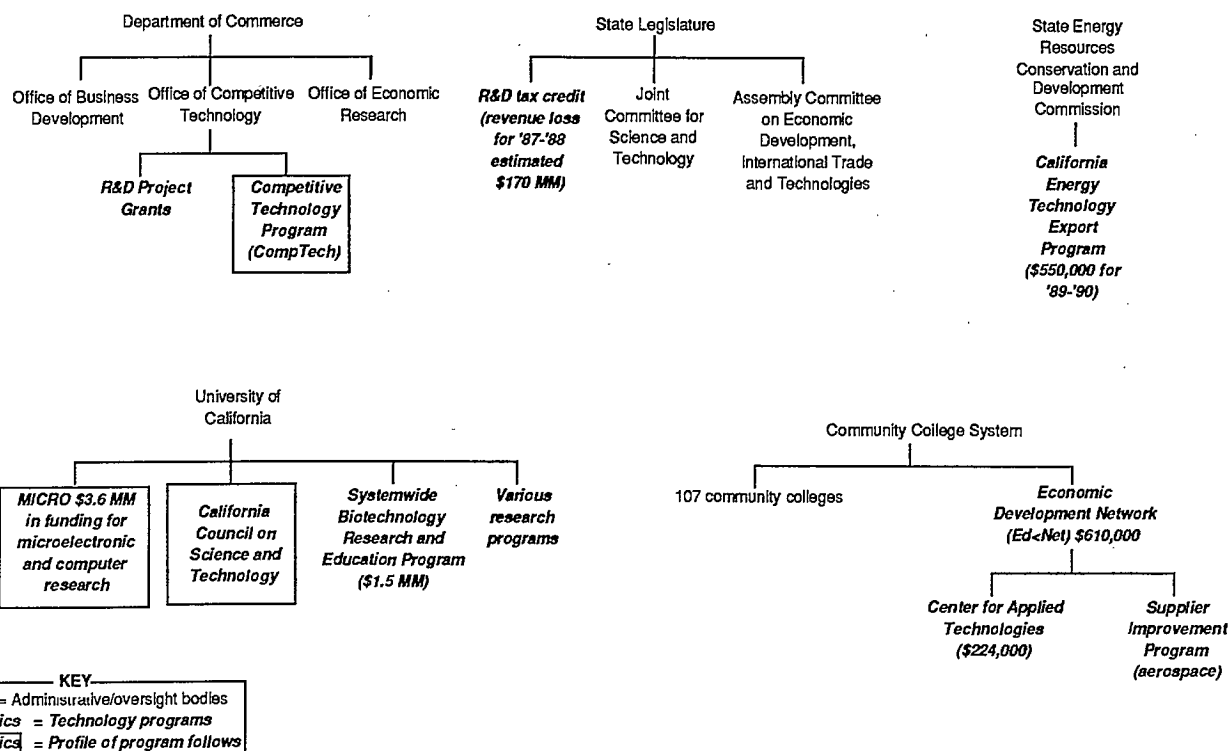


FIGURE 3 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: CALIFORNIA

Name of Program and Government Agency

- State: California
- Program: California Council on Science & Technology

Program Purpose and Objectives

Established as a nonprofit agency by the California Legislature in December of 1989, the Council is an alliance of the state's major public and private research universities and industry leaders formed to address issues that significantly affect science, technology and competitiveness in California. Twenty-one scientists, engineers, scholars and industry leaders comprise the membership of the Council. The board examines science and technology public policy issues of importance to the state, including science and technology components of economic, social, educational, and technical issues. The Council provides analyses and policy recommendations as well as develops and facilitates initiatives to implement policy in response to the Governor, the Legislature, and other relevant agencies and entities.

The Council addresses long-range R&D requirements for California to sustain its science and technology base, promote economic development, and improve its competitive position. The Council assesses and facilitates private sector-university relations and technology transfer. As appropriate, the Council provides coordination and assistance in developing and securing broad-based statewide science and technology projects. While the Council does not carry out or fund research, it coordinates and facilitates such funding. Advisory study/initiative panels, workshops, conferences, and roundtables are the primary mechanisms used to carry out Council activities.

Industrial Sector

No particular industrial sector or field of study is targeted.

Classification of Objectives

The Council's objectives can best be classified as the promotion of both basic research and applied research and development at California universities and /laboratories. The Council also encourages research in selected areas: K-12 science education, S&T and economic competitiveness, environmental enhancement, S&T indicators for the state, and earthquake research.

Ranking of Objectives

The Council does not rank its objectives.

Classification of R&D Type

Basic research, applied research, and technology development within California are supported by the Council.

Level of R&D Focus

The program is targeted toward the establishment of new R&D activities, including attracting federal laboratories, international projects, federal funding, and developing large, multi-institution S&T research consortia.

Program Beneficiaries

Any university that conducts research in California is eligible to participate in Council programs. The state legislature and executive office also contract the Council to conduct studies. Technology developed and knowledge gained from research organized by the Council remains the property of the researchers, and they are free to coordinate the assignment of rights among themselves.

Direct or Indirect Benefits

The Council was founded in December of 1989, and is too new to have measurable benefits. The Council intends to benefit the Governor and Legislature through its science and technology policy studies, and hopes to secure national and international research projects for public and private universities within the state. The Council is studying ways to benefit the state—improving California's competitive position and quality of life—by means of a statewide science and technology policy.

General or Targeted Benefits

Programs are generally available to all interested universities and businesses in California. Availability of research results are governed by the usual research policies of participating institutions.

Program Duration and Permanence

The Council was chartered in December of 1989 as a nonprofit agency, and is structured to be self-sustaining for perpetuity.

Types of Potential Subsidy Intervention/Form of Funding

No financial support of any type is proffered by the Council. The Council, as a service provider, creates alliances and consortia, and conducts policy studies for the state.

Description of How Program is Funded/Amount of Funding

The Council receives its core funding from five California universities: Stanford University, The University of California, California Institute of Technology, California State University, and the University of Southern California. These five institutions together provide \$500,000 per year for operating costs. The University of California pays 50 percent, and the other four pay 12.5 percent each. Research projects must be funded through other sources, such as grants, gifts, and contracts from state and federal government, industry, foundations, and other sources.

Provisions for Cost Recovery

There are no provisions for cost recovery.

Discrimination/Conditionality

There is no discrimination or conditionality, other than merit, in the selection of research projects and participating institutions.

Summary of Program's Administration and Operation

The Council is a nonprofit corporation formed at the request of the Legislature and governed by a ten-member board of directors. The Council's core budget presently is supported entirely by the founding universities. Projects must be funded by sponsors through grants, gifts, and contracts. Council activities are carried out by means of advisory study/initiative panels, workshops, conferences, and roundtables.

Using expert advisory panels, the Council develops independent and objective findings and recommendations to address the state's major science and technology related opportunities and

challenges. Normally, the Council panels use a combination of existing sources of information and data, as well as data from its own studies.

The Council both initiates projects and responds to requests. Past proposals have come from the Legislature, the Governor's office, state governmental agencies, foundations, universities, industrial associations, and corporations. The Council considers proposals to undertake studies in any of the scientific and engineering disciplines. The Council focuses on projects that require its unique ability at the state level to assemble expertise and to issue independent and objective reports. Projects submitted for Council consideration must already have sponsors.

Program Impact and Lessons

No major formal, publicly-available, third-party evaluations, legislative reports, or internal self-assessments of the council have been undertaken, and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: California
- Program: California Competitive Technology Program (CompTech)

Program Purpose and Objectives

Comptech was established in 1988 to enhance the competitiveness of California firms through funding public-private collaborative technology transfer projects. Comptech is the only statewide program specifically designed to promote applied research efforts to develop commercial products. The program is designed to make the resources of California's national laboratories and universities more available to private industry. Projects must be undertaken jointly by public agencies, universities, and/or nonprofit organizations with the participation of private firms in California.

Comptech Solicits Applications for Funding in five Program Areas:

- Collaborative research projects. These are product commercialization projects conducted and funded jointly by a California private-sector company, and a public agency or nonprofit laboratory.
- Consortium development projects. The consortium includes more than one private sector firm and at least one public agency or nonprofit laboratory, and plans to establish a nonprofit corporation for the purpose of managing the consortium.
- Entrepreneurial business development projects. These projects assist small, minority-owned, or women-owned businesses in California.
- Technology transfer innovation projects. This type of project is geared toward developing or enhancing an institutional process that transfers technology from research institutions to California companies.
- Unsolicited proposals. These are projects that do not fit one of the above program areas, but are funded because there is either a high likelihood of commercialization, a possible beneficial impact on the state's economy, or the opportunity to leverage other state funds.

Industrial Sector

CompTech funding is not restricted to specific industry sectors, though the California Department of Commerce has stated that priority consideration be given to projects that involve (i) superconductivity, (ii) manufacturing technology, and (iii) environmental enhancement. In 1988, the fields that had the greatest number of projects were optoelectronics, microelectronics, agriculture, electronics, medicine, superconductivity, and computer science.

Classification of Objectives

The programs objectives are classified as follows:

- Research and development (CompTech only funds projects that have commercial potential)
- Sectoral development (The program recently began to emphasize projects that involve manufacturing technologies)
- Social development (The program encourages funding for minority-owned and women-owned businesses)
- Small and medium-sized business assistance (Comptech encourages funding for small businesses, especially when state funding is critical for the project's viability)
- Environmental protection (In 1990, CompTech added an "environmental enhancement" category to its program selection criteria).

Ranking of Objectives

Priority is given to projects within the categories of (i) superconductivity, (ii) manufacturing technology, and (iii) environmental enhancement. The ultimate goal of each funded project is to have a beneficial and cost-effective impact on the state's economy.

Classification of R&D Type

CompTech sponsors applied research and development on technologies that are close to being marketable. The intent of the program is to encourage more technology transfer from the state's universities, nonprofit institutions, and federal laboratories to private sector firms.

Level of R&D Focus

The program aims to create new kinds of applied R&D activities that involve partnerships between public laboratories and private firms, rather than simply expand existing R&D activities.

Program Beneficiaries

Any public-private team where all partners are located in California is eligible for CompTech grants. A public-private team is a partnership involving one or more public agencies or nonprofit institutions and one or more private firms. The public-private team retains the rights to any technology developed or knowledge-gained through CompTech grants, and is free to select how it will assign proprietary rights among its members.

Direct or Indirect Benefits

No evaluation of direct or indirect benefits of CompTech has taken place. The program is structured to indirectly benefit nonprofit laboratories by requiring private firms to link up with nonprofit laboratories to be eligible for CompTech grants. The program has the added benefit of encouraging access to and collaboration with California's research laboratories by private firms. CompTech's advisory committee has recommended that the program take a more pro-active stance in developing R&D consortia in California. If successful, these consortia would create new avenues for industry-university cooperation.

General or Targeted Benefits

CompTech grants are generally available for applied R&D efforts, with high priority given to projects that involve superconductivity, manufacturing technology, or environmental enhancement.

Patent rights for technology developed with CompTech grants are determined in the private sector agreement between the grantee institution and the private firm(s). The California Department of Commerce may retain for state purposes limited intellectual property rights. This limited right is usually a royalty-free, nonexclusive, irrevocable license for government use of any knowledge, data, materials, and devices conceived during the term of the grant.

Program Duration and Permanence

CompTech is in its second year of funding. After the first year, the only significant change in the program's mandate has been the added priority given to projects that involve manufacturing technologies and environmental enhancement.

Types of Potential Subsidy Intervention/Form of Funding

The funding vehicle for the majority of CompTech projects is the matching grant. A small percentage of projects, those that involve mostly feasibility planning and/or involve smaller sums of money, may receive a grant without requiring matching industry funds.

Description of How Program is Funded/Amount of Funding

CompTech is appropriated money from general tax revenue. In its first year, fiscal year 1990, CompTech received 239 applications, and awarded \$6 million in grants for 28 projects.

Private sector matching funds totaled \$4.8 million for FY 1990, exceeding CompTech's minimum goal by almost 400 percent.

In FY 1991, CompTech will fund up to \$7.1 million in new projects with an anticipated matches approaching \$7 million.

Provisions for Cost Recovery

CompTech does not attempt to recover its costs, though the program does lever private sector matching funds.

Discrimination/Conditionality

CompTech considers all technology fields for potential grants, but gives high priority to proposals that involve superconductivity, manufacturing technologies, and environmental enhancement. The program also favors small, minority-owned and women-owned businesses.

Summary of Program's Administration and Operation

CompTech operates within the Department of Commerce and is governed by an Advisory Committee of 18 members. Advisory Committee members are selected by the legislature and by the governor and serve for a two-year term. CompTech staff develop solicitations, manage the application review process, negotiate grant agreements, manage the technology transfer projects, and develop consortia.

In 1990, the program's first fiscal year, CompTech funded 28 projects with \$6 million in total grants and obtained \$4.8 million in private sector matching funds. Thirteen public and private research institutions and three national laboratories located in the state are involved in currently funded projects, along with 31 participating California companies.

Program Impact and Lessons

Since the program's inception two years ago, no information has been collected documenting CompTech's impact, and no study of lessons learned has been undertaken.

Name of Program and Government Agency

- State: California
- Program: The Microelectronics Innovation and Computer Research Opportunities (MICRO) Program

Program Purpose and Objectives

The MICRO Program was established in 1981 by the State of California to support "innovative research in microelectronics technology, its applications in computer information sciences, and its necessary antecedents in other physical science disciplines." The objective is to help the California electronics and computer industries maintain their leadership by expanding relevant research and graduate student training and education at University of California Schools. Under the research part of the program, faculty members at the seven University of California campuses submit proposals for research projects that are at the cutting edge of technology and may lead to products several years into the future. Industry sponsors must support at least half the cost of the project. The Program is not meant to support product development, but rather promotes applied research in microelectronics and encourages stronger linkages between university researchers and their industry counterparts. The MICRO Program is meant to lay the groundwork for long-term interactions with industry, even though the projects themselves might not receive continued MICRO funding year after year.

An important objective of the MICRO Program is to train graduate students in microelectronics and computer science who, by being involved in the research, will upon graduation help to transfer the research results to California industry, become leaders in established companies, and become the entrepreneurs who form new companies that stimulate the economy of the state.

Industrial Sector

The Program targets the microelectronics and computer sectors by supporting applied research in the following fields:

- Microelectronics. Physical electronics; electronic materials technology and associated processing technology; the physics, design, and technology of electronic devices; microelectronic analog and digital circuit design, simulation and analysis; integration techniques for large-scale microelectronics systems; and computer-aided design of microelectronic devices
- Computer Science. Architecture; software; distributed processing and networking; computer graphics; computer theory; and artificial intelligence

- Applications. Signal and information processing; and computer-aided manufacturing (CAM) techniques for microelectronics.

Classification of Objectives

The Program's objectives can best be classified as applied research and sectoral development.

Ranking of Objectives

Objectives are not ranked.

Classification of R&D Type

The focus of MICRO is to encourage more applied research activity in the state.

Level of R&D Focus

The Program is targeted toward the creation of new R&D activities that involve partnerships between university researchers and their industry counterparts.

Program Beneficiaries

Any company that has a research or manufacturing facility in California is eligible to participate in the MICRO program. A U.S. subsidiary of a foreign-owned company is eligible to sponsor a MICRO proposal if that company has either a manufacturing or significant research facility in California.

The three constituent segments of the MICRO program benefit from the program. The University obtains financial support for its research and educational missions. The faculty members and students gain access to expensive equipment and facilities which are only available in the sponsoring industry. Industry gets fresh and innovative ideas from the research and recruits graduate students who are well-trained in the frontiers of the microelectronics fields. The State of California benefits by helping to maintain its leadership in electronics, microelectronics, and computer science. Although the results of research sponsored under the MICRO program are published openly, the participating industrial sponsors derive specific advantages by being closely associated with on-going projects and obtaining the results of research several months prior to their publication in the final report and in journals.

Direct or Indirect Benefits

The MICRO program has almost quadrupled in the level of state funding from its inception in FY1982, and this growth is seen as well in other aspects such as matching industrial contributions, number of participating firms, and the number of research projects funded each year. The number of participating companies has increased from 25 in 1981 to 90 in 1989, and the number of projects has increased from 35 in 1981 to 186 in 1989.

General or Targeted Benefits

The program is targeted to encourage applied research that will benefit the microelectronics, electronics, and computer science sectors.

Program Duration and Permanence

The MICRO program was established in 1981 by the State of California and continues to grow and gain broader support. Its mission has not changed over the years.

Types of Potential Subsidy Intervention/Form of Funding

The State and industry jointly fund the research projects, with industry contributions (cash or in-kind) matching at least one-to-one the State's contribution to each project.

Description of How Program is Funded/Amount of Funding

The state's contribution to the program comes from general tax revenue. In FY1990, 186 proposals were funded, receiving \$3,888,327 from the State and being matched by \$6,046,311 in cash and \$1,901,036 in equipment for a total of \$7,947,347 from industry. Support from the State has hovered around \$3.5 million per year since 1984.

The amount granted by MICRO for a given project is a function of the merit of the proposal, of the proposed budget, and of the total funding available. The average funding per project was \$20,350 in FY1989.

Provisions for Cost Recovery

There are no formal provisions to recover state government expenditures, except that industry must match state grants by at least a one-to-one ratio.

Discrimination/Conditionality

Projects are selected on the basis of their potential to further the state of knowledge in microelectronics and computer science, and in microelectronic and computer applications. The principal investigator must be a faculty member at a University of California institution, and the cooperating industrial company must have a relevant research or manufacturing facility in California.

Summary of Program's Administration and Operation

MICRO is governed by a nine-member Policy Board consisting of three representatives each from the University of California system, private industry, and California state government. The operation of MICRO is conducted by an executive committee consisting of six faculty members, one each from six of the UC campuses. Faculty members at University of California campuses submit proposals for research projects, and the state and private industry jointly fund the research. The research is carried out at the university by faculty members and their students. Each faculty member is responsible for obtaining a prior commitment from an industrial firm to support at least half the cost of the project. Cooperating companies designate a technical representative to serve as a liaison between the company and the university researchers.

Program Impact and Lessons

The operation of the MICRO program is based on a more "bottom-up" approach than most other research grant programs. The philosophy behind MICRO is centered on decentralization and entrepreneurialism. Individual faculty members must find industry sponsors themselves before submitting proposals, thus ensuring that projects reflect market demands and focus on topics that are ripe for investigation.

The program has been well received by industry and appears to be successful at linking efforts between state government, industry, and universities to support advanced research and education in high technology. These three constituent segments of the MICRO program appear to benefit equally. The selected university obtains financial support for its research and education missions. The faculty members and students gain access to expensive equipment and facilities which are usually only available in the sponsoring industry. Industry gets fresh and innovative ideas from the research and recruits graduate students who are well trained in the frontiers of microelectronics fields. The state of California benefits by helping to maintain its competitiveness in electronics, microelectronics, and computer science.

Although the results of research sponsored under MICRO are published openly, the participating industrial sponsors derive specific advantages by being closely associated with on-going projects and obtaining results of research several months prior to their publication in final form. Industry members have reported that through MICRO they were able to establish "unprecedented, fruitful cooperative efforts with university researchers," leading to interaction between industry and academia that would not have come about excepting for MICRO.

Name of Program and Government Agency

- State: California
- Metropolitan Region: Los Angeles
- Program: California Enterprise Zone Program

Program Purpose and Objectives

Enterprise Zones are specific geographic areas within the city of Los Angeles and elsewhere designated by the state to need added industrial and commercial expansion and investment. Five areas of Los Angeles, Pacoima, Central City, Greater Watts, San Pedro/Wilmington, and the Eastside have been designated Enterprise Zones under state legislation. The Enterprise Zone program offers reduced state taxes, reduced government regulation, and other incentives for firms that hire new employees or make new investments within the zones. The objectives of the program are to increase employment opportunities and to encourage investment in depressed areas.

The rationale behind the establishment of enterprise zones is that the reduction of government burdens on industry (such as taxes and regulation) can compensate for costs associated with operating businesses in distressed areas (such as high crime and less skilled labor).

Industrial Sector

No particular industrial sector is targeted in this program.

Classification of Objectives

The program's objectives can best be classified as regional development, social development, and small business assistance.

Ranking of Objectives

The primary purposes of the enterprise zones are to promote employment opportunities and encourage investment in distressed areas.

Classification of R&D Type

The program is more concerned with economic development than R&D.

Level of R&D Focus

The enterprise zones do not have an R&D focus.

Program Beneficiaries

For a community to be eligible to benefit from being designated an enterprise zone, it must pass three conditions:

- At least 51 percent of the population within the designated geographic area must meet certain low to moderate income conditions.
- At least 50 percent of the labor pool must reside within the area.
- The zone must receive the recommendation of the local City Council or governing agency.

For a business to be eligible to receive enterprise zone benefits, it must be located within the zone and have at least 50 percent of its payroll be residents within the zone.

Direct or Indirect Benefits

Businesses that hire employees or invest in enterprise zones receive substantial tax incentives and regulatory relief. Businesses that choose to construct facilities within a zone receive the assistance of various city departments in the form of priority servicing, conditional waivers, and expedited permit processing. Residents of enterprise zones often obtain access to more jobs and benefit from increased investment in the community.

General or Targeted Benefits

The program is generally available and not targeted to a specific sector.

Program Duration and Permanence

The Eastside Enterprise Zone was created along with 18 other enterprise zones in California in 1984. Two legislative acts established and continue to govern the designation and development of enterprise zones: (1) Assembly Bill (AB) 40, The Enterprise Zone Act (Assembly Member Nolan, R-Glendale); and (2) AB 514, The Employment and Economic Incentive Act (Assembly Member Waters, D-Los Angeles). The Eastside Enterprise Zone was established under the Waters Act, which requires more community participation and government intervention than the Nolan Act.

The 19 zones have a 15-year life span (those designated under the Waters Act have three renewable five-year terms) and are required by state law to be audited and evaluated every five years.

Types of Potential Subsidy Intervention/Form of Funding

The Eastside Enterprise Zone, along with all enterprise zones in California, receives federal, state, and local tax credits and regulatory relief. Incentives provided by the state include tax incentives related to property, sales, inventory, fixed asset or working-capital loan pools, loan guarantees, and tax credits for hiring new employees. The amount of allowable credits and deductions for individual businesses vary for each zone.

Local government investment incentives involve a comprehensive package of regulatory, tax and program incentives. Los Angeles has relaxed locally-oriented building codes and zoning laws, has reduced fees for building permits and local government services, and has established a streamlined permit process. Local tax incentives in the Eastside Enterprise Zone include the reduction of construction and business license taxes. Local programs for businesses within the zone include below prime rate financing, information on site location, and bookkeeping and marketing assistance.

Description of How Program is Funded/Amount of Funding

The federal and state governments do not provide direct monetary support to localities administering Enterprise Zones. In 1987, the California Franchise Tax Board cited \$1.6 million in tax credits had been provided to zone-participating businesses statewide. No analysis of foregone tax revenue or of the value of assistance provided by the city of Los Angeles has been conducted for the Eastside Enterprise Zone.

Provisions for Cost Recovery

There are no formal provisions for cost recovery since the intent of the program is to forego tax revenue to increase employment opportunities and to encourage investment in depressed areas.

Discrimination/Conditionality

For a community to be designated an enterprise zone, it must pass three conditions:

- At least 51 percent of the population within the designated geographic area must meet certain low to moderate income conditions.
- At least 50 percent of the labor pool must reside within the area.
- The zone must receive the recommendation of the local City Council or governing agency.

For a business to be eligible to receive enterprise zone benefits, it must be located within the zone and have at least 50 percent of its payroll reside within the zone.

Summary of Program's Administration and Operation

The Eastside Enterprise Zone is administered jointly by the Community Development Department of Los Angeles and the California Department of Commerce. There is a small staff headed by a manager who reports to the Los Angeles Industrial and Commercial Development Division. The enterprise zone staff provides business assistance to eligible businesses in the form of loan packaging, financial advising, business counseling, and referrals.

Program Impact and Lessons

Since the creation of the Eastside Enterprise Zone in 1986, no information has been collected documenting the zone's impact, and no study of lessons learned has been undertaken.

Name of Program and Government Agency

- State: California
- Metropolitan Region: San Francisco Bay Area
- Program: East Bay Small Business Development Center

Program Purpose and Objectives

The East Bay Small Business Development Center provides a broad array of services to small business owners and individuals starting businesses. The Center's goals are to assist in the development of small businesses by providing management assistance, business education and training, capital formation assistance, economic and business data dissemination, technical assistance, and technology transfer. The Center is organized to utilize services and resources from both the public and private sectors to meet the needs of small business at the local and regional levels. The Center is part of a statewide program that attempts to accomplish the following objectives:

- Provide direct, in-depth, one-on-one counseling, business conferences, and workshops to small business owners and entrepreneurs.
- Respond to local small business needs, demands, and economic development strategies.
- Utilize and target services and resources that will result in the creation and retention of jobs and increase local revenues.
- Promote and provide services to small businesses owned by special emphasis groups such as women and minority small business owners, as well as businesses located in economically distressed areas.
- Facilitate the transfer of new technological developments to the small business sector by linking R&D institutions to small business owners.
- Facilitate expansion into the international market by providing direct services and by linking export finance and assistance programs with small business owners.
- Develop the capacity to provide government procurement and private sector contract opportunities to small business owners.
- Provide the small business sector access to a statewide network of services, including a data base of services available to small businesses.
- Link federal, state, and local public and private funding sources and resources to develop local programs for small business development, and to avoid duplication.
- Provide information on and promote the development of small business incubators.

Industrial Sector

The Center's services are not restricted to specific industry sectors, but are available to all small business.

Classification of Objectives

The Center's objectives can best be classified as small business assistance and regional development.

Ranking of Objectives

The Center's primary objective is to provide counseling and technical assistance in all areas of business planning and management, finance and financial analysis, and marketing.

Classification of R&D Type

No R&D activities occur at the East Bay Small Business Development Center. The Center encourages linkages between small business and R&D institutions and promotes the adoption of off-the-shelf technologies.

Level of R&D Focus

The Center helps small business take advantage of recently developed technologies through technical training and technical assistance programs.

Program Beneficiaries

Small businesses in all industries located in and around Alameda County are the primary beneficiaries of the Center's activities. No restrictive conditions are placed on recipients.

Direct or Indirect Benefits

The Center focuses on directly benefiting small businesses and has not identified any indirect downstream beneficiaries. In FY 1988, the Center received 654 inquiries and provided counseling and technical assistance to 261 firms. The Center held 21 workshops of which 643 firms attended. The Center claims that as a consequence of its services 71 jobs were created and 71 retained in FY 1988 alone.

General or Targeted Benefits

The Center's services are generally available to firms in and around Alameda County.

Program Duration and Permanence

The East Bay Small Business Development Center in the Peralta Community College District was founded in 1985 by the U.S. Small Business Administration as a permanent program. In 1988, the state of California reestablished the California Small Business Development Center Program through the Office of California Community Colleges to offer additional support to the state's SBDC's.

Types of Potential Subsidy Intervention/Form of Funding

The Center receives its funding through grants from the U.S. Small Business Administration and the California SBDC Program. All state funds are from general tax revenue.

Description of How Program is Funded/Amount of Funding

The state of California contributed \$846,000 in FY1989 to be split among four SBDC's. The East Bay SBDC receives \$150,000 each year and received \$150,000 in FY1989.

Provisions for Cost Recovery

Nominal fees are sometimes charged for expenses incurred for business conferences and training workshops. Otherwise, there are no provisions to recover costs.

Discrimination/Conditionality

The Center's services are restricted to businesses located within Alameda County and neighboring counties who employ less than 50 people. All industry sectors from research to manufacturing to services are eligible to receive assistance.

Summary of Program's Administration and Operation

The East Bay Small Business Development Center was established under the guidelines of the U.S. Small Business Development Center Program in 1985. The Center has one full-time manager, two part-time business counselors, and one full-time administrative assistant. The

Center has an advisory board consisting of representatives from small business, finance, the local chamber of commerce, education, and government.

Program Impact and Lessons

The Center's director emphasized the importance of first identifying the needs of the local area and then determining how an SBDC can tailor its services to fit in the whole network of resource delivery. The California Department of Commerce attempts to monitor the number of jobs created and retained through state programs but does not keep data on the East Bay SBDC specifically.

Name of Program and Government Agency

- State: California
- Metropolitan Region: San Diego
- Program: San Diego Economic Development Corporation

Program Purpose and Objectives

The San Diego Economic Development Corporation is a partnership between business and government designed to promote the economic vitality of the San Diego region, to assist in the creation of employment opportunities, support economic growth, diversification and capital investment, and to address issues that affect the local economy.

Industrial Sector

EDC does not target specific industry sectors.

Classification of Objectives

EDC's primary objective is to help create an economic environment favorable to the growth and expansion of new and existing companies in San Diego County.

Ranking of Objectives

EDC has multiple objectives that are not ranked in terms of importance: attracting new companies, helping existing companies, encouraging the formation of new enterprises, and promoting a diversified economy.

Classification of R&D Type

No R&D activities occur under the aegis of EDC. EDC does, however, involve itself in attracting, assisting, and encouraging new high-technology corporations.

Level of R&D Focus

EDC does not concern itself with R&D activities, but does maintain a listing of available R&D space for corporate site-selection purposes.

Program Beneficiaries

Program beneficiaries include both foreign and domestic firms that seek information about and assistance in locating in San Diego. In FY 1989, EDC staff worked with 128 companies, responded to 166 company inquiries about San Diego County, and answered 3,370 research inquiries.

Direct or Indirect Benefits

Local businesses may have also benefited from an EDC campaign called "There's no Place Like Home," in which EDC encourages local companies to purchase goods and services from within San Diego County.

General or Targeted Benefits

EDC's services are generally available to all industry sectors.

Program Duration and Permanence

In 1975 EDC separated from the San Diego Chamber of Commerce and was established as a nonprofit organization. EDC continues to evolve and reflect the changing needs of the local economy, but its overall mission has not changed significantly.

Types of Potential Subsidy Intervention/Form of Funding

EDC provides networking, publication, and site location services free of charge to companies from all sectors. Revenues are received from the City and County of San Diego, the San Diego Unified Port District, membership dues, and publication sales.

Description of How Program is Funded/Amount of Funding

EDC Revenues are derived from the following sources:

Source	1988 (\$)	1989 (\$)
City of San Diego	394,200	435,000
County of San Diego	40,000	30,000
San Diego Unified Port District	82,500	82,500
Membership dues	261,154	245,850
Publication sales	72,080	56,527

Provisions for Cost Recovery

There are no provisions for or expectations of cost recovery. Local business, however, provides nearly 30 percent of the program's budget, and publication sales constitute six percent of revenue. No fees are charged for EDC services.

Discrimination/Conditionality

All sectors are eligible to receive EDC services.

Summary of Program's Administration and Operation

EDC is a nonprofit partnership between business and local government. Operating under the guidance of a Board of Directors composed of local business leaders, EDC supports a president, three vice presidents, a director, an office manager, and two support staff. Funding is received from the City of San Diego, the County of San Diego, the San Diego Unified Port District, business memberships, and from the sale of publications.

Program Impact and Lessons

No formal studies have been conducted to evaluate the impact of EDC's efforts. However, EDC in FY1989 worked with 128 companies, responded to 166 company inquiries about San Diego County, published five reports on San Diego, and answered 3,370 research inquiries.

CALIFORNIA

Competitive Technology Program
Department of Commerce
Mr. Thomas Walters, Director
Ms. Anne Sheehan, Deputy Directory
200 East Del Mar, Suite 206
Pasadena, CA 91107
(818) 568-9437

California Council on Science and Technology
Mr. L. Donald Shields, Director
Arnold and Mabel Beckman Court
National Academy of Science and Engineering
100 Academy Drive
Irvine, CA 92715
(714) 854-4150

Biotechnology Research and Education
Program
University of California
Dr. Susan Huttner, Assistant Director
405 Hilgard Avenue, MBI (UCLA)
Los Angeles, CA 90024-1570
(213) 825-4321

San Diego Economic Development
Corporation
Mr. Daniel Pegg, President
701 B Street, Suite 1850
San Diego, CA 92101
(619) 234-8484

Microelectronics Innovation and Research
Opportunities Program (MICRO)
University of California
Dr. C.R. Viswanathan, MICRO Executive
Committee
7514 Boelter Hall, UCLA
Los Angeles, CA 90024
(213) 825-5214

Economic Development Network (Ed<Net)
State Community Colleges
Ms. Joan Leonard, Director
1805 North Fine Street
Suite 104
Fresno, CA 93727
(800) 344-3812

Supplier Improvement Program
Department of Commerce
Office of Business Development
Ms. Janet Turner
(916) 322-5665

East Bay Small Business Development Center
Ms. Selma Taylor, Director
2201 Broadway, Suite 814
Oakland, CA 94612
(415) 893-4114

California Energy Technology Export
Program
California Energy Commission
Energy Resources
Mr. Tim Olsen, Program Manager
Mr. Ruben Tavares
(916) 324-3422

Assembly Committee on Economic
Development, International Trade and
Technologies
State Legislature
Ms. Diane Rude, Committee Consultant
1100 J Street, Suite 404
Sacramento, CA (916) 445-0424

Joint Committee for Science and Technology
State Legislature
Ms. Masako Dolan
(916) 324-4707

Community Development Department
City of Los Angeles
Ms. Margaret Gonzalez
215 W. Sixth Street, 3rd Floor
Los Angeles, CA 90014
(213) 485-4767

IV. FLORIDA

Florida has a relatively modest set of science and technology initiatives compared to other states of similar size in this study.(please see Figure 4 for organizational chart of state activities). The Florida High Technology and Industry Council, wielding both advisory and operating responsibilities, constitutes the state's main technology effort. The Council, comprised of 23 members appointed by the Governor, was created in 1984 to promote development of the state economy through high technology. The Council administers and supports the following programs:

The Applied Research Grants Program. This Program is designed to establish new relationships among Florida's academic institutions and private industry, create new advanced technology enterprises, improve the competitiveness of technology-oriented companies, increase cooperation among university researchers, and contribute to a technologically-skilled workforce. The Grants Program awards funds, usually for five years, to university faculty who obtain federal or industry matching grants to conduct research that has commercialization potential. To date, the State has invested a total of \$20.5 million over six years, while industry and federal matching contributions total \$35.8 million.

The Centers for Electronic Specialization Program. A partnership with Florida community colleges, the University of South Florida, and private industry, each of 16 Centers receive special education packages and equipment, along with industry support, to conduct hands-on training in the fields of Computer-Integrated Manufacturing, Computer Electronics, Computer Servicing, and Automotive Electronics. A separate program called the Electronic Emphasis offers a more general electronics training program. Each Center is located within a Florida postsecondary institution and is guided by an advisory council made up of industry representatives.

An additional program, operating through the Department of Commerce, is the Product Innovation Center. Working with businesses early in their conceptual stages, the Center helps identify, analyze, and match innovations and new products with existing Florida industry needs and assists inventors in converting their products into sales. The Center works closely with federal and state government resources, universities, and private-sector organizations, including venture capital clubs, inventor's societies, and high technology firms.

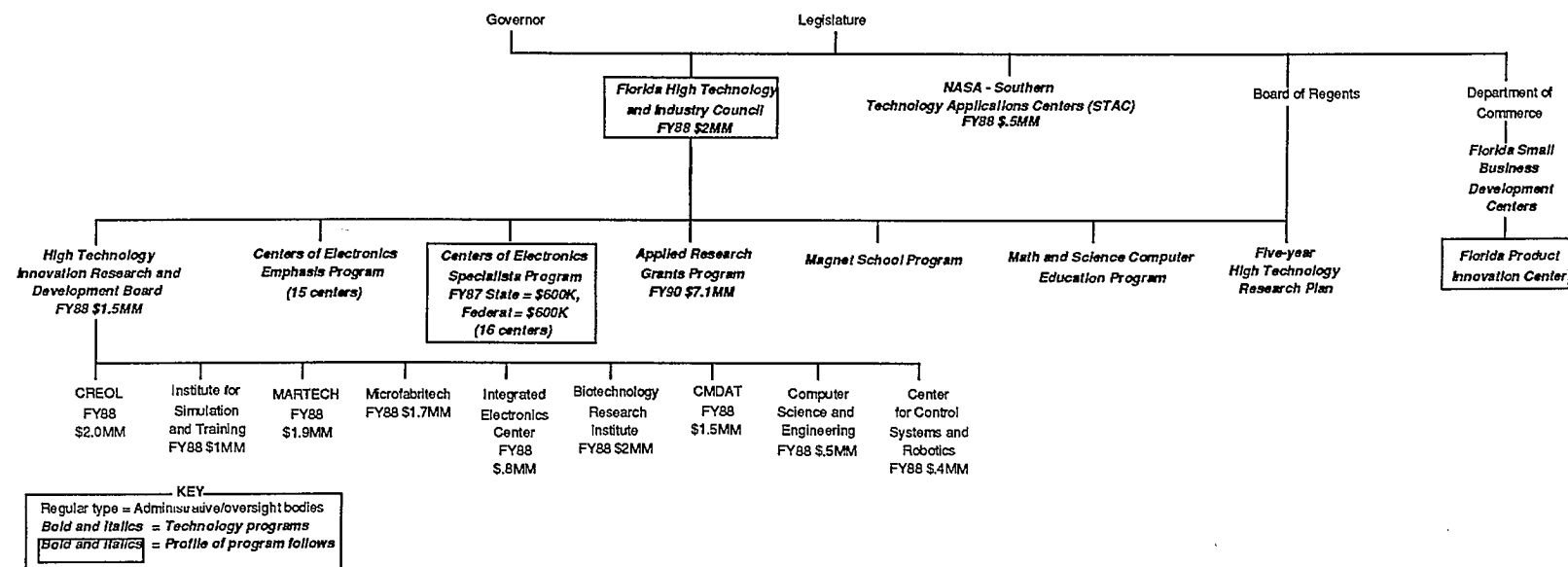


FIGURE 4. ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: FLORIDA

Name of Program and Government Agency

- State: Florida
- Program: Centers of Electronic Specialization

Program Purpose and Objectives

The Centers of Electronic Specialization is a partnership program developed by the Florida High Technology and Industry Council, the Florida State Legislature, Florida community colleges, the University of South Florida, and private industry. The Centers receive matching industry funds to provide hands-on, industry-based training in advanced or specialized electronics areas. Another program, called Centers of Electronic Emphasis, offers a more general electronics training program. The 11 Centers of Electronic Specialization were created in 1987, and five additional Centers of Automotive Electronics were initiated in 1988.

The Centers of Electronic Specialization are designed to provide industry with qualified, highly-skilled workers in the fields of Computer-Integrated Manufacturing, Computer Electronics, Computer Servicing, and Autotronics.

Industrial Sector

The Centers target the fields of Automotive Electronics, Computer-Integrated Manufacturing, Computer Servicing, and Computer Electronics.

Classification of Objectives

The Centers' objectives can best be classified as sectoral development of the electronics sector.

Ranking of Objectives

The primary objective of the Centers is to graduate highly trained and skilled electronics specialists to better serve the needs of Florida's electronics and manufacturing industries.

Classification of R&D Type

Funding is targeted toward providing technical training for technicians to better use available off-the-shelf electronics technologies.

Level of R&D Focus

The Centers focus on already-commercialized technologies.

Program Beneficiaries

Direct beneficiaries include firms in a wide variety of technology-intensive fields that hire graduates from the Centers. Though not required to begin employment with firms who are sponsors of the Centers, 88 percent of the graduates who are employed in electronics are employed in either the field they studied or in a closely related field.

Direct or Indirect Benefits

After the Centers' first year in operation, the Florida High Technology and Industry Council estimates that the 100 graduates will contribute \$1.8 million to the state's economy in gross wages.

General or Targeted Benefits

The Centers are teaching skills that will benefit the computer, manufacturing, and automotive industries in Florida. Sponsoring firms in a variety of fields also benefit through their exposure to Center graduates.

Program Duration and Permanence

The first centers were created in 1987 and the state will eventually have centers at each of 91 electronics programs at Florida's postsecondary schools.

Types of Potential Subsidy Intervention/Form of Funding

The Centers are subsidized directly by the state, and therefore would be considered a service that is provided below market cost. The Centers also receive federal and industry funding.

Description of How Program is Funded/Amount of Funding

The Centers received initial funding through the Florida legislature and are operated and administered by Florida postsecondary education institutions. In 1987, the state provided a one-time grant of \$600,000 and the federal government provided an additional \$600,000 to start up

the program. Between 1987 and 1988, local industry support has totaled \$975,000. Private sector funding represents 81 percent of the amount of public sector funding.

Provisions for Cost Recovery

There are no formal provisions for cost recovery for state and federal expenditures for the Centers.

Discrimination/Conditionality

The Centers have a nondiscrimination policy.

Summary of Program's Administration and Operation

Each Center is located within a Florida postsecondary education institution and is guided by a local advisory council made up of industry representatives. The Centers of Electronic Specialization use a standardized, turnkey education package that integrates classroom instruction with state-of-the-art equipment and facilities. Postsecondary institutions selected to be developed into Centers of Electronic Specialization were chosen through a competitive application procedure based upon the strength of their traditional electronics program, adequacy of facilities and equipment, strength of the instructional staff, and potential for student placement.

Program Impact and Lessons

Preliminary data shows that a 92 percent rate of employment and/or advanced training can be expected from program graduates, which is relatively high. The dropout rate so far has been a relatively low six percent. Program graduates are earning on average more than 66 percent above minimum wage, and each year the Centers return to the state's economy roughly \$1.8 million in the form of gross wages.

Name of Program and Government Agency

- State: Florida
- Program: Applied Research Grants, Florida High Technology & Industry Council Program

Program Purpose and Objectives

As part of a state initiative designed to diversify the Florida economy, the Florida High Technology and Industry Council (FHTIC) was created by Executive Order in 1984. The Council's Applied Research Grants Program is a peer-reviewed, university based grants program designed to support the development and application of advanced technology initiatives in the following areas:

- Biomedical Devices
- Biotechnology
- Computer Integrated Engineering/Manufacturing
- Electrooptics and Lightwave
- Microelectronics and Materials
- Simulation and Training
- Software and Computer Science.

The Applied Research Grants Program is designed to establish new relationships among Florida's academic institutions and private industry, create new advanced technology enterprises, improve the competitiveness of technology-oriented companies, increase cooperation among university researchers, and develop a technologically skilled workforce.

Industrial Sector

The program is directed at seven technology fields:

- Biomedical Devices
- Biotechnology
- Computer Integrated Engineering and Manufacturing
- Electrooptics and Lightwave Technology
- Microelectronics and Related Materials
- Simulation and Training
- Software and Computer Science.

Classification of Objectives

The program has two primary goals: building the state's graduate research infrastructure, and developing public-private research linkages. More specific goals, as formulated in the program's first "request for proposals", are to:

- Enhance the quality of graduate research in seven targeted technology areas by providing seed money to the most qualified university researchers in the state as determined by peer review.
- Fund university applied research which supports Florida industry and results in the enhancement/implementation of a "product" or "process" for/by industry.
- Encourage cooperation and collaboration among university researchers throughout the state.
- Transfer newly developed technology from the university to industry through industry mentors, reports and reviews, and hiring of graduate students.
- Leverage state revenue for industrial and federal research funding as direct project matching funds.
- Increase the number of Florida university graduates available to Florida high-technology industries.
- Enhance the magnitude of federal research support coming to Florida universities.
- Enhance the overall image of Florida's research community at the national level.

Ranking of Objectives

This program only offers applied research and development grants and, therefore, does not have competing objectives.

Classification of R&D Type

Funding is directed only toward applied research and development in seven selected fields.

Level of R&D Focus

This program is aimed at creating new vehicles for applied R&D through industry-university partnerships, and the leveraging of federal and private funding.

Program Beneficiaries

Eligible beneficiaries include all public and private Florida universities. FHTIC does not retain the rights to technology developed or knowledge gained as a result of its research grants.

Direct or Indirect Benefits

The following are some of the benefits of the program:

- Eight new company "spin-offs" and over 35 products have been realized to date.
- Over 28 patents have been issued and some 54 additional patents are currently pending.
- Matching funds in the amount of \$35.8 million have been generated, leveraging \$1.75 for every dollar spent.
- Over 1,400 publications/presentations have been published.
- Over 250 faculty members and 600 graduate students have received FHTIC grants.

General or Targeted Benefits

The program is targeted toward applied research in the following fields:

- Biomedical Devices
- Biotechnology
- Computer Integrated Engineering and Manufacturing
- Electrooptics and Lightwave Technology
- Microelectronics and Related Materials
- Simulation and Training
- Software and Computer Science.

Research results are publicly available as governed by individual university policies.

Program Duration and Permanence

The program began in October of 1984, and is considered a permanent institution.

Types of Potential Subsidy Intervention/Form of Funding

The funding vehicles for the program are grants and matching grants.

Description of How Program is Funded/Amount of Funding

The program is funded by state general tax revenue, with matching funds from universities, industry, and federal sources.

Total funds granted for the last six years, beginning in 1986, have been \$1.4 million, \$3.6 million, \$3.8 million, \$4.6 million, \$7.1 million, \$11.0 million, respectively. The cumulative state investment totals \$20.5 million, with \$35.8 million in industry and federal matching funds, and \$7.4 million in cumulative university matching funds.

Provisions for Cost Recovery

There is no formal provision for cost recovery of state government expenditures for the program, although multi-year grants require matching funds.

Discrimination/Conditionality

The program does not discriminate on the basis of nonneutral criteria. All proposals are reviewed by in-state and out-of-state peers.

Summary of Program's Administration and Operation

The FHTIC has a full-time director, is composed of 23 members, including the Governor, and meets quarterly. The FHTIC Research Committee is composed of the chair and vice chair from each of the seven Science and Technology Standing Subcommittees—each subcommittee being responsible for one of the seven technology fields. The subcommittees review the Applied Research Grant proposals, and select projects for funding.

Proposals are received for two types of grants:

- Planning grants: A one year grant to develop a new concept for implementation in the commercial marketplace. Funding is limited to \$20,000.
- Operational grants: This can be a multiyear program, requiring matching funds, which takes a mature concept and allows development at an average \$50,000 per year for commercialization

Program Impact and Lessons

Some of the results of the program include the following:

- Eight new company "spin-offs" and over 35 products have been realized to date.
- Over 28 patents have been issued and some 54 additional patents are currently pending.
- Matching funds in the amount of \$35.8 million have been generated, leveraging \$1.75 for every dollar spent.
- Over 1,400 publications/presentations have been published.
- Over 250 faculty members and 600 graduate students have received FHTIC grants.

The FHTIC Legislative Report Committee has reviewed all aspects of the Applied Research Grants Program and has concluded that the program has made a positive impact on Florida's research infrastructure, and technology and economic base.

It has been suggested that the program periodically review the seven selected research areas to ensure that:

- Research on defense applications is not over emphasized
- The state is ready to support emerging, new fields and sub fields as they come into being.

Name of Program and Government Agency

- State: Florida
- Program: Florida Product Innovation Center

Program Purpose and Objectives

The Product Innovation Center provides small business inventors and entrepreneurs with technical and market feasibility assessments. By working with businesses early in their conceptual stages, the Center can both promote their technologies and avoid unnecessary expenditures on ideas which do not have commercial application. Operating from an office in Alachua, the FPIC identifies, analyzes, and matches innovations and new products with existing Florida industry needs and assists inventors in converting their products into sales.

The FPIC works closely with federal and state government resources, universities, and private-sector organizations including venture capital clubs, inventor's societies, and high-technology firms.

Industrial Sector

FPIC services are not restricted to specific industry sectors, however, in 1990 the Center began placing special emphasis on assisting entrepreneurs with energy related products.

Classification of Objectives

The Center's objectives can best be classified as assisting small businesses with product development.

Ranking of Objectives

The goals and objectives of the FPIC are:

- To assist inventors/entrepreneurs with technical market feasibility studies.
- To match Florida manufacturers/marketers with new product lines.
- To link capital sources with pre-screened ideas and with qualified investment enhanced by Small Business Innovation Research grants and management/technical services.

Classification of R&D Type

The FPIC does not support R&D per se, but does assist in the commercialization of new technologies.

Level of R&D Focus

The FPIC focuses on commercializing and marketing new technologies and products.

Program Beneficiaries

Serving as the primary contact for innovation and technology transfer in Florida, the FPIC makes referrals to venture capitalists, manufacturers, legal and business consultants, and researchers throughout the state. In 1988, more than 450 inventors and entrepreneurs received more than 1,950 hours of counseling from the FPIC. In addition, 23 training programs were held throughout Florida to assist inventors in turning their ideas into dollars.

Direct or Indirect Benefits

Entrepreneurs and inventors benefit directly from the FPIC's services, and the intent is that the state as a whole will benefit indirectly from an increased rate of innovation and the diffusion of new product technologies.

General or Targeted Benefits

The Center's services are generally available to inventors and entrepreneurs in all fields and small businesses in all sectors. A special emphasis has been placed on assisting inventors with products that might have energy-saving applications.

Program Duration and Permanence

The Center evolved out of the Florida Small Business Development Centers Program in 1986, and is now a permanent program.

Types of Potential Subsidy Intervention/Form of Funding

The FPIC offers a variety of services to inventors and entrepreneurs, including legal advice, business planning, financial planning, management consulting, networking services, and technical assistance.

Description of How Program is Funded/Amount of Funding

The FPIC is funded jointly by the state and the federal government. The U.S. Small Business Administration offers an annual \$50,000 grant which is matched by funds from a combination of the Florida State University System and the Florida Department of Energy, for a total annual budget of roughly \$100,000.

Provisions for Cost Recovery

In 1990, the FPIC just began to charge nominal fees for services rendered. A technical assistance session costs \$100 and participation in a workshop costs \$15 per participant. These fees constitute only partial cost recovery.

Discrimination/Conditionality

Any entrepreneur or inventor who is a resident of Florida is eligible to receive FPIC services. High priority is given to energy products, otherwise, all potential products and inventions are considered on a first-come first-serve basis.

Summary of Program's Administration and Operation

The FPIC is a component of the Florida Small Business Development Center Program. The FPIC receives funding from the U.S. Small Business Administration, the Florida State System of Higher Education, and the Florida Department of Energy. The FPIC works closely with federal and state government resources, universities, and private-sector organizations including venture capital clubs, inventor's societies, and high-technology firms. With two full-time staff and one part-time staff, the FPIC also enlists the services of 25 volunteers to conduct technical evaluations and consulting.

Program Impact and Lessons

No formal studies or evaluations have been conducted of the FPIC, and many descriptions of the Center's impact are anecdotal in nature. The FPIC assists over 400 people a year, but does not actively track the progress of entrepreneurs and inventors after they receive assistance.

One fundamental challenge facing the Center is trying to meet increasing demand for services while funding levels have remained fairly constant. Presently, new sources of federal, state, and private money are being sought.

Name of Program and Government Agency

- State: Florida
- Metropolitan Region: Miami-Dade County
- Program: Center for Health Technologies for Research, Development, Design, Management and Training

Program Purpose and Objectives

The primary objective of the Center for Health Technologies is the creation of jobs and new businesses in the area of biomedical devices. The Center has future plans to target the biotechnology, pharmaceutical, and health-care delivery systems industries. It seeks to accomplish these goals by developing nationally and internationally significant health-technology industries in the Miami area. CHT functions include:

- Coordinating technology development and transfer
- Assisting in grant applications
- Providing shared technical services
- Incubating small companies
- Promoting, leading, and serving the health technology industry.

Industrial Sector

The initial focus of CHT is in the area of biomedical devices and instruments, such as permanently implantable and temporary therapeutic devices, and diagnostic instruments. The center later plans to expand into biotechnology, pharmaceutical, and health-care delivery systems.

Classification of Objectives

Objectives can be classified as research and development, sectoral development (health care technologies), regional development (South Florida), and small business assistance.

Ranking of Objectives

The center's most important objectives are regional development and sectoral development.

Classification of R&D Type

The center's incubator plans to house firms mostly in the advanced stages of R&D and aiming to create a new product, although service-oriented firms will be considered.

Level of R&D Focus

The center does not target any specific level of R&D. Referral services will be provided to firms seeking other companies in the health technology field that conduct a broad range of R&D activities. Incubator occupants will generally be conducting applied R&D leading to commercialization, rather than new R&D activities.

Program Beneficiaries

Principal program beneficiaries will be scientific and technical entrepreneurs in South Florida who have commercially intellectual property. Also, existing local medical technology firms can diversify their product lines with reduced risks. South Florida universities will benefit from increased research royalties, easier recruitment contributing to improved faculty, better trained graduate students, and better equipment.

Direct or Indirect Benefits

Direct benefits are a stronger health technology industry and entrepreneurial base in the state, availability of new health products, and the creation of new jobs. Indirect benefits include an improved research infrastructure in South Florida universities, a stronger regional economy, increased tax revenues, and better patient health care at lower costs.

General or Targeted Benefits

For the most part, benefits are targeted toward the medical technology sector. Initial efforts are focusing on biomedical devices. Future plans include expanding into pharmaceuticals and biotechnology.

Program Duration and Permanence

CHT was appropriated state money in 1990 and started operation in September of that year. This money must be reappropriated for the program to continue. The center is currently housed in a facility owned by the City of Miami.

Types of Potential Subsidy Intervention/Form of Funding

At this point in time, CHT does not provide monetary assistance in any form. It runs a referral service and operates the incubator, which provide at-cost services.

Description of How Program is Funded/Amount of Funding

CHT received a 1990 appropriation of \$350,000 from the state's general tax revenues. The money is appropriated through the state university system's budget. CHT has received another \$15,000 from local private businesses. The City of Miami provides CHT's facility at a token cost of \$1 a year. CHT also receives public relations, accounting and legal services at cost. While CHT will refer small businesses to service providers, the companies themselves must negotiate their own deals with the providers.

Provisions for Cost Recovery

There are no specific provisions for cost recovery at this time.

Discrimination/Conditionality

The main condition for use of CHT services, or participation in the incubator, is that the company operate within the medical technology field, specifically the biomedical field in the first few years of operation. Further restrictions may emerge as CHT develops criteria for participation in the incubator.

Summary of program's Administration and Operation

CHT's staff includes the president, vice-president, and a few support staff members. This staff runs day-to-day operations and makes recommendations to a volunteer board of directors. Participants in the incubator program will be selected by a review panel. However, CHT has yet to appoint the panel and has not yet developed selection criteria for participation in the incubator.

Program Impact and Lessons

Because CHT has just started operations, most of the lessons learned focus on starting a technology center. CHT's vice-president noted a few key lessons. First, it is important to coordinate a large group of diverse players, including public and private officials. Timing is also critical. This requires getting the right players in the right place at the right time (CHT's first \$350,000 appropriation was vetoed by the governor). Follow-up is very important to maintain continuity and keep various players on the team and involved. It also helps to have a "champion" who will hold the players together and who will work with the bureaucracy to find support. Finally, administrators with a business background are valuable because they appreciate and understand the difficulties of start-ups and small businesses.

Name of Program and Government Agency

- State: Florida
- Metropolitan Region: Orlando
- Program: Southern Technology Applications Center

Program Purpose and Objectives

One of STAC's key objectives is to move technology to the marketplace to support regional economic development. There are six STAC offices in Florida operating through the University of Florida system. The Orlando office, affiliated with the University of Central Florida, provides technology transfer and applications services to the private sector in the central Florida region.

STAC achieves the above goal by conveying knowledge, technologies, and value-added assistance to central Florida businesses. STAC's chief emphasis is on automated information research, interpretation, and evaluation. But STAC also offers a variety of other services, including NASA technology transfer assistance, space commercialization assistance, market research, feasibility studies, competitive analyses, product patentability assessments, and trademark research.

Industrial Sector

STAC does not limit its services to any particular industrial sector. Its largest client base is in the electronic optics and lasers, simulation and training, and space technologies sectors. STAC also serves clients in the biomedical and biotechnology sectors, agriculture, medicine, and other sectors.

Classification of Objectives

Program objectives can be classified as technology transfer, regional development, and small and medium-sized business assistance. Research and development is not an objective as STAC seeks to transfer already developed technologies to the private sector.

Ranking of Objectives

The most important program objective is technology transfer. It is believed that successful technology transfer will support regional development and assist small and medium businesses.

Classification of R&D Type

STAC does not seek to advance research and development. Rather it promotes the transfer of developed technologies from government labs to the private sector. However, companies may use STAC-provided information in their own research and development.

Level of R&D Focus

STAC does not seek to advance research and development. However, STAC information may indirectly determine private company R&D activities.

Program Beneficiaries

Principal program beneficiaries are private sector companies, particularly small and medium businesses. STAC services enable these businesses to become more efficient by providing them with useful information about markets for various products. There are also regional economic benefits to the 10-county area served by the Orlando STAC office. Additionally, NASA benefits from the positive public relations that results from STAC activities. The state universities benefit when STAC services lead to a licensing agreement for the participating university.

Direct or Indirect Benefits

Direct and indirect benefits are very difficult to gauge because STAC typically provides information and can not easily evaluate how this information is used. STAC tends to provide direct benefits in marketing, facilitating more efficient business operations. Most benefits are indirect, including business development, job creation, and regional development.

General or Targeted Benefits

Benefits are general as STAC services are widely available.

Program Duration and Permanence

STAC has been operating for 12 years and is going strong. Its survival is largely contingent on contract money earned from its clients. Originally providing information on NASA developed technologies and research, STAC has expanded its services to include other government agencies and additional technical data bases.

Types of Potential Subsidy Intervention/Form of Funding

STAC's principal funding vehicle is client contracts.

Description of How Program is Funded/Amount of Funding

In addition to client contracts, STAC also receives money from the state and federal governments. STAC's total annual budget is about \$1.5 million, distributed fairly evenly between private, state, and federal sources. The estimated \$500,000 provided by the state is appropriated through the state universities. Most of the money is appropriated through a line item in the budget of the Engineering Industrial and Experiment Station, which is part of the University of Florida's College of Engineering. The rest of the state money is appropriated through the state university associated with each regional office. Most of the federal money is provided through a contract with NASA under the Technology Utilization Program, which makes funds available for industrial application centers, such as STAC.

All STAC money is pooled into one fund at the central office and then apportioned to the separate regional offices according to annual budget requests. The Orlando regional office's annual budget ranges between \$80,000 and \$110,000, the latter being its anticipated budget for 1990. The University of Central Florida's College of Engineering provides the Orlando office in-kind office space and utilities (excluding phone) and a part-time secretary.

Provisions for Cost Recovery

As a nonprofit, STAC provides services at cost to its clients.

Discrimination/Conditionality

STAC services are not directly restricted, although given its focus on technical research and technology transfer, it serves a somewhat limited clientele.

Summary of Program's Administration and Operation

Regional offices are overseen by the headquarter office, although each is largely autonomous in its day-to-day operations. The headquarters administers the contracts with the federal agencies, but the regional offices develop their own budgets and solicit and serve their own clienteles. An annual report is made to a 13-member advisory committee, comprised of the STAC director,

the dean's of the state universities affiliated with each of the regional offices, and NASA representatives.

Program Impact and Lessons

One STAC administrator said the program has had a major impact and the office is clearly achieving its goals. Despite cynicism that inevitably arises when working with the government bureaucracy, he said that the program demonstrates there are good uses for federal dollars. While pleased with the success of the program, he said it has not reached its full potential and would benefit from better promotion. He said STAC clients react as if the information they receive is a "gift from heaven," convincing him that more people could use STAC services, to the benefit of the regional and state economies.

FLORIDA

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Executive Office of the Governor, The
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NASA Southern Technology
Applications Center (STAC)
College of Engineering and Applied
Sciences
Ms. Adriana Cantillo, Director
State University System of Florida
Miami, FL 33199
(305) 348-3039

Product Innovation Center
Ms. Pamela H. Riddle, Director
The Progress Center
One Progress Boulevard, Box 7
Alachura, FL 32615
(904) 462-3942

Entrepreneurship Program
Mr. James Hosler
Florida Department of Commerce
107 West Gaines Street
Tallahassee, FL 32399
(904) 488-9357

Florida Economic Development Center
Florida Entrepreneurial Network
Mr. Roy Thompson
335 College of Business
Florida State University
Tallahassee, FL 32306
(904) 644-1044

Florida Small Business Development
Centers
Mr. Gregory Higgins
University of West Florida
Pensacola, FL 32514
(904) 474-3016

Center for Health Technologies
Mr. Larry Bobo, Director
1145 NW Eleventh Street, Suite 126
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V. ILLINOIS

The Governor's Commission on Science and Technology is the state-wide science and technology agency for the State of Illinois. The Commission consists of about forty university, industry, business, labor, and government leaders who develop long-range plans, provide a forum for ideas, and make recommendations for new programs to support the advancement of technology in the state.

Organizationally, the Commission operates within the Department of Commerce and Community Affairs (please see Figure 5). The Department, through the Commission, administers virtually all the state's research and technology development programs. These include a number of grant, loan, and capital investment programs, the recipients of which are academic institutions, nonprofit research institutes, and private businesses (especially small firms) as well as individual researchers within them.

There are thirteen Technology Commercialization Centers located on university campuses and in two federal laboratories throughout the state but these Centers receive their core funding from the Board of Higher Education budget rather than the economic development budget of the Department. Also supported through the higher education budget is the Illinois Resources Network, an on-line information and retrieval service containing faculty and federal research specialist profiles from 12 universities and four federal research laboratories in Illinois.

As in most states, there are a number of research and technology development centers, technology transfer and commercialization centers, and technical and business assistance centers in Illinois' public and private universities. Funding sources may include state and federal governments, the business and industry sectors, and the universities themselves as well as affiliate fees, cooperative research fees, and fees for services.

Among the examples of special approaches within the Illinois research institutions are ARCH and CAMP. ARCH Development Corporation is a not-for-profit corporation formed by Argonne National Laboratory and The University of Chicago to take title to and license, or otherwise commercialize, inventions developed at both institutions. The Center for Advanced Manufacturing and Production (CAMP) at Southern Illinois University at Edwardsville is a mechanism through which industry and business in Illinois access faculty expertise and university facilities and

equipment to assist in the research and development of new ideas in manufacturing and production process technologies.

Most of the Department of Commerce and Community Affairs' research and technology development programs are administered by its Small Business Assistance Bureau. Only its Modernization Assessment Grant Program is not operated by the Bureau. The Illinois Technology Transfer and Commercialization Program (I-TEC) was formed in 1987 to encourage research and development in new and advanced technologies which can be commercialized by, or transferred to, an Illinois business. I-TEC consists of several separate programs, some of which were in existence before being incorporated into I-TEC:

- Technology Challenge Grant Program
- Technology Information Transfer Grant Program
- Technology Commercialization Centers Program
- Business Innovation Fund
- Equity Investment Fund.

The Finance Division of the SBA Bureau operates two research and technology development programs:

- Technology Venture Investment Program
- Small Business Incubator Program.

In addition to the Department's activities, the Illinois Department of Treasury administers a small Venture Fund.

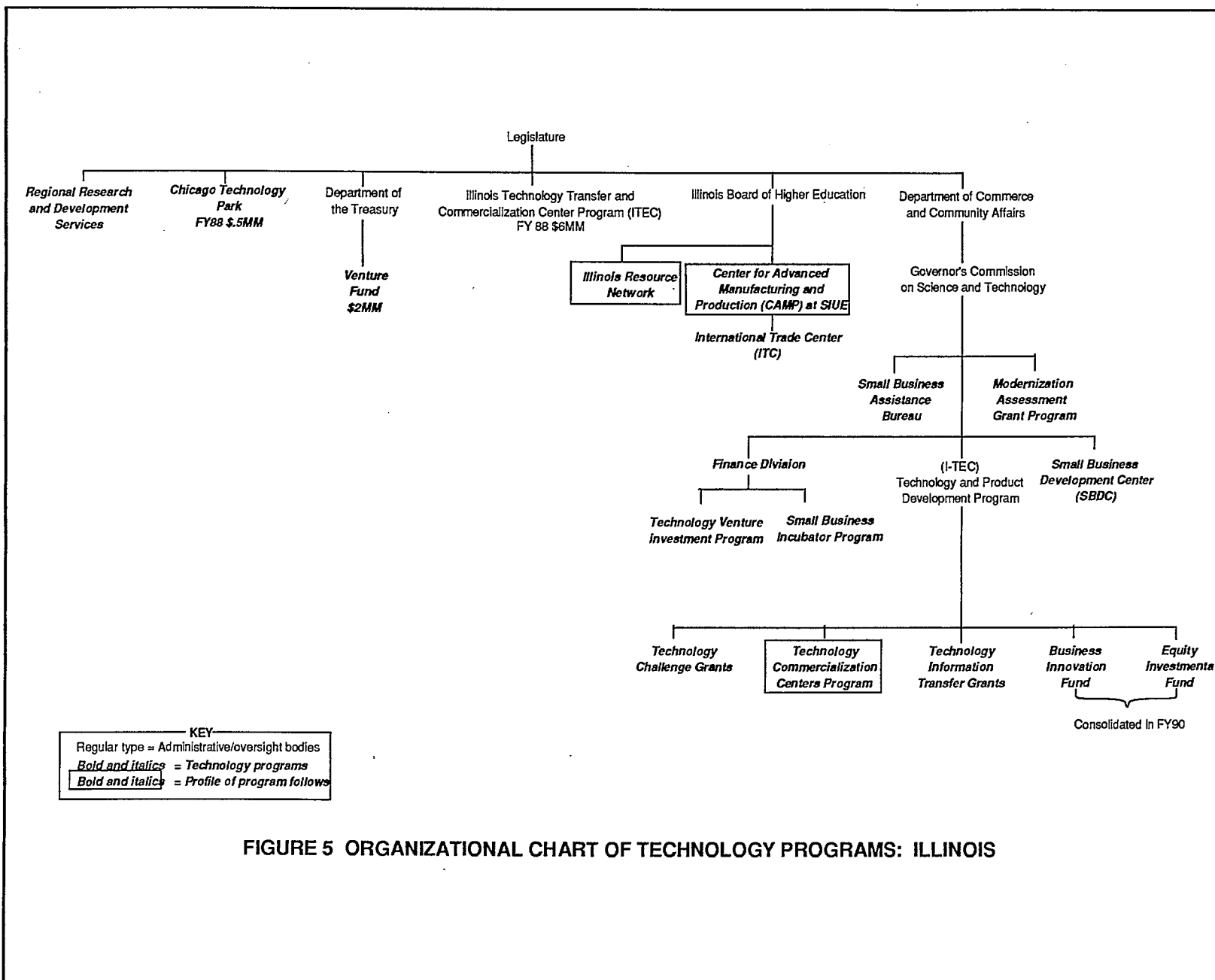


FIGURE 5 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: ILLINOIS

Name of Program and Government Agency

- State: Illinois
- Program: Center for Advanced Manufacturing and Production, Southern Illinois University at Edwardsville

Program Purpose and Objectives

The Center for Advanced Manufacturing and Production (CAMP) at Southern Illinois University at Edwardsville (SIUE) was established in 1985. The purpose of the Center is to assist Illinois industry and business in the research and development of new ideas in manufacturing and production process technologies and in the application of existing technologies to specific manufacturing and production processes.

CAMP is the institutional mechanism by which the manufacturing and production industry can access faculty and researcher resources, laboratory facilities, and equipment of the Schools of Engineering, Science, and Business at SIUE (as well as other academic institutions and federal laboratories throughout the state) for advice and assistance. A small core staff does the initial screening and assessment and draws on these resources.

The Center provides process technology development assistance; technical, managerial, and marketing advice; and training and retraining assistance. Specifically, CAMP provides the following services: initial screening, production analysis, and assessment of process technology needs; process technology data source location; production trouble shooting; process technology feasibility analysis; research and process technology development or enhancement; transfer and adaptation of existing process technologies; prototype development and testing; technical and safety analysis; marketing, finance, and business plan assistance; financing requirements/advice and direction/search assistance for capital; and training/retraining symposia and workshops, including on-site training assistance.

In addition to its core staff operations, the Center may seek additional funds from programs administered by the Illinois Department of Commerce and Community Affairs (DCCA) to undertake specific research projects directed at process technology development or enhancement. CAMP also works with specific firms to locate financing for special projects from state programs which require cooperative activities with academic institutions for research and technology development efforts.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors, although industrial sectors with traditional manufacturing or production processes are more likely to avail themselves of the services of CAMP than industries with technology-intensive products.

Classification of Objectives

The Center's program can be classified as follows:

- Research and development (with an emphasis on advanced technology processes)
- Regional development (in the southwestern sector of the state, although companies in any part of the state can request assistance)
- Small and medium-sized business assistance (although not limited to such businesses).

Although not specifically listed as a classification, other objectives of CAMP are technical, business, and management assistance, and financing advice.

Ranking of Objectives

Other than research and development, the provision of technical, business, and managerial assistance and financing advice to companies of all sizes, but particularly small and medium-sized firms, would appear to rank higher than regional development. With allocating funds research and technology development are the most important objectives; in conducting projects, the provision of advice and assistance receives the highest ranking.

Classification by R&D Type

To the extent project funds are used (versus faculty and researcher resources, laboratory facilities, and equipment of the Schools of Engineering, Science, and Business), CAMP supports applied research and development projects in cooperation with private companies on specific process technologies for their use.

Level of R&D Focus

The Center directs its research and technology development efforts as well as its technical, business, and financing assistance efforts toward the development and improvement of manufacturing process technologies and toward the transfer and adaptation of existing process

technologies. Thus, the Center builds on both its own existing R&D and assistance activities as well as those of SIUE's Schools of Engineering, Science, and Business.

Program Beneficiaries

Both established and start-up firms in the state are eligible for the services and projects of the Center. Manufacturing firms are the intended targets for the Center's efforts; however, entrepreneurs participating in the Center's programs may not yet be in a manufacturing mode.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the CAMP's host institution, SIUE (that generally favor the university unless otherwise negotiated).

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new, or the adaptation of existing, process technologies which can be used by manufacturing companies in the state. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: redirection of more institutional resources of the host institution, SIUE, to the promotion of process technology development and of process technology transfer and adaptation; and increased linkages between the private sector and the university not only for advice and assistance but also for collaborative research efforts and other arrangements.

General or Targeted Benefits

The services and projects of the Center are available generally to all manufacturing firms in the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual client firm, the results may or may not be available publicly or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host institution, SIUE, at that time.

Program Duration and Permanence

CAMP was established in 1985. While the core activities of the Center have not changed since their initiation, CAMP necessarily has evolved in two ways: first, its ability to respond to

requests from manufacturing companies continues to grow; and second, the nature of the requests continues to change as the same companies need different services or new types of potential client firms hear about the Center's services.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As a university-based research and assistance center, CAMP is a recipient, not a provider, of extramural funding for its research efforts and other services. Moreover, the Center has no independent source of funding to support advanced process technology development activities either internally within SIUE or in collaboration with private companies. CAMP may request matching grants from appropriate programs of DCCA to undertake specific research and technology development projects directed at improved manufacturing and production process technologies.

Description of How Program is Funded/Amount of Funding

Funding for the Center's core staff operations is provided through the Illinois Board of Higher Education through the Board's annual allocation of funds to the Center's host institution, SIUE. CAMP may request matching grants from appropriate programs of DCCA to undertake specific research and technology development projects directed at improved manufacturing and production process technologies. All funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Centers nor DCCA directly attempt to recover their total costs for the Centers' core staff operations and process technology development projects. There is no fee for initial screening, analysis, and assessment review by the Center, although fees generally are required for the follow-on services. Research and process technology development projects operate on a cost-sharing basis and a royalty or other arrangement may be negotiated. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Center's advice and assistance efforts, nor on its research and process technology development activities, although there is an emphasis on

clients in small and medium sized firms and in companies located in the southwestern sector of the state.

Program's Administration and Operation

Core funding is provided annually to the Center from the Board of Higher Education through the Board's annual allocation of funds to the Center's host institution, SIUE. Requests for project funding from the Center to DCCA are reviewed by staff of the Department and by external peer reviewers in the manner similar to all requests for project support under all the programs of the Department.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of CAMP has been undertaken and no information has been systematically collected documenting the program's impact. In the first five years of its existence, CAMP had assisted more than 35 companies on 43 projects in such areas as CAD/CAM, CIM, machine design, material flow analysis, and product development and testing. One firm had undertaken six projects using the Center's services.

Name of Program and Government Agency

- State: Illinois
- Program: Illinois Resource Network, Illinois Board of Higher Education

Program Purpose and Objectives

The Illinois Resource Network (IRN) was created to facilitate information exchange between academic institutions, federal laboratories, and research organizations and the business, industrial, community service, and governmental sectors of the state.

The Network is an on-line information retrieval service containing faculty and staff research specialist profiles from 12 universities and four federal research laboratories throughout the state. This state-wide, multi-institutional database contains more than 6500 profiles of individuals from every research discipline, from science and engineering to philosophy and classical studies.

Industrial Sector

The Network does not restrict its efforts to specific business and industrial sectors.

Classification of Objectives

The Network's program can be classified as follows:

- Research and development
- Small and medium-sized business assistance (although not limited to such businesses).

Although not specifically listed as a classification, a major objective of IRN could be categorized as information transfer.

Ranking of Objectives

Other than research and development, the only other important specified objective is the provision of information to companies of all sizes, but particularly small and medium-sized firms which receive about 90 percent of the Network's services.

Classification by R&D Type

Since IRN provides information on individuals to assist at all stages of the research and technology development process, it can be implied that the Network supports generic research and development across all classification types.

Level of R&D Focus

Since the Network provides information on individuals' current research expertise and objectives, the Network can be said to build on the existing R&D infrastructure of the participating institutions.

Program Beneficiaries

Manufacturing and service companies throughout the country, both established and start-up, are eligible for the services of the Network. No intellectual property and other proprietary rights are involved in IRN's operations.

Direct or Indirect Benefits

No formal assessment of the Network has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the needs of industry, business, community service, and governmental organizations in the state (although out-of-state requests are welcome).

For that subset of requests from in-state companies that are research and technology development related, R&D-based business and economic development would be the general orientation. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: redirection of more institutional resources of the participating institutions to the promotion of research and technology development and of technology transfer and commercialization; and increased linkages between the private and research sectors not only for advice and assistance but also for collaborative research efforts and other activities.

General or Targeted Benefits

The services of the Network are available generally to all industry, business, community service, and governmental organizations in the state (although out-of-state requests also are welcome).

To the extent that research and technology development activities are undertaken by individual researchers, or that technical or business assistance is provided by individual faculty or staff consultants, to caller-clients of the Network, the results may or may not be available at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the individual's participating institution.

Program Duration and Permanence

The Network was first proposed in 1980 by the University of Illinois and Northern Illinois University as a mechanism to expand opportunities for state government-university research cooperation. IRN was created officially in 1984 by the then eight participating Illinois universities and colleges, with the financial support of the Illinois Board of Higher Education and with the cooperation of the Governor's Commission on Science and Technology and the Illinois State Chamber of Commerce. The Illinois Department of Commerce and Community Affairs also has provided support for specific projects. The number of participating institutions has grown to the current total of 16 (12 universities and four federal laboratories).

While IRN's services basically have not changed since its inception, they necessarily have evolved in two ways: first, the ability of the researchers to respond to requests from technology-based companies continues to grow; second, the nature of the requests continues to change as the same companies need different services or new types of client firms hear about the Centers' services.

IRN's operations changed at the end of the 1990 fiscal year. The Network's Board of Directors made the decision to close the central Association Office, placing its duties with the liaison offices of each participating institution. As a result, each institution has received its own profiles and will be operating and maintaining its own database inhouse. The impact of this change will become clearer over the next several years.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable; only information search services are provided.

Description of How Program is Funded/Amount of Funding

The operating budget for the Network is approximately \$200,000 per year. IRN has been funded on an annual basis by a HECA grant from the Illinois Board of Higher Education. In

addition, the participating universities paid a membership fee based on their size. The Illinois Department of Commerce and Community Affairs has provided three grants to IRN throughout its existence.

IRN originally charged no fee for its searches. The current charge of \$25 per search is not a revenue generator and does not begin to cover the cost of a search.

Provisions for Cost Recovery

Even with the establishment of a \$25 search fee, the Network does not attempt to recover the full costs for its operations.

Discrimination/Conditionality

There are no formal or informal restrictions on the Network's information search services, although there is an emphasis in its marketing on small and medium-sized companies as clients.

Program's Administration and Operation

IRN's Board of Directors is comprised of faculty administrators from member institutions and individuals from the private sector. They act as a governing council to develop policies and direct the Network's future endeavors. IRN also has an Operating Council made up of faculty from each participating institution. This Council assists in implementing Board policies.

Operationally, a telephone call (toll-free in the state) is responded to by a specially trained searcher who elicits from the caller-client the needs, described as specifically as possible. Once the search has been categorized, the searcher uses the database to identify individuals most closely matched to needs. The database can be searched by free text or controlled vocabulary: any word, phrase, or subject, or by more than 6500 terms contained in an on-line thesaurus. The resulting profiles usually are mailed within a day. The caller-client determines which profile(s) are best suited to his or her needs. The caller client contacts the individual(s) listed in the profile(s) and makes any further arrangements. Requests are not limited to in-state business, industry, community service, and government organizations and individuals. IRN can be used for many purposes, such as locating individuals to assist in research and development activities, in proposal development or project consultation, or in employee training, as well as finding expert witnesses or conference speakers.

The profiles themselves are basically the resumes of the individuals in IRN's database, containing such items as each member's name, address, and phone contact, professional identification, organizational unit, research objectives, recent grants and contracts, education, work experience including nonuniversity or nonlaboratory employment, professional awards, and scholarly publications and presentations. These profiles are edited by the IRN liaison at each institution and then entered into the data base at the IRN Association Office located at the University of Illinois main campus in Urbana.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Illinois Resource Network has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Illinois
- Program: Technology Commercialization Centers, Illinois Department of Commerce and Community Affairs (DCCA) and Illinois Board of Higher Education

Program Purpose and Objectives

The Technology Commercialization Centers were created to foster the research and development of new and advanced technologies leading to new products, processes, and services which can be marketed by Illinois-based, technology-intensive companies, start-up firms, and entrepreneurs.

Thirteen Technology Commercialization Centers are located on university campuses and in two federal laboratories throughout the state. Each Center is linked with its host institution as well as with the other Centers throughout the state. These Centers form a network which links business and industrial needs with the Centers' and their host institutions' research expertise and resources and enhances the transfer and commercialization of technologies from academic institutions and federal research centers to private firms. They provide product development assistance; technical, managerial, and marketing advice; and direction for financial assistance.

Each Center provides some or most of the following specific services: initial screening and assessment of technical feasibility, marketability, and patentability; business and technical data source location; technical, safety, and legal analysis; business plan assistance; initial market analysis; product development; prototype testing; design and production analysis; strategic market analysis; full-scale product research and development; production and distribution services; general legal and accounting advice; incubator services; and financing requirements/advice and direction/search assistance for venture capital and informal investment risk capital.

In addition to their core operations, the Centers may request additional funds to undertake specific research projects directed at technical areas which promise commercial potential. The Department of Commerce and Community Affairs (DCCA) provides matching grants of up to \$25,000 to academic and nonprofit research institutions and small businesses to support advanced technology development activities directly related to commercialization that bridge universities, businesses, and government.

The Technology Commercialization Centers have access to other technology development and commercialization programs of DCCA to support their activities with specific firms, including the Technology Challenge Grant Program and the Technology Information Transfer

Grant Program. In addition, the Centers work with specific technology-based firms to locate financing for special projects from state programs which require cooperative activities with academic and nonprofit research institutions for research and technology development or technology transfer and commercialization efforts, such as the Business Innovation Fund.

Industrial Sector

The Centers do not restrict their efforts to specific industry sectors, although individual Centers and their host universities or laboratories may have particular expertise in one or more industrial sectors.

Classification of Objectives

The Centers Program can be classified as follows:

- Research and development (with an emphasis on technology development and commercialization potential)
- Small and medium-sized business assistance (although not limited to such businesses).

Although not specifically listed as a classification, a major objective of the Technology Commercialization Centers could be categorized under technical, business, and management assistance and financing advice.

Ranking of Objectives

Other than research and development, the only other important specified objective is the provision of technical, business, and managerial assistance and financing advice to companies of all sizes, but particularly small and medium-sized firms. Using funding allocation, research and technology development would become the most important objective; using projects, provision of advice and assistance would receive the highest ranking.

Classification by R&D Type

To the extent project funds are used (versus faculty and researcher resources and laboratory facilities and equipment of the institutions), the Centers support applied research and development projects in cooperation with private firms on specific technologies with near-term commercialization potential.

Level of R&D Focus

The Centers direct their research and technology development efforts as well as their technical, business, and management assistance efforts toward the development or improvement of products or processes with commercialization potential and toward the transfer and commercialization of existing technologies. Thus, the Centers build on their existing R&D and assistance infrastructure and that of their host institutions.

Program Beneficiaries

Both established and start-up firms in the state are eligible for the services and projects of the Centers. Manufacturing firms are the intended targets for the Centers' efforts; however, entrepreneurs participating in the Centers' programs may not yet be in a manufacturing mode.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the Centers' host institutions (that generally favor the universities involved).

Direct or Indirect Benefits

No formal assessment of the Technology Commercialization Centers program has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new products and services which can be marketed by companies in the state. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: redirection of more institutional resources of the host institutions to the promotion of technology development and of technology transfer and commercialization; and increased linkages between the private and research sectors not only for advice and assistance but also for collaborative research efforts and other activities.

General or Targeted Benefits

The services and projects of the Centers are available generally to all technology-based manufacturing firms in the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual client firm, the results may or may not be available at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host institution.

Program Duration and Permanence

The Centers Program was established in 1984. While the core activities of the Center have not changed since their initiation, they necessarily have evolved in three ways: first, their ability to respond to requests from technology-based companies continues to grow; second, the nature of the requests continues to change as the same companies need different services or new types of potential client firms hear about the Centers' services; and third, new programs are created at the state level for the Centers to draw upon or existing ones are changed.

Types of Potential Subsidy Intervention/Form of Funding

The Technology Commercialization Centers project funding program provides matching grants of up to \$25,000 to the Centers (as well as other academic and nonprofit research institutions and small businesses) to support advanced technology development activities directly related to commercialization that involve collaborative efforts between universities or other nonprofit research institutions and private firms.

Description of How Program is Funded/Amount of Funding

Core funding for the 13 Centers of \$200,000 per year for each Center is provided through the Illinois Board of Higher Education. Each Center also may request additional matching grants from appropriate programs of the Department of Commerce and Community Affairs to undertake specific research projects directed at technical areas that promise commercial potential. All funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Centers nor DCCA directly attempt to recover their total costs for the Centers' core operations and technology development and commercialization projects. There is no fee for initial reviews by the Centers, although fees generally are required for the follow-on services. Research and technology development projects operate on a cost-sharing basis and a royalty or other arrangement may be negotiated. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Centers' advice and assistance efforts and its research and technology development activities, although there is an emphasis on small and medium-sized companies as clients.

Program's Administration and Operation

Core funding is provided annually to the Centers from the Board of Higher Education through the Board's annual allocation of funds to the Centers' host institution. Requests for project funding from the Centers to DCCA are reviewed by Departmental staff and by external peer reviewers in the manner similar to all requests for project support under all the Department's programs.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Technology Commercialization Centers program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Illinois
- Metropolitan Region: Champaign-Urbana
- Program: Economic Development Corporation

Program Purpose and Objectives

The Economic Development Corporation was founded to help promote and improve the economy of the twin city region. Its activities include promoting the twin cities as one market, doing external marketing for the community, and acting as a one-stop resource center for new businesses and industries, as well as expanding businesses. The center acts on behalf of its member agencies, which include the City of Urbana, the City of Champaign, the Chambers of Commerce for both cities, the University of Illinois, Parkland College, Illinois Power Company, Illinois Bell Telephone and the Job Training Partnership.

Industrial Sector

The center does not restrict its activities to any specific industrial sectors. It promotes all businesses in the community and seeks to attract any new businesses to the region. However, the strong computer software and biotechnology base in the region has led the center to target several activities at these high-technology sectors.

Classification of Objectives

Objectives can be classified as marketing, small and medium business assistance, research and development as it relates to marketing and demographic studies, regional development, and infrastructure development. Although not a stated goal of the Corporation, it also does sectoral development in the software and biotechnology areas.

Ranking of Objectives

There is no explicit ranking of program objectives. However, marketing is the top priority and is considered the forerunner to regional development.

Classification By R&D Type

The EDC's activities are not tied to any type of R&D activity. In marketing the community, the EDC hopes to attract all types of new companies; it has made special efforts to attract and

develop new software and biotechnology companies. However, it does not have a designated preference based on type of R&D activity.

Level of R&D Focus

The EDC does not target its activities according to the level or focus of a company's R&D activities.

Program Beneficiaries

One intended program beneficiary is the Champaign-Urbana community, which gains a promotional and marketing advocate. This helps attract new companies to the area, which strengthens the economy, creates jobs and expands the tax base. EDC clients also benefit, primarily from free services and access to resources that save them time and money when looking to expand or set up new operations. Other beneficiaries include local universities and member organizations.

Direct or Indirect Benefits

Direct benefits include a more diverse and stronger local economy. By targeting software and biotechnology companies, the EDC indirectly helps create more skilled jobs. The presence of these companies indirectly enhances educational opportunities at local educational institutions.

General or Targeted Benefits

Although the EDC works for its member agencies, benefits are general. This is because its member agencies want to promote the region and attract new companies and strengthen existing companies. Consequently, the EDC works with all companies interested in locating in the area.

Program Duration and Permanence

The current EDC was created in 1986, when several different economic development organizations were folded into one. These organizations were the Economic Development Departments and the Chambers of Commerce for both Champaign and Urbana. Although the EDC's funding fluctuates with the economy, its budget has remained stable. There are periodic changes in its membership.

Types of Potential Subsidy Intervention/Form of Funding

The EDC does not run any financial assistance programs or subsidy intervention. It receives money from public sources, notably the twin cities and the University of Illinois. It also receives funding from its private sector members.

Description of How Program Is Funded/Amount of Funding

The EDC's budget has fluctuated between a high of \$240,000 and a low of \$170,000. Its 1990 budget was approximately \$208,000. It receives public funds from the general tax revenue base of the twin cities, Champaign and Urbana. Although substantially different in absolute terms, these contributions are about equal on a per capita basis. The EDC indirectly receives state funds through the University of Illinois and Parkland Community College. It also receives funds from its private sector members. In 1990, all sources contributed the following amounts:

• City of Champaign	\$66,000
• City of Urbana	\$28,000
• University of Illinois	\$12,500
• Parkland College	\$ 7,500
• Champaign Chamber of Commerce	\$40,000
• Urbana Chamber of Commerce	\$20,000
• Illinois Power Company	\$10,000
• Illinois Bell Telephone	\$ 4,000
• Other members	\$20,000

Provisions for Cost Recovery

There are no provisions for cost recovery.

Discrimination/Conditionality

EDC services are available to any companies looking to locate in the Champaign-Urbana metropolitan area.

Summary of Program's Administration and Operation

The EDC is run by a president, a vice president and a full-time staff of four. It also employs several University of Illinois student interns. The staff reports to a Technical Committee, which has immediate oversight of day-to-day activities. The Technical Committee reports monthly to the Executive Committee, which sets out policy details with advisory input from the Technical Committee. The Executive Committee reports to the Board of Directors, which makes all policy

decisions, including hiring and budgetary decisions. The board is comprised of 16 voting members, including a representative from each of the member agencies (including the mayors and a council person from each twin city) and a few community/interest group representatives. There are also five nonvoting, or ex officio, members on the Board of Directors.

Program Impact and Lessons

The EDC's vice-president said the program has had a solid impact, although there has been no formal assessment of this. Nonetheless, it is quite clear that the EDC is providing a valuable service by gathering and disseminating information to prospective businesses.

As for lessons, the program official said it has been very difficult working for twin cities. He said the city's interests diverge at times and it is difficult to make sound decisions that accommodate both. As a result, decisions are carefully thought through before they are presented.

Name of Program and Government Agency

- State: Illinois
- Metropolitan Region: Springfield
- Program: Certified Development Corporation Equity Fund

Program Purpose and Objectives

The central purpose of the Equity Fund is to provide equity financing to new and expanding companies. The \$100,000 fund was created from money available through the federal government's Community Development Block Grant program, run by the Department of Housing and Urban Development.

By underwriting some of the risk associated with new ventures, the program provides needed capital and helps new businesses attract bank financing that would not otherwise be available. The program is expected to create new businesses, generate new jobs, and expand the local tax base.

Industrial Sector

Equity Fund resources are available to all companies in the Springfield city limits, including high-tech companies. Program officials are currently considering applications to help finance development of a new soft drink and a new garbage disposal. Another prospect, financing the development of a new knife sharpener, fell through after disagreement over the company's business plan. To date, no funds have been disbursed.

Classification of Objectives

Program objectives can be classified as regional development, social development (stemming from strings attached to the federal funds that are used for equity financing) and small and medium business assistance.

Ranking of Objectives

Objectives can be ranked in the following order: small and medium business assistance; regional development; social development.

Classification By R&D Type

The small pool of available funds--\$100,000--makes it difficult to support R&D operations. Most companies seeking assistance have developed a product and need money for production, distribution or marketing.

Level of R&D Focus

Equity Fund dollars are not targeted toward R&D intensive operations. It is expected that funds will be used to support companies trying to bring new products to market.

Program Beneficiaries

There are several program beneficiaries. The successful applicant benefits from capital that can be used to produce or market its product. Equity financing from the city also helps secure bank financing. The banking community benefits from reduced exposure and more secure loans as a result of the city's equity stake. The city government benefits from the increased tax base resulting from the creation of new businesses and increased economic activity. Finally, the consumer benefits from new products in the marketplace.

Direct or Indirect Benefits

Because the Equity Fund was just initiated and no financing agreements have been reached, there is no track record for assessing the program. The intended direct beneficiaries include the new businesses and expanding businesses that receive the support; downstream suppliers who benefit from the new demand for their products; and the city, which benefits from the increased tax base. Indirect beneficiaries include the community, which benefits from job creation, increased government revenues, and a stronger local economy.

General or Targeted Benefits

Program funds are generally available and companies competing for equity funds are expected to sell their products in the open market.

Program Duration and Permanence

The program was initiated in 1990. To date, no program funds have been disbursed. While it is clear some companies would benefit from equity financing, the design, structure and long-term

viability of the program have not been established. As a result, its future is uncertain. Currently, federal funding is being used to finance the program. However, it is unlikely a similar level of federal funds will be available in the future since the Equity Fund includes unused funds accumulated in previous years.

Program officials hope to use the federal money to finance a few successful ventures during the first year or two. With an established track record, the hope is that private funds can be drawn in and used to sustain the program. Although the banking community has expressed interest in the program, it has not been actively involved, preferring to wait and see if the program is viable before joining the endeavor.

Types of Potential Subsidy Intervention/Form of Funding

Funds are to be disbursed as equity financing; the city will have an equity stake in the new company. Provisions to buy out the city stake will be negotiated on a case-by-case basis, but will typically include a return on equity to the city.

Description of How Program Is Funded/Amount of Funding

The Equity Fund currently contains \$100,000. This money is made available by the federal government through the Community Development Block Grant program, administered by the Department of Housing and Urban Development. As an entitlement city, Springfield receives block grants annually to generate jobs for low and moderate income individuals and to alleviate urban blight. Following several years of surpluses, which were carried forward each year, the city pulled together \$100,000 for the Equity Fund. No city funds are used for the program. Because unique circumstances allowed the fund's creation, the city hopes to secure private financing in the future.

Provisions for Cost Recovery

There are no specific provisions for cost recovery, however this is a goal of the program. Provisions to buy-out the city stake will be negotiated on a case-by-case basis. Since no funds have been disbursed, no details can be provided.

Discrimination/Conditionality

Program funds are only available to businesses within the corporate limits of the City of Springfield.

Additionally, because the funds are available through HUD's Community Development Block Grant program, recipients must meet two key conditions of this program: 51percent of all jobs created must be "made available" to low and moderate income individuals; and funds must be used to cure urban blight, which typically involves occupying a building or lot that is either vacant or in disrepair (and then renovated). The city hopes to avoid these restrictions in the future by replacing federal dollars with private money.

Summary of Program's Administration and Operation

The Equity Fund is administered by two staff members in the city's Community Development Department. These are the same staff members who run all the city's HUD programs. Decisions on who will receive Equity Fund monies is decided by a Board of Directors of the Certified Development Corporation. The CDC oversees the Small Business Administration's (SBA) loan program. Because the SBA board was underutilized, the city asked, and received permission, to use the Board to make decisions regarding equity loans. The board has 33 members, although most decisions are made by a 9-member sub group called the executive board. The executive board includes six bankers and three nonbankers. The board recruits and selects its own members.

Program Impact and Lessons

One program official said that although the program is still quite new, its impact has been positive. He said the idea has been well received within the banking community and that there is general optimism that the banking community will get involved within a year or two, assuming the city has some success getting the program off the ground. He added that it is too early to draw any useful lessons from the endeavor.

Name of Program and Government Agency

- State: Illinois
- Metropolitan Region: Chicago
- Program: The Chicago High Technology Association

Program Purpose and Objectives

The Chicago High-Technology Association grew out of a desire to create locally an environment in which high-technology enterprises could thrive. Its objective is to foster economic development by strengthening local companies. The Association is a private, nonprofit, membership organization.

To achieve its objectives, the Association provides programs and services to companies in the Chicago area. These include:

- A job bank to help local companies find skilled, technical employees
- A breakfast seminar series that focuses on business topics of interest to clients
- Information distribution through an in-house newsletter
- An advocacy program that seeks to establish and shape a high-technology agenda for the state of Illinois.

Industrial Sector

Despite its high-technology orientation, the Association is very horizontal, with members varying widely. Members include some individuals and very small businesses, as well as a few corporate giants. The sectoral focus of the Association's membership is also diverse. However, the membership includes a large number of software developers, hardware companies, bio-chemistry and biotechnology enterprises.

Classification of Objectives

Objectives can be classified as local/regional development, small and medium business assistance, technology transfer, adjustment to competition, and infrastructure development.

Ranking of Objectives

Program objectives are not explicitly ranked. However, two objectives stand out. Technology transfer, bringing product ideas to market, is a high priority. Also, establishing high technology development as a top community priority is also central to the Association's effort. This involves

changing attitudes in the community, lobbying and working as an advocate, and helping develop the community infrastructure needed to support such companies.

Classification By R&D Type

The Association does not conduct R&D or include it as one of its objectives. Its membership does include companies doing R&D, both basic and applied. However, Association services are geared toward companies trying to bring new products to market.

Level of R&D Focus

The Association does not conduct R&D or include it as one of its objectives.

Program Beneficiaries

The principal program beneficiaries are the enterprises and companies involved in the Association. They benefit from educational seminars, networking opportunities, referral services, and other services designed to make them more competitive. The university members benefit from the Association's technology transfer efforts. Ultimately, consumers benefit from new products and production capabilities.

Direct or Indirect Benefits

Direct benefits include stronger and more competitive local companies. The Association's activities indirectly generate more jobs, higher-skilled jobs, regional economic strength and diversity, better trained students, and new products.

General or Targeted Benefits

Benefits are targeted in that they are available to Association members only. However, the benefits of stronger businesses and a stronger local economy are generally available.

Program Duration and Permanence

The Association grew out of a city initiative in 1984. Chicago's Department of Economic Development sponsored a task force to assess the city's technology foundation and determine ways to organize it to have a greater impact on the local economy. Finding the technology community diverse and poorly organized, the task force recommended creating a networking

organization, which led to the Association. After receiving city funding through its early years, the Association has gradually lost its ties to the city. It is continuously scrambling for money, but it has a solid base of 280 dues-paying corporate members.

Types of Potential Subsidy Intervention/Form of Funding

The Association is funded by a mix of philanthropic contributions, membership fees and fundraising efforts. In the past, it received public funds from the City of Chicago. It does not directly receive any state funds, although it has occasionally sold services to the state.

Description of How Program Is Funded/Amount of Funding

The Association has a \$200,000 annual budget. The sources of these funds are philanthropic contributions (50 percent), membership fees (35 percent) and fundraising efforts (15 percent). When started in 1984, the Association received about \$25,000 a year from the City of Chicago, a sum it received for three or four years. The city funds were available through the Department of Housing and Urban Development Community Development Block Grant program. In 1987 or 1988, HUD barred the city from continuing to use these funds for the Association, arguing that the Association's activities did not have enough of an impact on low and moderate income individuals (a condition of block grant funds).

Provisions for Cost Recovery

The Association does not have any cost recovery provisions.

Discrimination/Conditionality

Association services are restricted in the sense that they are only available to members. Membership is open to anyone, including individuals, although the high-technology and business orientation produces a self-selected clientele.

Summary of Program's Administration and Operation

The Association is administered by a small staff that includes a president, an executive staff officer and one or two support staff. This staff handles day-to-day operations, reporting monthly to a 10-person Executive Committee. The Executive Committee, a subset of a 38-member Board of Directors, establishes most of the organization's policies and goals. Its members are represen-

tative of the Board, and tend to be its most active members. The full board, which meets quarterly, has broad oversight responsibilities.

Program Impact and Lessons

It is difficult to assess the Association's impact since its key objectives are to facilitate networking and provide services that will strengthen local high-technology companies. It is difficult to determine whether these services actually contribute to a company's improvement, or whether services are used effectively. However, the Association has grown, expanding its membership and its services, suggesting that it is fulfilling a need in the local community.

The most important lesson learned, according to one Association official, is the importance of responding to member needs and adjusting to changes in those needs.

Name of Program and Government Agency

- State: Illinois
- Metropolitan Region: Evanston
- Program: The University Research Park

Program Purpose and Objectives

The Research Park grew out of a city initiative aimed at generating economic development in the area. The principal objective of the Park is to provide an attractive and supportive environment for local businesses, as well as for those looking to relocate or expand. This, in turn, should lead to job creation and retention and stronger local businesses. The Park works closely with Northwestern University, as well as the state and city governments. The Park provides "state-of-the-art" office space, and runs a Technology Innovation Center and a small business incubator. It also houses a small business development center.

Industrial Sector

The Park does not explicitly target any industrial sector, although it has established three priority sectors in which it is concentrating its outreach efforts. These sectors, in order of priority, are: materials science, computer software and hardware, and biotechnology. These priorities are closely tied to the strength of the corresponding departments at Northwestern University, a park participant.

Classification of Objectives

Objectives can be classified as small and medium business assistance, research and development, regional development, sectoral development, and infrastructure development (with an emphasis on business infrastructure).

Ranking of Objectives

Priority objectives are regional development and small and medium business assistance.

Classification By R&D Type

In attracting tenants, the Park does not emphasize any type of R&D. However, lease guidelines for the Park require that 80% of the tenants have a research or technology focus for their

activities. In general, Park officials are seeking businesses with commercial products or those trying to bring a new product to market.

Level of R&D Focus

The Park does not consider a prospective tenant's R&D focus when making a leasing decision.

Program Beneficiaries

Intended beneficiaries are the companies occupying the Park, which get access to services, shared resources and state-of-the-art office space. The City of Evanston benefits from job creation and retention. Northwestern University benefits from enhanced opportunities for technology commercialization. The developer benefits from leased space in the Park. Finally, the Evanston community benefits from economic development.

Direct or Indirect Benefits

Direct benefits are the availability of state-of-the-art office space for high-technology companies and the availability of technical, management, and business assistance and services. Indirect benefits are the creation and retention of jobs, greater technology commercialization, improved economic growth and vitality, and an expanded tax base.

General or Targeted Benefits

Benefits are targeted in that most are limited to Park occupants. However, the enhanced business activities of Park occupants generate economic benefits that are generally available to the Evanston community.

Program Duration and Permanence

The Park developer began building in 1987. However, before that the City of Evanston was active acquiring land for the Park. Part of that land was already being used by the incubator, which was started in 1986 by Northwestern University. The Park is not yet fully developed. However, there are two buildings already constructed, one of which is fully leased. The second is almost all leased. A third building is nearing completion and a fourth is planned. There are 37 companies operating in the Park.

Types of Potential Subsidy Intervention/Form of Funding

Park land was either city or university owned, or acquired by the City of Evanston. Acquisitions, as well as land development and infrastructure improvement costs, were financed by city bond issues and a loan from Northwestern University. In addition to city bond issues, the city has established a \$24 million Tax Increment Financing District. This allows the city to freeze for 20 years property taxes on the land at predevelopment levels. The Park, however, will continue to pay property taxes according to the assessed valuation of the land and buildings. The difference between the predevelopment tax and the actual tax is placed in an increment fund. This money is used to acquire and develop new land, as it is needed.

The developer, who builds and owns the buildings in the Park, financed that construction through private sources at an estimated cost of \$4 million.

Description of How Program Is Funded/Amount of Funding

Park land was either city or university owned, or acquired by the City of Evanston. Acquisitions, as well as land development and infrastructure improvement costs, were financed by city bond issues and a loan from Northwestern University. In addition to city bond issues, the city has established a \$24 million Tax Increment Financing District. This allows the city to freeze for 20 years property taxes on the land at predevelopment levels. The Park, however, will continue to pay property taxes according to the assessed valuation of the land and buildings. The difference between the predevelopment tax and the actual tax is placed in an increment fund. This money is used to acquire and develop new land, as it is needed.

Sources of city funds include about \$1 million in bond issues, a \$4 million loan from Northwestern, about \$500,000 from the state's Build Illinois Program, and the rest from a variety of sources. Thus far, the City of Evanston has spent about \$6.6 million. The city has spent about \$2.1 million on land acquisition, \$1.4 million on capital improvements (underground utilities, etc.), about \$800,000 to relocated businesses and families located on the land, and about \$500,000 on architectural, engineering, and legal services. Finally, the city provides \$250,000 a year to the Park's operational budget. This \$250,000 comes from the city's Economic Development Fund, which is generated from taxes charged to businesses leaving the area (real estate transfer tax). Northwestern also provides \$250,000 to the Park's operational budget.

The Park developer, Charles H. Shaw Co., has spent an estimated \$4 million for building construction on Park land.

Provisions for Cost Recovery

The city recovers its costs through the Tax Increment Financing District. This mechanism allows the city to freeze for 20 years property taxes on the land at predevelopment levels. Park occupants, however, will continue to pay property taxes according to the assessed valuation of the land and buildings. The difference between the predevelopment tax and the actual tax is placed in an increment fund. This money is used to acquire and develop new land, as it is needed. The city issues bonds only as development occurs and the Increment Fund increases, facilitating a pay-as-you-go process.

Discrimination/Conditionality

The Research Park does not allow manufacturing companies to lease Park facilities. It also requires that 80% of the tenants have a research or technology focus. Seed funds are available only to Evanston companies.

Summary of Program's Administration and Operation

Park administration is divided among a couple organizations. Land acquisition was done by the City of Evanston and Northwestern University. These two partners formed a holding company for the land, called Top Core. The land was then transferred to Research Park Inc., which manages the Park. The city and Northwestern are both represented on the board of RPI, enabling them to oversee Park activities and ensure that it meets economic development objectives. The developer, Charles H. Shaw Company, handles the leasing and marketing for the Park. Broad guidelines for the Park's operation were outlined in a Master Plan, agreed to by Northwestern, the City of Evanston, and Shaw.

Program Impact and Lessons

No formal assessment of the Park's impact has been conducted. The park has attracted 37 companies so far and building on the property is continuing. Park companies now employ 450 people, compared with 20 employees in 1986. While this does not signify jobs created, it shows the Park's growth and indicates the demand for such a facility.

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VI. MASSACHUSETTS

State technology development programs in Massachusetts are administered primarily through state-created, state-supported, quasi-government organizations, with boards of directors representing industry, business, academia, and government (please see Figure 6). Five of the major quasi-government organizations are:

- Massachusetts Centers of Excellence Corporation
- Massachusetts Technology Development Corporation
- Massachusetts Industrial Finance Agency
- Massachusetts Technology Park Corporation
- Bay State Skills Corporation.

The Massachusetts Centers of Excellence Corporation (MCEC) was established in 1985 to stimulate economic development by promoting new technologies and new applications of existing technologies through partnerships among universities, industry, and government. Originally Centers were created in four areas: biotechnology, marine science, polymer science, and photovoltaics. In 1987, the Center for Applied Technology was added to assist small and medium-sized firms in developing new products and processes for traditional manufacturing industries.

The Corporation has a competitive grant program for joint industry-university/research institute projects near the commercialization stage in the target areas of four of the Centers (biotechnology, marine science, polymer science, and applied technology). The Corporation also provides support for the creation of new institutions, such as incubators and venture capital funds. Award expenditures by MCEC since it began making awards in 1987 total about \$7.7 million.

The other Center (photovoltaics) is separately funded and administered by the Massachusetts Executive Office of Energy Resources. This Center and the Center for Applied Technology provide information services, technical, business, marketing, and financial advice, demonstration projects, training, and other nonfinancial assistance.

The Massachusetts Technology Development Corporation (MTDC) was created in 1978 to provide direct financial assistance to start-up and small, expanding technology-based firms through debt or equity investments. In addition to its investment program, the Corporation assists firms in locating alternative sources of funding without making an investment itself and provides management assistance.

All of MTDC's investments are made as part of a joint venture with conventional private sector investors, with the private sector investment-partner investing two to four times the amount of capital which the Corporation provides. Through the end of the 1989 fiscal year, MTDC had invested a total of \$13.9 million in 50 firms, that had leveraged an estimated \$64.3 million at the time of initial investment. Subsequently, these companies raised an estimated additional \$152.2 million.

In 1986, the Corporation began investing \$2 million of the Massachusetts Pension Reserves Investment Trust. These funds are invested in companies at later-stage rounds of financing where there are substantial capital gains to benefit the Trust.

The Massachusetts Industrial Finance Agency (MIFA) was established in 1978 to promote private investment and employment growth through financial incentives, including tax-exempt and taxable industrial development bonds, direct loans, and loan insurance. MIFA has statutory authority to act as the state's investment bank and also issue bonds for the Commonwealth's educational and cultural facilities.

MIFA receives no state funding. It is supported by fees it charges when it issues bonds or manages programs. MIFA also invests public pension funds entrusted to it. In its 12-year history, the Agency has structured about \$5.6 billion in hard-asset financing for 2440 manufacturing and commercial companies and nonprofit institutions.

The Massachusetts Technology Park Corporation (MTPC) was created in 1982 as a \$40 million corporation to establish one or more educational centers containing design, fabrication, and testing facilities and equipment for postsecondary academic and practical training programs to satisfy the education and employment needs of Massachusetts business and industry.

The first MTPC project was the establishment of a Massachusetts Microelectronics Center with three components: a computer-aided design network, an integrated circuit fabrication facility, and a semiconductor instructional processing laboratory. The Center is funded by a \$20 million bond issue, matched by commitments from business and industry for machinery and equipment.

The Bay States Skills Corporation (BSSC) was established in 1981 to develop and expand skills training in the state consistent with employment needs. The Corporation administers three categories of training programs. Under the Industry Responsive 50/50 Matching Grants program, awards are made to education and training institutions which team up with one or more private companies and together train people for jobs in high growth industries. Under the Welfare/Employment and Training Choice program, the target population is welfare recipients and the

required match is only 20 percent. Under the Bay State Centers for Displaced Homemakers, counseling, workshops, skills training, education programs, and job placement services are provided through a network of 25 centers statewide. Since its creation, BSSC has brought together more than 1000 companies and 200 education and training institutions to train over 30,000 people throughout the state. The Corporation made awards exceeding \$4.0 million in the 1988 and 1989 fiscal years.

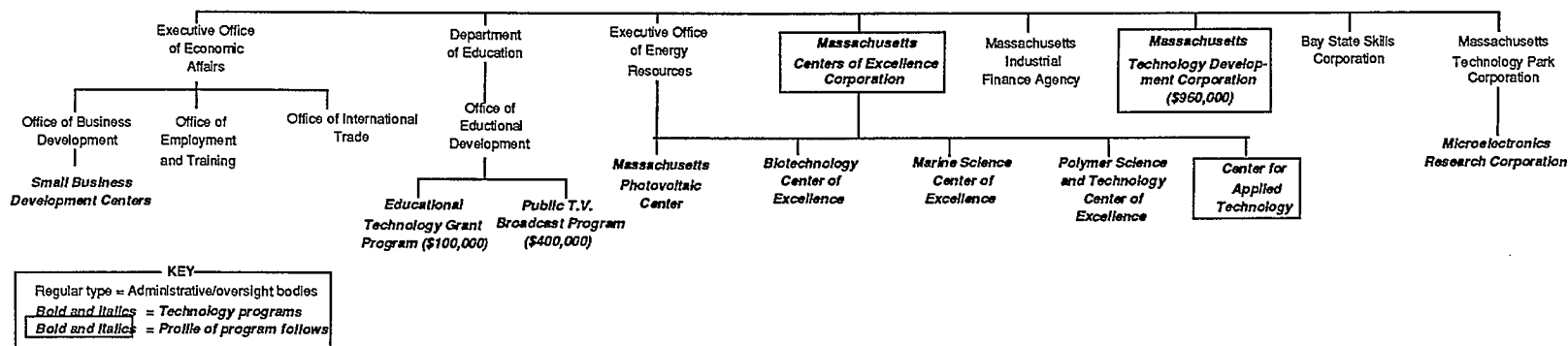


FIGURE 6 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: MASSACHUSETTS

Name of Program and Government Agency

- State: Massachusetts
- Program: Massachusetts Centers of Excellence Corporation

Program Purpose and Objectives

The Massachusetts Centers of Excellence Corporation (MCEC) was established in 1985 to stimulate economic development by promoting new technologies and new applications of existing technologies through partnerships among universities, industry, and government. Initially, four technologies were identified in which the state already enjoyed an academic and/or industrial edge and which had demonstrated long-range potential for growth. Centers were created in these four areas: biotechnology, marine science, polymer science, and photovoltaics. In 1987, the Center for Applied Technology was added to assist small and medium-sized firms in developing new products and processes for traditional manufacturing industries by linking businesses with needs to appropriate technical expertise and resources. The 1987 fiscal year was also the first full year of legislative funding.

Four of the five Centers of Excellence are in essence "Centers Partly Without Walls." Each Center is organized around one or two universities with expertise in the target research areas, and awards are made to research universities and nonprofit research institutes that submit competitive proposals in the selected research areas. Ultimately, research centers in all of the targeted research areas will be built at specific university locations.

The Corporation has a competitive grant program for joint industry-university/research institute projects near the commercialization stage in the target areas of four of the Centers (biotechnology, marine science, polymer science, and applied technology). Awards range from \$20,000 to \$300,000 and require matching contributions. MCEC, through its Center for Applied Technology, also supports and manages technical assistance projects.

The other Center (photovoltaics) is separately funded and administered by the Massachusetts Executive Office of Energy Resources. Its principal focus, the Massachusetts Photovoltaics Center, is located at Logan Airport in Boston in part to provide export marketing assistance. This Center and the Center for Applied Technology provide information services, technical, business, marketing, and financing advice, demonstration projects, training, and other nonfinancial assistance.

The Corporation also provides support for the creation of new institutions. A \$625,000 matching grant to the Massachusetts Biotechnology Research Institute (a consortium of regional

education institutions and a local business development corporation) led to the development of its incubator for startup biotechnology firms and to the formation of Commonwealth Bioventures, Inc., a venture capital firm that provides new biotechnology firms with seed capital and managerial assistance through limited partnerships and later stage capital with other investors. Through March 1990, this venture capital firm has generated about \$10 million from private individuals, banks, and other financial institutions.

Industrial Sector

The Corporation's funding is strictly limited to the four target research and technology development areas: biotechnology, marine science, polymer science, and applied technology. In the applied technology area, support is provided less for research than information services, technical, business, marketing, and financing advice, demonstration projects, training, and other nonfinancial assistance.

Classification of Objectives

The MCEC program's objectives can be classified as follows:

- Research and development (with emphasis on technology development or enhancement with near-term commercialization potential)
- Sectoral/industrial development (in four target areas)
- Small and medium-sized business assistance (although not all Centers are limited to such businesses).

Ranking of Objectives

Other than research and development, the most important specified objective is sectoral development, since Centers of Excellence were created in specific targeted industrial sectors. Of lesser importance is assistance to small and medium-sized businesses.

Classification of R&D Type

The Corporation, through the Centers, supports predominantly applied research and development projects, although demonstration or prototype development projects also are funded. These matching grant awards are for joint industry-university/research institute projects near the commercialization stage in the four target areas.

Level of R&D Focus

The Centers' projects are directed toward joint industry- university/research institute projects. Thus, they not only build on the existing R&D infrastructure but also create new kinds of applied R&D activities in new kinds of industry-research institution partnerships.

Program Beneficiaries

Both established and start-up firms in the state are eligible for the Centers' research program. Research and technology-based firms (which might license or eventually manufacture technology-based products) and manufacturing companies are the intended targets for the Centers' program.

To the extent intellectual property or other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the university/research institute partner (that generally favor the research institution), unless other negotiated arrangements are agreed to.

Direct or Indirect Benefits

No formal assessment of the Centers of Excellence program has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new technologies and new applications of existing technologies which are near the commercialization stage and can be marketed by companies in the state. In theory, this would imply the traditional benefits of jobs/firms created/retained. The implied indirect benefits include increased linkages between the private and research sectors for collaborative research and other activities.

General or Targeted Benefits

Research support under the Centers' programs in the four targeted areas is provided to the university/research institute partner of the joint industry-research institution effort. The research results from any such partnership may or may not be available at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the research institution (that generally favor disclosure).

Program Duration and Permanence

MCEC was established in 1985, Centers were established in four areas, and the Corporation's first awards were made in the 1987 fiscal year. One major change was the addition in 1987 of the Center for Applied Technology.

Types of Potential Subsidy Intervention/Form of Funding

The Corporation, through the Centers, provides matching grants for joint industry-university/research institute projects in the range from \$20,000 to \$300,000. Funds are awarded to the research institution. Matching funds are required and usually are provided by the industry partner.

Description of How Program is Funded/Amount of Funding

The Corporation made grants totaling approximately \$1.1 million in FY87, \$3.3 million in FY88, \$2.5 million in FY89, and \$0.8 million in FY90. All funds are from state general tax revenue. These grant awards were matched on an almost two-to-one basis by corporate and research institution funds. Moreover, these projects have leveraged an additional five times investment from the private sector and federal sources, excluding a \$20 million award from the federal government to construct a world-class Polymer Center at the University of Massachusetts, Amherst.

Provision for Cost Recovery

The Corporation does not directly attempt to recover its grant award costs, although the programs does leverage private sector matching funds. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are formal restrictions on the Corporation's competitive grant program in that proposals are accepted in only the four target research areas (biotechnology, marine science, polymer science, and photovoltaics). The technical, business, marketing, and financing advice of the Corporation's Center for Applied Technology is available only to small and medium-sized firms.

Program's Administration and Operation

As with most state technology programs in Massachusetts, the Corporation is a quasi-government organization. Its nine member board of directors has representatives from industry, academia, and government. The Corporation Board sets policy and makes funding decisions. Each of the five Centers has its own Technology Board from these same sectors that develops strategies and recommends projects for Corporation support.

The Corporation uses a two phase submission/review process. A Concept Paper is submitted by an eligible institution and evaluated by the appropriate technology board. If the board deems the proposed research or technology development project to be responsive to the goals of the MCEC program and of high merit in comparison to other projects, it may invite the submission of a formal proposal. The appropriate technology board reviews and evaluates the formal proposals and determines which if any of them will be recommended to the MCEC's Board for funding. Final determination on funding is made by the MCEC Board of Directors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Centers of Excellence program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Massachusetts
- Program: Massachusetts Technology Development Corporation

Program Purpose and Objectives

The Massachusetts Technology Development Corporation (MTDC) was created in 1978 to provide direct financial assistance to start-up and small, expanding technology-based firms through debt or equity investments in the form of the purchase of common or preferred stock accompanied by long-term notes on favorable terms. In addition to its investment program, the Corporation was to assist firms in locating alternative sources of funding without making an investment itself and to provide management assistance.

Through each phase of its existence, MTDC has pursued the following basic objectives on behalf of the state:

- Help create primary employment in technology-based industries in Massachusetts
- Attract and leverage private investment in Massachusetts companies
- Foster the application of technological innovations where Massachusetts companies are, or can be, leaders
- Nurture entrepreneurship among Massachusetts citizens, planting the seeds for long-term economic development in the state.

Industrial Sector

The Corporation's investment activities are not restricted to any specific industry sector.

Classification of Objectives

MTDC's objectives can be classified as follows:

- Research and development (with an emphasis on fostering technological innovation)
- Small and medium-sized business assistance (with an emphasis on nurturing entrepreneurship).

Although not specifically listed as a classification, the major underlying objective of MTDC's efforts is addressing the "capital gap" at whatever point in the technology development and commercialization process that problem appears at a given time, including but not limited to, zero-stage seed capital, early-stage prototype development capital, or later-stage expansion capital.

Ranking of Objectives

Other than research and development, the only other important specified objective that relates to the typology provided is small and medium-sized business assistance (with an emphasis on nurturing entrepreneurship).

Classification by R&D Type

MTDC's investments tend to occur at or after the prototype development, demonstration, and testing stage of the research, technology development, and commercialization process. Since MTDC's investments are in the private sector, they tend to support companies whose specific technologies might not otherwise be realized.

Level of R&D Focus

MTDC's investments tend to be targeted to expanding existing R&D activities and to establishing new activities, with an emphasis on the former.

Program Beneficiaries

Both established and start-up firms in the state are eligible for MTDC's investments. Manufacturing firms are the intended targets for that investment; however, technology-development-based entrepreneurial firms which may not yet be in the manufacturing mode also are appropriate candidates for MTDC's investments.

Direct or Indirect Benefits

No formal assessment of MTDC has been undertaken and, therefore, no identification of actual direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits as listed in MTDC's four basic objectives are increased employment, investment capital, technology commercialization, and entrepreneurship. This implies the traditional direct benefits of jobs/firms created/retained, using MTDC's resources to attract and leverage private investment capital for companies in the state.

General or Targeted Benefits

MTDC investment resources are available generally to all technology-based manufacturing firms in the state that meet the criteria for venture capital investment.

Program Duration and Permanence

MTDC was established in 1978 to address the then existing "capital gap" for expansion of early-stage technology companies. By the time MTDC commenced operation, the substantial reduction in the federal capital gains tax in 1978 and increased investment in venture capital by pension funds helped to stimulate a significant increase in venture capital funds. As private venture capital flourished in the early 1980s, MTDC focused more of its investment activity on start-up companies where the "capital gap" continued to exist. MTDC policies and practices are intended to complement, not to compete with, private financial institutions.

As the climate for venture capital investment in technology-based companies changed in the late 1980s, MTDC again had to respond increasingly to the financing needs of small, existing technology companies which were seeking to expand. In addition, MTDC increased its participation in portfolio company follow-on investments, necessitated by the financing climate for technology companies after the October 1987 stock market crash. Finally, MTDC has made efforts to continue to diversify its investments among industries and geographic areas of the state.

In 1986, the Corporation began investing \$2 million of the Massachusetts Pension Reserves Investment Trust. These funds are invested in companies at later-stage rounds of financing where there are substantial capital gains to benefit the Trust.

Types of Potential Subsidy Intervention/Form of Funding

MTDC provides direct financial assistance to start-up and small, expanding technology-based firms through debt or equity investments in the form of the purchase of common or preferred stock accompanied by long-term notes on favorable terms. All the Corporation's investments are made as a part of a joint venture with conventional private sector investors. Initial investments can range up to a maximum of \$500,000. Most are typically in the \$100,000 to \$250,000 range. The size of the Corporation's initial funding is determined by the capital needs of the firm and the investment of the co-investor(s). Generally, the private sector investor-partners will invest two to four times the amount of capital which the Corporation provides.

Description of How Program is Funded/Amount of Funding

Created with a combination of state and federal funds (\$3.0 million in two grants), the Corporation has been operating entirely on state funds and net capital earnings on investments. Through the 1989 fiscal year, the cumulative total of state appropriations was \$4.2 million.

During the 1988 fiscal year, the Corporation made a distribution back to the state of \$750,000 "in full satisfaction of all obligations of appropriated funds since its inception."

By the end of its tenth year of investment operations (June 1989), the Corporation reached the point where it anticipated it could become entirely self-supporting. The cumulative net realized gains on equity and debt investments since the 1980 fiscal year total over \$4 million. The investment balance at the end of the 1989 fiscal year was \$8.2 million.

Through the end of the 1989 fiscal year, the Corporation had invested a total of \$13.9 million in 50 firms. This cumulative investment leveraged an estimated \$64.3 million at the time of initial investment. Subsequently, these companies raised an estimated additional \$152.2 million.

Provision for Cost Recovery

Although the first investments by MTDC were made in FY80, the realization of significant gains or losses lagged between five and seven years, as anticipated. Through its investment strategy, MTDC has had net capital earnings from both its equity and capital investments, including loan interest payments and principal repayments as well as sales of stock in companies that undertook an initial public offering of their securities (eight of MTDC's portfolio companies have gone public). There also have been some capital losses but these have been outweighed heavily by capital earnings. As noted above, the cumulative net realized gains on equity and debt investments (i.e., cost recovery) has reached the point where MTDC could be self-supporting.

Discrimination/Conditionality

There are no formal or informal restrictions on MTDC's investment strategy beyond the criteria set forth in MTDC's charter and ordinary venture capital investment prudence and due diligence.

Program's Administration and Operation

As with most state technology programs in Massachusetts, the Corporation is a quasi-government organization: a publicly-funded but independently operated venture capital organization. Its eleven member board of directors has representatives from the industry, business, academic, and governmental sectors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of MTDC's investment program has been undertaken. However, as noted above, MTDC's investment strategy has evolved in response to changing needs for venture capital.

More importantly, the MTDC staff has been systematically collecting information documenting the program's impact, beyond cumulative net capital earnings. The principal operational objective has been to assist early-stage technology companies to start or expand. Thus, employment growth has been one readily identifiable impact of MTDC's investment program. As of mid-FY89, the 41 active companies in which MTDC had invested employed over 3,700 people, generating a state payroll tax revenue of over \$6 million. In addition, it is estimated these companies purchased over \$40 million of goods and services, much of which were from other companies in the state. Most importantly, these companies are export oriented, both nationally and internationally.

Name of Program and Government Agency

- State: Massachusetts
- Program: Center for Applied Technology

Program Purpose and Objectives

The Center for Applied Technology (CAT) was created in 1987 by the Massachusetts Centers of Excellence Corporation (MCEC). This Center is one of five Centers established by MCEC.

The purpose of the Center is to stimulate economic activity and job creation by solving technology-related problems common to small and medium-sized manufacturers in the state. By assisting the manufacturing sector, the Center will be able to retain and create jobs in manufacturing.

The Center addresses two fundamental problem areas facing small and medium-sized manufacturers. The first issue is that small companies often cannot find or afford the technical expertise needed for defining, evaluating, and solving their manufacturing or production process technology problems. The Center provides small and medium-sized manufacturing companies with direct access to technical services on planning and implementing change in these process technologies. A unique aspect of the Center's assistance is the requirement that workers be involved in the planning and implementation of any changes, thus reassuring workers that change will not jeopardize their jobs.

The second issue is that new technologies are frequently not designed with the needs of smaller manufacturers in mind. Often they are expensive, lack flexibility, are designed for large-scale applications, and sometimes displace workers. The Center sponsors industry-wide technology development and transfer projects with the objective of effective application and reasonable cost of new technologies to smaller companies and the preservation of employment. Academic institutions join with manufacturers, labor, and government agencies in the state to address critical technology needs of specific industrial sectors.

The Center builds upon the state's diverse manufacturing base and the resources of the state's university-based manufacturing science and engineering programs. The Center funds joint industry-university research projects that promote new manufacturing and production process technologies and new applications of existing technologies for economic growth.

The Center for Applied Technology is in essence a "Center Without Walls." The Center is organized around existing manufacturing science and engineering programs and research strengths of the state's universities and nonprofit research institutes.

The Corporation, through the Center, has a competitive grant program for joint industry-university projects near the commercialization stage in the manufacturing technology field. Awards range from \$20,000 to \$300,000 and require matching contributions.

The Center has worked with the state's leading manufacturing science and engineering institutions as well as with companies manufacturing technology products to obtain federal funding for research and development activities. Projects supported by the Center may be used as "seed capital" to demonstrate the technical feasibility of an innovation or as matching funds for federal support.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors, although industrial sectors with traditional manufacturing or production processes are more likely to avail themselves of the research and assistance services of the Center than industries with technology-intensive products.

Classification of Objectives

The Center's objectives can be classified as follows:

- Research and development (with an emphasis on advanced technology processes)
- Small- and medium-sized business assistance.

Ranking of Objectives

Other than research and development, small- and medium-sized business assistance is the only specified objective.

Classification By R&D Type

To the extent project funds are used for research projects (versus technical assistance), the Center supports predominantly applied research and development projects, although demonstration or prototype development projects also may be funded. These matching grant awards are for joint industry-university projects in the manufacturing process technology field that are near the commercialization stage.

Level of R&D Focus

The Center directs its research and technology development efforts as well as its technical, business, and finance assistance efforts toward the development or improvement of manufacturing process technologies and toward the transfer and adaptation of existing process technologies. Thus, the Center not only builds on the existing R&D infrastructure but also creates new kinds of applied R&D activities.

Program Beneficiaries

Both established and start-up firms in the state are eligible for the Center's research program. Manufacturing companies are the intended targets for the Center's efforts.

To the extent intellectual property or other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the university/research institute partner (that generally favor the research institution), unless otherwise negotiated.

Direct or Indirect Benefits

The intended direct benefits are the development of new manufacturing process technologies and new applications of existing technologies to address manufacturing and production problems and opportunities faced by companies in the state. In theory, this would imply the traditional benefits of jobs/firms created/retained. The implied indirect benefits include increased linkages between the private and research sectors for collaborative research and other activities.

General or Targeted Benefits

Research support in manufacturing process technologies under the Center's program is provided to the university/research institute partner of the joint industry-research institution effort. The research results from any such partnership may or may not be available at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the research institution (that generally favor disclosure).

Program Duration and Permanence

The Center for Applied Technology was established by MCEC in 1987 and the Center's first awards were made in the 1988 fiscal year. The approach of the Center remains unchanged, although the mix of research and technical assistance projects has evolved to more resources being allocated to technical assistance efforts.

Types of Potential Subsidy Intervention/Form of Funding

The Corporation, through the Center, provides matching grants for joint industry-university/research institute projects in the range from \$20,000 to \$300,000. Funds are awarded to the research institution. Matching funds are required and usually are provided by the industry partner.

Description of How Program Is Funded/Amount of Funding

The Corporation, through the Center, made grants for six research projects and fifteen small technical assistance projects in the manufacturing technology area totaling over \$1.0 million over the three fiscal years, FY 88 to FY 90. All funds are from state general tax revenue. These grant awards were matching on an almost two-to-one basis by corporate and research institution funds.

Provisions for Cost Recovery

The Corporation does not directly attempt to recover its grant award costs, although the program does leverage private sector matching funds. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Center's technical assistance efforts and its competitive grants program is that only small- and medium-sized companies are eligible.

Summary of Program's Administration and Operation

The Center for Applied Technology is one component of the MCEC, a quasi-government organization. The Corporation's nine member Board of Directors has representatives from industry, academia, and government. The Corporation Board sets policy and makes funding

decisions. The Center has its own Applied Technology Board from these same sectors that develops strategies and recommends projects for Corporation support.

The Corporation uses a two-phase submission/review process. A Concept Paper is submitted by an eligible institution and evaluated by the Applied Technology Board. If the Board deems the proposed research or technology development project to be responsive to the goals of the MCEC program, to the priorities of the Center's program, and of high merit in comparison to other projects, it may invite the submission of a formal proposal. The Applied Technology Board reviews and evaluates the formal proposals and determines which if any of them will be recommended to the MCEC's Board for funding. Final determination of funding is made by the MCEC Board of Directors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluation, legislative reports, or internal self evaluations of the Center for Applied Technology or the overall Centers of Excellence program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Massachusetts
- Metropolitan Region: Springfield
- Program: Special Training Institute on Manufacturing, Engineering, and Flexible Automation Systems

Program Purpose and Objectives

In 1988, in response to the needs of machine tool and manufacturing companies in the region, the Springfield Technical Community College developed a Special Training Institute on Manufacturing, Engineering, and Flexible Automation Systems. With support from the Bay States Skills Corporation (BSSC) (a state-created, state-supported, quasi-government corporation) under its Special Institutes program, College faculty worked with sponsoring organizations to update their understanding of industry's needs and to design an appropriate course offering at the College. The six sponsoring organizations, which collectively provided the one-to-one matching support, included the National Tooling and Machining Association. The College has the capacity to develop other special institutes as required by industry in the region.

Industrial Sector

The College does not restrict its efforts to technology-based firms or to specific industry sectors, although a substantial percentage of the needs for special training institutes are in technology fields or are required by technology-based firms.

Classification of Objectives

The College's program can be classified as: research and development, regional development, and small and medium-sized business assistance.

Ranking of Objectives

Other than research and development, regional development and small and medium-sized business assistance are of equal importance.

Classification By R&D Type

To the extent that technology-based companies are involved, the firms using the College's Special Institutes for training and retraining of their workforces tend to be the manufacturers.

Level of R&D Focus

The College's training and retraining activities tend to be targeted to existing R&D activities.

Program Beneficiaries

Both established and start-up companies in the region are eligible to participate with the College in developing and giving training and retraining programs.

Direct or Indirect Benefits

The intended direct benefits are the development of new, or expansion or retention of existing, industrial companies. This would imply the traditional benefits of jobs/firms created/retained.

General or Targeted Benefits

The College's Special Training Institutes are available generally to all manufacturing companies in the region.

Program Duration and Permanence

The College's Special Institute on Manufacturing, Engineering, and Flexible Automation Systems was established in 1988 and is still available to sponsoring companies.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The College develops and runs special institutes and, as such, is a recipient, and not a provider, of extramural funding.

Description of How Program Is Funded/Amount of Funding

The College received support for the development of the special training institute from the BSSC's Special Institute program that was matched by corporate and association sponsors.

Provisions for Cost Recovery

Not applicable. To the extent that the cost of developing the course offering was not covered by the BSSC grant and the matching funds from the organizational sponsors, it would be recovered from fees charged for giving the course.

Discrimination/Conditionality

There are no formal or informal restrictions on the College's training and retraining activities, except that the clientele are in the region.

Summary of Program's Administration and Operation

The College leadership determines whether new course offerings should be developed in response to industry's needs.

Program Impact and Lessons

No formal, publicly available, third-party evaluations, legislative reports, or internal self assessments of the College's Special Training Institute have been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Massachusetts
- Metropolitan Region: Southeastern Massachusetts (Fall River-New Bedford)
- Program: Marine Science Center of Excellence

Program Purpose and Objectives

The Marine Science Center of Excellence was created in 1985 by the Massachusetts Centers of Excellence Corporation (MCEC). This Center is one of five Centers established by MCEC.

The purpose of the Marine Science Center of Excellence is to stimulate economic activity and job creation in coastal Massachusetts, especially in the southeastern region with its concentration of marine companies. The Center funds joint industry-university/research institute projects in the marine sciences that promote new technologies and new applications of existing technologies for economic growth in that industrial sector.

The Marine Science Board identified water quality, marine electronics, and marine resources as areas of particular importance and significant potential for the state. These three areas have become priority marine science research thrusts.

The Marine Science Center of Excellence is in essence a "Center Partly Without Walls." Although organized around the existing marine science research strengths of Southeastern Massachusetts University (SMU) and Woods Hole Oceanographic Institute, awards also are made to research universities and nonprofit research institutes that submit competitive proposals in those three research areas within marine sciences. Ultimately, a marine science research center is expected to be built, probably at SMU.

The Corporation, through the Center, has a competitive grant program for joint industry-university/research institute projects near the commercialization stage in the marine sciences area. Awards range from \$20,000 to \$300,000 and require matching contributions.

The Center has worked with the state's leading research universities and research institutes as well as with corporations manufacturing marine products to obtain federal funding for research and development activities. Projects supported by the Center may be used as "seed capital" to demonstrate the technical feasibility of an innovation or as matching funds for federal support. MCEC is the recipient of a major federal grant to study the competitiveness of the US marine electronics industry, a significant commercial sector in the state. MCEC also has created a

federally-funded, multistate alliance to carry out research in aquaculture and was instrumental in winning designation for SMU as one of four national aquaculture research centers.

Industrial Sector

The Center's funding is limited to research and technology development in the marine science area and to three priority research thrusts within that program area.

Classification of Objectives

The Center's objectives can be classified as follows: research and development, sectoral/industrial development, regional development, and small- and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the ranking of the Center's objectives would be sectoral/industrial development, regional development, and small and medium-sized business assistance in that order.

Classification of R&D Type

The Center supports predominantly applied research and development projects, although demonstration or prototype development projects also are funded. These matching grant awards are for joint industry-university/research institute projects in the marine sciences that are near the commercialization stage.

Level of R&D Focus

The Center's projects are directed toward joint industry- university/research institute efforts. Thus, they not only build on the existing R&D infrastructure but also create new kinds of applied R&D activities.

Program Beneficiaries

Both established and start-up firms in the state are eligible for the Center's research program. Research and technology-based firms (which might license or eventually manufacture technology-based products) and manufacturing companies are the intended targets for the Center's program.

To the extent intellectual property or other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the university/research institute partner (that generally favor the research institution), unless other negotiated.

Direct or Indirect Benefits

The intended direct benefits are the development of new technologies and new applications of existing technologies in the marine sciences area that are near the commercialization stage and can be marketed by companies in the state. In theory, this would imply the traditional benefits of jobs/firms created/retained. The implied indirect benefits include increased linkages between the private and research sectors for collaborative research and other activities.

General or Targeted Benefits

Research support in the marine sciences under the Center's program is provided to the university/research institute partner of the joint industry-research institution effort. The research results from any such partnership may or may not be available at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the research institution (that generally favor disclosure).

Program Duration and Permanence

The Marine Science Center of Excellence was established by MCEC in 1985 and the Center's first awards were made in the 1987 fiscal year. The three research thrusts identified by the Marine Sciences Board (water quality, marine electronics, and marine resources) remain unchanged from their initial designation.

Types of Potential Subsidy Intervention/Form of Funding

The Corporation, through the Center, provides matching grants for joint industry-university/research institute projects in the range from \$20,000 to \$300,000. Funds are awarded to the research institution. Matching funds are required and usually are provided by the industry partner.

Description of How Program is Funded/Amount of Funding

The Corporation, through the Center, made grants for 13 projects in the marine sciences area totaling approximately \$2.0 million over the four fiscal years FY 87 to FY 90. All funds are from state general tax revenue. These grant awards were matched on an almost two-to-one basis by corporate and research institution funds.

Provision for Cost Recovery

The Corporation does not directly attempt to recover its grant award costs, although the program does leverage private sector matching funds. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The formal restriction on the Center's competitive grant program is that proposals are accepted only in three priority research thrusts in the marine science area (water quality, marine electronics, and marine resources).

Program's Administration and Operation

The Marine Science Center of Excellence is one component of the MCEC, a quasi-government organization. The Corporation's nine member board of directors has representatives from industry, academia, and government. The Corporation Board sets policy and makes funding decisions. The Center has its own Marine Science Board from these same sectors that develops strategies and recommends projects for Corporation support.

The Corporation uses a two phase submission/review process. A concept paper is submitted by an eligible institution and evaluated by the Marine Science Board. If the Board deems the proposed research or technology development project to be responsive to the goals of the MCEC program, to the priorities of the Center's program, and of high merit in comparison to other projects, it may invite the submission of a formal proposal. The Marine Science Board reviews and evaluates the formal proposals and determines which if any of them will be recommended to the MCEC's Board for funding. Final determination on funding is made by the MCEC Board of Directors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Marine Science Center of Excellence or the overall Centers of Excellence program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Massachusetts
- Metropolitan Region: Lowell-Lawrence-Haverhill
- Program: Lowell Department of Planning and Development

Program Purpose and Objectives

In the mid-1970s, the most serious issue facing the City of Lowell was the fact that two-thirds of its industrial property, mostly former textile mills, was vacant. A new city manager was hired and a city Department of Planning and Development (DPD) was formed with the second largest planning staff in the state.

With the exception of a university, Lowell lacked most of the ingredients of a high-technology center, except its location adjacent to the Boston area. With the support of DPD and careful land use planning, the city manager recruited Wang Laboratories, Inc. The corporation opened a small manufacturing facility in the city because of low land cost and a skilled labor force. In 1978 after outgrowing its location in nearby Tewksbury, the corporation decided to construct its world headquarters in Lowell.

Several reasons are stated for this decision:

- The City obtained a \$5 million Urban Development Action Grant (UDAG), which was loaned to the corporation at a low rate of interest
- The state financed a downtown heritage park linked to historic themes in the City
- The City's DPD was effective in increasing the efficiency of the private development process and in convincing the corporation that development would be orderly and attractive.

As a result of the City's efforts, the corporation constructed two 12-story office buildings for its world headquarters, a \$10 million research training center, and a 250,000 square foot manufacturing facility. The investment by the corporation in its own facilities contributed to the further growth of a high-technology infrastructure and generated the development, or relocation to the City, of many small and medium-sized supplier and support industries. In addition, the City began to attract computer, aerospace, and technical instrument companies—all of which fit the category of technology-based, growth-oriented firms. In the ten years from the mid-1970s to the mid-1980s, the unemployment rate in the City declined from about 15 percent to 2.3 percent.

Industrial Sector

The City does not restrict its efforts to specific industry sectors.

Classification of Objectives

The College's overall objectives can be classified as: research and development, and regional development.

Ranking of Objectives

Other than research and development, regional development is the only specified objective.

Classification By R&D Type

The private and academic research facilities located at the City undertake applied research as well as technology development. They support projects ranging from generic research and development to those involving specific technologies.

Level of R&D Focus

With the variety of organizations in the City and the variety of activities they undertake, their research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

The near-term, direct beneficiaries of the City's planning and development activities, its amenities and services, its university, and its location adjacent to the Boston area with its technology-based industrial base and research universities are the technology-based companies in the City itself as well as the state and region, to the extent such organizations were recruited from outside the state.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing, technology-based private companies. This would imply the traditional benefits of jobs/firms created/retained as well as personal, property, and business taxes paid.

General or Targeted Benefits

The services of the City's DPD are available generally to all manufacturing and service companies, although technology-based firms have received strong city support.

Program Duration and Permanence

The City's DPD was established in the mid-1970s. The Department's approach to planning and development necessarily has evolved in response to needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

The City has received some support for its development from the state and federal government grants and provided some support to companies or developers in the form of property tax incentives.

Description of How Program Is Funded/Amount of Funding

Funds for the City's Department of Planning and Development operations come from city general tax revenue. Support for specific development or infrastructure activities may come from city, state, and/or federal funds.

Provisions for Cost Recovery

Neither the City nor the state makes provisions for direct cost recovery. However, it can be inferred that they expect to recover their investment costs for the development and infrastructure projects through increased personal, property, and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on activities conducted by the City and its DPD.

Summary of Program's Administration and Operation

The Department of Planning and Development reports directly to the city manager.

Program Impact and Lessons

Formal, publicly available, third-party evaluations, and internal self-assessments of the City's planning and development activities have been undertaken and information has been systematically collected documenting the program's impact in such terms as numbers and types of companies locating in the City, their number of employees, and taxes paid.

The most important lesson learned from the experience of the Lowell DPD is that strategic policy planning, land use planning, and urban design at the city level can provide the environment for technology-based business and economic development, provided other factors are present such as a research university.

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VII. MICHIGAN

In Michigan, state technology development programs are administered through several types of organizations: a quasi-government organization (Michigan Strategic Fund), state agencies (Department of Commerce, Department of Treasury), a joint state agency-research institute operational activity (Michigan Modernization Service), and a joint executive-legislative branch board (Research Excellence Fund). An organizational chart of state activities is presented in Figure 7.

The Michigan Strategic Fund (MSF) was created in 1985 to increase the availability of private capital for small and medium-sized businesses and start-up firms. The Fund provides private financial institutions with new tools for financing and encourages the creation of new types of private financial institutions to address unmet financial needs.

The Fund finances three research institutes under its Centers of Excellence Program: Michigan Industrial Technology Institute, Michigan Biotechnology Institute, Metropolitan Center for High Technology. In addition, the Fund administers a Seed Capital Program, a Product Development Program, the State Research Fund, the Capital Access Program, and the Business and Industrial Development Corporations Investment Program.

The fund has a nine-person Board of Directors, six from the private sector and three from government. During the four-year period from the 1987 fiscal year through the 1990 fiscal year, the Fund allocated a total of over \$90 million, excluding direct allocations to capital programs and loan program authorizations.

The Michigan Department of Commerce administers a number of programs, of which two are related specifically to science and technology for industrial innovation: the Michigan Modernization Service and the Technology Transfer Network.

The Michigan Modernization Service (MMS) helps small and medium-sized manufacturing companies modernize their production processes through programmable automation. MMS is a partnership of the Department of Commerce and the Industrial Technology Institute, a nonprofit center for R&D in computer-aided manufacturing that was established with support from the Michigan Strategic Fund.

MMS operates through four programs: Technology Deployment Service, Market Analysis Service, Work Force Development Service, and New Enterprises Service. The MMS and the Technology Transfer Network are predominantly staff functions with limited grant authority. Thus, the extramural budgets for these two programs is less than \$0.4 million per year.

The Michigan Department of Treasury manages the Michigan Venture Capital Fund, the basis for which is a small percentage of the State Retirement Systems' assets.

The Fund makes venture capital investments in state-based companies which have demonstrated potential for rapid growth and meet criteria for good management, product/market position, and competitive strength. The typical investment by the Fund is at least \$500,000. The Fund co-invests with private venture capital firms.

The Fund's investments in individual businesses is diversified with an emphasis on high, growth, high-technology firms. As of early 1990, approximately \$860 million in total capital was available, of which over \$461 million was invested.

The Michigan Research Excellence Fund was created in 1985 to increase the availability of relatively flexible research monies for the state's 11 research universities. While not contributing directly to the state's R&D-based business and economic development, the Fund has the potential for building the research infrastructure required for such a strategic goal.

Fund monies are appropriated each year as part of the Higher Education budget and then allocated to the universities based on a formula which places great weight on the percent of sponsored research in the state that comes to that university. The four major research universities receive about 85 percent of the Fund's allocation, with the other seven receiving the remaining 15 percent.

Because Michigan does not have a centralized board of higher education, the Department of Management and Budget (DMB) has the lead responsibility for the three-person Board that makes decisions on individual projects and DMB also staffs the Board. This Board had representatives from DMB, the Speaker of the House, and the Senate Majority Leader.

The universities submit research proposals to draw down on the allocation. There are few limitations on the types of research activities except that they are limited to scientific, engineering, and biotechnology disciplines. Proposals presented to the Board compete against themselves and are either accepted or rejected. Monies are not reallocated by the Board from one university

to another, but are allocated on the scientific and technical merit (or lack thereof) of all proposals from all universities.

After five years of operation and the approval of over \$125 million in research awards, it appears that there has been growing support from the university research community regarding the capacity strengthening role of the Fund. The universities who were ambivalent about applied research and suspicious about any economic development thrust in their knowledge-focused research are more positive about the direction the Fund had taken. Federal and industrial-sponsored grants and contracts and federally-supported research centers all have increased and research faculty have been easier to attract.

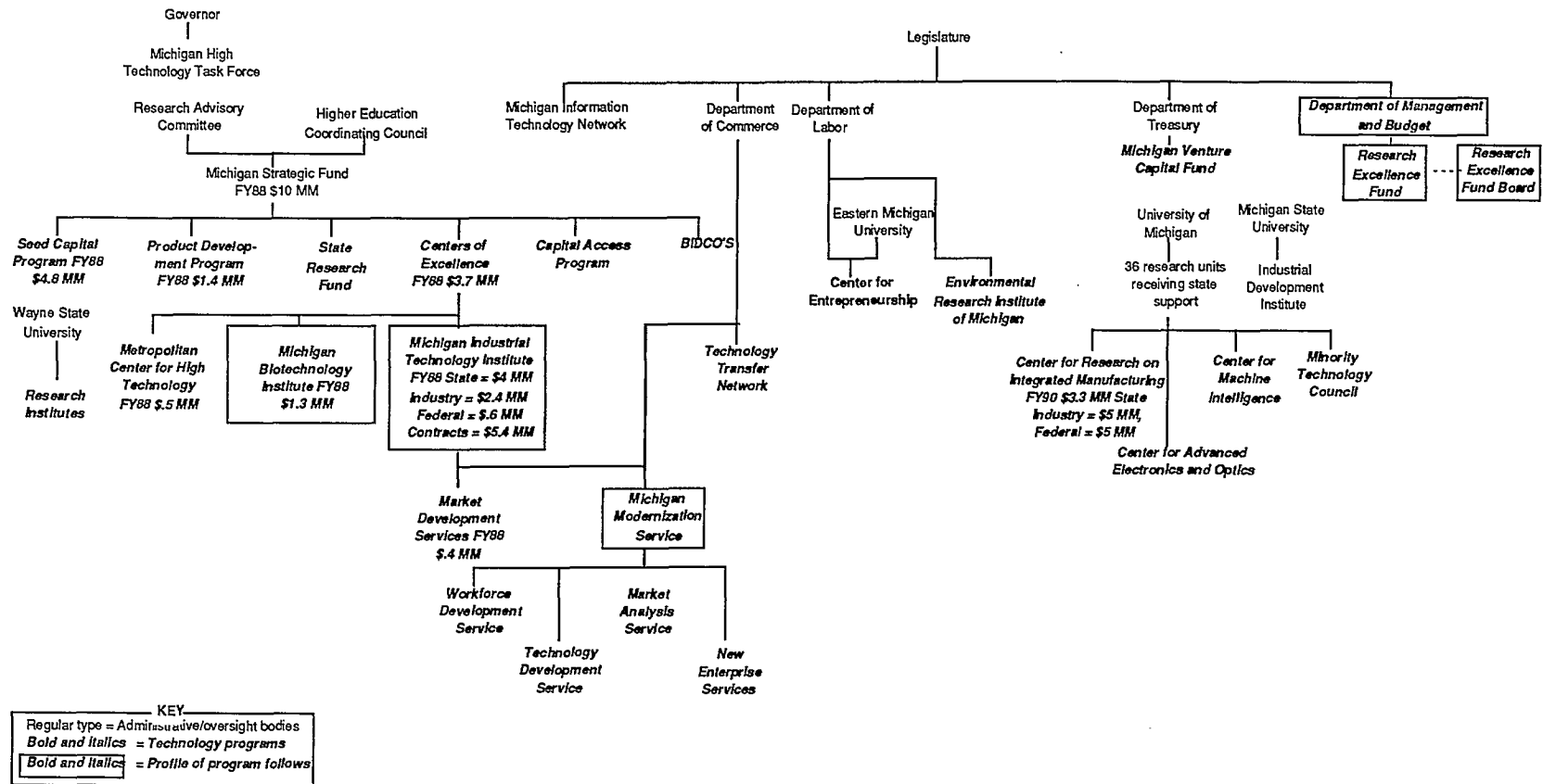


FIGURE 7 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: MICHIGAN

Name of Program and Government Agency

- State: Michigan
- Program: Technology Deployment Service, Michigan Modernization Service

Program Purpose and Objectives

Created in 1987, the Michigan Modernization Service (MMS) helps small and medium-sized manufacturing companies modernize their production processes through programmable automation. MMS is a partnership of the Michigan Department of Commerce and the Industrial Technology Institute, a nonprofit center for R&D in computer-integrated manufacturing.

MMS is a state-funded, state-managed consulting organization which employs private sector professionals to staff its field force. Thus, advice and assistance services are provided by knowledgeable, experienced professionals at no cost to the manufacturing companies.

MMS assists eligible firms in analyzing their operations, upgrading technologies, expanding markets, and retraining workers. MMS operates through four programs: Technology Deployment Service, Market Analysis Service, New Enterprises Service, and Work Force Development Service.

The objective of the Technology Deployment Service is to help firms adopt new, computer-operated manufacturing tools and processes. To achieve this objective, firms receive a free assessment of their operations and a referral to the Service's professional manufacturing consultants and/or to the Industrial Technology Institute. The Technology Deployment Service is the institutional mechanism by which the manufacturers can access the most appropriate consultant resources to modernize their production processes.

The Technology Deployment group is staffed with individuals qualified to assist manufacturing companies with advanced manufacturing technologies and practices, such as CAD/CAE, computer numerical control, manufacturing resource planning, and programmable logic controllers.

Client companies for the services of the Technology Deployment group tend to be "foundation" firms, many of which are suppliers to the state's larger manufacturers. These client companies tend to be mid-sized with 20 to 500 employees. Such firms are viewed as the foundation of the state's manufacturing economy.

Industrial Sector

The Service does not restrict its efforts to specific industry sectors, although industrial sectors with traditional manufacturing processes are more likely to avail themselves of assistance from the Technology Deployment Service than industries with technology-intensive products.

Classification of Objectives

The Service's program can be classified as follows:

- Research and development (with an emphasis on programmable automation technologies)
- Small and medium-sized business assistance.

Ranking of Objectives

Other than research and development, small and medium-sized business assistance would be the most important objective.

Classification by R&D Type

Since the Technology Deployment Service provides information and technical services, it can be implied that the Service supports generic research and development.

Level of R&D Focus

Since the Service directs its technical assistance efforts toward the modernization of manufacturers' production processes, it builds on the existing R&D and assistance infrastructure and that of its consultants and backup institutions, including the Industrial Technology Institute.

Program Beneficiaries

Established manufacturing companies are the intended targets for the assistance efforts of the Technology Deployment Service.

Intellectual property and other proprietary rights are not likely to be involved in these assistance activities.

Direct or Indirect Benefits

No formal assessment of the Service's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the modernization of manufacturers' production processes. In theory, this would imply the traditional benefits of jobs/firms created/retained. No indirect benefits appear to be implied.

General or Targeted Benefits

The assistance of the Technology Deployment Service is available to all small and medium-sized manufacturing firms in the state.

Program Duration and Permanence

The Michigan Modernization Service and its Technology Deployment Service component were created in 1987. While its core activities have not changed since their initiation, the Technology Deployment Service necessarily has evolved due to its increased ability to understand manufacturers' needs and to respond more appropriately.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The Technology Deployment Service provides technical assistance only.

Description of How Program is Funded/Amount of Funding

Funding for the Service's core staff and consultant operations is provided through the Michigan Department of Commerce. All funds are from state general tax revenue.

Provisions for Cost Recovery

The Technology Deployment Service makes no attempt to recover its total costs for the Service's core staff and consultant operations. There is no fee for initial screening, analysis, and assessment review by the Service staff or for the technical assistance by the field representative consultants. Fees generally are required for more complex problem solving. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Service's technical assessment and assistance efforts is that the manufacturers be small or medium-sized companies located in the state.

Program's Administration and Operation

The Technology Deployment staff does a technology assessment for a client company to evaluate current practices and determine opportunities for cost-effective deployment of program-mable technology. One of the Service's 30 to 40 field representatives (all of whom have engineering degrees and substantial manufacturing experience) reviews the assessment, conducts a day-long visit at the client company, and produces a report with specific recommendations to improve the use of existing technologies, to adopt new technologies, and to implement new methods. The report provides the basis for MMS to deliver other services and/or to use the technical expertise of the Industrial Technology Institute. Technical experts assist the manufacturers with practical acquisition and implementation issues related to specific technologies.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of MMS or its Technology Deployment Service has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Michigan
- Program: Industrial Technology Institute

Program Purpose and Objectives

The Industrial Technology Institute (ITI), located in Ann Arbor, Michigan, was founded in 1981 as a nonprofit, independent corporation. The Institute is one of three Centers of Excellence launched by the state at that time through the Michigan Strategic Fund with additional support from Michigan corporate and philanthropic foundations.

ITI is now one of the largest organizations in the country dedicated to developing and deploying advanced manufacturing technology. The Institute has grown to an annual budget of over \$10 million and a staff of about 150 technical professionals.

The purpose of the Institute is to assist American durable goods manufacturers in becoming more productive and competitive by developing and fostering the implementation of advanced automated manufacturing technologies. In order to achieve this objective, ITI emphasizes a broad interdisciplinary approach to integrating new automation technologies for computer-integrated manufacturing. Thus, the Institute conducts research, development, and technology transfer activities in the major technological, organizational, management, economic, and information aspects of advanced manufacturing technologies.

The Institute undertakes research and development on new ideas in manufacturing process technologies and on the application and adaptation of existing technologies to specific manufacturing processes. In addition to research, development, and applications engineering, the Institute provides a variety of other services, including prototype tool development, strategic and technical consulting, evaluation and testing services, specially tailored training programs, and information services.

ITI has its own building with high bay space, several specialty laboratories and testbeds, a computing LAN facility, a specialized information resource center, and conference and training facilities.

Industrial Sector

The Institute does not restrict its efforts to specific industry sectors, although the durable goods industrial sectors with traditional manufacturing processes are more likely to avail themselves of the services of ITI than industries with technology-intensive products.

Classification of Objectives

The Institute's program can be classified as follows:

- Research and development (with an emphasis on advanced manufacturing technology processes)
- Sectoral/industry development (with the emphasis on durable goods manufacturers).

Ranking of Objectives

Other than research and development, sectoral/industry development would be the most important objective.

Classification by R&D Type

ITI undertakes applied research and development projects both on advanced manufacturing technologies and on the major organizational, management, economic, and information aspects of advanced manufacturing technologies.

Level of R&D Focus

The Institute's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

Manufacturing companies, especially durable goods manufacturers, are the ultimate intended targets for the Institute's efforts. However, ITI's client list is not limited to such organizations.

ITI clients have included private companies, government agencies, education and research institutions, labor unions, professional societies, economic development groups, foundations, trade associations, and other organizations.

To the extent intellectual property and other proprietary rights are involved, the Institute retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Institute's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new, or the adaptation of existing, advanced manufacturing technologies which can be used by companies in the state and throughout the nation. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the private sector and a research institute not only for advice and assistance but also for collaborative research efforts or other arrangements.

General or Targeted Benefits

The services of the Institute are available generally to all manufacturing companies in the state and throughout the nation. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

ITI was established in 1981. While the basic approach of the Institute has not changed since its initiation, the Institute's services and programs areas necessarily have evolved in three ways: first, the Institute itself has grown in size and can address more issues; second, its understanding of the technological and nontechnological aspects of introducing advanced manufacturing technologies in companies continues to evolve; and third, the nature of the requests for ITI's services change.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As a Center of Excellence, ITI is a recipient, not a provider, of extramural funding for its research efforts and other services.

Description of How Program is Funded/Amount of Funding

Funding for certain of the Institute's core staff operations is provided through the Michigan Strategic Fund. Specific research and development projects may be supported also under the Fund's allocation or by industrial or government contracts. In addition, cooperative research and development projects are undertaken with industrial firms and consortia thereof. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Except for certain core staff activities and internally funded efforts under the Michigan Strategic Fund allocation, all research and service activities of ITI necessarily provide for full cost reimbursement. Where appropriate, a royalty or other arrangement may be negotiated.

Although the research and other services of the Institute are available to all companies in the nation, ITI was established by the state. Thus, it can be implied that the state expects to recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Institute's research and other services.

Program's Administration and Operation

ITI has a sixteen-member Board of Directors, representing the manufacturing, workforce, legal, financial, academic, and governmental sectors.

ITI has developed an approach to transferring new technologies and new concepts into the manufacturing environment through interaction with university researchers, manufacturing equipment vendors, and manufacturing end users. To stay abreast with the needs of industry, the Institute has organized its staff into a number of programs including automated inspection and monitoring, factory system design, industry and region analysis, technology assistance, distributed software in manufacturing, distributed system operations and management, manufacturing standardization support and testing, and training/retraining for manufacturing.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of ITI has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Michigan
- Program: Michigan Biotechnology Institute

Program Purpose and Objectives

The Michigan Biotechnology Institute (MBI), located in Lansing, Michigan, was created in 1983 as a nonprofit, independent corporation. The Institute is one of three Centers of Excellence launched by the state in the early 1980s. Initial capitalization was provided through the Michigan Strategic Fund with additional support from Michigan corporate and philanthropic foundations, other private sources, and state loans.

The purpose of the Institute is to facilitate commercialization and industrial applications of biological science research results and to develop renewable resource based business opportunities in the state. In order to achieve these objectives, MBI focuses on research and development of new biotechnology-based products and processes, technology transfer to industry, and collaboration between industrial, academic, and federal laboratories. Specific priority research areas include industrial enzyme technology, biomaterials and fermentation technology, and waste treatment biotechnology. Through laboratory research and pilot plant demonstrations, the Institute is working to turn surplus commodities and renewable agriculture and forest resources into higher value industrial products.

MBI has its own building with specialty research laboratories and pilot plant facilities. This center serves as a resource not only for the Institute but also for universities and industries in the state.

Industrial Sector

The Institute restricts its efforts to the biotechnology industry sector and, more specifically, to priority research areas within biotechnology (industrial enzyme technology, biomaterials and fermentation technology, and waste treatment biotechnology).

Classification of Objectives

The Institute's Program can be classified as follows:

- Research and development (with an emphasis on commercialization and industrial applications)
- Sectoral/industry development (with the emphasis on three priority research areas within the biotechnology field).

Ranking of Objectives

Other than research and development, sectoral/industry development would be the most important objective.

Classification by R&D Type

MBI undertakes applied research and development projects in three priority research areas within biotechnology that have potential for commercialization.

Level of R&D Focus

The Institute's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

Biotechnology companies are the ultimate intended targets for the Institute's efforts. However, MBI's client list also includes government agencies and education and research institutions.

To the extent intellectual property and other proprietary rights are involved, the Institute retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Institute's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new biotechnology based products and processes with near term commercialization potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the private

sector and a research institute not only for advice and assistance but also for collaborative research efforts or other arrangements.

General or Targeted Benefits

The services of the Institute are available generally to all biotechnology manufacturing companies in the state and throughout the Midwest. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

MBI was established in 1983. While the basic approach of the Institute has not changed since its initiation, the Institute's services and program areas necessarily have evolved in three ways:

- The Institute itself has grown in size and can address more issues
- Its understanding of the biological sciences and biotechnology development in the three priority research areas continues to evolve
- The nature of the requests for MBI's services continues to change.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As a Center of Excellence, MBI is a recipient, not a provider, of extramural funding for its research efforts and other services.

Description of How Program is Funded/Amount of Funding

Funding for certain of the Institute's core staff operations is provided through the Michigan Strategic Fund. Specific research and development projects may be supported also under the Fund's allocation or by industrial or government contracts. In addition, cooperative research and development projects are undertaken with industrial firms and consortia thereof. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Except for certain core staff activities and internally funded efforts under the Michigan Strategic Fund allocation, all research and service activities of MBI necessarily provide for full cost reimbursement. Where appropriate, a royalty or other arrangement may be negotiated.

Although the research and other services of the Institute are available to companies in the Midwest, MBI was established by the state. Thus, it can be implied that the state expects to recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The formal restriction on the Institute's research and other services is that projects are undertaken only in the three priority research areas in the biotechnology field (industrial enzyme technology, biomaterials and fermentation technology, and waste treatment biotechnology).

Program's Administration and Operation

Members of MBI's Board of Directors represent biotechnology research and manufacturing, academic, and governmental sectors.

The research division of the Institute consists of a scientific staff, primarily biologists and engineers, who may hold joint appointments with Michigan State University or other universities. There are also adjunct scientists, full-time university professors who work for MBI as consultants and as major professors for the traineeship programs.

The Institute attempts to facilitate interaction between universities and industry that leads to business and economic development and job creation. As a nonprofit corporation positioned between the academic and private sectors, MBI fosters linkages between them.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of MBI has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Michigan
- Program: Michigan Research Excellence Fund

Program Purpose and Objectives

The Michigan Research Excellence Fund was created in 1985 to increase the availability of relatively flexible research monies for the state's 11 research universities. While not contributing directly to the state's R&D-based business and economic development, the Fund has the potential for building the research infrastructure required for such a strategic goal.

Fund monies are appropriated each year as part of the Higher Education budget and then allocated to the universities based on a formula which places great weight on the percent of sponsored research in the state that comes to that university. The four major research universities receive about 85 percent of the Fund's allocation, with the other seven receiving the remaining 15 percent.

Industrial Sector

Research projects supported by the Fund are not limited to any specific industry sector.

Classification of Objectives

The Fund's only objective can be classified as research and development.

Ranking of Objectives

There is no objective other than research and development.

Classification of R&D Type

The Research Excellence Fund supports predominantly basic research with some applied research and development projects.

Level of R&D Focus

Under the Research Excellence Fund with its support predominantly of basic research, projects can reinforce existing R&D activities, build on existing R&D infrastructure, or create new kinds of R&D activities.

Program Beneficiaries

Only researchers in the 11 research universities in the state are eligible to apply for grant support from the Fund. To the extent intellectual property or other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the university.

Direct or Indirect Benefits

No formal assessment of the Research Excellence Fund has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are a strengthened research infrastructure at the state's research universities.

General or Targeted Benefits

Because the research supported with Fund monies is predominantly basic research in scientific, engineering, and biotechnology disciplines conducted at universities, the research results are likely to be made publicly available on a timely basis.

Program Duration and Permanence

The Michigan Research Excellence Fund was created in 1985 and has seen no major changes over its five years of operations.

Types of Potential Subsidy Intervention/Form of Funding

The Fund awards grants to the research institutions on behalf of the researcher who made the proposal. The awards are actually a drawing down on the allocation made to the university. As with most basic research, no matching funds are required.

Description of How Program is Funded/Amount of Funding

The Fund has approved over \$125 million in research awards during its five years of operation. All funds are from state general tax revenue.

Provision for Cost Recovery

As with most basic research, the Fund makes no attempt to recover its grant award costs. Indirectly, it is implied that the state will recover its investment costs over the long term through research and technology development based business and economic development with its increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Fund's competitive grant program is that proposals are limited to scientific, engineering, and biotechnology disciplines; not industrial sectors.

Program's Administration and Operation

Because Michigan does not have a centralized board of higher education, the Department of Management and Budget (DMB) was given lead responsibility for the Board that makes decisions on individual projects and DMB itself also staffs the Board. This Board has representatives from DMB, the Speaker of the House, and the Senate Majority Leader.

The universities submit research proposals to draw down on the allocation. There are few limitations on the types of research activities except that they are limited to scientific, engineering, and biotechnology disciplines. The research proposals themselves are not truly in a competitive environment once they leave the university. Proposals presented to the Board are judged solely on their own merits. Unspent monies are not reallocated by the Board from one university to another.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Centers of Excellence program has been undertaken and no information has been systematically collected documenting the program's impact.

After five years of operation and the approval of over \$125 million in research awards, anecdotal evidence exists that there has been some consciousness raising on the part of the university research community regarding the capacity strengthening role of the Fund. The universities who were ambivalent about applied research and suspicious about any economic development thrust in their knowledge-focused research are more positive about the direction the Fund had taken. Federal and industrial-sponsored grants and contracts and federally-supported research centers all have increased and research faculty have been easier to attract.

The capacity strengthening strategies that appear to be working for the universities are seed funding projects that increase the potential for federal basic research support and applied research projects building on federally-funded basic research activities.

Name of Program and Government Agency

- State: Michigan
- Metropolitan Region: Detroit
- Program: Metropolitan Center for High Technology

Program Purpose and Objectives

The Metropolitan Center for High Technology (MCHT) is an urban economic development program. It seeks to revitalize the downtown area of urban Detroit by attracting and supporting start-ups, particularly technology-based companies to the Center. As part of its economic development goal, the center also seeks to create jobs. To achieve these goals, center directors have refurbished 167,000 square feet of office space, started a business incubator, and initiated a number of referral services. The facility is 70 percent full, housing 42 organizations and a few Wayne State University R&D labs. There are presently 15 tenants in the incubator.

Industrial Sector

MCTH does not target any particular industrial sector, although high-technology companies are prevalent among those businesses located in the facility. Occupants range from an environmental testing company to biotechnology and computer software and hardware companies. MCTH officials are currently considering ways to take advantage of the numerous medical facilities in the area, including the possibility of specifically targeting the biomedical sector.

Classification of Objectives

Objectives can be classified as regional/local development, small and medium business assistance, technology transfer, and infrastructure development (with an emphasis on business infrastructure). Research and development is not an ongoing aspect of MCHT activities, although MCTH pulls together companies that do R&D, particularly applied research and product development.

Ranking of Objectives

While the principal objective is regional development, the vehicle for achieving that development is helping small businesses and start-up companies get off the ground. Therefore, business assistance is the MCTH's top objective. Technology transfer is also a high-priority objective. MCTH works with Wayne State University faculty to identify technologies that might have commercialization potential and it provides advice on how to spin-off a new product.

Classification of Objectives

MCTH does not do research and development, although many of the companies locating there are active in this area. Those that do R&D, especially incubator companies, are working in applied areas or product development.

Level of R&D Focus

While many companies locating at MCTH are doing research and development, this is not a prerequisite for renting space in the facility.

Program Beneficiaries

One intended program beneficiary is the small businesses that enter MCTH and its incubator. Tenants receive relatively inexpensive (although not subsidized) office space and numerous services specifically geared toward small businesses and start-ups. The City of Detroit and the state benefit from the economic development that occurs. The university benefits from technology transfer opportunities that extend beyond standard licensing, and it benefits as owner of the MCTH building.

Direct or Indirect Benefits

Direct benefits accrue to the small companies that occupy MCTH. Indirect benefits include a stronger local economy, more jobs for local residents, increased business for support service providers and the University, which owns the MCTH building and gains more and better opportunities to spin-off new technologies.

General or Targeted Benefits

Program benefits are targeted in the sense that MCTH is designed to promote economic development in downtown Detroit and, to a lesser degree, Wayne County. Additionally, only companies entering MCTH benefit from the business advantages and services it provides. Benefits are general in that all companies are eligible to enter MCTH and in as much as jobs and the fruits of local economic development are available to all members of the community.

Program Duration and Permanence

MCTH was launched in 1984. Although there have been no major changes or redirections of the program, there has been periodic fine tuning. Originally, program officials thought they could attract a large company to anchor the facility and act as a magnet to small businesses. However, with many large companies leaving Detroit for the suburbs, this aspiration was not met.

Financially, MCTH is quite stable. It is half way through the second year of a five-year grant, its second, from the Michigan Strategic Fund. While the grant has been renewed once, there are no guarantees that renewal will be forthcoming when the current grant runs out. Program officials are considering ways to replace state support with corporate and foundation support.

Types of Potential Subsidy Intervention/Form of Funding

MCTH does not make funds available as part of its program. Its own funds derive from a variety of public and private sources, including a state grant, rent from tenants, and corporate contributions.

Description of How Program Is Funded/Amount of Funding

Metro Center operates from a \$1.5 million annual budget. The building is owned by Wayne State University. Federal money, available through the Urban Development Action Grant program, was used to refurbish the building. The Center has a five-year, \$4.7 million grant from the Michigan Strategic Fund. The Michigan Strategic Fund receives its revenues from licenses paid to the state for rights to exploit the state's natural resources. MCTH's sources of funds for 1990 are as follows:

• State Funds	\$1 million
• Corporate Contributions	\$150,000
• Technology Development Grants	\$25,000
• Office Rental Fees	\$270,000
• Other	\$20,000

At-cost fees are charged for some services. Incubator companies receive subsidized office and management services. MCTH is just starting to raise a revolving loan fund to provide operating capital to companies. It has raised about \$30,000 toward a goal of \$100,000. Typical loans will be in the range of \$10,000. These will be standard loans and not seed money.

Provisions for Cost Recovery

There are no provisions for cost recovery. Most services are provided at-cost, with some at subsidized rates. Other sources of funds are grants and donations.

Discrimination/Conditionality

MCTH is open to all businesses, although officials have targeted technology-based and high-technology companies. However, the Detroit area does not have a strong base in these fields. As a result, MCHT has worked with and housed a variety of ventures. Although there were no specific conditions tied to the state money, the grant agreement with the Michigan Strategic Fund outlines MCHT's economic development goals in general terms.

Summary of Program's Administration and Operation

MCHT has a 15 member staff that handles day-to-day operations. Eight of these staff members are professionals, including one Ph.D, and seven are clerical and support staff. There is a CEO of the organization, and a vice-president of finance and marketing development. The professional staff also includes a grant writer, a technical writer, a client services person, and two people working with incubator tenants. There is a 35-member Board of Directors, comprised of representatives of major corporations and Detroit-based nonprofits. The board outlines policies and establishes the general direction of the organization. The staff serves as the implementation arm. The staff determines which companies enter the incubator and makes policy recommendations to the board. It also has some flexibility in budgeting.

Program Impact and Lessons

After high expectations early on, MCHT officials had problems making their original concept fly and had to refocus their objectives. Originally, they envisioned an applied research center, along the lines of Michigan's Centers for Excellence. However, it was clear that such a center would have high costs (especially overhead), would create relatively few jobs and would have a limited, long-term, economic impact. Rather than bring in scientists and do research, officials decided to work with small businesses that would have a more immediate economic impact and that would generate more community employment.

Name of Program and Government Agency

- State: Michigan
- Metropolitan Region: Kalamazoo
- Program: Institute for Technological Studies

Program Purpose and Objectives

The Institute for Technological Studies, located at Western Michigan University, acts as a bridge between the laboratory and intellectual resources of the university and the regional (Kalamazoo County) business community. The Institute typically handles a wide variety of inquiries, ranging from simple business questions to product design problems. Through the institute, the business gains access to mostly technical assistance usually from university professors.

Industrial Sector

Although the Institute will try to handle virtually any inquiry, its focus is in the area of engineering. Sectorally, it tends to work with automotive companies and plastic and plastic molding companies, which are the principle industries located in the region.

Classification of Objectives

Objectives can be classified as research and development, regional development (to the extent that growth is the result of interactions facilitated by the institute), and small and medium business assistance. The Institute also promotes environmental protection in that it helps plastics companies in the region with recycling.

Ranking of Objectives

The Institute's primary objective is providing assistance to small and medium businesses, particularly manufacturers. Other objectives—regional development, research and development and environmental protection—are all about equal, but secondary to business assistance.

Classification By R&D Type

Although the Institute is not engaged in research and development, it typically works with companies that do applied research and development and product development. The institute also helps companies with problems in the design and manufacture of products. The institute does not try to spin-off businesses from research and development conducted at the university.

Level of R&D Focus

The Institute has no R&D focus. It will attempt to answer any inquiry, whether it concerns new R&D activities or existing R&D efforts.

Program Beneficiaries

There are several program beneficiaries. First, Institute clients benefit by gaining access to experts who can help solve their problems and enable them to get their job done. University students benefit from employment opportunities generated by the client companies. Individual faculty members benefit because they gain practical business experience and, in some cases, consulting fees.

Direct or Indirect Benefits

Direct benefits are fees earned by the university and/or its staff through consulting for regional businesses; learning and job opportunities for students; and more efficient and successful businesses in the region. The principal indirect benefit is the improved reputation of the university as a result of supporting regional business.

General or Targeted Benefits

Benefits are general in that the Institute helps any businesses so that they can offer better products and services. Since it often helps manufacturers, the benefits achieved by working with the Institute are not highly visible.

Program Duration and Permanence

The program was started in 1980 and has seen little change over the years. Because of the low cost of running the Institute, it has been relatively easy keeping the program in operation. The program is funded through the College of Engineering and it will remain in operation as long as the College appropriates funds for the program. Administering the program is part of the job description of the associate dean of the College, further underscoring the Institute's permanence.

Types of Potential Subsidy Intervention/Form of Funding

Institute funding comes from the state legislature appropriation to Western Michigan University. The university appropriates a share of its total budget to the College of Engineering, which then appropriates some of its budget to the Institute.

Description of How Program Is Funded/Amount of Funding

Until recently, the institute operated on a \$25,000 annual budget, appropriated by the College of Engineering from its share of the university's overall budget. Last year, two additional institutes were placed under the directorship of the Institute for Technological Studies. As a result, the Institute for Technological Studies now receives \$165,000 annually, although most of this is used to fund the Institute for Innovation and Enterprise and the Energy Research Institute. Clients pay the Institute for its services, which usually involves providing a consultant to help with a specific issue. Some of this fee goes to the university to cover overhead. The rest is either paid directly to the consultant or placed in a fund that is used by the university for professional activities. The choice between these two options is determined on a case-by-case basis.

Provisions for Cost Recovery

The institute strives for cost recovery, but has not met this goal.

Discrimination/Conditionality

There are no requirements restricting access to the institute. Self-selection occurs in that the Institute can only offer support in areas where the university has some expertise. While the institute typically works with small businesses in the western Michigan region, it has occasionally worked with multinational corporations.

Summary of Program's Administration and Operation

The program is administered by the associate dean of the College of Engineering, who is the only program official. Individuals or businesses call the institute and this individual then locates appropriate resources on the university campus. The two other institutes each has its own director, who have a reduced teaching load as a result of these duties.

Program Impact and Lessons

The program has had a positive impact, providing a communication network between the university and the community. It also provides practical experience to university faculty who might become hidebound without such contact.

The Institute's director emphasized the importance of having a long-range plan when starting such an operation. She said the Institute has low visibility and has lost money, but seems to be maintained due to the goodwill provided to the community. However, this objective has not been specified and the value of this goodwill has never been quantified, making it difficult to determine if program benefits, even if intangible, exceed its losses. A better long-term plan would help determine for how long and at what cost the program should be sustained.

Name of Program or Government Agency

- State: Michigan
- Metropolitan Region: Marquette
- Program: Northern Economic Initiatives Center

Program Purpose and Objectives

NEIC was founded to promote economic development by supporting small, local firms in their business endeavors. NEIC seeks to improve the competitiveness of Upper Peninsula firms by providing training, information, counseling and encouragement to firms in a few targeted sectors. In particular, it helps firms expand their markets by supporting their efforts to find clients outside the region and by diversifying their product lines.

NEIC programs include:

- A small business development center
- Market services that provides analysis, trade show promotions, a cottage industry conference and test marketing
- Industry services, such as networking opportunities, employee training, purchasing and marketing
- Field services, such as small and large manufacturer site visits; field audits and customized consultations and a peer group loan fund

Industrial Sector

NEIC targets four industrial sectors, based on the strengths of the Upper Peninsula economy. These sectors are: secondary wood manufacturing; food processing; artisans and home accessory producers; and metal turning and fabrication companies. NEIC targets 80 percent of its activities and resources to these sectors and the remaining 20 percent to all others.

Classification of Objectives

Objectives can be classified as small and medium business assistance, sectoral /industrial development, technology transfer, adjustment to competition (in the sense that NEIC helps businesses modernize) and economic diversification.

Ranking of Objectives

Program objectives are not explicitly ranked. Priorities are economic diversification, small and medium business assistance and sectoral/industrial development.

Classification of R&D Type

NEIC does not target R&D-intensive operations.

Level of R&D Focus

NEIC does not target R&D-intensive operations.

Program Beneficiaries

The most important program beneficiaries are the growth-oriented enterprises in the Upper Peninsula region. Through economic diversification and support of these companies, NEIC strives to smooth out business cycles that periodically devastate the area. This has the benefit of maintaining employment and the tax base.

Direct or Indirect Benefits

Direct benefits are the services provided by NEIC to targeted businesses. Indirect benefits are economic diversification and greater economic stability.

General or Targeted Benefits

Benefits are targeted to businesses with growth potential and the potential to diversify the local economy. NEIC has established four priority sectors: secondary wood manufacturing; food processing; artisans and home accessory producers; and metal turning and fabrication companies.

Program Duration and Permanence

NEIC was started in 1985 by Northern Michigan University. It originally targeted micro enterprises; small, self-employed cottage industries that were product producing. Since then, it has switched to a sectoral approach aimed at mitigating the effects of business cycles on the regional economy. Financially, it has consistently grown and now has a fairly diverse and stable base.

Types of Potential Subsidy Intervention/Form of Funding

As of 1991, NEIC will operate three loan funds with \$300,000 in capital. These are:

- Trade Show loans. This fund will help finance local companies attend state and national trade shows where they can market their products. Loans are expected to average about \$1,000.
- The Micro Enterprises Fund. This fund will help nonbankable firms make the move from customized production and services to production for broader markets. Typical loans will be about \$5,000.
- Contract Financing Fund. This fund will lend money to small enterprises on the strength of negotiated supply contracts. This fund is intended to ease the burden of fulfilling a supply contract before receiving contract revenues.

Each fund is a standard loan program.

Description of How Program is Funded/Amount of Funding

NEIC started with a \$140,000 budget in 1985, with the federal government contributing about \$30,000 and the state contributing the rest. In 1990, its operational budget was \$700,000, divided between the federal government (15percent), contracts from several state departments (60 percent), two foundations (25 percent) and a variety of other sources (10 percent). The federal money comes through the Economic Development Administration's program to support small business development centers. About half of the state money comes from the Research Excellence Fund, which has provided a stable base and enabled NEIC to leverage additional funds (in this case, as matching funds for federal dollars).

Provisions for Cost Recovery

NEIC expects to achieve cost recovery on its loans. There are no cost recovery provisions for its other funds.

Discrimination/Conditionality

NEIC devotes 80 percent of its resources to firms in four targeted sectors: secondary wood manufacturing; food processing; artisans and home accessory producers; and metal turning and fabrication companies. The remaining 20 percent is used for other firms in the area. NEIC does not work with start-up companies. Rather, it restricts its activities to those firms already in business, usually for one to two years.

Summary of Program's Administration and Operation

NEIC has a nine-member professional staff and anywhere between five and ten student interns. It also has various arrangements with faculty and staff members at Northern Michigan University. This staff runs day-to-day operations and is overseen by the NEIC director. There is no NEIC board of directors. NEIC is accountable to Northern Michigan University's Board of Control.

Program Impact and Lessons

No formal assessment of the program's impact has been made. However, the program director said studies show that NEIC clients have generated \$107,000 in new business relationships after working with NEIC.

One lesson learned, according to the director, was the difficulty of providing customized services. After a period of providing site visits and customized counseling, NEIC found this was relatively ineffective. Many businesses did not have the money or follow-through to implement the suggestions. Today, NEIC still makes site visits and offers customized counseling, but it works with groups of businesses, often competitors, with common problems. Based on models in Italy and Denmark, and with Ford Foundation support, NEIC is helping firms work together to solve their problems. Once solved, these firms should be able to expand their markets outside the immediate region.

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VIII. NEW YORK

The New York State Science and Technology Foundation administers most of the state's technology programs. The purpose of the Foundation is to promote basic and applied scientific research and technology development as well as scientific, engineering, and technological education. The Foundation also supports the growth of technology-based business and economic development. An organizational chart of all science and technology activities is presented in Figure 8.

The Foundation is a public corporation, with a twelve person Board of Directors representing the industrial, business, academic, and governmental sectors. The Board is chaired by the Commissioner of Economic Development, who is also the Chairman and Chief Executive Officer of the New York State Urban Development Corporation.

During the five-year period from FY86 to FY90, the Foundation made about 800 awards totaling over \$100 million. Its technology-related programs can be organized into three clusters:

- University-Industry Programs: Centers for Advanced Technology, Supercomputing Facility/Theory Center, National Center for Earthquake Engineering Research, Research and Development Grants Program, and New York State Education and Research Network (NYSERNet).
- Industrial Innovation Programs: Small Business Innovation Research Promotion Program, Technology and Disabilities Program, Productivity Development Program, Industrial Innovation Extension Service Program, and Regional Technology Development Organization Program.
- Corporation for Innovation Development Program.

Centers for Advanced Technology Program. This Program has created ten cooperative research and development centers at universities in the state. Centers have been created in applied research and technology development fields which have significant potential for economic growth in the state. Each center must have corporate affiliates/sponsors which are provided a variety of services and opportunities that vary from Center to Center. The Centers may receive federal research grants, both of which serve as matching funds for Foundation support.

National Supercomputing Facility/Theory Center Program. Located at Cornell University, the Supercomputing Program provides research universities and industries in the state with advanced supercomputing capabilities. A consortium of corporations and government agencies form the Cornell Theory Center's Research Institute and they work closely with academic researchers to develop and use supercomputing applications.

National Center for Earthquake Engineering Research. The Earthquake Center at the State University at Buffalo undertakes or sponsors earthquake engineering research that is focused on earthquake mitigation-efforts in structural systems and lifeline systems to minimize loss of life and property damage.

Research and Development Grants Program. This Program awards grants to support projects at academic and nonprofit research laboratories that are industrially relevant and have a distinct potential for commercialization. Most such projects involve industrial collaboration.

New York State Education and Research Network (NYSERNet). NYSErNet is an innovative, high speed telecommunications data transmission network, connecting 33 industrial, academic, private, and federal laboratory researchers throughout the state.

Small Business Innovation Research (SBIR) Promotion Program. Established in 1984, this Program awards "seed capital" research contracts of up to \$50,000 to small, technology-based firms which have completed their Phase I SBIR work plans and have applied for Phase II awards.

Technology and Disabilities Program. This Program, initiated in the 1989 fiscal year, supports the development of marketable products to serve the needs of disabled clientele.

Productivity Development Program. Created in 1985, this Program funded feasibility studies, testing, and analysis of new process technologies. The Program required one-for-one matching funds from participating firms. This Program completed its final year of operation in FY89 and is being replaced by an expanded state initiative, the Industrial Effectiveness Program.

Industrial Innovation Extension Service. This Extension Service is a state-wide network of field representatives who provide direct technical assistance and advice to small and medium-sized manufacturing firms. These field representatives can call on a sophisticated network of resources to help clients find the appropriate academic and industrial experts and resources.

Regional Technology Development Organization Program. The Program has supported the building of a network in the state's ten economic development districts of regionally based, not-for-profit organizations directed at supporting existing technological industries, developing efforts to support entrepreneurial momentum, and fostering technology transfer.

Corporation for Innovation Development. The Corporation makes direct investments in start-up or relatively young companies in strategic, emerging technologies. Created in 1982, the Corporation is designed to address the long-term capital needs of growing technology-intensive firms.

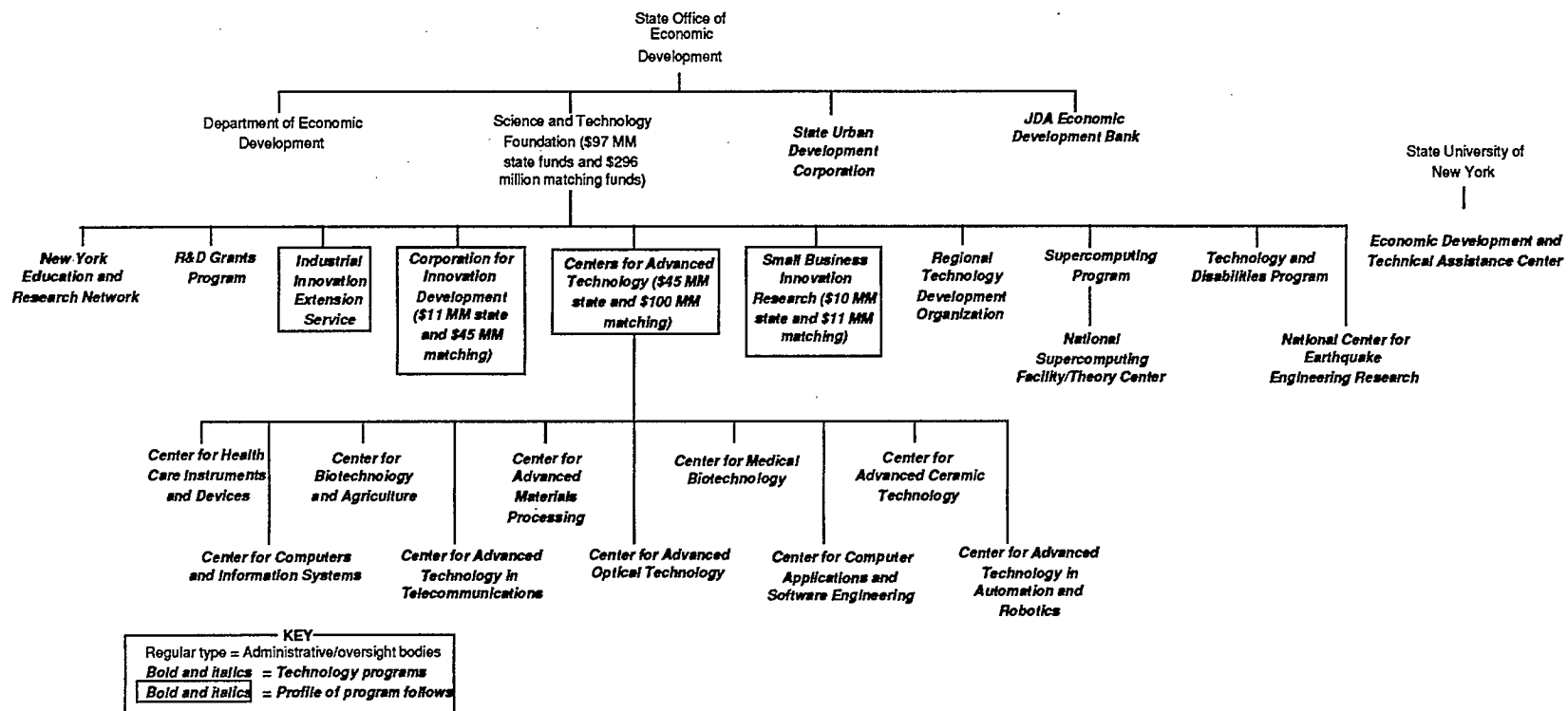


FIGURE 8 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: NEW YORK

Name of Program and Government Agency

- State: New York
- Program: Corporation for Innovation Development Program, New York State Science and Technology Foundation

Program Purpose and Objectives

The Corporation for Innovation Development (CID) Program was established within the New York State Science and Technology Foundation in 1981 and did not begin funding until 1983. The purpose of the Program is to foster the formation and development of innovative technology-intensive start-up and young industry/business ventures.

To achieve this objective the Program operates as a revolving investment fund, providing early-stage financing to qualified companies in the state to commercialize innovative technologies. While all technology-based products or services are considered, high priority is given to the fields of electronics/information and medical/biological and to specific areas of interest within each of these fields.

To be eligible, a firm must have a working model that has been successfully tested under operating conditions and is ready for introduction in a large or rapid growth market. Prototypes, demonstration projects, and feasibility studies are not eligible for investment.

Investments normally range from \$50,000 to \$150,000, but may approach \$250,000 under certain circumstances. Proceeds from the investment are intended to be used primarily for working capital. Use of the investment proceeds for research and development is strictly limited and may be used for the development and/or refinement of a new product or service based on an existing one.

Investments can include both debt and equity financing. Matching funds on a three-to-one basis are required for the Program's investments and may include monies from other lenders or equity investors as well as from state or federal programs. Thus, the Program both provides early-stage capital and stimulates the flow of high-risk venture capital directly to innovative growth businesses.

The CID Program Investment Fund is comprised of appropriations from the state and grants from the federal government (US EDA). Through a return on capital and appreciation of its investment, the Foundation has established an ongoing pool of venture capital money to provide for continued new investment and support of innovative ventures.

The CID Program is not involved in day-to-day management operations of companies in which it has invested. However, the Program may provide help in developing business plans, providing referral to other capital sources, formulating strategic plans, and providing limited management assistance. In addition, the CID Program may arrange for other technical, financial, and marketing support to entrepreneurs in technology-based small companies.

Industrial Sector

Although all sectors/industries are eligible, high priority for the Program's investment activities is given to the electronics/ information and medical/biological fields and specific research areas within them and, thus, to the industry sectors represented by those fields and specific areas.

Classification of Objectives

CID's Program objectives can be classified as follows:

- Research and development (with an emphasis on fostering technological innovation)
- Sectoral/industrial development (with a high priority given to the electronics/information and medical/biological fields, although all sectors/industries are eligible)
- Small and medium-sized business assistance (with an emphasis on start-ups and young, growing firms).

Although not specifically listed as a classification, the major underlying objective of the CID Program's efforts is addressing the early-state venture capital gap.

Ranking of Objectives

Other than research and development, the most important specified objective is small and medium-sized business assistance, since only these companies are eligible. Of lesser importance is sectoral/industry development, because the identified technology fields and their specified component research areas are only given high priority and the other technology fields of other industrial sectors are not excluded.

Classification by R&D Type

CID Program's investments tend to occur after the prototype development, demonstration, and testing stage of the research, technology development, and commercialization process. To be eligible, a firm must have a working model that has been successfully tested under operating

conditions and is ready for introduction in a rapid growth market. Since the Program's investments are in the private sector, they tend to support companies whose specific technologies might not otherwise be commercialized.

Level of R&D Focus

CID Program's investments are targeted to expanding existing R&D activities.

Program Beneficiaries

Start-up and young, growing companies in the state are eligible for the Program's investments. Research and technology-intensive entrepreneurial firms are the intended targets for investment, whether or not they are or expect to become manufacturers.

Direct or Indirect Benefits

No formal assessment of the CID Program has been undertaken and, therefore, no identification of actual direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits as listed in the Program's basic objective are to foster the formation and development of innovative technology-intensive start-up and young industry/business ventures by providing early-stage financing to such companies to commercialize innovative technologies. This implies the traditional direct benefits of jobs/firms created/retained, using the Program's resources to attract and leverage private investment capital for companies in the state.

General or Targeted Benefits

Although the Program's investment resources are available to all technology-intensive firms in the state that meet the criteria for venture capital investment, high priority is given to the electronics/information and medical/biological fields and to specified research areas within those two fields.

Program Duration and Permanence

The CID Program was established in 1981 to stimulate the flow of high risk capital directly into innovative growth companies by providing them debt and equity capital, on a three-to-one matching basis. The policies and practices of the CID Program are intended to complement, not to compete with, private financial institutions.

Types of Potential Subsidy Intervention/Form of Funding

The CID Program provides direct financial assistance to start-up and young, expanding technology-intensive firms through debt or equity investments in the form of the purchase of common or convertible preferred stock which may be accompanied also by long-term notes on favorable terms. In the event an equity position is impractical because of the venture's structure or other reasons, the Program's participation may be based upon a royalty stream or participation in the growth of the venture's future income stream, such as gross revenue or net income.

All the CID Program's investments are made as a part of a joint effort with other private or public sector investments, such as other equity investors, bank loans, or other sources. Initial investments can range up to a maximum of \$250,000. Most are typically in the \$50,000 to \$150,000 range. The size of the Program's initial funding is determined by the capital needs of the firm to achieve its plan and reach the next level and the matching funds of the co-investment. A minimum three-to-one dollar match is required for the Program's investment.

Description of How Program is Funded/Amount of Funding

Created with a combination of state and federal funds (a grant from US EDA), the CID Program operates as a revolving investment fund. In the seven operating years through FY90, the cumulative total of the Program's 73 investments was \$12.8 million. This cumulative investment leveraged an estimated additional \$69.2 million at the time of initial investment. These 73 separate investments represent both initial and follow-on investments in the 40 separate companies that constitute the Program's portfolio.

At some future time, the CID Program is anticipated to reach the point where it could become entirely self-supporting, based on the cumulative net realized gains from return of capital and investment appreciation.

Provision for Cost Recovery

Although the first investments by the CID Program were made in FY83, the realization of significant gains or losses are anticipated to lag between five and nine years. Through its investment strategy, the CID Program has had net capital earnings from both its equity and debt investments, including loan interest payments and principal repayments as well as sales of stock in companies that undertook an initial public offering of their securities or were subject to a private buyout. There also have been some capital losses but these have been outweighed heavily by capital earnings. Over the long term, the CID Program is anticipated not only to have cumulative

net realized gain on equity and debt investments (i.e., cost recovery) but also to reach the point where it could be self-supporting.

Discrimination/conditionality

The formal restriction on the CID Program's investment strategy (beyond the criteria set forth in its charter and ordinary venture capital investment prudence and due diligence) is the high priority given to investments in companies with products in the electronics/information and medical/biological fields and in specified research areas within those two fields. Companies with products in other technology fields are not excluded but only given a lower priority.

Program's Administration and Operation

The CID Program invests only after careful consideration and study of the company's business plan, financial plan, management team, technology/product/market competition, long-range potential for liquidity, and potential for job creation.

The application for a CID Program investment is a two stage process. The information requested in the Preliminary Application generally is contained in a business plan, which may be submitted as an alternative. The assessment process at this stage includes careful studies and analyses of all aspects of the company and its product and may involve a site visit. Based on this review and assessment, a Final Application may be invited that emphasizes financial information. After intensive review, research, and evaluation, the CID Program staff makes an investment recommendation to the CID Investment Review Committee. Following its own review and evaluation, this Committee makes a recommendation to the Foundation's Board regarding funding. This final decision to commit capital to the investment is made by the Board of the Directors of the Foundation.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of CID's investment program has been undertaken. No information has been systematically collected documenting the program's impact, beyond matching funds coinvested and jobs created/retained (over 500 through FY89).

Name of Program and Government Agency

- State: New York
- Program: Centers for Advanced Technology Program, New York State Science and Technology Foundation

Program Purpose and Objectives

The Centers for Advanced Technology (CATs) Program was created in 1982 to encourage greater collaboration between private industry and the research universities in the state for applied research and technology development in selected fields. The Program is designed to meet the state's (and the nation's) needs for increased investment in industrially-relevant applied research and technology development, increased collaboration between the industry/business and university sectors, and increased numbers of research, professional, and technical personnel in key disciplines.

To accomplish this objective, the Program fostered the creation of university-based, world-class centers of technological excellence that build on the research strengths within the state's major research institutions and that address the state's economic development objectives. Ten Centers have been created in the following advanced technology fields: advanced ceramic technology, advanced materials processing, computers and information systems, computer applications and software engineering, advanced technology in automation and robotics, advanced technology in telecommunications, advanced optical technology, health care instruments and devices, medical biotechnology, and biotechnology in agriculture. Seven of these Centers were designated in FY84, two in FY88, and one in FY89.

Each Center is a cooperative research and technology development facility in its specific advanced technology field. Each Center is expected to catalyze technological innovation by taking the findings of basic research in science and engineering and applying them to practical use in business and industry as products, processes, and services. The Centers also serve as focal points for the formation of partnerships among the participating university, businesses, industrial companies, and government.

The Foundation, through the CATs Program, provides partial funding of each Center's operations. Each Center is eligible to receive up to \$1 million per year, contingent on its acquiring at least an equal amount from other sources, particularly private industry. The Centers' funds are directed toward a variety of functions, including research, technology development, outreach and dissemination of information, technology transfer and commercialization, procurement of

specialized equipment, conduct of education programs, and support for faculty, research staff, and graduate students.

Industrial Sector

Each Center restricts its efforts to a specific advanced technology field and, thus, to industry sector(s) represented by that field. The ten advanced technology fields fostered by the ten Centers are listed above.

Classification of Objectives

The Centers Program can be classified as follows:

- Research and development (with an emphasis on industrially-relevant advanced technology development)
- Sectoral/industrial development (in ten advanced technology fields).

Ranking of Objectives

Other than research and development, the only other important specified objective is sectoral/industrial development.

Classification by R&D Type

The Centers support applied research and advanced technology development projects in cooperation with private firms on specific industrially-relevant technologies with commercialization potential.

Level of R&D Focus

The applied research and advanced technology development efforts of the Centers both build on and expand their existing R&D assistance infrastructure.

Program Beneficiaries

Established manufacturing companies tend to be the participants in the Centers' programs, because of the matching support requirements for individual projects. Some small and medium-sized firms do participate in projects at the Centers. While the CATs Program was created to

assist companies in the state, out-of-state firms also participate in the Centers' programs and their contributions now qualify as matching funds.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the Centers' host institutions (that generally favor the universities involved).

Direct or Indirect Benefits

The New York State Legislature enacted a law during FY88 requiring the Foundation to submit more formal annual reports on the CATs Program. Reports for the first five years were essentially progress reports. The 1987-1988 Annual Report is the first to identify measurable gains in new research findings, new product developments, new company spinoffs, and variety of sources of matching fund support. In addition, the CATs Program has generated some extremely valuable intangible benefits, such as the increasing acceptance within the university research community of industrially-relevant applied research and advanced technology development and the growth in "entrepreneurial spirit" among faculty, research staff, and graduate students.

Thus, benefits include both the more direct, traditional ones of jobs/firms created/retained and the more indirect benefits with longer-term results such as: redirection of more university resources to applied research and advanced technology development, and increased collaboration between the private and research sectors.

General or Targeted Benefits

The applied research and advanced technology development projects of the Centers are available generally to those technology-based manufacturing firms in the state and throughout the nation that can benefit from the ten specified advanced technology fields of the Centers. To the extent that these activities are undertaken on behalf of, or with, an individual client company or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the university at which the Center is based.

Program Duration and Permanence

The Centers Program was established in 1982. Seven Centers were designated in FY84, two in FY88, and one in FY89. The basic approach of the Centers, undertaking industrially-relevant

applied research and advanced technology development activities, has changed little since their initiation.

Types of Potential Subsidy Intervention/Form of Funding

The Foundation's Centers for Advanced Technology Program awards a contract to each Center for up to \$1 million annually, contingent upon matching funds on a one-to-one basis being obtained from private and nonstate governmental sources. At least four-fifths of the required matching funds must be from the private sector and up to one-third may be in the form of equipment donated by industry. These requirements emphasize the importance placed on industry-university collaboration and industrially-relevant applied research and technology development.

Description of How Program is Funded/Amount of Funding

Each of the ten Centers receives up to \$1 million annually. During the 1990 fiscal year, the Foundation's awards under the CATs Program totalled \$9.75 million. Over the seven year history of the CATs Program, the Foundation awarded a total of \$54.8 million to the Centers. All funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Centers nor the Foundation directly attempt to recover their total costs for the Centers' operations. All applied research and advanced technology development projects operate on a cost-sharing basis and a royalty or other arrangement also may be negotiated. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are formal restrictions on the Centers' applied research and advanced technology development efforts in that projects are undertaken only in the ten advanced technology fields of the Centers.

Program's Administration and Operation

Foundation funding for each Center is provided annually based in part on the proposed work program and in part of annual evaluations. These evaluations are based on criteria included in the previous year's contract with each CAT. Each year, teams of expert consultants in the appropriate fields of technology visit the Centers, conduct an in-depth review, and issue a report to the Foundation. Strengths and weaknesses are cited and, where appropriate, recommendations for changes indicated. Each site team report, Center response, and Foundation staff summary is then forwarded to the CATs Program Steering Committee of the Foundation's Board of Directors. The Committee then forwards its report and recommendations to the Board, which makes the final funding determinations.

Program Impact and Lessons

As noted above, the 1987-1988 Annual Report is the first to identify both measurable impacts and intangible benefits.

At least 17 companies have been formed, creating more than 200 jobs. About 40 patents have been awarded for developments growing out of Centers' research, with many more pending.

Over the seven-year history of the program through FY90, the Foundation's support of \$54.8 million has leveraged a total of about \$131 million in matching funds. Collectively, the Centers have won the co-sponsorship of over 225 private companies and federal agencies and they conduct over 250 collaborative research projects annually. Several of the Centers have received special designation and support from federal agencies as a "Center of Excellence."

In addition, the CATs Program has generated some extremely valuable intangible benefits, such as the increased acceptance within the university research community of industrially-relevant applied research and advanced technology development; the redirection of more university resources to applied research and advanced technology development; increased collaboration between the private and research sectors; and the growth of entrepreneurship and entrepreneurial activity among faculty, research staff, and graduate students.

Name of Program and Government Agency

- State: New York
- Program: Small Business Innovation Research Promotion Program, New York State Science and Technology Foundation

Program Purpose and Objectives

The Small Business Innovation Research (SBIR) Promotion Program was established within the New York State Science and Technology Foundation in 1984 and made its first investments in the 1985 fiscal year. The purpose of the Program is to encourage more technology-intensive companies in the state to participate in the federal government's SBIR program. The Program achieves this objective through publicity and information dissemination, technical assistance (including proposal writing assistance) available through statewide seminars and one-on-one counseling, and the provision of matching awards.

The federal SBIR program requires major federal agencies to set aside a small percentage of their R&D budget for research by small, technology-oriented firms. The federal program is structured in three phases. Phase I awards are for up to \$50,000 and support six-month preliminary feasibility analysis. Phase II funding provides up to \$500,000 over a two-year period for further innovation development of products with commercial potential. Phase III is designed to leverage additional support from non-SBIR sources in the private sector or in full federal research programs, to support further development to the production stage.

The Foundation, through the SBIR Promotion Program, provides matching research contracts of up to 50 percent of the federal Phase I award (with a maximum of \$25,000) to small firms, which already have received federal Phase I SBIR awards. In order to qualify, the firm must have completed the Phase I research, had the Phase I report accepted, and submitted a complete Phase II proposal. These matching research contracts are effectively early-stage seed capital for firms which have demonstrated to the federal government the technological feasibility of an innovation. In addition, these awards permit the Phase I winners to maintain operations and research during the critical, often lengthy, period between completion of Phase I research and the start of Phase II work.

In order for a company to be eligible for a matching award, it must be based in the state, conduct the research in the state, and maintain its residency in the state during Phase II. Firms are limited to one state matching award per state fiscal year. No state monies can be expended for travel, equipment, or facilities. No more than one-third of the state award can be used to subcontract for research or other related services.

Industrial Sector

Research projects supported by the SBIR Promotion Program are not limited to any specific industry sector.

Classification of Objectives

The Program's objectives can be classified as follows:

- Research and Development (with an emphasis on fostering technological innovation)
- Small and medium sized business assistance (with an emphasis on start-up and young technology-intensive companies).

Ranking of Objectives

Other than research and development, the only other specified objective is small and medium-sized business assistance, since only these firms are eligible.

Classification of R&D Type

The Program supports predominantly applied research and development projects up to the prototype stage.

Level of R&D Focus

The SBIR Promotion Program's matching awards are targeted toward reinforcing existing R&D activities.

Program Beneficiaries

Only firms which have won Phase I SBIR awards are eligible to apply for matching research contract awards from the Program. These research and technology-intensive entrepreneurial firms are the intended targets for investment through the research contract awards, whether or not they are or expect to become manufacturers. Licensing of patents or joint ventures with large manufacturers are potential outcomes.

All intellectual property or other proprietary rights are assigned to the small firm receiving the state award.

Direct or Indirect Benefits

No formal assessment of the SBIR Promotion Program has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are a strengthened research capacity of innovative, technology-intensive, small and medium-sized entrepreneurial firms. In addition to promoting technological innovation and product development, the economic development objectives of the Program imply the traditional direct benefits of jobs/firms created.

General or Targeted Benefits

The Program's matching research contract awards are available to all technology-intensive small firms in the state which have won federal Phase I SBIR awards and which meet certain administrative criteria.

Because the research supported under the Program is conducted predominantly or exclusively at private firms the research results are not likely to be publicly available at all, or at least not on a timely basis.

Program Duration and Permanence

The SBIR Promotion Program was created in 1984 and made its first investments in FY85. In FY90, the maximum amount awarded under the Program was reduced from \$50,000 to \$25,000, or half the federal SBIR Phase I award (whichever is smaller). This change was the result of spending cutbacks required by a greatly reduced Foundation budget. In addition, firms are now limited to one award per state fiscal year under the Program. Finally, the criteria for evaluating awards now place greater emphasis on commercialization potential.

Types of Potential Subsidy Intervention/Form of Funding

The Program makes matching research contract awards to technology-intensive small firms in the state which have won federal Phase I SBIR awards and which meet certain administrative criteria.

Description of How Program is Funded/Amount of Funding

In the six operating years through FY90, the cumulative total of the Program's 287 matching awards was over \$12.2 million. These awards in turn were matched by an additional \$13.8 million. All funds are from state general tax revenue.

Provision for Cost Recovery

The Program makes no attempt to recover its matching research contract award costs. Indirectly, it is implied that the state will recover its investment costs over the long term through research and technology-development based business and economic development with its increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restrictions on the Program's awards is that the technology-intensive small firms in the state have won federal Phase I SBIR awards and meet certain administrative criteria.

Program's Administration and Operation

In order to qualify for a matching research contract award under the Program, the firm must have completed the Phase I research, had the Phase I report accepted, and submitted a complete Phase II proposal. In addition, a separate state research proposal must be submitted and reviewed against published criteria prior to a funding recommendation by the Program staff to the Foundation Board.

Project Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the SBIR Promotion Program has been undertaken. No information has been systematically collected documenting the program's impact, beyond matching funds generated and the relative ranking of the state in federal SBIR awards. Since the SBIR Promotion Program's inception in 1984, the state has progressively increased its share of federal SBIR research awards won. It also has moved from ninth place to fifth place in the nation in total federal SBIR awards.

Name of Program and Government Agency

- State: New York
- Program: Industrial Innovation Extension Service Program, New York State Science and Technology Foundation

Program Purpose and Objectives

The Industrial Innovation Extension Service (IIES) Program was established within the New York State Science and Technology Foundation in 1985. The purpose of the Program is to assist small and medium-sized, established manufacturers improve their productivity, profitability, and competitiveness through manufacturing improvements.

To achieve this objective, the Program supports a network of regional field representatives who help companies identify technology-related problems in their manufacturing processes and to determine the best strategies for addressing those problems. The field representatives help the firms research, evaluate, and implement opportunities for technology- and productivity-related improvements in their manufacturing processes. At no charge, these field representatives provide direct technical expertise and the support of a network of resources. This direct, flexible, hands-on approach helps the transfer and adaptation of new and existing manufacturing technologies to a broad group of potential users with specific manufacturing and production process needs.

Specifically, the IIES field representatives provide the following services or direct client manufacturers to experts and resource for such services: initial screening, production analysis, and assessment of process technology needs; process technology data source location; production trouble shooting; process technology feasibility analysis; transfer and adaptation of new and existing process technologies; and financing requirements and advice.

Management assistance and worker training/retraining also can be requested by client manufacturers. In these situations, the field representatives act as brokers, referring the clients to an appropriate local organizations which can provide the needed services.

Currently operating through five regional pilot project locations, IIES field representatives eventually will be located throughout the state. Each pilot project organization is the organizational mechanism for networking with other local, regional, and state organizations to help client manufacturers find the appropriate academic and industrial experts and resources. Three of the pilot project organizations are at universities, two at nonprofit organizations. Each pilot project organization has a different extension service delivery structure. Supporting each regional project is the Rensselaer Polytechnic Institute's (RPI's) Center for Industrial Innovation which

offers access to state-of-the-art manufacturing technology and specialized engineering and technical expertise.

The IIES Program follows the successful technology transfer model of the Agricultural Cooperative Extension Service.

Industrial Sector

The IIES Program does not restrict its efforts to specific industry sectors, although industrial sectors with traditional manufacturing or production processes are more likely to avail themselves of the services of the IIES Program than industries with technology-intensive products.

Classification of Objectives

The IIES Program can be classified as follows:

- Research and development (with an emphasis on advanced manufacturing process technologies)
- Small and medium-sized business assistance (although not limited to such businesses).

Ranking of Objectives

Other than research and development, the only other important objective is small and medium-sized business assistance.

Classification by R&D Type

Since the IIES Program supports field representative in providing direct technical assistance and in locating other experts and resources, it can be implied that the Program supports generic research and development.

Level of R&D Focus

Since the Program's field representatives direct their technical assistance efforts toward the improvement of manufacturers' production processes, it builds on the existing R&D and assistance infrastructure, including the network of resources, the regional pilot project organizations, and the Center for Industrial Innovation.

Program Beneficiaries

Established manufacturing firms with traditional manufacturing or production processes are the intended targets for the Program's assistance efforts.

Intellectual property and other proprietary rights are not likely to be involved in these assistance activities.

Direct or Indirect Benefits

No formal assessment of the Program's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the improvement of manufacturers' production processes. In theory, this would imply the traditional benefits of jobs/firms created/retained. No indirect benefits appear to be implied.

General or Targeted Benefits

The assistance services of the Program are available generally to all manufacturing firms in the state.

Program Duration and Permanence

The IIES Program was established in 1985. The activities of IIES field representatives have not changed appreciably since the Program's initiation.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The university- or nonprofit organization-based pilot project networks and their field representatives provide technical assistance services only.

Description of How Program is Funded/Amount of Funding

Funding for the IIES field representatives and the pilot project network organizations is provided through the IIES Program of the Foundation. In the six operating years through FY90, the cumulative total of the Program's 19 awards was over \$2.75 million. These awards were matched by an additional \$1.3 million. All funds are from state general tax revenue.

Provisions for Cost Recovery

The IIES Program makes no attempt to recover its total costs for the IIES field representatives and the pilot project network organizations. There is no fee for the technical services for initial screening, analysis, and assessment review and for the assistance in researching, evaluating, and implementing technology- and productivity-related improvements in their manufacturing processes. There is no charge either for the field representatives who provide direct technical expertise or for the resource support network. Fees generally are required for the follow-on services. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality.

The only formal restriction on the assistance efforts of the IIES field representatives and the pilot project network resources is that the client manufacturers be located in the state, although there is an emphasis on small and medium-sized firms.

Program's Administration and Operation

The IIES field representatives have an initial meeting with the client manufacturers to learn more about the firm and its problems, while allowing the company to get a more thorough understanding of the assistance and resources available through the Program. At the second meeting, the field representative works with the company to identify more specifically the manufacturing process technology problems and to determine the most appropriate strategies for addressing those problems. The company and the field representative work together to identify and secure the appropriate and available expertise and resources to implement the strategy.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the IIES Program has been undertaken. No information has been systematically collected documenting the program's impact, beyond matching funds generated and companies assisted in a typical year. In FY89, for example, the Program provided technical assistance to more than 350 companies and more than 220 company-specific projects were conducted.

Name of Program or Government Agency

- State: New York
- Metropolitan Region: Brooklyn
- Program: The Metropolitan Technology Development Center (Metrotech)

Program Purpose and Objectives

Metrotech is aimed at generating economic development in the Brooklyn area. The principal objective of the Park is to provide an attractive and supportive environment for local businesses. Its development was motivated by two issues. First, the need to revitalize a small part of downtown Brooklyn, where Polytechnic University was having difficulty attracting students and retaining faculty because of neighborhood blight. Second, Metrotech was devised in an effort to retain businesses leaving the metropolitan area because of high costs of space and services.

Metrotech provides "state-of-the-art" office space at relatively low prices. Its facilities enable high-tech companies, particularly computer-intensive operations to avoid brown outs and other service problems found in other parts of the city.

Industrial Sector

Metrotech facilities are available to a broad array of companies, however it has specifically targeted telecommunications and information technology companies. Many of these companies are large, computer-intensive service operations.

Classification of Objectives

Objectives can be classified as regional/local development, research and development, and infrastructure development.

Ranking of Objectives

Priority objectives are research and development and infrastructure development (providing modern facilities needed by large, computer-intensive operations).

Classification of R&D Type

Metrotech is currently trying to attract more research oriented companies. It is particularly interested in the research arms of large companies. It is not focusing these efforts on any particularly type of R&D.

Level of R&D Focus

Metrotech does not consider a prospective tenant's R&D focus when making a leasing decision. It would like to attract research operations that complement Polytechnic University's research strengths.

Program Beneficiaries

Intended beneficiaries are the companies occupying Metrotech, which get access to state-of-the-art office space; Polytechnic University, which hopes to reverse enrollment declines and retain faculty; and Brooklyn and metropolitan New York, which hope to retain jobs and benefit from economic growth.

Direct or Indirect Benefits

Direct benefits are the availability of state-of-the-art office space for high-technology companies. Another direct benefit is a revitalized section of downtown Brooklyn. Indirect benefits are the creation and retention of jobs, improved economic growth and vitality, an expanded tax base and an improved reputation for Polytechnic University and new opportunities for technology transfer.

General or Targeted Benefits

Benefits are targeted in that most are limited to Metrotech occupants. However, the enhanced business activities of Metrotech occupants are generally available to the Brooklyn community.

Program Duration and Permanence

Initiated a couple year ago, Metrotech has rapidly achieved success and stability. It has the strong support of New York City, as well as the Burrough of Brooklyn. There are now two buildings on the site. No additional building will occur until the building space is leased.

Types of Potential Subsidy Intervention/Form of Funding

Metrotech has benefitted from a generous incentive package from New York City and a variety of funding mechanisms. Numerous incentives have been made available to Metrotech occupants. For the first 13 years, companies pay property tax according to the land's valuation at the time when it was condemned, prior to redevelopment. Over the following 10 years, property taxes will rise 10 percent per year up to the appropriate level based on the commercial value of the land; there is a \$500 corporate tax credit per employee per year for 12 years; New York City's 6 percent occupancy tax is waived for 12 years; energy costs are reduced by 37.5 percent for eight years. This incentive package was created for Metrotech, but has been extended to all new developments in the Five Burrough area of the city.

Description of How Program is Funded/Amount of Funding

New York City has paid about \$100 million to make Metrotech possible. This includes land acquisition, relocation costs for property tenants at the time it was purchased, demolition costs, and infrastructure improvement costs. The city will recapture this money over a 30 year period through ground lease agreements with the developer. Although this cost is passed on to Metrotech occupants, space in the facility rents for substantially less than other parts of the city (about \$25 per square foot, versus \$55 in downtown Manhattan). Moreover, all Metrotech buildings are entirely new and state of the art.

The city has also provided a \$17 million advance to develop public open space in the Metrotech neighborhood. This money goes for demapping city streets, moving subway vents, adding water mains, and providing seating, lighting, public information booths and other amenities. The city has also helped finance Metrotech buildings. It has taken a \$15.5 million equity stake in two of the project's buildings. This money was made available through the Federal Urban Development Action Grant program.

The developer's construction costs have been financed through standard commercial bank loans.

Provisions for Cost Recovery

The city's \$100 million investment in the Metrotech land will be recovered through a ground lease agreement with the developer. All other expenditures are investments or loans and are expected to be repaid.

Discrimination/Conditionality

Metrotech guidelines prohibit leasing space to government agencies (unless operating in the research or engineering areas), manufacturers and wet labs.

Summary of Program's Administration and Operation

There is no central administration for Metrotech. The university, city and the developer have worked together closely and have a detailed agreement on the goals and objectives of the project. As owner, the developer is in charge of the buildings and work with a property manager. The university has a Metrotech project manager who watches out for the school's interests.

Program Impact and Lessons

Metrotech may have already had an impact on Polytechnic University. Enrollments were up in 1990 and there has been greater community recognition of the university. Also, Chase Manhattan Bank recently agreed to move into Metrotech, scuttling plans to move its operations to New Jersey. Chase will employ 6,000 people. Metrotech is a bigger development than Rockefeller Center and, according to one official, "the hottest thing going in the city."

Name of Program and Government Agency

- State: New York
- Metropolitan Region: Rochester
- Program: High Technology of Rochester, Inc.

Program Purpose and Objectives

High Technology of Rochester (HTR) seeks to promote economic development in the Rochester region by supporting high-technology companies and new ventures. HTR achieves this goal by providing business advisory services, capitalization programs, location assistance and technology-transfer assistance.

Industrial Sector

Although HTR is open to the entire Rochester community, it concentrates its activities in a few key sectors. These sectors are optics and imaging, which is the most dominant, biotechnology and software. HTR administrators decided to emphasize these fields after conducting an analysis of the community. The organization works closely with three local universities—the University of Rochester, Rochester Institute of Technology and Monroe Community College—each of which has a strong optics and imaging department.

Classification of Objectives

Objectives can be classified as research and development (as it relates to technology transfer); sectoral development; regional development; adjustment to competition (in conjunction with the state's Industrial Innovation Extension Service); small and medium business assistance; export promotion (which is still in the planning stages); and infrastructure development.

Ranking of Objectives

There is no explicit ranking of program objectives, although HTR's mission emphasizes the development of new businesses, making small and medium business assistance an implicit priority.

Classification By R&D Type

HTR supports companies engaged in R&D. Typically, R&D activities tend toward the applied and development end of the spectrum.

Level of R&D Focus

HTR's mission emphasizes developing new businesses and helping them bring new products to market. Consequently, the organization does not focus much attention on R&D activities, *per se*. Rather, it focuses on the commercialization potential of the company's product.

Program Beneficiaries

There are several program beneficiaries. Rochester entrepreneurs benefit from a variety of services designed to support their businesses and help them grow. Local academic institutions benefit from improved technology spin-off opportunities and increased opportunities for students to get hands-on business experience. The community benefits to the extent that HTR contributes to any economic upswing. The local government and community benefits from an increased tax base that accompanies economic growth.

Direct or Indirect Benefits

Direct benefits resulting from HTR activities include a stronger entrepreneurial base in the region, an expanded business sector, and both a stronger local business sector and a stronger local economy. This also helps create jobs and a larger local tax base. Indirect benefits include stronger research departments in the universities and better qualified university graduates.

General or Targeted Benefits

Benefits are general in that HTR services are open to the entire Rochester community. However, the program is tailored to just a few sectors, particularly the optics and imaging sector.

Program Duration and Permanence

The program was started in 1988 and appears to be on stable ground financially and programmatically.

Types of Potential Subsidy Intervention/Form of Funding

HTR does not currently make money available as part of its program services. It does work extensively with the financial community to help clients secure necessary funding. HTR is also developing a seed fund to help finance new ventures. Program administrators hope to raise \$750,000 by early 1991. This money would be made available in small amounts, probably

around \$20,000-\$40,000. HTR has not worked out further details on the program at this time. HTR's state funding must be matched by nonstate sources, either public or private.

Description of How Program Is Funded/Amount of Funding

HTR's 1990 budget was about \$350,000, which is equally divided between public and private sources. Unfortunately, at this point, the HTR director declined to provide further information on the program and terminated the interview. However, a city official said that the City of Rochester has provided HTR \$12,500 annually since its inauguration. The State Science and Technology Foundation has designated HTR a state Technology Development Organization and provides the program \$170,000 annually. State money must be matched one for one by nonstate sources, such as private donors and municipal government funds.

***Provisions for Cost Recovery**

There are no cost-recovery provisions for the programs described. State funds must be matched. The seed fund will likely be designed to achieve cost recovery, but details have not been worked out at this time.

***Discrimination/Conditionality**

The program is available to all members of the Rochester community. However, HTR gears its operations toward the optics and imaging, biotechnology and software sectors.

***Summary of Program's Administration and Operation**

***Program Impact and Lessons**

*Information may be incomplete, or it could not be obtained because the HTR director terminated the interview before answering these questions.

Name of Program or Government Agency

- State: New York
- Metropolitan Region: Troy and Albany
- Program: Rensselaer Polytechnic Institute Incubator Center

Program Purpose and Objectives

The RPI Incubator Center seeks to support and develop small businesses in the Albany/Troy region. The incubator helps start-up companies locate needed services and ties them into a network of research professionals, advisors, service providers and students that provide technical, business and management assistance. It also provides, at cost, standard business resources, such as copiers, a fax machine, security, building maintenance, etc. The goal is to help new businesses survive the early high-risk stage of the start-up process. The incubator also seeks to enhance the educational environment, working closely with RPI to provide students with hands-on business experience.

Industrial Sector

Participation in the incubator is limited to technology-based companies, although this is broadly defined and therefore includes a wide variety of businesses. Most companies now occupying the facility are in high-technology sectors, with computer and software companies dominating. There are also biotechnology companies, manufacturers, chemical companies, and an environmental law firm, which represents the low-tech end of the spectrum.

Classification of Objectives

Program objectives can be classified as regional development, small and medium business assistance, research and development (with an emphasis on technology development and commercialization potential) and infrastructure development (with an emphasis on business services). An additional program objective is to enhance the educational environment by promoting interaction between the RPI and the incubator occupants and affiliates.

Ranking of Objectives

There is no formal ranking of objectives; they are all considered equally important.

Classification of R&D Type

Since the incubator's focus is on building new businesses, incubator occupants tend to be in the advanced stages of R&D. Although some do basic research, most are engaged in applied research or product development. The incubator maintains a close relationship with RPI and tries to help local entrepreneurs who have taken advantage of basic research that has been done in university labs. In general, the incubator works with companies that expect to bring a product to market within two to three years. Some occupants stay less time, while others have remained throughout the incubator's ten year existence.

Level of R&D Focus

Incubator efforts do not target any specific form of R&D activity. Participation in the program hinges on technology transfer, product development, and near-term commercialization potential. To some extent, effective technology transfer requires building on existing R&D activities at the university.

Program Beneficiaries

The most important program beneficiaries are the start-up companies situated in the incubator. They receive a variety of technical, business and management services designed to mitigate the risks associated with a new venture. Individual entrepreneurs benefit by gaining experience starting and managing a new enterprise. The university benefits from its close relationship with the incubator, which provides hands-on business and entrepreneurial experience to students, as well as opportunities to create spin-off companies from university research. The local and regional economy benefit from new economic activity and an expanded tax base. Service providers benefit from new demand generated by the new companies. Finally, investors benefit from the return they earn when new companies achieve success.

Direct or Indirect Benefits

Program benefits have not been formally documented. Of the 60 companies that have participated in the incubator, "very few" have gone out of business. Companies receive direct benefits in the form of low-cost assistance. The university also receives direct benefits, particularly the School of Management's Center for Entrepreneurship, which integrates incubator companies into its curriculum. Jobs for students and other individuals are another direct benefit from incubator activities. Service providers used by the incubator companies also benefit directly.

General or Targeted Benefits

Although incubator services are limited to companies located in the incubator, participation in the program is generally available to all technology-based companies willing to locate in the region. In principal, the incubator is open to foreign firms, although none has applied. Since the program goal is to develop new businesses that bring new products to market, the results are also generally available.

Program Duration and Permanence

The RPI Incubator Center was started in 1980 and has developed a very stable foundation since then. It is financially self-sufficient, covering its operational expenses with rent payments made by incubator occupants. This does not, however, cover repayment of principal on an outstanding debt. This obligation is currently met through payments from a reserve fund, but new repayment options are under review.

During its ten years, the program has grown while consistently expanding and improving the array of services offered to its occupants. There have been no notable changes in the program's mandate or direction. However, early efforts by RPI to provide venture capital to incubator companies were abandoned when the university determined that it did not have the requisite expertise to make such investment decisions.

Types of Potential Subsidy Intervention/Form of Funding

The incubator does not make funds available to its clients, although it does try to link companies with potential sources of finance. Early efforts by RPI to provide equity capital were abandoned. Incubator occupants are charged rent, which is the sole source of operational funds. Services are provided at-cost to incubator occupants.

Description of How Program is Funded/Amount of Funding

Because services are offered at cost, the incubator's primary funding source is rent charged for space (rent is about \$8 per square foot, generating about \$250,000 annually). The incubator owns the 33,000 square foot building, which it bought with \$600,000 in city bonds and \$200,000 in state bonds. The incubator is responsible for the principal plus interest on the loans. Interest on the city loan is two-thirds of the prime rate, with a floor of 8 percent (there is also a ceiling, but that has not come into play). The incubator paid the state \$60,000 in interest over 10 years for the \$200,000 state bond. Rent payments have generated sufficient revenue to pay for

operational expenditures and interest payments. Loan principal has been gradually reduced via payments from a reserve fund. However, the reserve fund is expected to run out within a year. To pay off the loan principal, incubator officials are looking at new options, including refinancing the debt and seeking direct donations.

Provisions for Cost Recovery

The incubator does not have any cost recovery provisions. It uses rental fees to cover its operational expenses and interest payments on the state and city loans. Other services are offered at cost.

Discrimination/Conditionality

There are no explicit restrictions limiting participation in the incubator except that the company must be technology based. This requirement is loosely applied. Incubator occupants have equal access to services and the network of people connected with the incubator.

Summary of Program's Administration and Operation

The incubator staff includes a director and one support person. Because of the incubator's close relationship with RPI, some support is available from the university. Specifically, the coordinator for the Center for Entrepreneurship works out of the incubator facility and serves as the director's "right-hand". In turn, the director spends a fair share of his time developing programs that integrate the university and the incubator.

Program Impact and Lessons

The program director said the incubator has had a tremendous impact during its 10 years. He said it has served as a catalyst for developing an entrepreneurial base in a region where little such activity existed before. The growth of an entrepreneurial base has spawned new development programs that have also helped the regional economy. However, he emphasized the time needed to develop this entrepreneurial base, adding that the region is still a long way from becoming a Silicon Valley.

As for lessons, he emphasized the need to structure the program correctly from the beginning. He said it is important to achieve financial self-sufficiency, noting that this is considerably more difficult if the program is poorly designed.

He also emphasized the qualifications of the director. Because an incubator is often run by one or two people, their abilities are crucial to the endeavor's success.

Name of Program or Government Agency

- State: New York
- Metropolitan Region: Syracuse
- Program: Central New York Technology Development Organization

Program Purpose and Objectives

The purpose of the Central New York TDO is to market state and local development programs to technology based companies in support of economic development in the five county area around Syracuse. TDO activities include:

- Acting as an intermediary between businesses and the bureaucracy
- Organizing seminars on topics of client interest
- Helping businesses find and apply for funding, technical assistance and other resources available through the federal, state, and municipal government, as well as other sources
- Making referrals for companies with technical problems often linking them to appropriate university or private sector experts
- Performing a number of community support activities, such as acting as a sponsor for an elementary school science fair

Industrial Sector

The TDO's services are not restricted to any specific industrial sector. An estimated 400 of its client companies are technology-based operations. Another 200 client companies are manufacturers, with many using high-technology processes, such as CAD/CAM and robotics.

Classification of Objectives

Objectives can be classified as regional development and small and medium business assistance. An additional program objective is adjustment to competition, with an emphasis on productivity development and improvement, particularly for manufacturers. Although export promotion is not part of the Central New York TDO's mission, it does a limited amount of this. For example, it recently sponsored an event involving a visiting Chinese delegation.

Ranking of Objectives

There is no explicit ranking of objectives. However, the greatest emphasis is placed on productivity development and improvement. Regional development is the second most important objective.

Classification of R&D Type

The TDO is not itself engaged in R&D. While it works with and promotes companies that do R&D, the type of R&D does not restrict the TDO's clientele.

Level of R&D Focus

The TDO's operations are not directed toward R&D activities. TDO inevitably works with companies representing all points of the R&D spectrum, but most clients are actively trying to bring a product to market and are therefore in the applied or development stages of their research.

Program Beneficiaries

Intended program beneficiaries are the companies who receive TDO services. These include mainline manufacturers who are engaged in productivity development, as well as start-up companies trying to bring a product to market and establish their business. Other beneficiaries include the educational institutions, which get a better sense of the needs of technology-based companies. The state benefits from additional economic activity, which creates jobs and a broader tax base.

Direct or Indirect Benefits

Direct benefits include sounder companies in the five county area surrounding Syracuse. With regional businesses growing and more stable, this indirectly generates benefits for the regional economy, the local economy (through an expanded tax base), the universities (through job opportunities and improved job training).

General or Targeted Benefits

Benefits are generally available in that the Central New York TDO does not restrict access to its activities and services. However, the organization typically works directly with a client, and

resulting benefits of that interaction may be available (in terms of new products or new jobs) or may not be available.

Program Duration and Permanence

The program was started in 1984 with a budget of \$25,000. It has grown in subsequent years and has a 1990 budget of \$575,000. A large part of this growth occurred between 1986 and 1988, when the organization's budget jumped from about \$200,000 a year to \$400,000 a year. Last summer, Central New York TDO added a productivity development program for area manufacturers. Because the organization depends to a large extent on public funding, its stability is dependent on political and state budgetary trends.

Types of Potential Subsidy Intervention/Form of Funding

The Central New York TDO is not provide financial assistance to its clients, although it does help clients find funding sources.

Description of How Program is Funded/Amount of Funding

The Central New York TDO had a \$575,000 budget in 1990. Its program funding comes from three sources. First, New York state contributes \$350,000. Most of this money, \$200,000, comes from the Science and Technology Foundation. The remaining \$150,000 comes from the Industrial Technology Extension Service in the Department of Economic Development. This money funds two engineers who work on productivity development activities. Second, the private sector contributes \$200,000, mostly paid as fees for services rendered. Finally, the organization pulls in an estimated \$25,000 a year in grants for specific projects. Grants are provided by both state and private sources.

Provisions for Cost Recovery

Central New York TDO does not make money available as part of its programs. As a non-profit, it provides services at or below cost.

Discrimination/Conditionality

There are no explicit conditions restricting participation in TDO programs or use of its services. In general, the program targets technology-based companies, which tend to be its principal clientele.

Summary of Program's Administration and Operation

The program is administered by three full-time staff members; a director and two engineers working specifically on productivity development. The Central New York TDO is located in the offices of Knowledge Systems and Research, a private company. This company provides support services and equipment. The Chamber of Commerce and the Metropolitan Development Association provide staff support for specific projects. There is a 38-member Board of Directors and a seven-member Executive Committee, a sub group of the full board. The board serves primarily an audit function. It reports three times a year to the Science and Technology Foundation.

Program Impact and Lessons

The Central New York TDO has had a solid impact in its region. Notably, it has helped pull together a wide assortment of economic development organizations, which have now achieved general agreement on an overall strategy and the activities related to those goals. Problems tend to occur in areas where there is overlap, or where communications are weak.

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New York State Science and Technology
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Industrial Innovation Extension SeNice
New York State Science and Technology
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Mr. Tab Wilkins
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Corporation for Innovation Development
Contact: New York State Science and
Technology Foundation (above)

Research and Development Grants Program
Contact: New York State Science and
Technology Foundation (above)

Supercomputer Program at Cornell National
Supercomputing Facility
Contact: New York State Science and
Technology Foundation (above)

New York Education and Research Network
Contact: New York State Science and
Technology Foundation (above)

Small Business Innovation Research
Program (SBIR)
Contact: New York State Science and
Technology Foundation (above)

Regional Technology Development
Organization Program
Contact: New York State Science and
Technology Foundation (above)

High Technology of Rochester, Inc.
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55 St. Paul Street
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Central New York Technology
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Rensselaer Polytechnic Institute
Incubator Center
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Metropolitan Technology Development
Center
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IX. NORTH CAROLINA

In North Carolina, state technology development programs are administered through several types of organizations: a state agency (Department of Economic and Community Development), a quasi-independent Board within a state agency (Board of Science and Technology), and a state-sponsored, independent, private, nonprofit corporation (North Carolina Biotechnology Center). An organizational chart of state activities is presented in Figure 9.

The North Carolina Department of Economic and Community Development houses the Technology Development Authority and the North Carolina Science and Technology Research Center. In addition, the Department administers the Microelectronics Center of North Carolina which has its own independent board of directors chaired by a university chancellor.

The Technology Development Authority (TDA) was established in 1983 to assist the development of the state's technology-based entrepreneurial firms. The TDA administers two programs: an Innovation Research Fund and an Incubator Facilities Program.

The Innovation Research Fund is a source of early stage, seed capital, equity financing for small businesses for innovative research leading to the development or improvement of new products, processes, or services.

The Incubator Facilities Program consists of two funding programs. The Incubator Action Fund provides matching funds for the establishment of small-scale demonstration incubators. The Incubator Building Fund provides one-time awards to nonprofit organizations for the establishment of large-scale, permanent incubator facilities.

The North Carolina Science and Technology Research Center, a NASA Industrial Applications Center, facilitates the transfer of technology developed by NASA and other federal agencies through a technical assistance program.

The North Carolina Microelectronics Center (NCMC) supports an integrated program in manufacturing research and technology development for North Carolina universities, Research Triangle Institute, and the commercial electronics industry. The program conducts basic and applied research and technology investigations relevant to industrial requirements for next-generation, submicron integrated circuits. NCMC operates an advanced manufacturing research facility to provide collaboration among researchers from appropriate university, industry, and government institutions. Support is provided by a state appropriation for both capital and opera-

tions, by grants and contracts with the federal government and industry, and by fees from industrial affiliates. Founded in 1980, NCMC is administered by the Department but has an independent board of governors.

The North Carolina Board of Science and Technology, chaired by the Governor, is made up of 15 representatives from industry, business, academia, and state and local government. The Board is housed within the state's Department of Administration and its Executive Director serves as Science Advisor to the Governor.

The Board was established in 1963 to identify areas of research with commercialization potential and to recommend policies, programs, organizational structures, and financial requirements that would promote these areas. The Board has initiated a variety of research and technology development activities, most of which are now operated by other state agencies, state universities, or state-sponsored, private, nonprofit corporations.

Currently, the Board administers three small research grant programs: an Entrepreneurial Fellowship Program, a Science and Engineering Development Awards Program, and an International Exchange Program.

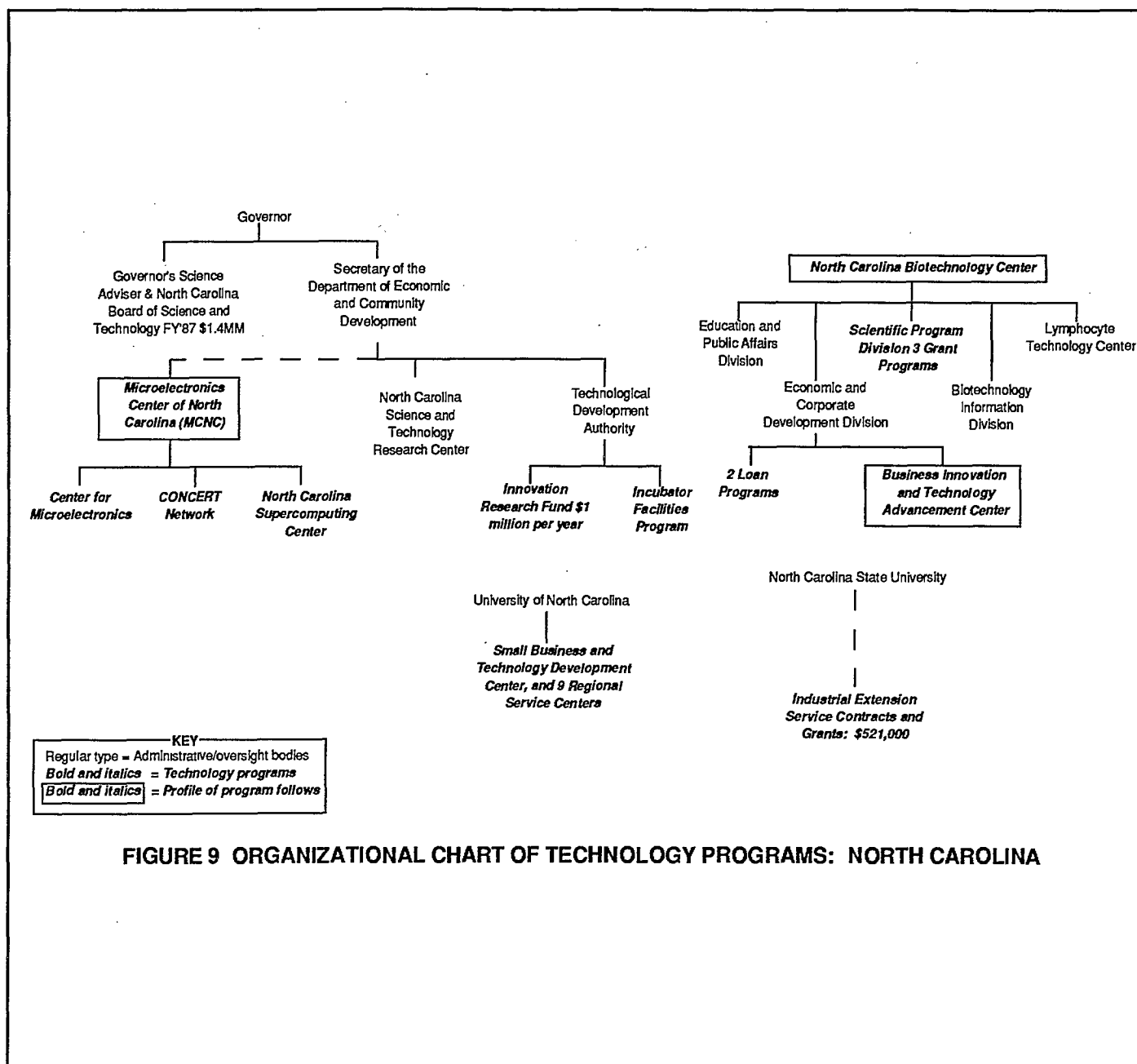
The North Carolina Biotechnology Center (NCBC) was founded in 1981 as a program area of the North Carolina Board of Science and Technology. In 1984, it became a state-sponsored, independent, private, nonprofit corporation. The Board of Directors has 35 members representing the academic, industrial, and governmental sectors.

NCBC's mission is to promote long-term economic development and societal benefits statewide by strengthening the biotechnology research and technology development infrastructure of the state.

The Center encourages research and commercial development in biotechnology and provides grants to university researchers and small research firms working on commercially feasible biotechnology products. NCBC's Scientific Program Division has three grants programs: Academic Research Initiation Grants, Institutional Development Grants, and Event Support Grants.

The Center's Economic and Corporate Development Division assists entrepreneurs and firms through three programs: Economic Development Finance Program, Research Initiation Loan Program, and Business Innovation and Technology Advancement Center.

In addition, NCBC cosponsors and administers the Lymphocyte Technology Center which coordinates basic immunological research on the campuses of five state universities with an emphasis on research projects which have potential commercial application.



Name of Program and Government Agency

- State: North Carolina
- Program: North Carolina Biotechnology Center

Program Purpose and Objectives

The North Carolina Biotechnology Center (NCBC) was founded in 1981 as a program area of the North Carolina Board of Science and Technology. In 1984, it became a state-sponsored, private, nonprofit corporation. The Board of Directors has 35 members representing the academic, industrial, and governmental sectors.

NCBC's objective is to promote long-term economic benefits to the state through biotechnology research, development, and commercialization. The Center is essentially a "Center Without Walls." It has no research facilities and conducts no research. Rather, it works to catalyze the progression of biotechnology from basic research in the laboratory to commercial products or processes in the marketplace.

To achieve its objective, the Center works to strengthen the biotechnology research capabilities of the state's universities, research institutes, and private companies; supports research by university researchers and small research firms working on commercially feasible biotechnology products and processes; encourages biotechnology research and technology development partnerships among universities, industry, and government; facilitates technology transfer and the commercialization and industrial applications of biotechnology research results; assists business/industry development in the biotechnology area; and educates and informs the public about biotechnology.

NCBC Scientific Program Division has three grants programs:

- Academic Research Initiation Grants, which provide seed funding for innovative biotechnology research projects at universities
- Institutional Development Grants, which enhance biotechnology resources of academic and nonprofit research institutions through such activities as laboratory renovations and purchases of new equipment, especially for multiusers
- Event Support Grants, which promote information sharing related to biotechnology through conferences, workshops, and seminars.

The Center's Economic and Corporate Development Division assists entrepreneurs and firms through three programs:

- Economic Development Finance Program, which provides long-term, low-interest loans of up to \$250,000 to young and growing biotechnology firms to help them demonstrate the scientific and business feasibility of their ideas, enabling them to obtain funding from other private and public sources
- Research Initiation Loan Program, an early-stage investment loan program, which provides firms with up to \$25,000 to gather preliminary data and test the feasibility of new product ideas
- Business Innovation and Technology Advancement Center, supported by a grant from NCBC, that helped equip a laboratory shared by biotechnology firms in an incubator for technology-based firms.

The Division also sponsors or supports conferences, workshops, and seminars to encourage networking, information sharing, technology transfer, and entrepreneurial development.

In addition to the programs noted above, NCBC cosponsors and administers the Lymphocyte Technology Center (LTC), an industry-university cooperative research center. With the support of NCBC, the National Science Foundation, and corporate and government sponsors, LTC coordinates basic immunological research on the campuses of five state universities with an emphasis on research projects which have commercial potential.

Industrial Sector

NCBC funding is limited to research and technology development in the biotechnology field and, thus, to that industry sector.

Classification of Objectives

The Center's Program can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Sectoral/industry development (with an emphasis on the biotechnology field)
- Small and medium-sized business assistance (with an emphasis only in several programs).

Ranking of Objectives

Other than research and development, the most important specified objective is sectoral/industry development, because only activities in the biotechnology field can be supported. Of lesser importance is small and medium sized business assistance, because these companies are emphasized or required in several programs.

Classification by R&D Type

NCBC supports basic research, applied research, and development projects in the biotechnology field. Because of the wide variety of its programs, the Center's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Center's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, since there is a wide variety within its programs.

Program Beneficiaries

The biotechnology research units of universities and research institutes as well as research and technology-intensive entrepreneurial biotechnology companies in the state are eligible for the Center's research and development investments.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the research organization, unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the strengthening of the research and development biotechnology infrastructure as well as the development of new biotechnology based products and processes with near term commercialization potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits may include: redirection of more institutional

resources of research institutions to the promotion of research and technology development on commercially feasible products and processes; increased linkages between the private sector and research institutions not only for advice and assistance but also for collaborative research efforts or other arrangements.

General or Targeted Benefits

The programs of the NCBC are available generally to all biotechnology research units of universities and research institutes as well as research and technology-intensive entrepreneurial biotechnology companies in the state. To the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

NCBC was founded in 1981 and became a state-sponsored, independent, private, nonprofit corporation in 1984. The basic approach of the NCBC and the variety and mix of its programs and services necessarily has evolved since its initiation to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

NCBC, through its Science Program Division and its Lymphocyte Center, has four grant programs, the recipients of which are research institutions. Through its Economic and Corporate Development Division, the Center has two long-term, low interest loan programs (for private companies) and one grant program (that supports the creation/operation of a biotechnology incubator).

Description of How Program is Funded/Amount of Funding

Over the 5-year period from FY86 through FY90, NCBC awarded grants and signed loan agreements totalling about \$19.3 million. In 1989, the Center awarded 68 grants totaling about \$2.5 million to universities and research institutions, executed about \$240,000 in three loan agreements with growing companies, and made a \$156,000 grant to an incubator/innovation center. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Only the two long-term, low-interest loan programs of the Center provide for full cost reimbursement from the private company recipients. The research grants do not require cost recovery. However, since these research grants are for projects ranging from basic research to commercialization of products and processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The formal restriction on all the Center's research and other services is that projects are undertaken only in the biotechnology field. For the grants programs, the eligible applicants are limited to universities and research institutions, while for the loan programs they are limited to private firms.

Program Administration and Operation

The Center attempts to facilitate interaction between research institutions and industry that leads to business and economic development and job creation. As a nonprofit corporation positioned between the academic and private sectors, NCBC fosters linkages between them.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of NCBC has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: North Carolina
- Program: Microelectronics Center of North Carolina

Program Purpose and Objectives

The Microelectronics Center of North Carolina (MCNC) was incorporated in 1980 as a state-sponsored, private, nonprofit corporation. MCNC is linked administratively to the Department of Economic and Community Development but has an independent Board of Governors. This Board consists of fourteen members from the research, business/industry, and government communities.

The overall mission of MCNC is to foster advanced research in microelectronics, communications, and supercomputing to:

- Build the technology infrastructure for the attraction, retention, and growth of science-based industry in the state
- Support universities, research institutions, and industry in the state with state-of-the-art research facilities and contribute in research, teaching, and technology development
- Involve leading industry in collaborative research
- Support economic development agencies in the state in their industrial development programs.

The primary purpose of the Center's microelectronic efforts is to foster the development of design, fabrication, and test technologies for the prototype, and ultimately commercial manufacture, of next generation submicron integrated circuits. To achieve this objective, the Center supports and manages an integrated program in advanced manufacturing research and technology development in modern electronics for the 5 major research universities in the state, Research Triangle Institute (RTI), and the commercial electronics industry. The program conducts basic and applied research and technology investigations relevant to industrial requirements for these circuits.

NCMC operates an advanced manufacturing research facility to provide collaboration and active involvement among researchers from appropriate university, research institute, industry, and government communities. Essential to the commercial relevance and effectiveness of this consortium is a level of involvement of Industrial Affiliates and Industry Associates that develops a sense of ownership and shared responsibility for the direction of MCNC's technical programs. MCNC provides an environment for the transfer of technology products and processes among all members of the MCNC industry-university-government consortium.

The primary purpose of the Center's communications and supercomputing efforts is to promote collaborative research and education among universities and industries in the state. To that end, NCMC also manages a state-wide communications network (linking 9 research universities, RTI, and MCNC) and, in June 1988, was assigned responsibility for organizing and operating the Supercomputing Center.

MCNC has approximately 200 full-time equivalent staff and over 20 resident professional and visiting scientists from industry. These Center research staff complement the research expertise in the universities, RTI, and private companies.

Industrial Sector

The Center restricts its efforts primarily to the biotechnology industry sector and secondarily to industrial sectors where work activities would be enhanced by the use of a supercomputer and the application of advanced concepts in computation science to industrial problems .

Classification of Objectives

The Center's Program can be classified as follows:

- Research and development (with an emphasis on advanced design, fabrication, and test technologies in microelectronics and on advanced computational science for supercomputing)
- Sectoral/industry development (with the emphasis on microelectronics and industries enhanced by supercomputing).

Ranking of Objectives

Other than research and development, sectoral/industry development would be the most important objective.

Classification by R&D Type

MCNC undertakes basic and applied research, development, and demonstration projects for advanced design, fabrication, and test technologies in microelectronics; and basic and applied research in advanced computational science for supercomputing.

Level of R&D Focus

The Center's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities, as appropriate.

Program Beneficiaries

Research and technology-intensive manufacturing companies in the field of microelectronics and in fields which would be enhanced by the advanced computational capacity of supercomputing are the ultimate intended targets for the Center's efforts. However, MCNC's client list is not limited to such organizations. The Center's clients have included private companies, government agencies, and education and research institutions. To the extent intellectual property and other proprietary rights are involved, the Center retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of design, fabrication, and test technologies for the prototype, and ultimately commercial manufacture, of next generation submicron integrated circuits. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the private sector and research institutes not only for advice and assistance but also for collaborative research efforts or other arrangements.

General or Targeted Benefits

To the extent that research and technology development activities are undertaken at the Center on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

MCNC was established in 1980. While the basic approach of the Center in the microelectronics field has not changed since its initiation, the Center has changed significantly with the assignment of responsibility for managing the state-wide communications network and for organizing and operating the Supercomputing Center.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As a Center of Excellence, MCNC is a recipient, not a provider, of extramural funding for its research efforts and other services.

Description of How Program is Funded/Amount of Funding

Support is provided by a state appropriation for both capital and operations, by grants and contracts with the federal government and industry, and by fees from industrial affiliates. Investment in property, plant, and equipment through FY89 exceeded \$52 million, the majority of which was supplied by the state. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Since most of the activities of the Center are conducted intramurally, cost recovery is not relevant. All cooperative research and technology development projects operate on a cost-sharing basis and a royalty or other arrangement also may be negotiated. Indirectly, it can be implied that the state expects to recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The formal restrictions on the Center's research and technology development activities is that projects are limited to the fields of microelectronics and advanced computational science.

Program's Administration and Operation

An active Industry Executive Council provides guidance to the Center's management on overall technology directions and strategy. Industry and university working groups address specific technical issues.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of MCNC have been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: North Carolina
- Program: Business Innovation and Technology Advancement Center

Program Purpose and Objectives

The Business Innovation and Technology Advancement Center (BITAC) is a private, non-profit business incubator/innovation center for biotechnology companies and other technology-intensive firms. Sponsored by North Carolina State University and the Greater Raleigh Chamber of Commerce, the Center was launched in FY89 with the financial support of the Economic Development Finance Program of the Economic and Corporate Development Division of the North Carolina Biotechnology Center (NCBC).

The BITAC Center is directed specifically toward bringing technology from the Research Triangle area into a facility that will promote the commercialization of products based on such technologies. An initial \$156,000 grant was used to outfit a laboratory with equipment biotechnology companies need that would be shared by the incubator's tenants. The first 5 tenants were all biotechnology-related companies which were attracted by the availability of the equipment.

Providing support to BITAC is consistent with NCBC's objective of promoting long-term economic benefits to the state through biotechnology research, development, and commercialization. NCBC is essentially a "Center Without Walls." It has no research facilities and conducts no research. Rather, it works to catalyze the progression of biotechnology from basic research in the laboratory to commercial products or processes in the marketplace.

Industrial Sector

BITAC currently does not limit its incubator tenants to biotechnology firms but gives them higher priority for available space.

Classification of Objectives

BITAC's provision of incubator space with a laboratory outfitted with biotechnology equipment can be classified as follows:

- Research and development (with an emphasis on technology development and commercialization of products and processes)
- Sectoral/industry development (with an emphasis on the biotechnology field)
- Small and medium-sized business assistance (with an emphasis on start-ups and young, growing companies).

Ranking of Objectives

Other than research and development, the most important specified objective would be small and medium-sized business assistance, because only small start-ups and young, growing firms can be accommodated in an incubator. Of lesser importance is sectoral/ industry development, because companies in the biotechnology field are only given higher priority for space in the incubator and others are not excluded.

Classification by R&D Type

Incubator tenants at BITAC generally will be undertaking applied research and technology development activities leading to a prototype. These activities will tend to be specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

BITAC's incubator tenants' research and development efforts will tend to build on and expand existing R&D activities.

Program Beneficiaries

BITAC's incubator tenants will tend to be technology-based start-ups or young, growing companies, most (and perhaps all) of which will be in the biotechnology field.

The issue of intellectual property and other proprietary rights does not arise when a firm becomes an incubator tenant.

Direct or Indirect Benefits

BITAC's incubator tenants clearly are the near-term beneficiaries. Technology-oriented incubators significantly increase the probability of success of new entrepreneurial ventures. In theory, this would imply the traditional benefits of jobs/firms created/retained as the longer term benefit.

General or Targeted Benefits

BITAC's incubator space is available generally to all technology-based start-ups or young, growing companies, particularly if they are in the biotechnology field, which is given priority for

space. In all incubators, it is generally true that research results remain the property of the incubator tenant.

Program Duration and Permanence

BITAC was launched during the 1989 fiscal year and, during its first year, nearly filled up its available space (8,500 square foot) due to the size of the laboratory outfitted with equipment needed by start-up and small, growing biotechnology firms. To accommodate more tenant companies, BITAC plans to add 10,000 square feet of new lab space which will be ready for occupancy in the spring of 1991.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. BITAC provides only incubator space, an equipped laboratory, shared services, and a network of assistance providing professionals.

Description of How Program is Funded/Amount of Funding

To outfit the laboratory with equipment needed by start-up biotechnology firms, BITAC was awarded a grant of \$156,000 under the Economic Development Finance Program of the Economic and Corporate Development Division of the North Carolina Biotechnology Center (NCBC). The state funds are from state general tax revenue.

Provisions for Cost Recovery

Since the award to BITAC was a grant, NCBC has made no provision for cost recovery. However, since the grant was for an incubator/innovation center, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on BITAC's operation of the incubator is the priority given to biotechnology firms for empty space.

Program's Administration and Operation

In addition to moderately priced office space and shared office services, BITAC offers individual laboratories, shared lab equipment, and professional services at reduced rates from local lawyers, accountants, venture capitalists, and other professionals. This network of professionals meets regularly with BITAC's tenant entrepreneurs to assist them with technical problems, business problems, venture capital financing, legal issues, marketing strategies, and other matters. An assistance team of three or four professionals is assigned to each company to monitor the company's progress and to provide timely advice. BITAC's close ties with NC State University also gives the incubator tenants quick access to university research expertise and laboratory equipment.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of BITAC's incubator/innovation center has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: North Carolina
- Metropolitan Region: Raleigh-Durham-Chapel Hill
- Program: Research Triangle Park

Program Purpose and Objectives

In 1956, then Governor Luther Hodges met with representatives from the three leading research universities in the Raleigh, Durham, and Chapel Hill area (North Carolina State University, Duke University, and University of North Carolina) and members of the local business community to discuss the concept of a research park in the "Research Triangle." The state donated large tracts of land in the Research Triangle area that were combined with other land for use as a high-technology research park. The state also built and maintained key access roads in the area.

The original project was not successful. The development of the land as the Research Triangle Park has gone through several phases. In 1958, the Research Triangle Foundation was created and approximately 4,000 acres including the land of the original project was bought by the Foundation. The original \$2.0 million in financing to create the Foundation and purchase the land was raised from corporate and private contributions (the Foundation is now self-sustaining).

In 1959, the Research Triangle Institute, a contract research organization, was formed and became one of the Park's earliest occupants. One of the first industrial laboratories constructed at the Park was that of Monsanto. The Park grew slowly during the early 1960s and by 1965 there were only nine laboratories employing a total of less than 1,000 people.

The beginning of a second developmental phase occurred in the mid 1960s and the Research Triangle Park became a visible reality, when IBM Corporation and a major research and development complex of the US EPA located there.

In a new phase of development beginning about 1980, General Electric selected the Park for its Microelectronics Center and both the state-supported Microelectronics Park of North Carolina and the North Carolina Biotechnology Park were located within the Park. These state-supported Centers are intended, among other objectives, both to draw upon the research infrastructure of the three research universities in the area and of the current tenants in the Park and to act as magnets and attract other technology-based companies to the area.

The Research Triangle Park currently has 54 separate, major research facilities with a workforce of more than 32,000. The 6,800 acres of the Park make it the largest planned research

park in the nation. Approximately \$2.0 billion has been spent on the facilities already occupied and an additional almost \$700 million is expected to be spent on construction or renovation projects that are under construction or have been announced.

Industrial Sector

The Park does not restrict its occupant companies to specific industry sectors.

Classification of Objectives

The Park's overall objectives can be classified as: research and development and regional development.

Ranking of Objectives

Other than research and development, regional development is the only specified objective.

Classification by R&D Type

The private, academic, and governmental research facilities located at the Park undertake basic and applied research as well as technology development. They support projects ranging from generic research and development to those involving specific technologies.

Level of R&D Focus

With the variety of organizations at the Park and the variety of activities they undertake, the Park's occupants' research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

The near-term, direct beneficiaries of the Park's existence, its facilities and services, and its location near the three research universities are the research laboratories and other facilities of the private, academic, and governmental organizations in the Park.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing, research-intensive or technology-based private, academic, and government sector organizations. This would imply the traditional benefits of jobs/firms created/retained as well as personal, property, and business taxes paid.

General or Targeted Benefits

The facilities and services of the Park are available generally to all research-intensive or technology-based private, academic, and government sector organizations, although laboratories and other research facilities are encouraged.

Program Duration and Permanence

The Park was established in 1956 and its concept has not changed since its initiation.

Types of Potential Subsidy Intervention/Form of Funding

The Park has received some support for its development from the state (roadway and utility infrastructure around the Park) and from the Foundation's original sponsors (corporate and private).

Description of How Program is Funded/Amount of Funding

Large tracts of land in the park were originally donated by the state. From the sale and lease of land and other Park services, the Research Triangle Foundation is now self-supporting.

Provisions for Cost Recovery

To the extent that costs are recovered by the Foundation, they occur through the sales and leases of land and charges for other services. This cost recovery would be applicable only to land purchase, site preparation, and internal infrastructure development and improvements. It can be inferred that the state expected to recover its investment costs for the land and infrastructure development through increased personal, property, and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the research and other activities conducted by organizations at the Park.

Program's Administration and Operation

The Foundation has a five-member Board of Directors, representing the private and academic sectors, that sets policy for the operations of the Park.

Program Impact and Lessons

Formal, publicly-available, third-party evaluations of the Park have been undertaken and information has been systematically collected documenting the program's impact in such terms as numbers and types of organizations located in the Park and their number of employees. The most important lessons learned from the experience of the Research Triangle Park are:

- Perseverance, a long-term perspective, and a long-term economic, social, and political commitment are required if the objective sought is to develop a balanced mix of different types of facilities and research capabilities.
- Development of a park of this scale and types of occupants tends to make that one part of a state even more attractive to high-technology and technology-based firms than it would have been otherwise. This may make it difficult to balance technology-based economic development across the state.

Name of Program and Government Agency

- State: North Carolina
- Metropolitan Region: Charlotte
- Program: The Ben Craig Center

Program Purpose and Objectives

The Ben Craig Center is a nonprofit corporation, associated with the University of North Carolina at Charlotte. The Center is comprised of a business incubator and a Small Business Development Center (SBDC). The Center also sponsors the Southeast Technology Commercialization Conference, which is designed to increase awareness of developing technologies in the state. Companies meeting certain criteria have the opportunity to participate in a business review forum, in which they present their business plans to a panel of Advisory Board members for advice and counsel. Although the Center was formally created in 1986, the programs it administers had been started the previous year.

The Center's programs are directed at established business and industrial firms as well as small and emerging companies in the eight-county region around Charlotte. Drawing on its own staff and the university and business community resources, the Center provides entrepreneurs and companies guidance, advice, and counseling on starting, growing, and running a business.

The SBDC assists business growth by providing outreach services in the form of technical, management, and financial advice to entrepreneurs and by increasing access to financing and other strategic contacts. The SBDC services include informational materials and seminars as well as short- and long-term free managerial consulting by staff and business and industrial volunteers (e.g., SCORE).

The business incubator houses small, growth-oriented companies in the start-up or early stage of development in an environment conducive to their success and at a moderate cost. About one-third of the incubator tenants are technology-based firms, with an emphasis on information technology. The incubator offers tenant access to shared common facilities, partially subsidized professional services, university resources (e.g., expertise, information, and modern facilities and equipment), financing and other business contacts.

The incubator originally was in a vacant building which had been the educational center for a church and contained about 27,000 square feet. In late 1990, the incubator moved to a new facility at the University Research Park with 50,000 square feet. The older building could house up to 16 firms, and the newer one about 40.

During the five-year period of its existence, the Center has had about 20 firms in its incubator, of which six have left either as graduates or as no longer existing. The move to the new facility has permitted the Center to provide space to an Italian firm which intends to enter the U.S. market.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors.

Classification of Objectives

The Center's provision of both incubator facilities and advisory services can be classified as: research and development, regional development, and small- and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the other two specified objectives would be approximately equal.

Classification By R&D Type

About one-third of the incubator tenant firms are technology based, a characteristic shared by a smaller percentage of companies receiving technical, managerial, and financing services under the SBDC program. To the extent that technology-oriented companies are involved, the companies assisted by the Center's program will tend to be undertaking applied research and technology development activities leading to a prototype. These activities will tend to range from generic research and development to those involving specific technologies leading to products and processes with commercial potential and industrial applications.

Level of R&D Focus

With the variety of organizations assisted by the Center's programs and the variety of activities they undertake, the client companies' research and development efforts will tend to build on and expand existing R&D activities.

Program Beneficiaries

The near-term, direct beneficiaries of the Center's existence, its incubator facilities and assistance services, and its location within a university research park are the individual entrepreneurs, new firms, growing companies, and established businesses assisted as well as the region.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing companies. This would imply the traditional benefits of jobs/firms created/retained as the longer term benefit.

General or Targeted Benefits

The facilities and services of the Center's programs are available generally to all industrial companies and business firms, although there is an emphasis on recruiting technology-based, start-ups or young, growing companies for the incubator facility.

Program Duration and Permanence

The Center was launched in 1986, although the program is administers had been in existence for one year. The Center's approach has not changed since its initiation, although its programs evolve to address changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The Center's programs provide only incubator space and shared services to their incubator tenants and technical, managerial, and financing services and network brokering to business firms and industrial companies in the region.

Description of How Program Is Funded/Amount of Funding

The Center's incubator is supported by a \$30,000 annual operational grant from its Incubator Facilities Program. The Authority provided \$200,000 for capital expenses when the first incubator facility was being renovated. The Center's technical, managerial, and financing assistance program is supported by a contract from the U.S. SBA with state matching funds. The annual budget for the incubator in its new facility is approximately \$500,000, and for the SBDC assistance and services about \$180,000. The state funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Center nor the state makes provision for cost recovery. However, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Center's operation of the incubator or its provision of assistance and services, except that the programs are limited to entrepreneurs and companies in the region.

Summary of Program's Administration and Operation

The Center has a 30-member governing board that represents the private, academic, and governmental sectors. Each firm in the incubator has a five-person Business Advisory Committee from the Center's Board and outsiders that meets at least quarterly to provide review and assistance.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Center's incubator/assistance services program effort has been undertaken and only limited information has been systematically collected documenting its impact.

Name of Program and Government Agency

- State: North Carolina
- Metropolitan Region: Greensboro-Winston-Salem
- Program: The Greensboro Business Center

Program Purpose and Objectives

The Greensboro Business Center, which began operations in mid-1988, is a business incubator operated by a private, nonprofit corporation. The building it occupies was donated by a local bank and funding for renovation, equipment, and initial operations was supplied by the city and county and two local foundations. After the Center opened, the state provided about \$35,000 for equipment and operational needs under its Incubator Facilities Program.

While the Center is in a 10,000 square foot building, only about one-third of it is net rentable space. As a result, the Center is moving to a vacant industrial building where it initially will occupy 45,000 square feet. The move is being assisted by a \$200,000 grant from the state's Incubator Facilities Program.

The current building has room for 14 firms. During the two-and-a-half-year period of its existence, the Center has had a total of 20 firms at the Center, eight of which graduated. Two of the firms, both graduates, were technology-oriented.

In addition to being provided fully furnished office space and support services and facilities, the 16 members of the Board of Directors and the 14 members of the corporation are available for business, management, marketing, and financing advice and networking. In addition, each firm has assigned to it an advisory committee which determines whether the firm will be admitted to the Center and which meets with the firm at least every three months until it graduates.

The firms have access to three universities in the region: the University of North Carolina at Greensboro, Winston-Salem State University, and North Carolina A&T University. The manager of the Center has met with the Dean of the School of Business at UNC-Greensboro and of the School of Engineering at NC-A&T to develop increased working relationships between them and the Center. Included would be changes in the curriculum to allow faculty-student teams to address business and technical problems of incubator tenants for academic credit.

The move to larger quarters will allow the Center to become more of an entrepreneurial institution and allow other business assistance organizations (such as SBDC and SCORE) to co-locate with the Center.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors.

Classification of Objectives

To the extent that technology-oriented companies are involved, the Center's provision of incubator space can be classified as: research and development, regional development, and small and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the other two specified objectives would be approximately equal.

Classification by R&D Type

Incubator tenants at the Center that are technology-oriented generally will be undertaking applied research and technology development activities leading to a prototype. These activities will tend to be specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Center's tenants' research and development efforts will tend to build on and expand existing R&D activities.

Program Beneficiaries

The Center's tenants will tend not to be technology-based companies.

Direct or Indirect Benefits

The Center's tenants clearly are the near-term beneficiaries. Incubators significantly increase the probability of success of new entrepreneurial ventures. In theory, this would imply the traditional benefits of jobs/firms created/retained as the longer term benefit.

General or Targeted Benefits

The Center's incubator space is available generally to all start-ups or young, growing companies.

Program Duration and Permanence

The Center was launched at the end of the 1988 fiscal year and, during its first year, nearly filled up its available space. To accommodate more tenant companies, the Center plans to move to a much larger facility during the 1991 fiscal year.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The Center provides only incubator space, shared services, and a network of assistance providing professionals.

Description of How Program is Funded/Amount of Funding

The Center was provided two grants from the state's Incubator Facilities Program, one for equipment and operational expenses and one for the forthcoming move. The state funds are from state general tax revenue.

Provisions for Cost Recovery

Since awards to the Center are grants, the state makes no provision for cost recovery. However, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Center's operation of the incubator.

Program's Administration and Operation

In addition to moderately priced office space and shared office services, the Center offers professional services at no cost or reduced rates from local lawyers, accountants, venture capitalists, and other professionals. This network of professionals meets regularly with the Center's

tenant entrepreneurs to assist them with technical problems, business problems, venture capital financing, legal issues, marketing strategies, and other matters. An assistance team of three or four professionals is assigned to each company to monitor the company's progress and give it timely advice. The Center's close ties with UNC-Greensboro and NC A&T also gives the incubator tenants quick access to university research expertise.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Center's incubator/innovation center have been undertaken and only limited information has been systematically collected documenting its impact, e.g., employment growth has risen four-fold for the 20 companies which have been or currently are tenants.

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X. OHIO

The two primary Ohio agencies for science and technology for industrial innovation and economic development are the Ohio Department of Development and the Ohio Board of Regents. An organizational chart of state activities is presented in Figure 10.

The Ohio Department of Development administers five major programs, three of which are located within its Division of Technological Innovation: the Thomas Edison Program, the Small Business Innovation Research Program, and the Ohio Technology Transfer Organization. The other two programs are the Ohio Coal Development Office and the Ohio Advanced Technology Center.

Thomas Edison Program. This Program, established in 1983, is a public/private partnership which sponsors three initiatives: Edison Technology Centers, Edison Incubators, and Edison Seed Development Fund.

Each of these program initiatives encourages economic development through technological innovation by fostering cooperative research and development efforts that have the potential to generate new technologies, products, or production processes. Each program is intended to offer benefits both to participating industrial companies and to academic institutions.

Edison Technology Centers. The Centers Program, created in 1984, fosters research in a specific set of promising industrial technologies. Nine Centers have been established each with a focus on a technology area where the state has a leadership position. Each Center consists of one or more academic institutions and nonprofit research institute partners. Their research agendas are designed by industrial boards to ensure that the results can be useful to industry and ultimately applied.

The Centers perform an array of services, although not all Centers provide all of them: basic/generic research conducted to satisfy the needs of a group of sponsoring companies, applied/proprietary research contractually available to individual firms, technology consulting, technology transfer, scientific education, and technological training and retraining.

Each project undertaken by a Center is industry-driven with one or more industrial sponsors and with at least half of its support coming from its industrial partners.

Edison Incubators. This Program, established in 1985, supports university-based facilities in seven communities that provide to start-up businesses low-cost space and many business and technical services. Because of the technical nature of their tenant firms, Edison Incubators provide a greater degree of business and managerial consulting services than many other types of incubators.

Edison Seed Development Fund. This Fund provides matching grants to business/academic partnerships for research and development leading to the commercialization of promising new technology-driven products and processes. Each project is industry-driven with at least half of its support coming from nonstate sources. The grants, awarded to the academic partner, are made to support joint university-industry applied research and development activities at two different stages of the innovation development cycle: early-stage studies of technical feasibility and commercialization potential; and later-stage development of a commercial product or demonstration prototype.

Ohio Small Business Innovation Research (SBIR) Program. This Program awards technical assistance grants to various organizations throughout the state, which in turn work with small business firms to increase the number of successful applications.

Ohio Technology Transfer Organization (OTTO). OTTO originally was founded in 1979 at Ohio State University and transferred to the Department in 1983. OTTO operates, at no cost to the user, a regionally-distributed, statewide network of technology transfer agents out of 24 state-supported technical and community colleges and four major state universities.

Ohio Coal Development Program. This Program, created in 1984, provides financial assistance for clean coal research and development projects, with priority given to cost-effective sulfur removal process technology.

Ohio Advanced Technology Center. This Center, currently in its planning stage, is intended to develop closer research ties between Wright-Patterson Air Force Base and the state's industry and universities.

The Ohio Board of Regents has instituted several programs specifically aimed at increasing research and development in high-technology fields, including: Research Challenge Program, Ohio Supercomputer Center, and Ohio Aerospace Institute.

Research Challenge Program. This Program, part of the larger Selective Excellence Program, was initiated in 1986. The Program is directed at creating incentives to bring

sponsored research into the state by building nationally competitive research programs at the state's universities.

Ohio Supercomputer Center. This Center, created in 1986, is the nation's only supercomputer center funded wholly by a state. Based at Ohio State University, the Center is linked to more than 20 college and university campuses statewide for easy access by academic and industrial researchers.

Ohio Aerospace Institute. The Institute, established in 1988, is intended to develop closer research and education ties among NASA Lewis Research Center, graduate universities in the state, and the state's aerospace industry.

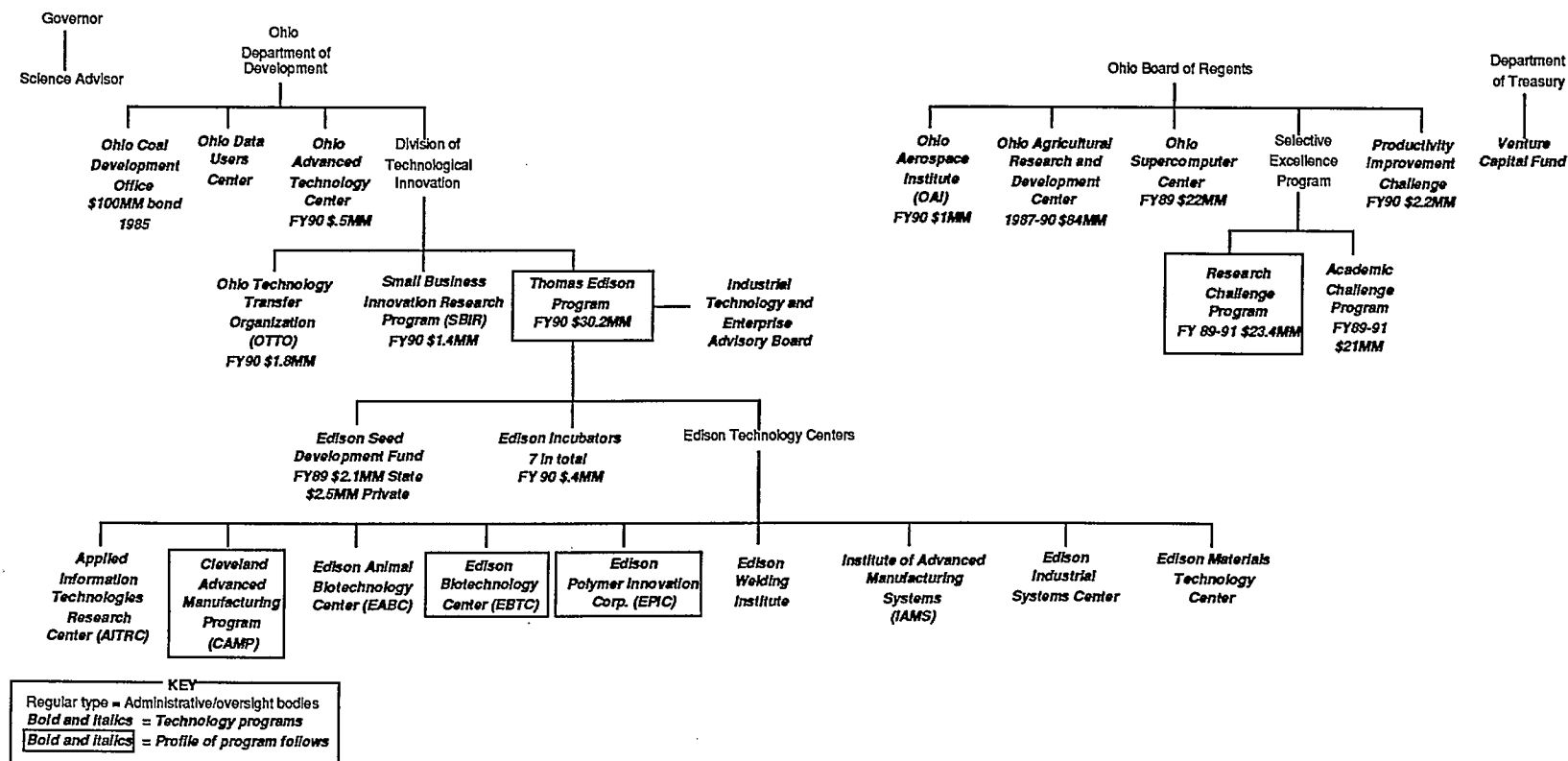


FIGURE 10 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: OHIO

Name of Program and Government Agency

- State: Ohio Department of Development Ohio Division of Technological Innovation
- Program: Thomas Edison Program

Program Purpose and Objective

The Thomas Edison Program is administered by the Ohio Department of Development through its Division of Technological Innovation. The Program, established in 1983, is a public/private partnership which sponsors three initiatives: Edison Technology Centers, Edison Incubators, and Edison Seed Development Fund.

Each of these program initiatives encourages economic development through technological innovation by fostering cooperative research and development efforts that have the potential to generate new technologies, products, or production processes. Each program is intended to offer benefits both to participating industrial companies and to academic institutions.

Edison Technology Centers. The Centers Program, created in 1984, fosters research that is intended to stimulate the research, development, and use of promising industrial technologies which will aid many individual companies in the state. Each Center consists of one or more academic institution and nonprofit research institute partners. Their research agendas are designed by industrial boards to ensure that the results can be useful to industry and ultimately commercialized.

Nine Centers have been established each with a focus in one of the following technology areas where the state has a leadership position: applied information technologies, advanced manufacturing sciences, advanced manufacturing technologies, biomedical technologies, animal biotechnology, advanced polymers, advanced welding and joining technologies, industrial systems, and advanced material technologies.

The Centers perform an array of services, although not all Centers provide all of them: basic/generic research conducted to satisfy the needs of a group of sponsoring companies; applied/proprietary research contractually available to individual firms; technology consulting; technology transfer; scientific education; and technological training and retraining. Equipment and facilities are provided on a fee basis to member companies.

Each project undertaken by a Center is industry-driven with one or more industrial sponsors who are required to provide at least half of the project support. Companies pool resources through research consortia to achieve long-term research objectives that may be too risky or

expensive for any one firm to undertake. Active participation by companies from the inception of a research project ensures a vested interest in the results and, thus, greatly improves the probability that the technology will be transferred and commercialized.

Centers originally were funded for a five-year period and were expected to achieve financial self-sufficiency by the end of that time. However, it has been recognized that Centers specializing in new or emerging technologies (such as biomedical technology and animal biotechnology) may require a longer term than Centers focussing on other technologies.

Edison Incubators. The Edison Incubator Program, established in 1985, supports university-based facilities that provide to start-up businesses low-cost space and many business and technical services. Because of the technical nature of their tenant firms, Edison Incubators provide a greater degree of business and managerial consulting services than many other types of incubators.

Edison Incubators have been supported in seven communities. Business persons, community groups, local universities and colleges, and fellow tenants — all actively participate in each of the Incubators. Incubator tenants frequently become customers, suppliers, and technical advisors to each other. Each Incubator has a management team which has developed networks of technical and business contacts to assist the tenants. Each Incubator is guided by a Board of Trustees comprised of successful entrepreneurs, community leaders, representatives from the local academic institution(s).

In general, start-up firms stay in an Incubator for one to three years. Since the first Incubator opened, dozens of companies have graduated to their own facilities. Many of these firms continue to receive consulting services from the Incubators.

Edison Seed Development Fund. This Fund, created in 1984, provides matching grants to business/academic partnerships for research and development leading to the commercialization of promising new technology-driven products, processes, and systems. Each project is industry-driven with at least half of its support coming from non-state sources. The grants, awarded to the academic partner, are made to support joint university-industry applied research and development activities at two different stages of the innovation development cycle.

Class I grants of up to \$50,000 are provided for early stage studies of technical feasibility and commercialization potential. Participants in successful Class I projects are encouraged to apply for Class II awards. Class II awards up to \$250,000 are made to develop a commercial product

or demonstration prototype. Class II awards are not restricted to Class I recipients. Projects are not limited to any specific technology area.

Industrial Sector

The Thomas Edison Program, through the Edison Technology Centers program, funds nine Centers each of which is focussed on a specific technology field. The Program's two other initiatives do not restrict their efforts to specific technologies and their counterpart industry sectors.

Classification of Objectives

The Program can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Sectoral/industry development (although only in the Edison Technology Centers Program)
- Small and medium-sized business assistance (although directly only in the Edison Incubators program).

Ranking of Objectives

Other than research and development, the most important specified objective is sectoral/industry development. Of lesser importance is small and medium-sized business assistance.

Classification by R&D Type

The Program supports basic research, applied research, and development projects, all leading to the development and commercialization of technology-driven products and processes. Because of the wide variety of its programs, the Fund's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Program's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, given the variety within its programs.

Program Beneficiaries

Since there is wide variety within the programs supported under the Program, program beneficiaries range from research and technology-intensive entrepreneurial firms to established manufacturing companies in the state. In only one program are the beneficiaries companies operating in specific technology fields.

The Edison Technology Centers conduct, and the Edison Seed Development Fund supports, both generic and proprietary research. Access to research results may be limited to the sponsoring industrial partner(s) or may be available to them on a preferential basis before publication. The participating research institutions generally retain exclusive intellectual property and other proprietary rights to the technologies they create and may market or license them, usually to the participating firm(s), although in some instances the sponsoring companies have the rights to the patents as well as the licenses.

Direct or Indirect Benefits

The Ohio Science and Technology Commission issued a report in early 1990 assessing the state's science and technology-based business and economic development strategy and programs and producing findings and recommendations for state actions and investment into the year 2000. The 11 programs created since 1979 were reviewed, of which three collectively had cumulative budgets exceeding 80 percent of the half-billion dollars spent by the state: the Thomas Edison Program and the two research and development programs which are natural resource specific in agriculture and in coal.

The document stressed non-quantifiable, indirect benefits, demonstrating the primary contribution of the Program to the recognition of the state as a leader in the development and application of advanced technology. The report concludes that the state's programs have upgraded the state's research and development infrastructure, improved the environment for technological innovation, strengthened linkages between industry/business and research institutions, nurtured the human resources for a technology-based economy, and are considered important factors in the state's strong economic recovery since the recession of the early 1980s.

General or Targeted Benefits

Program support under the Edison Technology Centers is available only to the nine Centers that undertake research and technology development activities related to specific technological

fields. Through the Edison Incubators Program, the beneficiaries are new, technology-intensive entrepreneurial firms.

Within the three programs supported by the Program and to the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

The Thomas Edison Program was created in 1983 and made its first awards in FY84. The basic approach of the Program and the variety and mix within its three programs necessarily has evolved since its initiation to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

The Program's awards are in the form of grants, which in two of its three programs are made to research institutions or consortia thereof (in the Technology Centers). Projects supported under the Technology Centers or Edison Seed Development Fund are industry-driven with one or more industrial partners and with at least half of its support coming from its industrial partners.

Description of How Program is Funded/Amount of Funding

Through FY90, the Edison Centers have teamed nearly 700 companies with Ohio's research universities in more than 1,000 projects. Industry has contributed \$149 million, more than matching the state's investment of \$104.2 million.

Through the same period, \$3.0 million has been provided to the seven incubators through the Edison Incubators program.

Over the seven-year period of the program's existence through FY90, the Edison Seed Development Fund has supported over 140 projects with over \$13.3 million in grants and private matching funds exceeding \$17.3 million.

Thus, over the seven operating years of the Thomas Edison Program from FY84 through FY90, the Program has made awards totalling over \$120 million under the three programs it administers. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Program does not directly attempt to recover its costs from its three research and technology development programs. However, research institutions seek a return on investment in successfully commercialized projects supported by the Technology Centers or Edison Seed Development programs in the form of limited royalties on sales of the newly developed products or a share of the fees received by the industrial sponsor if the technology is licensed. This return generally is limited to the amount of the investment plus discounted interest charges.

Moreover, in those same two programs, all research institution projects are industry-driven with one or more industrial sponsors who are required to provide at least half of the project support. In the aggregate for both programs, the ratio has been about 1.4 to 1.

Since the Program's research and development efforts through its three programs are directed at generating new, commercially viable technologies, products, or production processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, and other transfer payments.

Discrimination/Conditionality

There are formal restriction only on the applied research and technology development efforts of the Technology Centers supported in the Program, in that projects are undertaken only in the nine advanced technology fields of the Centers.

Program's Administration and Operation

The Thomas Edison Program receives advice on the selection of projects for funding from the Industrial Technology and Enterprise Advisory Board. The Board consists of nine members representing the industrial, business, academic, and government communities.

Program Impact and Lessons

The Ohio Science and Technology Commission issued a report in early 1990 assessing state's science and technology-based business and economic development strategy and programs and producing findings and recommendations for state actions and investment into the year 2000. However, the Program was only one of eleven reviewed and the findings and recommendation of the Commission covered the state's overall approach.

Other than this report, no other formal, publicly-available, third-party evaluations, legislative reports, or internal self-evaluations of the overall Thomas Edison Program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Ohio
- Program: Edison BioTechnology Center

Program Purpose and Objectives

The Edison BioTechnology Center (EBTC), located in Cleveland, Ohio, was created in 1987 as a non-profit, independent corporation. The Center is one of nine Edison Technology Centers launched by the state in the mid 1980s.

The purpose of the Center to facilitate the development and commercialization of biomedical and biotechnical products, primarily related to biomedical applications, and to develop biotechnology industrial/business opportunities in the state. In order to achieve these objectives, EBTC focuses on research and development of new biotechnology-based products and processes, technology transfer to industry, and collaboration between industrial, academic, and medical laboratories. Specific priority research areas include diagnostics, bioprocesses, and biomaterials. Additionally, EBTC is coordinating research in Functional Electrical Simulation.

EBTC links, and operates through, four research institutions with more than 30 corporate sponsors. The four research institutions are Case Western Reserve University, the Cleveland Clinic Foundation, Metro Health Medical Center, and University Hospitals of Cleveland.

By providing a forum where companies with biomedical and biotechnical product development interests can interact with institutional researchers, EBTC provides many benefits to its corporate sponsors. EBTC members have the opportunity to build relationships with companies and institutions possessing the expertise to develop and transfer practical applications of research into the marketplace. All EBTC members have access to specialized material, equipment, and laboratory space. Start-up ventures can locate in Cleveland's Edison Incubator for technology-intensive businesses.

Industrial Sector

The Center restricts its efforts to the biomedical and biotechnical industry sector and, more specifically, to priority research areas within biotechnology (diagnostics, bioprocesses, biomaterials, and Functional Electrical Simulation).

Classification of Objectives

The Center's Program can be classified as follows:

- Research and development (with an emphasis on commercialization and industrial applications)
- Sectoral/industry development (with an emphasis on four priority research areas within the biotechnology field).

Ranking of Objectives

Other than research and development, sectoral/industry development would be the most important objective.

Classification by R&D Type

EBTC undertakes applied research and development projects in four priority research areas within biotechnology that have potential for commercialization.

Level of R&D Focus

The Center's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

Biotechnology companies that sponsor the Center are the primary intended targets for the Center's efforts. Ultimately, all companies in the biotechnology sector are beneficiaries.

To the extent intellectual property and other proprietary rights are involved, the Center, through its participating research institutions, retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new biotechnology based products and processes with near-term commercialization potential. In theory, this would imply the traditional benefits of jobs /firms created/retained. Implied indirect benefits include increased linkages between the

private sector and the participating research institutions for collaborative research efforts or other arrangements and assistance.

General or Targeted Benefits

The services of the Center are available generally to the sponsoring biotechnology manufacturing companies, most of which are based, or have facilities, in the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual sponsoring firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

EBTC was established in 1987. The basic approach of the Center has not changed since its initiation and the variety and mix of its activities have evolved to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As an Edison Technology Center, EBTC is a recipient, not a provider, of extramural funding for its research efforts. EBTC's corporate sponsors pay an annual fee and, in addition, provide monies for specific projects. Projects undertaken by the Center are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. The remaining funds of the Center come from an award under the state's Edison Technology Centers Program.

Description of How Program is Funded/Amount of Funding

Funding for the Center's operations is provided through the state's Edison Technology Centers Program. Over the three-year period of the Center's existence through FY90, it has received \$3.5 million from that Program. In addition, cooperative research and development projects are undertaken with sponsoring industrial companies and consortia thereof. All state funds are from state general tax revenue.

Provisions for Cost Recovery

EBTC does not directly attempt to recover all its costs from its research and development activities. Except for certain core staff activities and internally sponsored projects under the Edison Technology Centers Program annual allocation, all research projects of EBTC are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. In addition, EBTC may seek a return on investment in successfully commercialized projects in the form of limited royalties on the sales of newly developed products or a share of the fees received by the industrial sponsor if the technology is licensed. This return generally is limited to the amount of the investment plus discounted interest charges.

Discrimination/Conditionality

The formal restriction on the Center's research and other services is that projects are undertaken only in four specified priority research areas in the biotechnology field (diagnostics, bio-processes, biomaterials, and Functional Electrical Simulation).

Program's Administration and Operation

EBTC's board of directors represent biotechnology research and manufacturing sectors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of EBTC have been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Ohio
- Program: Ohio Research Challenge Program

Program Purpose and Objectives

The Ohio Research Challenge Program was created in 1986 to increase the availability of relatively flexible research monies for the state's sixteen research universities and free-standing medical institutions. While not contributing directly to the state's R&D-based business and economic development, the Program has the potential for building the research infrastructure required for such a strategic goal.

During the three bienniums covering the first six years of operation through FY91, the Program has been allocated \$73.8 million. Awards to each academic institution range from \$50,000 to \$12 million per year. Awards made during the first two years of the Program's operation have produced a four-to-one match in follow-on funds to date. Federal and industrial-sponsored grants and contracts and federally-supported research centers all have increased and research faculty have been easier to attract.

The capacity strengthening strategies that appear to be working for the universities are seed funding projects to increase the potential for federal basic research support and applied research projects building on federally-funded basic research activities.

Industrial Sector

Research projects supported by the Program are not limited to any specific industry sector.

Classification of Objectives

The Program's only objective can be classified as research and development.

Ranking of Objectives

There is no objective other than research and development.

Classification of R&D Type

The Research Challenge Program supports predominantly basic research with some applied research and development projects.

Level of R&D Focus

With Program's support predominantly of basic research, projects can reinforce existing R&D activities, build on existing R&D infrastructure, or create new kinds of R&D activities.

Program Beneficiaries

Only researchers in the 16 research universities and medical institutions in the state are eligible to apply for grant support from the Program. To the extent intellectual property or other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the university.

Direct or Indirect Benefits

No formal assessment of the Research Challenge Program has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are a strengthened research infrastructure at the state's research universities.

General or Targeted Benefits

Because the research supported with Program monies is predominantly basic research in scientific and engineering disciplines conducted at universities, the research results are likely to be available and on a timely basis.

Program Duration and Permanence

The Ohio Research Challenge Program was created in 1986 and has seen no major changes over its five years of operations.

Types of Potential Subsidy Intervention/Form of Funding

The Program awards grants to the research institutions on behalf of the researcher who made the proposal. The awards are actually a drawing down on the allocation made to the institution. As with most basic research, no matching funds are required.

Description of How Program is Funded/Amount of Funding

The Program has been allocated \$73.8 million for research awards during the three bienniums covering the first six years of operation through FY91. All funds are from state general tax revenue.

Provision for Cost Recovery

As with most basic research, the Program makes no attempt to recover its grant award costs. Indirectly, it is implied that the state will recover its investment costs over the long term through research- and technology-development-based business and economic development with its increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Program's competitive grant program.

Program's Administration and Operation

Program monies are appropriated each year as part of the Higher Education budget and then allocated to the universities based on a formula which places great weight on the percent of sponsored research in the state that comes to that university and which provides a capacity-strengthening incentive for institutions underrepresented in the state's research and development enterprise.

The universities submit research proposals to draw down on the allocation. There are few limitations on the types of research activities, although they tend to be in the physical, natural, and biological sciences, engineering, and social sciences. The research proposals themselves are competitive within the university environment itself. Proposals presented to the Board essentially compete against themselves, since monies are not reallocated by the Board from one university to another.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Ohio
- Program: Cleveland Advanced Manufacturing Program

Program Purpose and Objectives

The Cleveland Advanced Manufacturing Program (CAMP), located in Cleveland, Ohio, was created in 1984 as a nonprofit, independent corporation. The Program is one of nine Edison Technology Programs launched by the state in the mid 1980s.

The purpose of the Program is to facilitate the research, development, and refinement of manufacturing and production techniques and technologies and the application of such technologies to specific manufacturing and production processes in the state. In order to achieve these objectives, CAMP focuses on manufacturer-sponsored and research and development; technology transfer to, and application by, industry; technical assistance; education, training, and retraining; and collaboration between industrial and academic laboratories. Specific priority research areas include sensor support systems, advanced manufacturing applications, and artificial intelligence. In addition, the Program offers manufacturers employee training to prepare workers to install, operate, and maintain technologically advanced manufacturing systems.

CAMP links, and operates through, three academic research institutions with more than 60 corporate sponsors. The three research institutions are the Center for Automation and Intelligent Systems Research at Case Western Reserve University's Case Institute of Technology, the Advanced Manufacturing Center of Cleveland State University's Fenn College of Engineering, and the Unified Technologies Center of Cuyahoga Community College.

By providing a forum where companies with manufacturing and production process development interests and needs can interact with institutional researchers, CAMP provides many benefits to its corporate manufacturing sponsors. CAMP members have the opportunity to build relationships with companies and institutions possessing the expertise to develop and transfer practical applications of research into the marketplace.

Three levels of corporate sponsorship have been established: basic and applied research in a subject of particular interest to a group of sponsoring companies; demonstration projects, made possible by support of one or more sponsoring companies; and individual research projects contractually performed for a sponsoring company on a proprietary basis. In addition to the sponsoring companies, more than 300 companies have benefitted from CAMP projects and services.

In recognition of its program, the Center was chosen in 1989 as one of only three federal manufacturing technology centers nationwide.

Industrial Sector

The Program does not restrict its efforts to specific industry sectors, although industrial sectors with traditional manufacturing or production processes are more likely to avail themselves of the research and services of CAMP than industries with technology-intensive products.

Classification of Objectives

The Program can be classified as: research and development (with an emphasis on advanced manufacturing technology processes).

Ranking of Objectives

There is no other objective than research and development.

Classification by R&D Type

CAMP undertakes applied research and development projects in the manufacturing technology field that have application potential.

Level of R&D Focus

CAMP directs its research and technology development efforts as well as its technology transfer, technical assistance, and training efforts toward the development or improvement of manufacturing and production process technologies. Thus, the Program's research and development efforts build on and expand existing R&D activities.

Program Beneficiaries

Manufacturing companies that sponsor CAMP are the primary intended targets for the Program's efforts. Ultimately, all companies in the manufacturing sector are beneficiaries.

To the extent intellectual property and other proprietary rights are involved, the Program, through its participating research institutions, retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Program's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development or improvement of manufacturing and production processes with near term application potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the private sector and the participating research institutions for collaborative research efforts or other services or assistance.

General or Targeted Benefits

The services of the Program are available primarily to the sponsoring manufacturing companies, most of which are based, or have facilities, in the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual sponsoring firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements. The consulting services and training assistance is available to manufacturing companies in the state.

Program Duration and Permanence

CAMP was established in 1983. The basic approach of the Program has not changed since its initiation and the variety and mix of its activities have evolved to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As an Edison Technology Center, CAMP is a recipient, not a provider, of extramural funding for its research efforts. Corporate sponsors pay an annual fee to joint CAMP as general members and/or one or more of its five research centers as research members. In addition, they participate in, and provide monies for individual projects. Projects undertaken by the Program are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. The remaining funds of the Program come from an award under the state's Edison Technology Centers Program.

Description of How Program is Funded/Amount of Funding

Funding for the Program's operations is provided through the state's Edison Technology Centers Program. Over the eight-year period of the Program's existence through FY90, it has received over \$10 million from that Program. In addition, cooperative research and development projects are undertaken with sponsoring industrial companies and consortia thereof. This \$12 million in Program funds has leveraged about \$60 million, a five-to-one ratio. All state funds are from state general tax revenue.

Provisions for Cost Recovery

CAMP does not directly attempt to recover all its costs from its research, transfer, assistance, and education activities. Except for certain core staff activities and internally sponsored projects under the Edison Technology Centers Program annual allocation, all research projects of CAMP are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners.

Discrimination/Conditionality

There are no formal or informal restrictions on the Program's research, assistance, training, and other services.

Program's Administration and Operation

CAMP's board of directors represent the research and manufacturing sectors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of CAMP have been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Ohio
- Program: Edison Polymer Innovation Corporation

Program Purpose and Objectives

The Edison Polymer Innovation Corporation (EPIC), located in the Akron-Cleveland industrial corridor in Ohio, was created in 1984 as a non-profit, independent corporation. The Corporation is one of nine Edison Technology Corporations launched by the state in the mid 1980s.

The purpose of the Corporation to facilitate the development and commercialization of new polymers and polymer production processes and to develop polymer industrial/business opportunities in the state. In order to achieve these objectives, EPIC focuses on research and development of new polymer-based products and processes, technology transfer to industry, and collaboration between industrial and academic laboratories. Specific priority research areas include thermoplastic processing, lightweight composites, polymer blends, membranes and coatings, polymers in medical applications, polymers in electronic and optics, and synthesis and scale-up of new polymers.

EPIC links, and operates through, four polymer research programs at two research universities with more than a dozen corporate sponsors. The four research programs are the Institute of Polymer Science and the Polymer Engineering Center at the University of Akron and the Center for Applied Polymer Research and the Macromolecular Science Department at Case Western Reserve University. The University of Akron focuses on the synthesis and creation of new polymers and the processing of polymers, while Case Western Reserve University is working primarily on specific polymeric applications.

By providing a forum where companies with polymer product and polymer production process development interests can interact with institutional researchers, EPIC provides many benefits to its corporate sponsors. EPIC members have the opportunity to build relationships with companies and institutions possessing the expertise to develop and transfer practical applications of research into the marketplace. All EPIC members have access to specialized material, equipment, and laboratory space.

Industrial Sector

The Corporation restricts its efforts to the polymer industry sector and, more specifically, to specified priority research areas within polymers and polymer production processes.

Classification of Objectives

The Corporation's Program can be classified as follows:

- Research and development (with an emphasis on commercialization and industrial applications)
- Sectoral/industry development (with an emphasis on specified priority research areas within the polymer field).

Ranking of Objectives

Other than research and development, sectoral/industry development would become the most important objective.

Classification by R&D Type

EPIC undertakes applied research and development projects in specific priority research areas within the polymer technology that have potential for commercialization.

Level of R&D Focus

The Corporation's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

Polymer companies that are the Corporation's sponsors are the primary intended targets for the Corporation's efforts. Ultimately, all companies in the polymer sector are beneficiaries.

To the extent intellectual property and other proprietary rights are involved, the Corporation, through its participating research institutions, retains these rights unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Corporation's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the development of new polymer based products and processes with near term commercialization potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the

private sector and the participating research institutions for collaborative research efforts or other arrangements and assistance.

General or Targeted Benefits

The services of the Corporation are available generally to the sponsoring polymer manufacturing companies, most of which are based, or have facilities, in the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual sponsoring firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

EPIC was established in 1984. The basic approach of the Corporation has not changed since its initiation and the variety and mix of its activities have evolved to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As an Edison Technology Center, EPIC is a recipient, not a provider, of extramural funding for its research efforts. Each of EPIC's corporate sponsors pays an annual fee, half of which is allocated to the Corporation for generic research and half to specific projects of interest to that sponsor. Projects undertaken by the Corporation are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. The remaining funds of the Corporation come from an award under the state's Edison Technology Centers Program.

Description of How Program is Funded/Amount of Funding

Funding for the Corporation's operations is provided through the state's Edison Technology Centers Program. Over the seven-year period of the Corporation's existence through FY90, it has received \$9.7 million from that Program. In addition, cooperative research and development projects are undertaken with sponsoring industrial companies and consortia thereof, which currently averages about \$1.0 million per year. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Corporation does not directly attempt to recover all its costs from its research and development activities. Except for certain core staff activities and internally sponsored projects under the Edison Technology Centers Program annual allocation, all research projects of EPIC are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. In addition, EPIC may seek a return on investment in successfully commercialized projects in the form of limited royalties on the sales of newly developed products or a share of the fees received by the industrial sponsor if the technology is licensed. This return generally is limited to the amount of the investment plus discounted interest charges.

Discrimination/Conditionality

The formal restriction on the Corporation's research and other services is that projects are undertaken only in specific priority research areas in the polymer field.

Program's Administration and Operation

EPIC's board of directors represent polymer research and manufacturing sectors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of EPIC has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Ohio
- Metropolitan Region: Columbus-Cincinnati-Dayton
- Program: Ohio Advanced Technology Center

Program Purpose and Objectives

The Ohio Advanced Technology Center, currently in its planning stage, is intended to develop closer research ties between Wright-Patterson Air Force Base (W-PAFB) and the industries and universities in the region in order to accelerate the transfer of federal technology, to foster cooperative research at the federal installation's laboratories, to facilitate research by laboratory personnel at the research universities and private industries in the region, and to increase the level of federal research contracting in the state and region.

The Center was catalyzed by the efforts of the W-PAFB, the Chamber of Commerce of the three metropolitan areas, the Ohio Technology Transfer Organization (OTTO), the Edison Technology Centers in the region, and the four research universities in the region (University of Cincinnati, University of Dayton, Ohio State University, and Wright State University).

One important component of the proposed technology transfer strategy is to expose federal research to the scrutiny of the private sector for its industrial applications and commercialization potential at each stage of its development. Thus, external, market-oriented review will occur significantly earlier in the time frame of the research and development process than traditionally occurs.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors.

Classification of Objectives

The Center's program can be classified as: research and development (with an emphasis on technology transfer and application); and regional development (in the southwestern sector of the state).

Ranking of Objectives

Other than research and development, the only other important specified objective is regional development.

Classification by R&D Type

Since the Center fosters technology transfer, collaborative research, and related activities, it can be implied that the Center supports generic research and development.

Level of R&D Focus

Since the Center fosters technology transfer, collaborative research, and related activities, it builds on the existing R&D infrastructure of W-PAFB.

Program Beneficiaries

Both established and start-up manufacturing firms in the region are eligible for the technology transfer and related services and projects of the Center.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights would tend to follow the policies and procedures of the W-PAFB.

Direct or Indirect Benefits

The intended direct benefits are the transfer and application, adaptation, or installation of existing technologies which can be used by manufacturing companies in the region. This would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: increased linkages among the private sector, the universities, and the federal laboratory not only for the transfer of technology but also for collaborative research efforts and other arrangements.

General or Targeted Benefits

The technology transfer and related services and projects of the Center are available generally to all manufacturing firms in the region. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual client firm, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the federal laboratory.

Program Duration and Permanence

The Center was established in FY89 and is currently in its planning stage.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. As an organization that fosters technology transfer and related activities, it does not itself provide subsidies or other funding to other institutions. Thus, the Center is a recipient, not a provider, of extramural funding for its services and activities.

Description of How Program is Funded/Amount of Funding

Funding for the Center's planning phase has been provided by a \$500,000 grant from the state through the Ohio Department of Development (ODOD). Once it becomes operational, the Center's total budget is anticipated to be at a level of about \$1.0 million, of which approximately half would come from corporate sponsor membership fees. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Center nor ODOD expect directly to recover their support for the Center's operations. Indirectly, it is implied that the state will recover its investment costs through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Center's technology transfer and related services and activities, although there is an emphasis on companies located in the southwestern sector of the state.

Program's Administration and Operation

The Interim Board of Directors represents the industrial, business, academic, and laboratory sectors and the final Board is anticipated to be representative of the same sectors.

Program Impact and Lessons

Since the Center has not yet become operational, no formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations have been undertaken and no information has been systematically collected documenting its impact.

Name of Program and Government Agency

- State: Ohio
- Metropolitan Region: Cincinnati
- Program: Greater Cincinnati Venture Association

Program Purpose and Objectives

In 1982, the Cincinnati Chamber of Commerce, with the aid of a \$150,000 grant from the Gannet Foundation and a \$50,000 grant from the City of Cincinnati (using CDBG funds), attempted to establish a venture capital fund in the region. Although no venture fund was ever established, the need for such seed capital was clear and an alternative approach was created.

The Greater Cincinnati Venture Association convenes a monthly meeting of private venture capitalists or their representatives to hear a presentation of a business plan from an individual or firm seeking early stage venture capital. The business plan previously had been reviewed by Association staff and a small group of knowledgeable company executives and legal and financial advisors. The Association does not broker the investment itself; rather, individual investors contact the individual making the presentation if there is interest. Individuals or firms making requests for venture capital assistance are not limited to the Cincinnati region, although most are from the area.

Industrial Sector

The Association does not restrict its efforts to technology-based firms or to specific industry sectors, although a substantial percentage of the presentations are from technology-based firms or individuals with technology-based ideas.

Classification of Objectives

The Association's program can be classified as: research and development (with an emphasis on fostering technological innovation), regional development (with an emphasis on the Cincinnati region), and small and medium-sized business assistance (with an emphasis on nurturing entrepreneurship).

Ranking of Objectives

Other than research and development, regional development would be the most important objective, with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

To the extent that technology-based companies are involved, the firms using the Association's mechanism for securing investments tend to be at or after the prototype development, demonstration, and testing stage of the research, technology development, and commercialization process. Since these investments are in the private sector, they tend to support companies whose specific technologies might not otherwise be realized.

Level of R&D Focus

Investments made through the Association's mechanism tend to be targeted to expanding existing R&D activities as well as establishing new R&D activities, with an emphasis on the former.

Program Beneficiaries

Both established and start-up companies are eligible to make presentations. Although the companies are not required to be from the Cincinnati area, they tend to be so because venture capital investors generally want to provide oversight with their investment.

Direct or Indirect Benefits

The intended direct benefits are the development of new, or expansion of existing, industrial companies as well as increased employment, investment capital, technology commercialization, and entrepreneurship. This would imply the traditional benefits of jobs/firms created/retained, using the Association's approach to attract and leverage private investment capital from individuals for companies in the region.

General or Targeted Benefits

The private investment resources identified through the Association's mechanism are available generally to all technology-based companies preferably in the region that meet the criteria for venture capital investments.

Program Duration and Permanence

The Association was established in 1984 and its concept has not changed since its initiation.

Types of Potential Subsidy Intervention/Form of Funding

The private venture capital resources identified through the Association's mechanism provide direct financial assistance to start-up and small, expanding technology-based firms through debt or equity investments.

Description of How Program is Funded/Amount of Funding

The Association is funded by annual membership fees of \$100 for individuals and \$250 for firms. The City of Cincinnati provided \$50,000 for the original effort to establish a venture capital fund in the region.

Provisions for Cost Recovery

Not applicable. The Association recovers its costs from membership fees. Since the Association does not track the investment deals consummated, it is unclear whether the private investors individually or collectively recover their investments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Association's activities.

Program's Administration and Operation

The Association has a Board of Directors of representatives of the industrial, business, financial, and legal sectors.

Program Impact and Lessons

No formal, publicly-available evaluations of the Association have been undertaken and no information has been systematically collected documenting the Association's impact.

Name of Program and Government Agency

- State: Ohio
- Metropolitan Region: Cleveland
- Program: Primus Venture Partners

Program Purpose and Objectives

As a result of a study of Cleveland's economic profile sponsored by the Gund Foundation, Cleveland Tomorrow, Inc. was created. A nonprofit corporation, Cleveland Tomorrow, Inc. is led by the private sector. One of its initiatives was the creation of the Venture Partners, which made its first investments in 1984. The Partners' investments are limited to Ohio, with an emphasis on the greater Cleveland area.

Industrial Sector

The Partners' fund does not restrict its efforts to specific industry sectors, although its investments reflect the industrial base of Cleveland and Ohio.

Classification of Objectives

The Partners' program can be classified as: research and development (with an emphasis on fostering technological innovation), regional development (with an emphasis on the Cleveland region), and small and medium-sized business assistance (with an emphasis on nurturing entrepreneurship).

Ranking of Objectives

Other than research and development, regional development would be the most important objective with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

The Partners' investments tend to occur at or after the prototype development, demonstration, and testing stage of the research, technology development, and commercialization process. Since the Partners' investments are in the private sector, they tend to support companies whose specific technologies might not otherwise be realized.

Level of R&D Focus

The Partners' investments tend to be targeted to expanding existing R&D activities as well as establishing new R&D activities, with an emphasis on the former.

Program Beneficiaries

Both established and start-up companies are eligible for the Partners' investments. The Partners' investments are limited to Ohio, with an emphasis on the greater Cleveland area.

Direct or Indirect Benefits

The intended direct benefits are the development of new, or expansion of existing, industrial companies as well as increased employment, investment capital, technology commercialization, and entrepreneurship. This would imply the traditional benefits of jobs/firms created/retained, using the Fund's resources to attract and leverage private investment capital for companies in the region.

General or Targeted Benefits

Investment resources of the Partners are available generally to all technology-based companies in the state and preferably in the region that meet the criteria for venture capital investments. These investments are targeted toward high-growth opportunities in medical technologies and factory automation.

Program Duration and Permanence

The Partners' first fund, which closed in early 1984, was capitalized at \$30 million and its first investments were made in April of that year. A second fund, capitalized at \$75 million, closed in April 1987 and monies from that fund still are being invested. All limited partners in the first fund that still existed participated in the second fund.

There are currently about 40 companies in the Partners' investment portfolio, of which 30 are located in Ohio and 12 in Cleveland. In addition, 15 companies are no longer in the portfolio, nine of which had initial public offering, were acquired, or were subject to a management buyout and six of which are no longer in existence. Over one-third of the 40 companies in the portfolio are technology-based and about another third depend upon the application of technology to its products or processes (e.g., manufacturing and distribution growth companies).

Types of Potential Subsidy Intervention/Form of Funding

The Fund provides direct financial assistance to start-up and small, expanding technology-based firms through debt or equity investments in the form of the purchase of common or preferred stock accompanied by long-term notes on favorable terms.

Description of How Program is Funded/Amount of Funding

Created with a combination of Gund Foundation and private funds, the Partners' two funds are a total of \$105 million, of which about \$75 million has been invested to date.

Provisions for Cost Recovery

Through its investment strategy, the Partners has had net capital earnings from both its equity and capital investments, including loan interest payments and principal repayments as well as sales of stock in companies that undertook an initial public offering of their securities.

Discrimination/conditionality

There are no formal restrictions on the Fund's investment strategy, beyond the criteria set forth in its charter and ordinary venture investment prudence and due diligence.

Program's Administration and Operation

The Partners has a Board of Directors that makes its investment decisions.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Partners' have been undertaken and no information has been systematically collected documenting the Partners' impact.

OHIO

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XI. PENNSYLVANIA

The Department of Commerce, through its Office of Technology Development, contains the two major state science and technology programs directed at economic development: Ben Franklin Partnership Fund and Industrial Resource Centers Program. In addition, the Office acts as staff for the Board of the Ben Franklin Partnership Fund, handles related technological initiatives and issues, and coordinates science and technology issues with other state and private organizations (see Figure 11 for organizational activities).

Ben Franklin Partnership Fund. The Ben Franklin Partnership (BFP), created in 1982, supports a wide range of initiatives and programs that link private firms with research and education resources in order to help create new advanced-technology firms, to improve the competitive ability of young, small, technology-oriented companies, to make traditional industries more competitive nationally and internationally, and to develop a technologically skilled workforce in the state. About 95% of the Fund's investments have been in the Challenge Grant Program that has generated an almost four-to-one match.

Four programs are funded through the BFP Fund appropriations:

- Challenge Grant Program for Technological Innovation
- Small Business Research Seed Grant Program
- Pennsylvania Technical Assistance Program (PENNTAP)
- Small Business Development Centers Program.

In addition, the Board of the BFP Fund has been given responsibility to administer four other programs:

- Small Business Incubator Loan Program
- Seed Venture Capital Fund
- Engineering School Equipment Grant Program
- Pennsylvania Economic Revitalization tax Credit Program.

Challenge Grant Program for Technological Innovation. Through this Program, four Ben Franklin Technology Centers have been established throughout the state to support local initiatives and activities. These Technology Centers, located at major research universities or consortia thereof, are independent, nonprofit corporations, governed by Boards of Directors, comprised of university officials and at least 50 percent private industry executives.

The Technology Centers may use BFP funds to support a wide range of initiatives. This support may be in the form of grant awards, equity positions, or investments with royalty pay-back provisions. Matching funds are required for all projects.

Eligible activities include: creation and support of centers of excellence, joint industry-university applied research and development efforts (in the specified technology areas which vary for each Technology Center), research and development by small firms, regional or state-wide technology development initiatives, operational support for incubators, entrepreneurial development, technology transfer, and education, training, and retraining.

The four regional Technology Centers established by the BFP Board, their organizational structure, and their recent primary research and development areas are:

- Northeast Tier Ben Franklin Technology Center, based at Lehigh University
- Ben Franklin Technology Center of Southeastern Pennsylvania, housed at the University City Science Center in Philadelphia
- Ben Franklin Technology Center of Western Pennsylvania, an affiliate of both Carnegie-Mellon University and the University of Pittsburgh
- Ben Franklin Technology Center of Central/Northern Pennsylvania, based at Pennsylvania State University.

Industrial Resource Centers Program. This Program, also administered by the Department's Office of Technology Development, was established in 1988. This Program is directed at helping small and medium-sized manufacturing firms improve product quality, productivity, and profitability by modernizing their manufacturing strategies and systems as well as their manufacturing process techniques and technologies.

To meet this objective, the Program created and supports 9 Industrial Resource Centers throughout the state to provide a variety of practical, hands-on services to manufacturing companies. These Resource Centers are independent, nonprofit corporations, managed by industry executives who work together to form a statewide manufacturing assistance network.

State Employees Retirement System (SERS) Venture Capital Program. This Program was created in the state's Department of Treasury to invest up to 1% of the assets of its funds in venture capital. SERS invests capital as a limited partner in venture capital limited partnerships which are funds set up for the purpose of investing in and managing young, relatively small, rapidly growing firms. The venture capital limited partnerships in turn invest on an equity, debt, or warrant basis.

Pennsylvania Industrial Development Authority. The Authority, within the Department of Treasury, makes below market loans to Industrial Development Corporations for land and building acquisition and building construction and renovation. The Authority provides preferential interest rates for projects designated as advanced technology and expects to allocate up to 25% of its subsidy appropriations to such projects.

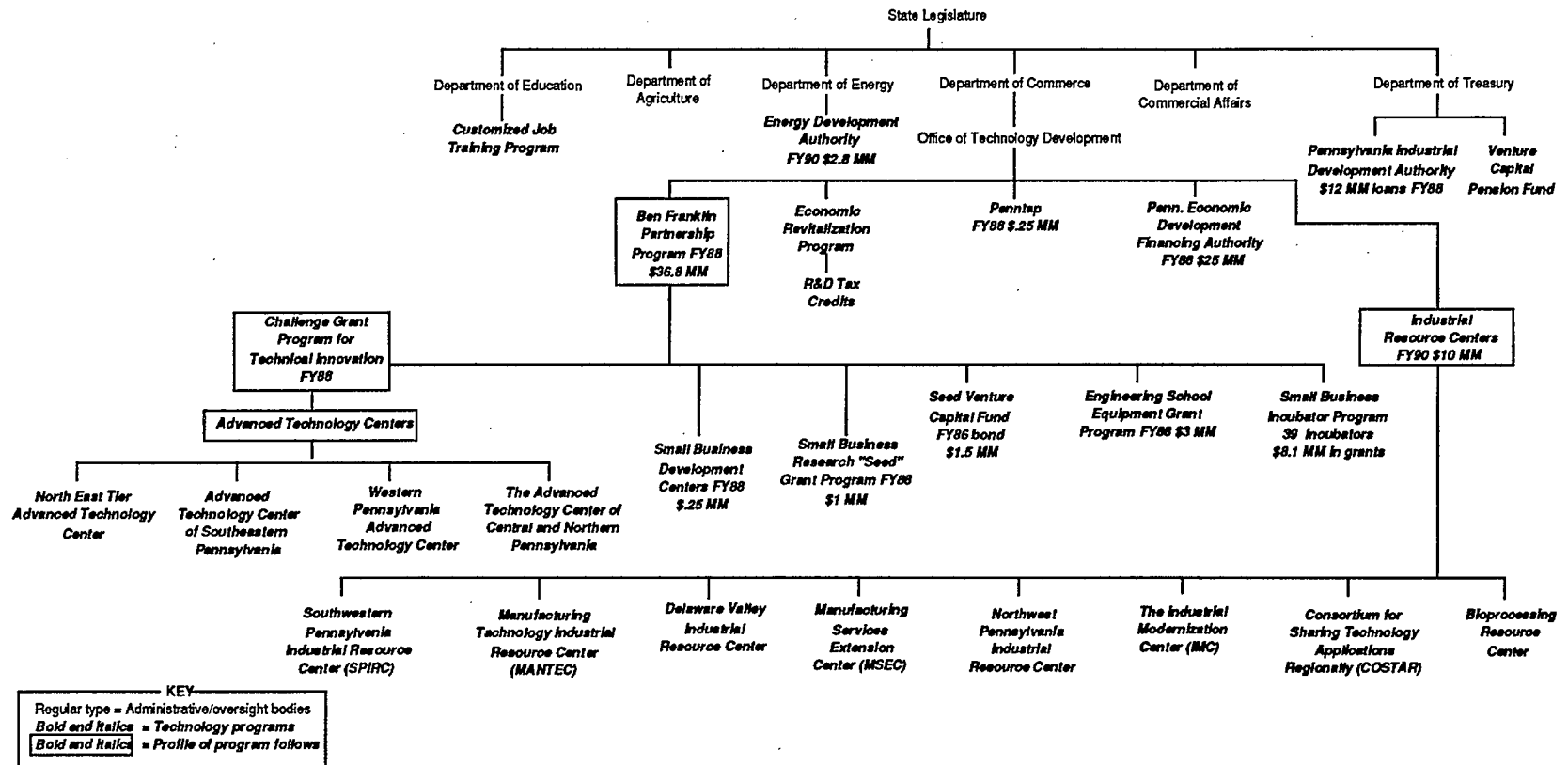


FIGURE 11 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: PENNSYLVANIA

Name of Program and Government Agency

- State: Pennsylvania
- Program: Ben Franklin Partnership Fund

Program Purpose and Objectives

The Ben Franklin Partnership Fund (BFP) is administered by the Department of Commerce's Office of Technology Development. The BFP Fund supports a wide range of initiatives and programs that link private firms with research and education resources in order to help create new advanced-technology firms, to improve the competitive ability of young, small, technology-oriented companies, to make traditional industries more competitive nationally and internationally, and to develop a technologically skilled workforce in the state.

Created in 1982, the Fund has made about 95% of its investments in the Challenge Grant Program that has generated an almost four-to-one match. Over two-thirds of state funding for BFP has been received by universities; less than 20% has been invested directly in private firms. The largest share of the BFP funds have been invested in research and development projects. Almost nine-tenths of these R&D funds have been invested in only five technology fields: factory automation, robotics, computers and microelectronics, advanced materials, and biotechnology.

Four programs are funded through the BFP Fund appropriations:

- Challenge Grant Program for Technological Innovation
- Small Business Research Seed Grant Program
- Pennsylvania Technical Assistance Program (PENNTAP)
- Small Business Development Centers Program.

In addition, the Board of the BFP Fund has been given responsibility to administer three other programs:

- Small Business Incubator Loan Program
- Seed Venture Capital Fund
- Engineering School Equipment Grant Program, and

Challenge Grant Program for Technological Innovation. Through this Program, four Ben Franklin Technology Centers were created throughout the state, in 1984, to support local initiatives and activities. These Technology Centers, located at major research universities or consortia thereof, are independent, nonprofit corporations. The Technology Centers are responsible for identifying and generating technology innovation opportunities and, with BFP funds, supporting technology development and application projects drawing on their region's strengths. This support may be in the form of grant awards, equity positions, or investments with royalty payback

provisions. Matching funds are required for all projects. Eligible activities include: creation and support of centers of excellence, joint industry-university applied research and development efforts (in the specified technology areas which vary for each Technology Center), research and development by small firms, regional or statewide technology development initiatives, operational support for incubators, entrepreneurial development, technology transfer, and education, training, and retraining.

The four regional Advanced Technology Centers are:

- Northeast Tier Ben Franklin Technology Center, based at Lehigh University
- Ben Franklin Technology Center of Southeastern Pennsylvania, housed at the University City Science Center in Philadelphia
- Ben Franklin Technology Center of Western Pennsylvania, an affiliate of both Carnegie-Mellon University and the University of Pittsburgh
- Ben Franklin Technology Center of Central/Northern Pennsylvania, based at Pennsylvania State University.

Small Business Research Seed Grant Program. This Program directly supports businesses or individual entrepreneurs that are developing or commercializing new technologies. This Program also serves as a mechanism for supporting projects under the federal Small Business Innovation Research Program.

Pennsylvania Technical Assistance Program (PENNTAP). PENNTAP, a partnership between Penn State University and the Fund, links individual firms which are experiencing technical problems with resources that provide solutions and answers. PENNTAP does not conduct research but refers firms to research/testing facilities.

Small Business Development Centers Program. With 13 university-based locations and more than 60 outreach facilities, these Centers provide business management advice and assistance to small firms, usually in their early stages. Working in conjunction with the Technology Centers, they also provide technical assistance and training.

Small Business Incubator Program. This Program, through loans and grants, assists in the construction, renovation, equipping, and furnishing of new incubator facilities for technology-based small businesses.

Seed Venture Capital Fund. This Fund has helped to establish five privately-managed seed capital funds that have been certified by the BFP Board. Each of these new funds has one

Technology Center as a limited partner. The funds provide equity financing to businesses during their early stages of development.

Engineering School Equipment Grant Program. This Program supports the purchase or upgrading of equipment in the state's 15 accredited engineering schools.

Industrial Sector

The BFP Fund's seven major programs do not restrict their efforts to specific technologies and their counterpart industry sectors, although almost nine-tenths of these R&D funds have been invested in only five technology fields: factory automation, robotics, computers and automation, advanced materials, and biotechnology.

Classification of Objectives

BFP Fund Programs can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Regional development (although the Advanced Technology Centers collectively cover the state)
- Small and medium-sized business assistance (with a dedicated focus in four of the seven programs).

Ranking of Objectives

Other than research and development, the most important specified objective is regional development (through the Challenge Grant Program for Technological Innovation). Of lesser importance is small and medium-sized business assistance, even though this objective is the focus of five other programs.

Classification by R&D Type

BFP Fund supports basic research, applied research, and development projects, all leading to the development of new technologies with commercial potential. Because of the wide variety of its programs, the Fund's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The BFP Fund's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, given the variety within its programs.

Program Beneficiaries

Since there is a wide variety within the programs supported under the BFP Fund, program beneficiaries range from research and technology-intensive entrepreneurial firms to established manufacturing companies in the state. In each Advanced Technology Center, the companies operating in that region of the state are the beneficiaries, although the four Centers collectively cover the whole state.

To the extent funds are not provided directly to a private company and intellectual property and other proprietary rights are involved, the assignment of these rights tends, unless otherwise negotiated, to follow and favor the policies and procedures of the research organization.

Direct or Indirect Benefits

In addition to regular progress reports which provide systematically collected information documenting the Fund's impacts, the program also has been subject to two major internal assessments and a legislative "sunset" audit. The regular progress reports covered traditional benefits, such as jobs/firms created/retained; personal/business taxes; patents issued/applied for; individuals/companies assisted; workshops held/attendees; products/processes/services developed/commercialized; SBIR entrepreneurs assisted/success ratios for assisted firms; business incubators established; incubator tenants/graduates; training programs developed/courses evaluated; and training program enrollees/graduates.

In the assessment documents, less quantifiable benefits are noted, demonstrating the primary contribution of the BFP Fund to the recognition of the state as a leader in the development and application of advanced technology. Such indirect benefits would include: strengthened capacity of business/industrial, research, and/or governmental institutions; new or increased linkages between the private and research sectors; new collaborative partnerships or other institutional arrangements between private companies and research institutions; research university participation in the state's economic development process; creation of a positive climate within the state for the application of advanced technologies by established companies and for the creation of new advanced technologies firms; creation of important networks of business/industry, research university, and other development groups to promote advanced technology; development of new

or additional sources of investment financing, especially early stage seed venture capital; and increased ability to attract federal funds, especially for establishing research centers.

General or Targeted Benefits

BFP Fund support under the Challenge Grant Program for Technological Innovation is available only to the four regional Advanced Technology Centers that in turn make awards within their regions for a variety of research and technology development projects not related to specific technological fields. Although most of the monies awarded to the ATCs go to universities and other research institutions, the ultimate beneficiaries are predominantly small and medium-sized businesses. In four other BFP Fund programs, the benefits are available only to technology-based small businesses.

Within the programs supported by the BFP Fund and to the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

The Ben Franklin Partnership Fund was created in 1982 and replaced the Pennsylvania Science and Engineering Foundation. The Fund made its first awards in FY 1983 under the Challenge Grant Program for Technical Innovation. The basic approach of the BFP Fund and the variety and mix of its programs and services necessarily has evolved since its initiation to meet changing needs and opportunities. The Small Business Research Seed Grant Program, the Small Business Incubator Program, the Seed Venture Capital Fund, and Engineering School Equipment Grant Program were added in FY 1984. The preexisting PENNTAP and Small Business Development Centers Programs were incorporated into the Fund in FY 1986.

Types of Potential Subsidy Intervention/Form of Funding

Given the variety of programs supported or administered by the BFP fund, the form of funding ranges from contracts to grants and loans. In addition, recipients of two of the programs are themselves intermediary organizations (the four Advanced Technology Centers and the Seed

Venture Capital Fund) that make grants, enter into contracts, make royalty payback investments, or use debt and equity instruments.

Description of How Program is Funded/Amount of Funding

Over the eight-year period of its existence from FY 1983 through FY 1990, the BFP Fund has made awards totalling over \$190 million under the seven programs it administers. All state funds are from state general tax revenue.

Provisions for Cost Recovery

BFP Fund does not directly attempt to recover its costs from either the research and technology development programs or assistance and services programs. The Challenge Grant Program, which constitutes almost 95% of the Fund's investments to date, is itself a matching fund program, whose four Advanced Technology Center recipients support projects on a cost-sharing basis. In the aggregate over the period of their existence, the four Centers have generated almost four times their awards in matching funds. In recent years, the Centers have invested more than half of their state funds in projects with royalty or other payback provisions, with their long-term potential for continuation and expansion of the Centers' operations.

The Small Business Incubator Program and the Engineering School Equipment Grant Program also require matching support. The Seed Venture Capital Fund has leveraged its investment in the seed capital funds it created by an almost ten-to-one match. Finally, since these research grants are for projects ranging from basic research to commercialization of products and processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on any of the BFP Fund's programs is that a project supported under one of the four Advanced Technology Centers is expected to benefit private firms in that Center's region. However, these four Centers collectively cover the entire state.

Program's Administration and Operation

The BFP Fund is managed by a policymaking Board representing the industrial, business, labor, academic, and governmental sectors. The Board establishes policy and administrative guidelines for the Fund, recommends to the Governor and Legislature funding levels for various Fund components, and has final approval for all grants and investments. The Board administers the four programs which are funded through BFP Fund appropriations and three other programs which have been assigned to it .

Program Impact and Lessons

Two major formal internal self assessments and a legislative "sunset" audit of the BFP Fund have been undertaken and information has been systematically collected documenting the program's impact.

Among the many lessons learned at the strategic public policy development level are the following:

- With an initial emphasis on getting a program started and making it acceptable to the private, academic, and governmental sectors, short-term criteria for awards (such as nonstate match and jobs/firms created/retained) tend to drive a program at the expense of more long-term criteria (such as the development and commercialization of new products and processes).
- Quantitative factors (such as jobs/firms created/retained) tend to be predominantly short-term criteria and tend to drive a program at the expense of qualitative factors (such as new or increased linkages between the private and research sectors) that are longer-term oriented.
- Strategic technology development plans need to be more fully integrated with economic development plans at the metropolitan, regional, and statewide levels.

Name of Program and Government Agency

- State: Pennsylvania
- Program: Challenge Grant Program for Technological Innovation, Ben Franklin Partnership Fund

Program Purpose and Objectives

The Ben Franklin Partnership (BFP) Fund is administered by the Department of Commerce's Office of Technology Development. The BFP Fund supports a wide range of initiatives and programs that link private firms with research and education resources in order to help create new advanced-technology firms, to improve the competitive ability of young, small, technology-oriented companies, to make traditional industries more competitive nationally and internationally, and to develop a technologically skilled workforce in the state.

The Challenge Grant Program for Technological Innovation is the largest program administered by the BFP Fund. Four Advanced Technology Centers have been established throughout the state to support local initiatives and activities. They each received planning grants in the 1983 fiscal year and their first operational awards the following fiscal year.

These Advanced Technology Centers, located at major research universities or consortia thereof, are independent, nonprofit corporations. The Centers are responsible for identifying and generating technology innovation opportunities and, with BFP Fund monies, supporting projects drawing on their region's strengths.

The Centers may use BFP Fund monies to support a wide range of initiatives. Matching funds are required for all projects. Eligible activities include: creation and support of centers of excellence, joint industry-university applied research and development efforts (in the specified technology areas which vary for each Center), research and development by small firms, regional or statewide technology development initiatives, operational support for incubators, entrepreneurial development, technology transfer, and education, training, and retraining.

The four regional Advanced Technology Centers are:

- Northeast Tier Ben Franklin Technology Center, based at Lehigh University
- Ben Franklin Technology Center of Southeastern Pennsylvania, housed at the University City Science Center in Philadelphia

- Ben Franklin Technology Center of Western Pennsylvania, an affiliate of both Carnegie-Mellon University and the University of Pittsburgh
- Ben Franklin Technology Center of Central/Northern Pennsylvania, based at Pennsylvania State University.

Industrial Sector

The Challenge Grant Program itself does not restrict its efforts to specific technologies or their counterpart industry sectors, although almost nine-tenths of these R&D funds have been invested in only five technology fields: factory automation/CAD-CAM, robotics, computers and automation, advanced materials, and biotechnology.

Classification of Objectives

The Challenge Grant Program can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Regional development (although the Advanced Technology Centers collectively cover the state)
- Small and medium-sized business assistance (although they directly receive less than one-fifth of the Program's monies).

Ranking of Objectives

Other than research and development, the most important specified objective is regional development, with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

The Program supports basic research, applied research, and development projects, all leading to the development of new technologies with commercial potential. Because of the wide variety of projects supported by its Centers, the Program's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Program's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, given the wide variety of projects supported by its Centers.

Program Beneficiaries

Since there is a variety of projects supported by its Centers, Program beneficiaries range from research and technology-intensive entrepreneurial firms to established manufacturing companies. Companies operating in one region of the state can become the direct beneficiaries only of the Advanced Technology Center covering that region, although the four Centers funded by this Program collectively cover the whole state.

To the extent funds are not provided directly to a private company and intellectual property and other proprietary rights are involved, the assignment of these rights, unless otherwise negotiated, tends to follow and favor the policies and procedures of the research organization.

Direct or Indirect Benefits

In addition to regular progress reports which provide systematically collected information documenting the Program's impacts, the BFP Fund of which the Program is a part, also has been subject to two major internal assessments and a legislative "sunset" audit. The regular progress reports covered traditional benefits, such as jobs/firms created/retained; personal/business taxes; patents issued/applied for; individuals/companies assisted; workshops held/attendees; products/processes/services developed/commercialized; SBIR entrepreneurs assisted/success ratios for assisted firms; training programs developed/courses evaluated; and training program enrollees/graduates.

In the assessment documents, less quantifiable benefits are noted, demonstrating the primary contribution of the Program to the recognition of the state as a leader in the development and application of advanced technology. Such indirect benefits would include: strengthened capacity of business/industrial, research, and/or governmental institutions; new or increased linkages between the private and research sectors; new collaborative partnerships or other institutional arrangements between private companies and research institutions; research university participation in the state's economic development process; creation of a positive climate within the state for the application of advanced technologies by established companies and for the creation of new advanced technologies firms; creation of important networks of business/industry, research

university, and other development groups to promote advanced technology; development of new or additional sources of investment financing, especially early stage seed venture capital; and increased ability to attract federal funds, especially for establishing research centers.

General or Targeted Benefits

Support under the Challenge Grant Program is available only to the four regional Advanced Technology Centers that in turn make awards within their regions for a variety of research and technology development projects. Although most of the monies awarded to the ATCs go to universities and other research institutions, the ultimate beneficiaries are predominantly small and medium-sized businesses.

Within the programs supported by the Program and to the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

The BFP Fund made its first awards in FY 1983 under the Challenge Grant Program. The basic approach of the Program has not changed but the administrative structure of the Centers has. Originally, the four Centers were governed by a Board of one university or a consortium thereof; now they are private, nonprofit, independent corporations. Also, the variety and mix of the projects of its Centers necessarily has evolved since its initiation to meet changing needs and opportunities. For example, robotics has decreased significantly in importance as a technology field supported by the Centers.

Types of Potential Subsidy Intervention/Form of Funding

The Centers may use BFP Fund monies to support a wide range of initiatives. This support may be in the form of grant awards, equity positions, or investments with royalty payback provisions. Matching funds are required for all projects.

Description of How Program is Funded/Amount of Funding

Funds are allocated to the four Advanced Technology Centers at the start of each fiscal year based on a competitive formula which takes into account five criteria: performance measures (e.g., job creation/retention, company startup, new product/process development), obtaining cash match support, accomplishments resulting from previous years' funding, meeting objectives of regional strategies during previous year, soundness of proposed work plan in meeting BFP Fund mission.

Over the eight year period of its existence from FY 1983 through FY 1990, the Challenge Grant Program has made awards totalling almost \$160 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Program does not directly attempt to recover its costs from either the research and technology development programs or assistance and services programs. The Program is itself a matching fund program, whose four Advanced Technology Center recipients support projects on a cost-sharing basis. In the aggregate over the period of their existence, the four Centers have generated almost four times their awards in matching funds. In recent years, the Centers have invested more than half of their state funds in projects with royalty or other payback provisions, with their long-term potential for continuation and expansion of the Centers' operations. Since these research grants are for projects ranging from basic research to commercialization of products and processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Program is that a project supported under one of the four Advanced Technology Centers is expected to benefit private firms in that Center's region. However, these four Centers collectively cover the entire state.

Program's Administration and Operation

The Advanced Technology Centers, located at major research universities or consortia thereof, are independent, nonprofit corporations, governed by Boards of Directors, comprised of university officials and at least 50 percent private industry executives. They represent a consortia of

private sector, labor, research universities, other higher educational institutions, and economic development groups. The Boards establish policy and administrative guidelines for the Centers. They are responsible for identifying and generating technology innovation opportunities and, using BFP Fund monies, have final approval for all grants and investments.

Program Impact and Lessons

Two major formal internal self assessments and a legislative "sunset" audit of the BFP Fund have been undertaken and information has been systematically collected documenting the program's impact.

The many lessons learned at the strategic public policy development level that relate to the BFP Fund apply also to the Challenge Grant Program. Among those lessons are the following:

- With an initial emphasis on getting a program started and making it acceptable to the private, academic, and governmental sectors, short-term criteria for awards (such as nonstate match and jobs/firms created/retained) tend to drive a program at the expense of more long-term criteria (such as the development and commercialization of new products and processes).
- Quantitative factors (such as jobs/firms created/retained) tend to be predominantly short-term criteria and tend to drive a program at the expense of qualitative factors (such as new or increased linkages between the private and research sectors) that are longer-term oriented.
- Strategic technology development plans need to be more fully integrated with economic development plans at the metropolitan, regional, and statewide levels.

Name of Program and Government Agency

- State: Pennsylvania
- Program: Industrial Resource Centers Program

Program Purpose and Objectives

The Industrial Resource Centers (IRCs) Program, established in 1988, is directed at helping small and medium-sized, traditional and emerging manufacturing firms improve product quality, productivity, and profitability by modernizing their manufacturing strategies and systems as well as their manufacturing process techniques and technologies.

To meet this objective, the Program creates and supports nine Industrial Resource Centers throughout the state to provide a variety of practical, hands-on services to manufacturing companies.

These Centers are independent, nonprofit corporations, managed and operated by industry executives who work together to form a statewide manufacturing assistance network. Working together as a network, the IRCs provide comprehensive services to assist companies that want to learn about, identify, and implement modern manufacturing techniques and technologies.

Funds are provided by the Program to the Centers in the form of matching grants over a three-year funding period. Although the maximum award allowed originally was set at \$2 million per year, \$10 million was provided to the nine IRCs in the first year of funding. These awards represent the first allocation in what is expected to be a three-year program. The initial match requirement was on a one-to-one basis in the startup year, a ratio that is expected to rise to two-to-one. Contributions are matched from industry, academic institutions, foundations, federal government, and other nonstate sources. Each Center is eventually expected to become self-sustaining without funds from the Program, with a target time of three years.

Each IRC has a professional staff with expertise and skills in various manufacturing areas including manufacturing management, industrial engineering, computer engineering, factory automation, and strategic planning. Services are provided by either Center personnel or consultants from industry and academia. To make these services affordable to smaller manufacturers, Program funds subsidize the cost of the assistance.

Services provided by the Centers may include providing manufacturing and/or management advice, identifying appropriate new techniques or technologies, developing manufacturing strategies, integrating computers and/or automation into the manufacturing process, upgrading

quality controls, improving production planning and inventory control, and providing specialized, customized training. During the first 18 months of the Program's operation, the IRC Network served more than 600 manufacturers in the state.

Eight of the Resource Centers are located strategically throughout the state and serve manufacturing companies in their region. The ninth, the Bioprocessing Resource Center, provides special assistance statewide to emerging companies in the biotechnology sector. This Center provides advanced pilot plant services for testing industrial processes involving fermentation, bioreaction, and biological separations. Specialized training, protein and DNA chemistry services, and biocomputing services also are available.

Although assisting individual companies is the primary task of the Centers, the network also has a mandate to develop initiatives of a more generic nature with broader impact for manufacturers. The IRC Network has been instrumental in creating several regional and statewide manufacturing associations and consortia. In addition, the Network is working with several large manufacturers of original equipment to develop quality improvement programs for implementation by the instate suppliers. The IRCs also have been developing innovative work force training and retraining initiatives, such as a teaching factory.

Industrial Sector

In eight of the nine Centers, the Program does not restrict its efforts to specific technologies or their counterpart industry sectors. However, individual IRCs, serving companies in their region, would tend to emphasize an apparent clustering around a limited number of technology fields that merely mirrors the traditional clustering which takes place among industrial firms. In the ninth Center, the Bioprocessing Resource Center, there is intended to be a focus on the biotechnology industry.

Classification of Objectives

The IRCs Program can be classified as follows:

- Research and development (with a range from applied research to application, refinement, and development of manufacturing techniques and technologies)
- Sectoral/industry development (although only in one Center)
- Small and medium-sized business assistance (although all sizes of manufacturing firms can be serviced).

Ranking of Objectives

Other than research and development, the most important specified objective is small and medium-sized business assistance, with sectoral/industry development of lesser importance.

Classification by R&D Type

The Program supports applied research, and development projects, all leading to the modernization of manufacturing strategies and the application, refinement, or development of manufacturing techniques and technologies with industrial potential. Because of the wide variety of projects supported and services provided by its Centers, the Program's research and development efforts are both generic in nature and specific to products and processes with industrial applications.

Level of R&D Focus

The Program's research and development efforts build on and expand existing R&D activities.

Program Beneficiaries

Since there is a variety of services provided and projects supported by its Centers, Program beneficiaries range from new or young technology-based entrepreneurial manufacturing firms to established, traditional manufacturing companies. Companies operating in one region of the state can become the direct beneficiaries of any IRC but the initial point of contact is expected to be with the Center within the firm's region.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends, unless otherwise negotiated, to follow and favor the policies and procedures of the research organization assisting in the applied research or technology development activity.

Direct or Indirect Benefits

Since the Program has been initiated only in FY 1988, no assessment of the Centers has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the modernization of manufacturing strategies and the application, refinement, and development of manufacturing process techniques and technologies. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: increased linkages between the private manufacturing sector and academic institution-based technical expertise.

General or Targeted Benefits

The services and projects of the IRCs are available generally to all manufacturing companies in the state. To the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

The IRCs Program was established in 1988. The basic approach of the Program and of the Centers has not changed since their inception. The variety and mix of services and projects of the Centers necessarily has evolved since their initiation to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

The Centers may use Program monies to support a wide range of services and projects. Most of the Centers resources are directed toward staff and consultant expertise. Applied research or technology development projects are undertaken as required using a grant mode. These projects generally involve a consortia of firms or the expectation that there will be multiclient manufacturing companies interested in the results. Matching funds are required for all such projects.

Description of How Program is Funded/Amount of Funding

Funds are allocated to the nine IRCs at the start of each fiscal year based on a competitive proposal process with specific selection criteria. Most Centers are on a multiyear planning basis, although their contract may be for one to three years.

Over the three year period of its existence from FY 1988 through FY 1990, the Program has made awards totalling about \$30 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Program nor the Centers directly attempt to recover their costs from either the research and technology development projects or assistance and services activities. Research and technology development projects operate on a cost-sharing basis and a royalty or other arrangement may be negotiated. Indirectly, it may be implied that the state expects to recover its

investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction by the Program is that a project supported or a service provided by the Bioprocessing Resource Center is expected to benefit biotechnology companies.

Program's Administration and Operation

The IRCs are independent, nonprofit corporations, governed by Boards of Directors, comprised predominantly of private sector executives, active in or retired from manufacturing companies. The Boards establish policy and administrative guidelines for their Centers.

Program Impact and Lessons

No major formal, publicly available, third party evaluations, legislative reports, or internal self assessments of the IRCs Program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Pennsylvania
- Program: Ben Franklin Technology Center of Northeast Pennsylvania

Program Purpose and Objectives

The Challenge Grant Program for Technological Innovation is the largest program administered by the Ben Franklin Partnership Fund (BFP) Fund of the Pennsylvania Department of Commerce. Four Technology Centers have been established throughout the state to support local initiatives and activities.

The Ben Franklin Technology Center of Northeast Pennsylvania, headquartered at Lehigh University, is an independent, nonprofit corporation. The Technology Center is responsible for identifying and generating technology innovation opportunities and, with BFP Fund monies, supporting projects drawing on its regional strengths. The Technology Center works to encourage economic growth on a regional basis and to build on the strong relationship between innovation, economic growth, and jobs.

The Technology Center may use BFP Fund monies to support a wide range of initiatives. The main strategy of the Technology Center is to make companies and academic/research institutions in the region aware of the benefits of collaboration and to motivate them to participate in joint projects by providing partial support in many instances. Companies and academic/research institutions are encouraged to continue their joint efforts even after the Technology Center withdraws as a facilitator and funder. Matching funds are required for all projects.

Eligible activities include: creation and support of centers of excellence, joint industry-university applied research and development efforts, research and development by small firms, regional or statewide technology development initiatives, operational support for incubators, entrepreneurial development, technology transfer, and education, training, and retraining.

While not limited to any specific technology field, the Technology Center's recent primary research and technology development areas have included: advanced manufacturing/CAD-CAM, polymers and advanced materials, microelectronics, and biotechnology. The Technology Center allocated about three-quarters of the BFP program funds it received toward R&D, a figure somewhat higher than the average of about two-thirds for the four Technology Centers.

The Technology Center has involved over 80 academic institutions and research institutes, about 1200 private firms, and over 100 foundations and other organizations in its projects.

Private companies have received less than one-sixth of the BFP program funds awarded recently by the Technology Center in its region, a figure somewhat below the average of the four Technology Centers of about one-fifth. Conversely, universities and other research institutions in the region have received about four-fifths of the BFP program funds, higher than the average of about two-thirds.

Industrial Sector

The Technology Center does not restrict its efforts to specific technologies or their counterpart industry sectors, although over nine-tenths of its R&D funds have been invested in only four technology fields: advanced manufacturing/CAD-CAM, polymers and advanced materials, microelectronics, and biotechnology.

Classification of Objectives

The Technology Center's program can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Regional development (although the Advanced Technology Centers collectively cover the state)
- Small and medium-sized business assistance (although they directly receive less than one-sixth of the Technology Center's monies).

Ranking of Objectives

Other than research and development, the most important specified objective is regional development, with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

The Technology Center supports basic research, applied research, and development projects, all leading to the development of new technologies with commercial potential. Because of the wide variety of projects it supports, the Technology Center's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Technology Center's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, given the wide variety of projects supported by its Technology Center.

Program Beneficiaries

Since there is a variety of projects supported by the Technology Center, program beneficiaries range from research and technology-intensive entrepreneurial firms to established manufacturing companies in the Technology Center's region.

To the extent funds are not provided directly to a private company and intellectual property and other proprietary rights are involved, the assignment of these rights tends, unless otherwise negotiated, to follow and favor the policies and procedures of the research organization.

Direct or Indirect Benefits

In addition to regular progress reports which provide systematically collected information documenting the Technology Center's impacts, the BFP Fund, which supports the Technology Centers, also has been subject to two major internal assessments and a legislative "sunset" audit. The regular progress reports covered traditional benefits, such as jobs/firms created/retained; personal/business taxes; patents issued/applied for; individuals/companies assisted; workshops held/attendees; products/processes/services developed/commercialized; SBIR entrepreneurs assisted/success ratios for assisted firms; training programs developed/courses evaluated; and training program enrollees/graduates.

In the assessment documents, less quantifiable benefits are noted, demonstrating the primary contribution of the Technology Center to the recognition of the state as a leader in the development and application of advanced technology. Such indirect benefits would include: strengthened capacity of business/industrial, research, and/or governmental institutions; new or increased linkages between the private and research sectors; new collaborative partnerships or other institutional arrangements between private companies and research institutions; research university participation in the state's economic development process; creation of a positive climate within the state for the application of advanced technologies by established companies and for the creation of new advanced technologies firms; creation of important networks of business/industry, research university, and other development groups to promote advanced technology; development of new or additional sources of investment financing, especially early

stage seed venture capital; and increased ability to attract federal funds, especially for establishing research centers.

General or Targeted Benefits

The Technology Center makes awards within its region for a variety of research and technology development efforts. Although most of the monies go to universities and other research institutions, the ultimate beneficiaries are predominantly small and medium-sized businesses.

Within the projects supported by the Technology Center and to the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

The Technology Center received its first monies in FY 1983 from the BFP Fund through its Challenge Grant Program. The basic approach of the Technology Center has not changed but its administrative structure has. Originally, the Center was governed by a university Board; now it is private, nonprofit, independent corporation. Also, the variety and mix of its projects necessarily has evolved since its initiation to meet changing needs and opportunities. For example, entrepreneurship activity has increased significantly in importance after the enhanced availability of early-stage venture capital resulting from the creation by the Technology Center of the NEPA Venture Fund.

Types of Potential Subsidy Intervention/Form of Funding

The Technology Center uses BFP Fund monies to support a wide range of initiatives. This support may be in the form of grant awards, equity positions, or investments with royalty pay-back provisions. Matching funds are required for all projects.

Description of How Program is Funded/Amount of Funding

Funds are allocated by the BFP Fund to the Technology Center at the start of each fiscal year based on a competitive formula which takes into account five criteria: performance measures

(e.g., job creation/retention, company startup, new product/process development), obtaining cash match support, accomplishments resulting from previous years' funding, meeting objectives of regional strategies during previous year, soundness of proposed work plan in meeting BFP Fund mission.

Over the eight-year period of its existence from FY 1983 through FY 1990, the Technology Center has made awards totalling over \$40 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Technology Center does not directly attempt to recover its costs from either the research and technology development programs or assistance and services programs. Technology Center awards require cost-sharing by the recipient. In the aggregate over the period of its existence, the Technology Center has generated significantly over three times its awards in matching funds. In recent years, the Technology Center has invested about half of its state funds in projects with royalty or other payback provisions, with their long-term potential for supporting the continuation and expansion of the Center's operations. Since these research grants are for projects ranging from basic research to commercialization of products and processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Technology Center's awards is that a project supported by the Technology Center is expected to benefit private firms in its region. However, these four Technology Centers collectively cover the entire state.

Program's Administration and Operation

The Technology Center, located at the Lehigh University campus, is an independent, non-profit corporation, governed by Boards of Directors, comprised of university officials and at least 50 percent private industry executives. They represent a consortia of business/industry/ banking, labor, academic, and economic development sectors. The Board establishes policy and administrative guidelines for the Center. It is responsible for identifying and generating technology innovation opportunities and, using BFP Fund monies, has final approval for all grants and investments.

Program Impact and Lessons

Two major formal internal self assessments and a legislative "sunset" audit of the BFP Fund have been undertaken and information has been systematically collected documenting the program's impact.

The many lessons learned at the strategic public policy development level that relate to the BFP Fund apply also to the Challenge Grant Program's four Technology Centers. Among those lessons are the following:

- With an initial emphasis on getting a program started and making it acceptable to the private, academic, and governmental sectors, short-term criteria for awards (such as nonstate match and jobs/firms created/retained) tend to drive a program at the expense of more long-term criteria (such as the development and commercialization of new products and processes).
- Quantitative factors (such as jobs/firms created/retained) tend to be predominantly short-term criteria and tend to drive a program at the expense of qualitative factors (such as new or increased linkages between the private and research sectors) that are longer-term oriented.
- Strategic technology development plans for a Technology Center need to be more fully integrated with economic development plans at the metropolitan and regional levels.

Name of Program and Government Agency

- State: Pennsylvania
- Metropolitan Region: Philadelphia
- Program: University City Science Center

Program Purpose and Objectives

The University City Science Center in Philadelphia was founded in 1967 by a consortium of 23 (now 28) universities, colleges, and health and health and medical institutions. The Center is located on 16 acres of land that was cleared and prepared for redevelopment by the City of Philadelphia and sold to a nonprofit corporation funded by these institutions. The city and the consortium currently have a redeveloper's agreement, whereby the city will sell additional land as needed.

The Center operates as an incubator and a technology park. The Center has ten buildings containing over two million square feet of laboratory and office space and houses over 105 companies and organizations employing over 6,000 workers. Many of the companies are engaged in high-technology or education activities and at least 40 new firms have been created at the Center, many of them in the high-technology sector. Long range plans call for the Center to contain five million square feet of space and house 20,000 employees.

Industrial Sector

The Center does not restrict its efforts to specific industry sectors.

Classification of Objectives

The Center's program can be classified as: Research and development, regional development, and small- and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the most important specified objective would be regional development with small- and medium-sized business assistance of lesser importance.

Classification by R&D Type

Organizations housed in the Center's facilities undertake basic and applied research as well as technology development. They support projects ranging from generic research and development to those involving specific technologies.

Level of R&D Focus

With the variety of organizations at the Center and the variety of activities they undertake, the Center's tenants' research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

The near-term, direct beneficiaries of the Center's facilities and services are the industrial, business, and nonprofit companies in the Center itself as well as the state and region to the extent such organizations were recruited from outside the state or region.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing, industrial companies, business firms, and nonprofit institutions. This would imply the traditional benefits of jobs/firms created/retained as well as personal, property, and business taxes paid.

General or Targeted Benefits

The facilities and services of the Center are available generally to all industrial companies, business firms, and nonprofit institutions, although technology-based companies are encouraged.

Program Duration and Permanence

The Center was established in 1976 and its concept has not changed since its initiation.

Types of Potential Subsidy Intervention/Form of Funding

The Center has received funds from a variety of sources: its own consortium members and city, state, and federal programs. Federal and city urban renewal grant funds were used to prepare

the land for development and upgrade streets and utilities. Pennsylvania Industrial Development Authority loan funds were used to help finance building construction. A five million dollar federal Urban Development Action Grant was used to construct a residential conference center.

Description of How Program is Funded/Amount of Funding

Over \$100 million has been invested to date, excluding the original federal urban renewal grant and city matching funds. All city funds are from city general tax revenue.

Provisions for Cost Recovery

To the extent that costs are recovered, they occur through rent charges for office and laboratory space and other services. This cost recovery would be applicable only to building and facility construction and not to the original site preparation and infrastructure improvements. It can be inferred that the city and state expect to recover their investment costs through increased personal, property, and corporate taxes and reduced unemployment, welfare, and other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the research and other services conducted by companies at the Center.

Program's Administration and Operation

The Center has a Board of Directors, representing the consortium members, that sets policy for its operations.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations or internal self-assessments of the Center have been undertaken and information has been systematically collected documenting the Center's impact only in terms as numbers and types of companies located in the Center and their number of employees.

Name of Program and Government Agency

- State: Pennsylvania
- Metropolitan Region: Pittsburgh
- Program: Pittsburgh High Technology Council

Program Purpose and Objectives

The Pittsburgh High Technology Council, incorporated in 1983 as a nonprofit corporation, works as a trade association to support the development of a strong high-technology community throughout southwestern Pennsylvania. The Council serves as a resource center for companies in need of assistance, provides direct assistance through seminars and workshops, serves as a focal point for promotional and educational programs, and works with other organizations to promote the region for high technology industry.

The Council maintains an aggressive public relations program on behalf on the region's high-technology industry and works with members of state and local government on issues to improve the region's business climate. It also engages in industry network building and a CEO Network; the latter network matches chief executive officers in established smaller high-technology companies with their counterparts in emerging firms to provide direct long-term assistance. The Council's new business assistance program targets services to existing and start-up companies in some of the older mill towns.

The CEO Venture Fund, a spin-off of the CEO Network, with venture capital funds of \$10 million, provides seed and follow-on funding for start-up technology companies. Begun in 1986 at an initial capitalization of \$3 million with \$750,000 in seed money provided by the Ben Franklin Partnership Fund, the first Fund was finally capitalized at \$10 million and is now fully invested. A second Fund, begun in 1989 has been capitalized at \$35 million. Investments have been made in 14 firms many in multiple rounds and three firms have been sold off. Many of the Fund's investments are coinvested with other venture funds.

The Council uses the partnership concept. It works closely with members of the high-technology community and the many other organizations in the region, most of which have been created in the 1980s to support the development of advanced technology throughout the region.

Industrial Sector

The Council does not restrict its efforts to specific industry sectors, although they must be technology-based.

Classification of Objectives

The Council's program can be classified as: Research and development, regional development, and small and medium-sized business assistance.

Ranking of Objectives

Other than research and development, regional development would become the most important objective. Small and medium-sized business assistance would be of lesser importance because the assistance is not limited to such businesses.

Classification by R&D Type

The Council itself directly conducts no R&D activities. Rather, it supports management assistance, promotion and marketing activities, and the creation of venture capital – all on behalf of new and existing high-technology companies.

Level of R&D Focus

Since no R&D activities are conducted directly by the Council, the level of R&D focus is not applicable.

Program Beneficiaries

The near-term, direct beneficiaries of the Council's services are high-technology companies in the southwestern region of the state.

Direct or Indirect Benefits

The intended direct benefits are the development of new, or expansion of existing, technology-based companies in the region. In theory, this would imply the traditional benefits of jobs/firms created/retained as well as personal, property, and business taxes paid.

General or Targeted Benefits

The services of the Council are available generally to all high-technology companies in the region.

Program Duration and Permanence

The Council was established in 1983 and its concept has not changed since its initiation.

Types of Potential Subsidy Intervention/Form of Funding

Subsidy intervention is not applicable, except that the Council developed and spun off a venture capital fund.

Description of How Program is Funded/Amount of Funding

The Council's operating budget of about \$2 million comes from membership fees and grants from the Western Pennsylvania Advanced Technology Center (a Ben Franklin Partnerships Technology Center), the Allegheny Conference on Community Development, and other local industrial and private foundations.

Provisions for Cost Recovery

To the extent that costs are recovered, they occur through such approaches as conference fees, publication charges, etc.

Discrimination/Conditionality

There are no formal or informal restrictions on the activities of the Council.

Program's Administration and Operation

The Council's Board of Directors includes executive's of many of the region's smaller high-technology companies, Penn's Southwest Association, the Regional Industrial Development Corporation, and Carnegie-Mellon University.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Council has been undertaken.

Name of Program and Government Agency

- State: Pennsylvania
- Metropolitan Region: Harrisburg-York
- Program: Manufacturing Technology Industrial Resources Center

Program Purpose and Objectives

The Manufacturing Technology Industrial Resource Center (MANTEC), established in 1988, is directed at helping the 3,200 small and medium-sized, traditional and emerging manufacturing firms in the ten-county Harrisburg-York region improve product quality, productivity, and profitability by modernizing their manufacturing strategies and systems as well as their manufacturing process techniques and technologies.

The Center is an independent, nonprofit corporation, managed and operated by industry executives who work together to form a regional manufacturing assistance network. MANTEC is headquartered at the York International Corp. in York and is sponsored by the York County Industrial Development Corporation in cooperation with more than 100 private companies and 23 economic development and educational institutions in the region.

MANTEC has a professional staff with expertise and skills in various manufacturing areas including manufacturing management, industrial engineering, computer engineering, factory automation, and strategic planning. Services are provided by either Center personnel or consultants from industry and academia. To make these services affordable to smaller manufacturers, state funds subsidize the cost of the assistance.

MANTEC provides comprehensive services to assist companies that want to learn about, identify, and implement modern manufacturing techniques and technologies. Such services provided by the Center may include providing manufacturing and/or management advice, identifying appropriate new techniques or technologies, developing manufacturing strategies, integrating computers and/or automation into the manufacturing process, upgrading quality controls, improving production planning and inventory control, and providing specialized, customized training.

Although assisting individual companies is the primary task of the Center, MANTEC also has a mandate to develop initiatives of a more generic nature with broader impact for manufacturers, such as creating regional manufacturing associations and consortia.

Industrial Sector

MANTEC does not restrict its efforts to specific technologies or their counterpart industry sectors. However, the Center, does emphasize technology fields that reflect the region's industry base.

Classification of Objectives

The Center's activities can be classified as follows: research and development (with a range from applied research to application, refinement, and development of manufacturing techniques and technologies); regional development (south-central region of the state); and small and medium-sized business assistance (although all sized manufacturing firms can be serviced).

Ranking of Objectives

Other than research and development, the most important specified objective is regional development, with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

The Center supports applied research, and development projects, all leading to the modernization of manufacturing strategies and the application, refinement, or development of manufacturing techniques and technologies with industrial potential. Because of the wide variety of projects supported and services provided by the Center, MANTEC's research and development efforts are both generic in nature and specific to products and processes with industrial applications.

Level of R&D Focus

The Center's research and development efforts build on and expand existing R&D activities.

Program Beneficiaries

The Center's beneficiaries range from new or young technology-based entrepreneurial manufacturing firms to established, traditional manufacturing companies in the region. A company operating in another region of the state can become the direct beneficiary of MANTEC if the Center has a singular capacity to assist such a firm.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends, unless otherwise negotiated, to follow and favor the policies and procedures of the research organization assisting in the applied research or technology development activity.

Direct or Indirect Benefits

The intended direct benefits are the modernization of manufacturing strategies and the application, refinement, and development of manufacturing process techniques and technologies. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include: a stronger regional economy, enhanced tax revenue, and increased linkages between the private manufacturing sector and academic-institution-based technical expertise.

General or Targeted Benefits

The services and projects of MANTEC are available generally to all manufacturing companies in the region. To the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

MANTEC was established in 1988. The basic approach of the Center has not changed since its inception. The variety and mix of services and projects of the Center necessarily will evolve to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

The Center uses monies from the state's Industrial Resources Centers (IRC) Program to support a wide range of services and projects. Most of the Center resources are directed toward staff and consultant expertise. Applied research or technology development projects are undertaken as required using a grant mode. These projects generally involve a consortia of firms or the expectation that there will be multiclient manufacturing companies for the results. Matching funds are required for all such projects.

Description of How Program is Funded/Amount of Funding

Funds are provided to the Center by the state's IRC Program in the form of matching grants over an initial three-year funding period. Initial funding of \$1.25 million was provided to MANTEC in FY89, its first year of funding, with a similar amount the following fiscal year. Support from the state has been matched on about a five-to-one basis from industry, academic institutions, foundations, and other nonstate sources. The Center is eventually expected to become self-sustaining without funds from the state IRC Program, with a target time originally set at three years. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Center does not directly attempt to recover its costs from either its research and technology development projects or its assistance and services activities. Research and technology development projects operate on a cost-sharing basis and a royalty or other arrangement also may be negotiated.

Discrimination/Conditionality

There are no formal or informal restrictions on the research and development or assistance and service activities of the Center.

Program's Administration and Operation

MANTEC is an independent, nonprofit corporation, governed by a Board of Directors, comprised predominantly of private sector executives, active in or retired from manufacturing companies. The Board establishes policy and administrative guidelines for the Center.

Program Impact and Lessons

No major formal, publicly available, third party evaluations, legislative reports, or internal self assessments of MANTEC's program have been undertaken and no information has been systematically collected documenting the Center's impact.

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XII. TEXAS

Within the state of Texas there are a great number of science and technology programs, with some receiving an exceptionally high level of state funding. As Figure 12 shows, most initiatives and programs are not administered by any one state agency. In 1988, the Texas Department of Commerce established the Office of Advanced Technology to help coordinate and support technology-based economic development efforts within Texas. The key players in planning and implementing science and technology programs include the University of Texas system, the Texas A&M University system, and the Texas Higher Education Coordinating Board.

Total State funding for science and technology programs, excluding the Texas A&M administered Texas Engineering Experiment Station, was \$61 million in FY's 1987 through 1989. The largest share of this budget was allocated to the Advanced Technology Program, which received \$40 million, or nearly two-thirds of the state total. The Advanced Research Program received \$20 million, or one-third of the total. Relatively small shares were allocated among other programs such as the Technology Business Development Division and the Center for Technology Development and Transfer.

The Advanced Research Program provides grants to public educational institutions to conduct basic research, with the goals of attracting research scientists to Texas and strengthening the state's research base. Eligible recipients are college and university faculty. There is no matching fund requirement. Grant money can be used for equipment, supplies, support staff salaries, and research salaries for basic research projects.

The Advanced Technology Program is designed to provide grants for applied research in public and private educational institutions. Eligible applicants are colleges and universities. Entities that are not eligible for Program grants include research consortia, government laboratories, corporations, and individuals. Eligible projects must demonstrate commercial potential and be related to one of the selected targeted technologies. Goals of the program include attracting prominent research scientists to Texas, expanding the state's technology base, creating new products and businesses, and providing support to existing business and industry.

The Texas Engineering Experiment Station, which is both a direct recipient of State funds and a component of the Texas A&M University system, administers a number of programs in

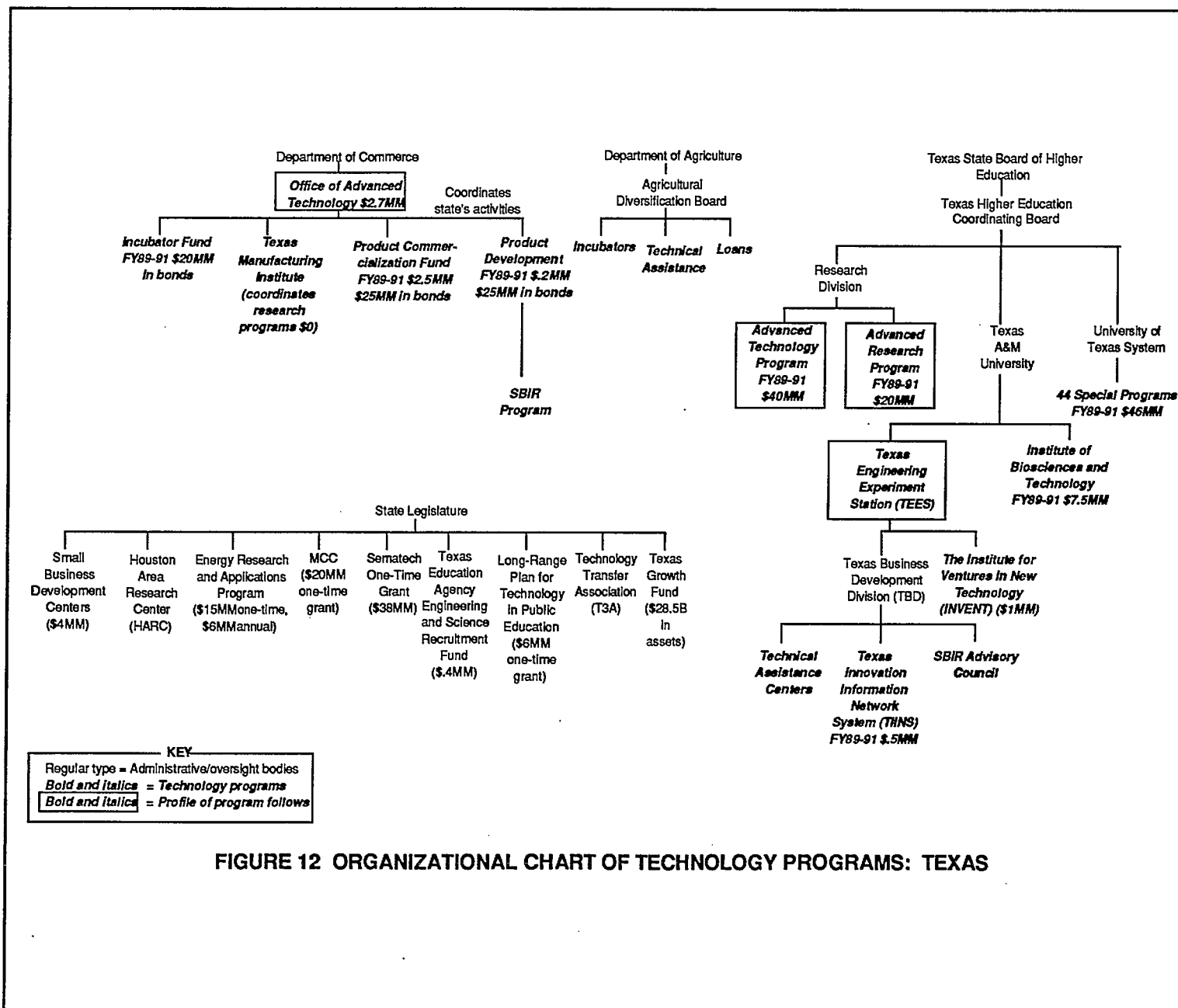
support of technology development and technology transfer. TEES objectives, considered generally, are to foster innovations in research, education, and technology that support and assist the private sector. Through its Technology Business Development Division, TEES identifies and brokers research concepts across Texas to promote the commercialization of University research, working toward the goal of licensing intellectual property and forming new ventures. The Institute for Ventures in New Technology (INVENT) provides technical and managerial assistance to small businesses and entrepreneurs in evaluating and developing new products and processes. INVENT uses the faculty and graduate students of Texas A&M and other Texas universities to do technical consulting.

In 1989, the Office of Advanced Technology began coordinating and administering the following programs:

Product Commercialization Fund. This fund was appropriated \$500,000 from general tax revenue and \$2 million from the Texas Oil Overcharge Settlement Fund to make loans to finance the commercialization of new or improved products or processes for which financing is not readily available from private sources.

Product Development Fund. This fund provides equity and royalty financing to companies in their earlier stages of R&D who have failed to obtain private-source financing.

Through its science and technology efforts, Texas has been able to attract substantial federal research and development monies. The state gained national recognition for its ability to leverage state funds to attract the Microelectronics and Computer technology Corporation (MCC), Sematech, and the Superconducting Super Collider (SSC). With the establishment of the Office of Advanced Technology in the Texas Department of Commerce, Texas will implement increasingly coordinated state-level science and technology programs.



Name of Program and Government Agency

- State: Texas
- Program: Advanced Technology Program

Program Purpose and Objectives

The Advanced Technology Program was established along with the Advanced Research Program by the Texas Legislature in 1987. The The Advanced Technology Program awards competitive grants for applied research at Texas universities that shows promise toward developing new products or processes. While the Program seeks to enhance economic growth, its main objectives are:

- To promote and strengthen the state's human resource base in technology
- To develop new products and processes
- To contribute to the application of science and technology to businesses within the state.

Grants cover 12 different applied research fields. These include areas in which Texas traditionally has had research strength, such as agriculture, biomedicine and energy, as well as emerging fields, such as materials science, microelectronics, and biotechnology. Other fields receiving awards are aerospace, manufacturing technology, marine technology, environmental sciences and engineering, information science, and telecommunications.

Industrial Sector

The Advanced Technology Program does not target funds to a specific industrial sector. Rather, funds are distributed to a wide variety of applied research fields that are specified in the program's statute. The list of eligible applied research areas can be amended and, in 1989, the legislature added environmental sciences and engineering to the list. However, the Program's enabling legislation does not establish any priorities among these fields or establish any minimum funding requirement for a given research area.

Classification of Objectives

The above objectives can best be classified as research and development aimed particularly at developing new technologies, human resources, and the state economy. Broadly conceived, the goal is to identify excellence in the state's public and private universities as opposed to channeling funds into new and promising activities.

Ranking of Objectives

Research proposals are evaluated according to five criteria, which are weighted to reflect the importance of program objectives. These are:

- Merit and soundness of the proposal (40 points)
- Capability of the investigator(s) (20 points)
- Prospects for commercialization, leveraging, and technology transfer (20 points)
- Education and training (10 points)
- Institutional commitment and resources (10 points).

Classification of R&D Type

The focus of the Program is applied research, as opposed to the Advanced Research Program, which targets basic research.

Level of R&D Focus

The Program targets existing and new applied research activities at Texas public and private universities.

Program Beneficiaries

Grant money is available to individuals or teams from any of the state's public or private institutions of higher education. Rights to any new technologies is determined by intellectual property policies at the sponsoring university. There is no standard policy for state universities, although university policy must adhere to several criteria established by the state. The state criteria allow for university proprietorship of technology developed and knowledge gained.

Direct or Indirect Benefits

Although there has been no formal evaluation of program benefits, the development of the state's applied research capacity is considered a direct benefit. Other indirect benefits include the development of new technologies for licensing to Texas companies, and the creation of jobs in high-technology industries.

General or Targeted Benefits

The program is general in the sense that funding is allocated according to the strength and merit of the proposal rather than research area.

Program Duration and Permanence

The program was established in 1987 by the state legislature. Funding is appropriated biennially. The legislature can revise the list of research fields in which grants are awarded, enabling the program to remain up to date.

Types of Potential Subsidy Intervention/Form of Funding

All funds are awarded as grants.

Description of How Program is Funded/Amount of Funding

All funding comes from the state's general tax revenue and is appropriated by the state legislature. In both 1987 and 1989, the program received \$40 million and administrators anticipate requesting the same amount in 1991. In 1987, two private foundations funded the review panels that evaluated proposals and determined grant recipients. Funding for the review panels was added to the 1989 appropriation.

In 1987, grants averaged \$187,000. The average declined to \$160,000 in 1989 and administrators expect it to fall further in the future. Project funding is for two years. Recipients can apply for a second round of funding, but must undergo a new review process. There is no ceiling on awards. However, awards to researchers representing the University of Texas and the Texas A&M systems are restricted to 70% of all funds awarded under the Advanced Technology Program and the Advanced Research Program.

Provisions for Cost Recovery

There are no provisions for or expectations of cost recovery

Discrimination/Conditionality

Grant eligibility is restricted to individuals and teams associated with public or private institutions of higher education. Grants are awarded first and foremost on the basis of merit. Researchers affiliated with the University of Texas and the Texas A&M systems are restricted to 70% of all funds awarded under the Advanced Technology Program and the Advanced Research Program.

Summary of Program's Administration and Operation

The Advanced Technology Program is administered by the state's Higher Education Coordinating Board. Members of the 18-member board are appointed to six-year terms by the governor. The board is served by a 12-member advisory committee composed of scientists and engineers that devise program guidelines and establish several criteria for evaluating proposals.

Proposals are reviewed by at least one of 13 review panels organized by research field. Each panel ranks the proposals it reviews. Some projects are reviewed by more than one panel. In a final meeting, panel chairmen make funding recommendations based on the quality of the projects reviewed. These presentations are followed by a vote that determines how funds will be distributed between research fields. Chairmen are not permitted to vote for projects in their own research area. Once these allocations are made, panel chairs select specific projects from their prioritized lists.

Program Impact and Lessons

No formal studies have been conducted to assess the program's impact or to determine lessons learned.

Name of Program and Government Agency

- State: Texas
- Program: The Texas Engineering Experiment Station (TEES)

Program Purpose and Objectives

The Texas Engineering Experiment Station is a state agency that conducts basic and applied research in support of business, industry, and public systems, for both the state and the nation. Established in 1914, it was incorporated as part of Texas A&M University in 1948 and is closely tied to various other university engineering programs. TEES research objectives are

- To promote state economic development, leadership, and quality of life
- To develop new technologies and encourage entrepreneurship
- To leverage and network human, physical, and capital resources
- To enhance and strengthen higher education.

Industrial Sector

TEES activities encompass a broad range of technology-related research fields. Of its 46 divisions, 10 correspond to the traditional academic disciplines included in Texas A&M's College of Engineering. An additional six divisions mirror disciplines included in the University's Colleges of Architecture, Business Administration, Education, Geosciences, Liberal Arts, Science, and Veterinary Medicine. Several divisions are interdisciplinary centers. TEES does not target any specific industrial sector.

Classification of Objectives

TEES objectives can generally be categorized as research and development, sectoral development, and regional development. Because TEES involves 36 autonomous divisions, the classification of objectives may vary considerably throughout the agency.

Ranking of Objectives

TEES does not explicitly rank its objectives. Where ranking is appropriate, it is left to the individual divisions within the agency.

Classification of R&D Type

TEES-based R&D ranges from very basic to very applied, typically depending on the research focus of the division.

Level of R&D Focus

The R&D focus is determined by the division. As a result, new as well as existing R&D activities are supported. TEES reserves a small pool of funds each year that can be used to support new projects as they arise.

Program Beneficiaries

The primary beneficiaries of the program are university departments associated with TEES.

Direct or Indirect Benefits

TEES activities help strengthen university research, attract new faculty to the state universities, train graduate students, and generate new technologies.

General or Targeted Benefits

TEES benefits are generally available. In the last five years, the agency has made a concerted effort to spin-off new technologies into private companies and to license new technologies.

Program Duration and Permanence

TEES is a state agency. It was created in 1914 and in 1948 was incorporated as a part of the Texas A&M University System. It is funded biennially by the state legislature. Over the last six years, TEES has submitted, with its budget request, several specific research initiatives that are considered likely to have a major impact on the economic development of the state. Because state funds have been limited, these initiatives have rarely received money. However, they help identify internal priorities and keep agency research up-to-date. Also, changes in state policies in the early 1980's enabled TEES to begin a more active technology transfer program that includes spin-off companies and licensing.

Types of Potential Subsidy Intervention/Form of Funding

TEES has used a number of funding vehicles. A large portion of its budget is disbursed directly to the divisions. However, TEES does occasionally provide loans and often matches federal funds on various projects.

Description of How Program is Funded/Amount of Funding

TEES has annual total expenditures of about \$45 million. Of this amount, it receives \$7 million from the state's general tax revenues. Half of this appropriation, \$3.5 million, is used for contract administration and general business. TEES puts about \$9 million into research projects. This includes the remaining \$3.5 million appropriated by the state. It also includes about \$5.5 million in indirect costs, which TEES is allowed to retain.

Provisions for Cost Recovery

Currently, there are no provisions for cost recovery. However, cost recovery may occur under policy changes that allow the creation of start-up companies and technology licensing.

Discrimination/Conditionality

TEES funds are only available to its divisions, which must generally be technology-related.

Summary of Program's Administration and Operation

TEES has a director and an administrative apparatus that oversees contract administration and agency business. Its operations are highly decentralized with considerable discretion residing in the various divisions. Each division determines its own research priorities and how its annual allocation will be spent.

Program Impact and Lessons

One official noted the importance of creating an incentive system that reinforces research objectives. TEES has done this by proportionately allocating funds to the most active research divisions and by granting the division heads more authority and responsibility. This enables experts in the various fields to determine which research projects will be supported. By decentralizing authority, TEES has managed to minimize intrusions by less knowledgeable administrators.

Name of Program and Government Agency

- State: Texas
- Program: Advanced Research Program

Program Purpose and Objectives

The Advanced Research Program was established along with the Advanced Technology Program by the Texas Legislature in 1987. The Advanced Research Program awards competitive grants in basic research with the purposes of strengthening human resources in research and technology fields and strengthening university expertise.

Grants are awarded in 10 different research fields: astronomy, atmospheric sciences, biological sciences, chemistry, computer and information sciences, earth sciences, engineering, marine sciences, materials science, mathematics, physics, and social and behavioral sciences.

Industrial Sector

The Advanced Research Program does not target funds toward a specific industrial sector. Rather, funds are distributed to a wide variety of research fields that are specified in the program's statute. The program is structured so that the list of eligible research areas can be amended. For example, in 1989, the legislature added environmental sciences and engineering to the list. The program's enabling legislation does not establish any priorities among these fields or establish any minimum funding requirement for a given research area.

Classification of Objectives

The above objectives can best be classified as basic research designed to foster excellence in university research. The program is designed to enhance the state's human resource base in science and technology research.

Ranking of Objectives

No emphasis is given to any one or more of the selected fields. Research proposals are evaluated according to four criteria, which are weighted to reflect the importance of program objectives. These are:

- Merit and soundness of the proposal (45 points)
- Capability of the investigator(s) (25 points)

- Education and training (20 points)
- Institutional commitment and resources (10 points).

Classification of R&D Type

The focus of the program is basic research and is designed to complement the Advanced Technology Program, which targets applied research.

Level of R&D Focus

Program funds are not targeted to emphasize any particular one of the preselected fields, but are allocated to the best proposals received. While many of the strongest proposals come from research teams representing well developed areas of activity, strong proposals in areas of new activity can and do receive funding.

Program Beneficiaries

The availability of grant money is limited to individuals or teams from the state's public institutions of higher education and the faculty and students at these universities are the primary beneficiaries.

Direct or Indirect Benefits

Although there has been no formal evaluation of program benefits, the development of the state's basic research capacity is considered the most direct benefit to the state. Other benefits include establishing new research activities within universities and providing more research opportunities for students.

General or Targeted Benefits

The program is general in the sense that funding is allocated according to the strength and merit of the proposal rather than research area.

Program Duration and Permanence

The program was established in 1987 by the state legislature. Funding is appropriated biennially. The legislature can revise the list of research fields in which grants are awarded, enabling the program to remain up to date.

Types of Potential Subsidy Intervention/Form of Funding

All funds are awarded as grants.

Description of How Program is Funded/Amount of Funding

All funding comes from the state's general tax revenue and is appropriated by the state legislature. In both 1987 and 1989, the program received \$20 million and administrators anticipate receiving the same amount in 1991. In 1987, two private foundations funded the review panels that evaluated proposals and determined grant recipients for both the Advanced Research Program and the Advanced Technology Program. Funding for the review panels was added to the 1989 appropriation.

In 1987, grants averaged \$137,000. The average declined to \$111,000 in 1989. Project funding is usually for two years. Recipients can apply for a second round of funding, but must undergo the same review process as before. There is no ceiling on awards. However, awards to researchers representing the University of Texas and the Texas A&M systems are restricted to 70% of all funds awarded under the Advanced Technology Program and the Advanced Research Program.

Provisions for Cost Recovery

There are no provisions for or expectations of cost recovery.

Discrimination/Conditionality

Grant eligibility is restricted to individuals and teams associated with public institutions of higher education. Proposals must be for research in one of the preselected fields: astronomy, atmospheric sciences, biological sciences, chemistry, computer and information sciences, earth sciences, engineering, marine sciences, materials science, mathematics, physics, and social and behavioral sciences. Grants are awarded first and foremost on the basis of merit. Researchers affiliated with the University of Texas and the Texas A&M systems are restricted to 70% of all funds awarded under the Advanced Research Program and the Advanced Technology Program.

Summary of Program's Administration and Operation

The Advanced Research Program is administered by the state's Higher Education Coordinating Board. Members of the 18-member board are appointed to six year terms by the governor. The board is served by a 12-member advisory committee composed of scientists and engineers. The advisory committee devises program guidelines and establishes criteria for evaluating proposals.

Proposals are reviewed by at least one of 13 review panels organized by research field. Each panel ranks the proposals it reviews. Some projects are reviewed by more than one panel. In a final meeting, panel chairmen make funding recommendations based on the quality of the projects they reviewed. These presentations are followed by a vote that determines how funds will be distributed between research fields. Chairmen are not permitted to vote for proposals in their own research field. Once these allocations are made, panel chairs select specific projects from their prioritized lists.

Program Impact and Lessons

No formal studies have been conducted to assess the program's impact or to determine lessons learned.

Name of Program and Government Agency

- State: Texas
- Program: Office of Advanced Technology, Department of Commerce

Program Purpose and Objectives

The Office of Advanced Technology, at the broadest level, seeks to create jobs and diversify the state economy. In support of this objective, the office promotes technology-based small businesses in Texas, particularly those trying to bring new products to market. Its functions include:

- Providing financial support under the recently established Product Commercialization Fund and the Product Development Fund.
- Acting as a source of information on state and federal programs and services, technology industry networks and associations, and on scientific and management expertise within Texas universities. This information is available for inventors, entrepreneurs, and members of industry.
- Promoting state technology resources and capabilities in state, national, and international markets.

Industrial Sector

The Office of Advanced Technology targets 12 industrial sectors, although its work is not exclusively restricted to these areas. These fields are: agriculture, biomedicine, energy, materials science, microelectronics, biotechnology, aerospace, manufacturing technology, marine technology, environmental sciences and engineering, information science, and telecommunications.

The office recently identified six of the twelve fields as top priorities. These are: aerospace, microelectronics and computers, telecommunications, renewable energy, environmental science, and biotechnology and biomedicine.

Classification of Objectives

Program objectives can be classified as small business assistance and sectoral development, although the office also promotes regional development and research and development.

Ranking of Objectives

The most important program objective is small business assistance, followed by sectoral development. Beyond that, program objectives are fairly evenly ranked.

Classification of R&D Type

The office will support companies in any stage of research and development, as long as product commercialization is the primary objective. Although guidelines have yet to be finalized, the Product Commercialization Fund is expected to make loans available to companies in the later stages of R&D. The Product Development fund will provide equity and royalty financing to companies in the earlier stages of R&D.

Level of R&D Focus

The office supports R&D efforts where product commercialization is an explicit goal and appears promising. Office programs therefore support new R&D as well as existing R&D activities.

Program Beneficiaries

The primary beneficiaries are small, technology-based businesses developing new products in the state of Texas. Information and brochures now available from the office are widely distributed.

Direct or Indirect Benefits

Direct benefits include information and materials provided to interested small businesses. When the Product Commercialization Fund and the Product Development Fund begin operating in March 1991, direct benefits will include financial assistance. Indirect benefits include job creation, a stronger R&D infrastructure for technology companies, and a more diverse state economy.

General or Targeted Benefits

Currently, the office provides general benefits that are available to a variety of companies seeking assistance. The office provides a variety of sectoral-based resource directories, which include information on finance sources, public-funded programs, university research centers, and other resources that support specific industrial sectors. So far, the office has produced about seven directories, but it expects to expand the number to 15 in the near future. Benefits from the Product Commercialization Fund and the Product Development Fund may be more specifically targeted, although Fund rules have not been finalized at this time. The Product

Commercialization Fund currently has \$2 million in oil overcharge money that has been designated for energy programs.

Program Duration and Permanence

The program was established in 1987 by the state legislature, but was not staffed until mid-1988. The office was not created by a specific act of the legislature, rather it is referenced in several different statutes. However, it is considered a permanent office within the State Department of Commerce.

Types of Potential Subsidy Intervention/Form of Funding

The Office is currently a point of contact for and source of information to Texas businesses and does not distribute funds. Its operating budget comes from Department of Commerce funds, which are appropriated by the legislature. Beginning around March, 1991, the office will disburse funds through the Product Commercialization Fund and the Product Development Fund. Funds from the former will be made available on a loan basis. Funds from the latter, targeting riskier R&D, will be in the form of equity and royalty financing and loan guarantees. It is likely that, at a minimum, state funds will have to be matched by private sources, although rules governing the two funds have not yet been finalized.

Description of How Program is Funded/Amount of Funding

The Office of Advanced Technology has received all its funds from the state's general tax revenue. In FY 1989, the office received \$63,875 and in FY 1990, it was appropriated \$244,479, of which \$227,080 was expended. The FY 1991 appropriation was \$857,704, although the actual operating budget was \$407,704.

The FY 1991 appropriation included \$500,000 for the new Product Commercialization Fund and \$98,804 for administration of the Product Development Fund. Of the FY 1991 total, \$450,000 specified for the Product Commercialization Fund has been rolled over to the FY 1992 budget, leaving \$50,000 in to be used in FY 1991 for program administration. The Product Commercialization Fund received an additional \$2 million from the state's share of oil overcharge money. This money is specifically targeted toward energy-related technology commercialization.

The Product Development Fund is authorized to receive up to \$25 million, all through general obligation bonds. OAT officials expect to issue the bonds in \$5 million increments, with the first issue expected late in FY 1991. The \$98,804 available for the Product Development Fund will be taken from that bond issue and used for administration costs during the 1991 fiscal year.

Provisions for Cost Recovery

There are no cost recovery provisions for the general services provide by the Office of Advanced Technology. Although guidelines for the Product Commercialization Fund and the Product Development Fund have not been finalized, these programs are expected to strive for full cost recovery.

Discrimination/Conditionality

There are no current restrictions limiting access to office services. Some restrictive conditions may apply in the case of the Product Commercialization Fund and the Product Development Fund, however the rules for these funds have not been finalized. Specifically, financing may be limited to Texas-owned companies or companies seeking financing for R&D activities that will be conducted in state.

Summary of Program's Administration and Operation

The Office of Advanced Technology is administered by the State Department of Commerce. It is responsible for monitoring all state technology programs and providing information and services to technology-based businesses in the state. The Office is run by a program manager.

The Product Commercialization Fund and the Product Development Fund are managed by the Office of Advanced Technology, with the support of a seven-member advisory committee. The governor, lieutenant governor, and the speaker of the legislature each appoint two members to the committee. The final member is appointed by the Higher Education Coordinating Board. The advisory committee will help write the rules and guidelines governing the two funds. It will also make financing recommendations to the Commerce Department's Board of Governors, which will make all final decisions.

Program Impact and Lessons

The program manager emphasized two lessons learned. First, there is a critical lack of funding available for the later stages of research and development. This constrains and slows commercialization of new products and allows foreign companies to step into the void. A second lesson is that it is difficult to measure the impact of programs such as the Office of Advanced Technology and it is important not to expect too much too soon. There have been no formal studies to date of lessons learned or program impact.

Name of Program and Government Agency

- State: Texas
- Metropolitan Region: Austin
- Program: Austin Technology Incubator

Program Purpose and Objectives

The Austin Technology Incubator seeks to nurture local technology companies by providing office space and support services for tenant companies. The Incubator brings together under one roof new start-up companies with a technology-related idea, service, or product. The companies benefit from low overhead, shared resources, and a volunteer network of advisors while they develop and bring new products to market. The objective is to provide a proactive environment to allow entrepreneurs to develop newer technologies with a greater likelihood of success.

Industrial Sector

The Austin Technology Incubator does not favor any particular industrial sector. Four types of firms can qualify for participation in the incubator. These are:

- Firms in the start-up stage of operation
- Technology transfer projects from universities and the private sector
- Spin-outs from other corporations
- Firms relocating from other geographic areas.

Classification of Objectives

Program objectives are to facilitate the growth of new businesses, strengthen the city's entrepreneurial base, and create jobs.

Ranking of Objectives

The ranking of program objectives are reflected in the six principal criteria applied in selecting firms for the Incubator. Eligible firms must have:

- A product or service based on new technologies or technologically innovative concepts with a goal toward developing a patentable product or process.
- Entrepreneurs with adequate technical education or business experience to exploit the technology
- Entrepreneurs willing to accept guidance, share management responsibility with others, and possibly give up equity to make the company successful

- A written business plan that includes market analysis and development strategies, cash-flow analysis, financial projections, funding requirements, and background on the management team.

These criteria are not explicitly ranked.

The product or process should have the potential to reach significant revenue levels, enabling the company to graduate from the Incubator within two or three years.

Classification of R&D Type

The Austin Technology Incubator houses firms mostly in advanced stages of R&D (commercialization within three years), or those already with a product in hand. Firms typically fall into the following four categories: those in the start-up stage of operation; technology transfer projects from universities and the private sector; spin outs from other corporations; and relocations from other geographic areas.

Level of R&D Focus

The Incubator does not target any specific type of R&D. Rather, it provides a supportive environment in which companies can continue whatever R&D they have underway. With the Incubator's support, companies may be able to expand existing R&D or start new activities. However, program selection criteria favors companies with a product or service based on new technologies or technologically innovative concepts.

Program Beneficiaries

The Austin Technology Incubator's primary beneficiaries are the participating companies, which are typically small start-ups with technology-based products or services. So far, the Incubator has had eight tenants, two of which have graduated and left the facility.

Direct or Indirect Benefits

The program provides direct benefits to the tenant companies in the form of low overhead, shared resources, and a volunteer network that offers advice in areas such as accounting, law, marketing, finance, engineering, and management. The program benefits the City of Austin by creating jobs—an estimated 87 in the first year—and by strengthening the city's technology-based economy. It also helps generate new products for the marketplace.

General or Targeted Benefits

Participation in the Incubator is generally available in that many different types of companies may apply. However, participating firms must meet several criteria which essentially restrict participation to new start-up companies or those offering products or services based on new technologies or technologically innovative concepts.

Program Duration and Permanence

The Austin Technology Incubator admitted its first tenant in March 1989. It is a permanent program, jointly supported by the City of Austin, the University of Texas' IC² Institute, the UT Graduate School of Business, the Greater Austin Chamber of Commerce, and the Austin private sector.

Types of Potential Subsidy Intervention/Form of Funding

The Austin Technology Incubator receives funding from a variety of public and private sources. City money is provided from general revenues. A large portion of the Incubator's services are provided through in-kind contributions.

Description of How Program is Funded/Amount of Funding

The Incubator has received the following financial commitments:

- \$50,000 a year from the City of Austin for three years. ATI has received 1989 and 1990 funds, and the city has already committed funds for 1991.
- \$25,000 per year for three years from the Greater Austin Chamber of Commerce. Funds for the first two years have been received. Third year funds have yet to be appropriated.
- \$50,000 per year for two years from private investors.
- \$163,000 of in-kind services were donated by the University of Texas and about 30 local businesses.
- \$70,000 in 1990 from Travis County.

Provisions for Cost Recovery

There are no cost recovery provisions. Tenants are charged a nominal \$0.50 per square foot for space in the Incubator.

Discrimination/Conditionality

There are some conditions for participating in the Incubator, although these are very general. Most importantly, a company must be directed toward providing a product or service based on new technologies or technologically innovative concepts and must have growth potential. Foreign companies are eligible to participate as long as they meet the set criteria.

Summary of Program's Administration and Operation

The Incubator is administered by the University of Texas at Austin Graduate School of Business and the IC² Institute, also part of the University of Texas at Austin. There is a director who oversees day-to-day operations and helps screen applicants for spots in the Incubator. Companies that participate in the Incubator are selected from a pool of applicants by a 14-member advisory committee.

Program Impact and Lessons

It is estimated that the Incubator has created 87 new jobs in its first year of operation and is well on its way toward its three-year goal of 200 new jobs. One important impact of the incubator is helping to attract and encourage high-tech companies to locate in Austin. The director stated that generally this is a more effective approach than promising to create the infrastructure after a company has located in the area.

Name of Program and Government Agency

- State: Texas
- Metropolitan region: Houston
- Program: Small Business Development Center at Victoria

Program Purpose and Objectives

The Small Business Development Center's principal objective is to assist and develop small businesses in a 10-country area surrounding Houston, including Victoria and nine contiguous counties. To achieve this goal, the center provides free counseling to small business owners and managers and to those interested in starting a new business. The SBDC organizes workshops and seminars, and operates a small business incubator.

Industrial Sector

The SBDC does not target any specific industrial sector. The center originally anticipated building on the presence of petrochemical companies, expecting to spark spin-off companies, but this did not happen. It has also attempted to attract assembly and light manufacturing industries, but has had very limited success in this endeavor. The incubator now houses a children's clothing manufacturer, a secretarial service, two distributors, a publishing company, and a printing company.

Classification of Objectives

Program objectives are classified as small business assistance and regional development.

Ranking of Objectives

Program objectives are small business assistance and regional development.

Classification of R&D Type

The SBDC does not actively support research and development, and incubator occupants do not conduct R&D.

Level of R&D Focus

The SBDC does not actively support research and development and incubator occupants do not conduct R&D.

Program Beneficiaries

There are several program beneficiaries. Local small businesses and start-up companies benefit from services provided by the SBDC. Local development agencies, notably the Chamber of Commerce and the Economic Development Corporation, benefit from SBDC research and referrals. The University of Houston at Victoria benefits from SBDC outreach activities and learning opportunities provided to part-time student employees.

Direct or Indirect Benefits

Direct benefits include services such as counseling and workshops provided to local small businesses and start-up companies. Indirect benefits include regional economic growth and economic diversification.

General or Targeted Benefits

Benefits are general in the sense that they are widely available. Most benefits will accrue to small businesses, which will presumably benefit the broader regional economy.

Program Duration and Permanence

The SBDC was started in 1987 with support from the local Economic Development Council, the University of Houston at Victoria, and the City of Victoria.

Types of Potential Subsidy Intervention/Form of Funding

The SBDC does not provide money as part of its services. SBDC does provide free space in the incubator and free counseling. There is a nominal charge for workshops. The SBDC also provides a copy machine and personal computers to the six incubator occupants. The equipment was purchased when the SBDC started operations.

Description of How Program is Funded/Amount of Funding

The SBDC receives in total about \$142,000 annually from three principal sources: the City of Victoria, the State of Texas, and the U.S. Small Business Administration. The City of Victoria owns the building where the SBDC offices and the incubator are located. Although the SBDC pays \$12,000 a year in rent for the space, the money is provided by the Economic Development Corporation from the \$60,000 annual appropriation it receives from the city. SBDC receives about \$90,000 in state funds, appropriated to the University of Houston at Victoria. The SBA provides the SBDC \$40,000 a year from a fund designated to support small business centers.

Provisions for Cost Recovery

There are no cost recovery provisions for this program.

Discrimination/Conditionality

Typically, small businesses participate in SBDC programs, and there are few formal conditions restricting access. Participation in the incubator requires that a company is a start-up and that it has a business plan.

Summary of Program's Administration and Operation

The program is administered by three full-time staff members: a director, counselor, and support staffer. The SBDC also hires part-time students and recent graduates. The SBA and the University of Houston oversee many of the programs. The incubator had an advisory committee for 24 months, but it dissolved when it became clear that its role was limited and did not warrant the effort. The SBDC is considering formulating a new advisory committee to help businesses increase export activities, an area of growing interest among local businesses.

Program Impact and Lessons

The SBDC director said the program's impact has been good, but limited. He emphasized the importance of continually promoting the program and marketing its services. He also emphasized the importance of having a university research base to generate and attract new companies, particularly in high-technology, R&D intensive industries. He noted that the SBDC hoped to build more of a high-technology base in the area by encouraging spin-offs from the petrochemical industries in the area. This has not happened. According to the director, the limited focus on research at the University of Houston at Victoria has forced the SBDC to take a general business orientation.

Name of Program and Government Agency

- State: Texas
- Metropolitan Region: San Antonio
- Program: Texas Research and Technology Foundation

Program Purpose and Objectives

The Foundation's principal objective is to encourage technology-driven economic development. The Foundation achieves this goal by supporting start-up companies and by encouraging research organizations and private companies to locate in the San Antonio/South Texas region. The Foundation has developed the 1500 acre Texas Research Park for high-tech companies to cluster. In addition to research organizations and private companies, the park includes a 20,000 square-foot high-technology incubator. Although it is not yet operating, the incubator will accommodate an estimated 15 companies.

Industrial Sector

The Foundation has been focusing its activities toward the biotechnology sector. The first occupants of the research park are the Institute of Biotechnology and the Bio-containment facility of the Southwestern Foundation for Biomedical Research. Realistically, however, the Texas Research and Technology Foundation expect a much broader group of high-tech industries to locate at the research park, including material science, environmental, computer and electronics, and others.

Classification of Objectives

Objectives can be classified as research and development, sectoral/industrial development, small and medium business assistance, infrastructure development, and regional economic development (San Antonio/South Texas region).

Ranking of Objectives

The Foundation's two top priorities are regional development and sectoral development. Sectoral development here means "high-technology" development, although the Foundation places a special emphasis on biotechnology.

Classification of R&D Type

Most R&D conducted by companies in the Research Park will be either applied research or development work. The Institute of Biotechnology does some basic R&D and it is likely other occupants of the park will too. There is also a requirement that businesses entering the park devote about 15 percent of their activities to R&D.

Level of R&D Focus

The Foundation does not specify the level of R&D targeted. However, R&D activities as a percent of total business activities must exceed a minimum threshold (15%) to be eligible to locate at the park. In general, activities of park occupants will be directed toward the later stages of R&D and technology commercialization.

Program Beneficiaries

Businesses locating at the Research Park will benefit from access to cutting-edge research and university-related activities. They will also benefit from the collaborative environment created at the park and from entrepreneurial services geared toward science and technology companies. The area universities will benefit from faculty cross appointments and from easier recruitment as the park becomes a science magnet in South Texas.

Direct or Indirect Benefits

Direct benefits include a stronger and more diverse regional economy due to the growth of small businesses and start-up companies, job creation, better universities, and a stronger infrastructure supporting high-technology industries. Although the Foundation has been around for several years, the Research Park has only recently started recruiting occupants and therefore has not evaluated program benefits.

General or Targeted Benefits

Benefits are generally available. Although there is some effort to target biotechnology industries within the high-tech sector, a broader group of industries will be involved in the research park and benefits will be widely spread.

Program Duration and Permanence

The Texas Research and Technology Foundation was founded in 1984. The land for the research park was donated in 1986/87 and was developed by 1989. The Foundation is a private nonprofit organization, drawing its funds from private donors.

Types of Potential Subsidy Intervention/Form of Funding

The foundation does not provide funds at this time, although there is some consideration of subsidizing clients in the park for a few years. The incubator will provide standard in-kind services, but no direct financial support.

Description of How Program is Funded/Amount of Funding

The Foundation's work is currently funded by private donors. However, in late 1989, it received \$7.3 million from the City of San Antonio to develop the infrastructure for the 1,500 acre research park. This was a one-time grant made possible by the sale of Cable TV rights. The City of San Antonio also waived fees for building permits, sewer permits, and industrial district fees totalling an estimated \$2.38 million. This money was placed in a trust and is to be used for future improvements in the park. Finally, the City allowed the park a seven year reprieve from city taxes and agreed not to annex the land where the park is situated.

Provisions for Cost Recovery

There are no provisions for cost recovery.

Discrimination/Conditionality

There are no strict conditions for participating in the research park. The Foundation emphasis is on biotechnology companies. Participation is expected to be much broader, although limited to high-tech companies. Incubator occupants will generally be limited to companies close to the product commercialization stage.

Summary of Program's Administration and Operation

The Foundation is run by a president and a 12-member staff who conduct day-to-day operations. This staff is responsible for screening companies locating in the research park and the technology incubator, as well as overseeing the park's operations. There is a Board of Governors, which oversees operations, and a Board of Trustees.

Program Impact and Lessons

The program's impact was described as "improving." One Foundation official explained that the research park was developed before any clients were committed to locating there, revealing one of the most important lessons learned. As a result, the park has been operational for nearly a year, but is only partially occupied. The official noted that it is important to follow standard business practices and procedures, such as developing a business plan, doing pre-marketing, and conducting feasibility studies. It is also important to involve multiple strata of the community.

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XIII. VIRGINIA

Virginia's Center for Innovative Technology (CIT) administers most of the state's technology programs. CIT is a state-sponsored, nonprofit corporation established in 1984. CIT's mission is to promote economic development in the Commonwealth of Virginia through advancing, mobilizing, and transferring scientific, engineering, and technology resources (see Figure 13 for organizational activities).

CIT has a twenty-member board of directors, representing the industrial, business, and academic sectors. Directors are appointed by the governor and serve five-year staggered terms.

CIT's objectives are:

- Increase Virginia's stature as a state which supports high quality research activities and encourages scientific and technological innovation; and
- Improve economic development by mobilizing the state's scientific and technological resources to improve industrial productivity and foster an environment supportive of technology-related business activities.

Through a state-wide network of colleges, universities, and research institutions, CIT operationally supports organizations and projects at several stages of the innovation cycle: basic and applied research, technology development, technology transfer, and technology commercialization.

Research Institutes Program. Four Research Institutes, each centered at one of Virginia's research universities, serve as focal points for jointly sponsored industry/CIT projects. These Research Institutes identify, recommend, and administer cooperative R&D projects in strategic technology fields. Each Research Institute is responsible for the state-wide management of research projects within its technical field. Usually supported for one year, these projects are aimed at enhancing industrial productivity and/or university research facilities. Since 1985, about 500 partnerships between industry and the Research Institutes have been fostered and over two dollars in industry matching funds have been generated for each dollar of CIT research grants support.

Technology Development Centers Program. These Centers are located in university laboratories and conduct industrially oriented research in specific technologies which are deemed

to have economic potential for the state. Since 1987, 10 Centers have been created, each with five-year financial commitments from CIT to ensure self-sufficiency and to develop a critical mass of industrially-oriented research. The Centers are expected to be self-supporting after the initial five-year funding.

Innovation Centers Program. CIT has provided funding to 9 universities to create a network of Entrepreneurship Centers and of Incubators. An Entrepreneurship Center provides outreach services in the form of technical, management, and financial advice to entrepreneurs. An Incubator offers similar assistance and, in addition, provides to start-up firms physical space and shared support services as well as access to university expertise, information, modern facilities, and equipment.

Technology Transfer Program. CIT supports the Virginia Community College System to field technology transfer agents. These agents help established, small to medium-sized businesses solve technology-related problems and improve competitiveness, productivity, and profitability by maximizing new or improved technologies.

Commonwealth Technology Information Service (CTIS). Operated by CIT itself, this Service provides information to businesses on the expertise and research interests of university, government, and industry research personnel, and on research facilities and equipment in the state. CIT also develops, markets, and licenses intellectual property on behalf of state agencies and institutions.

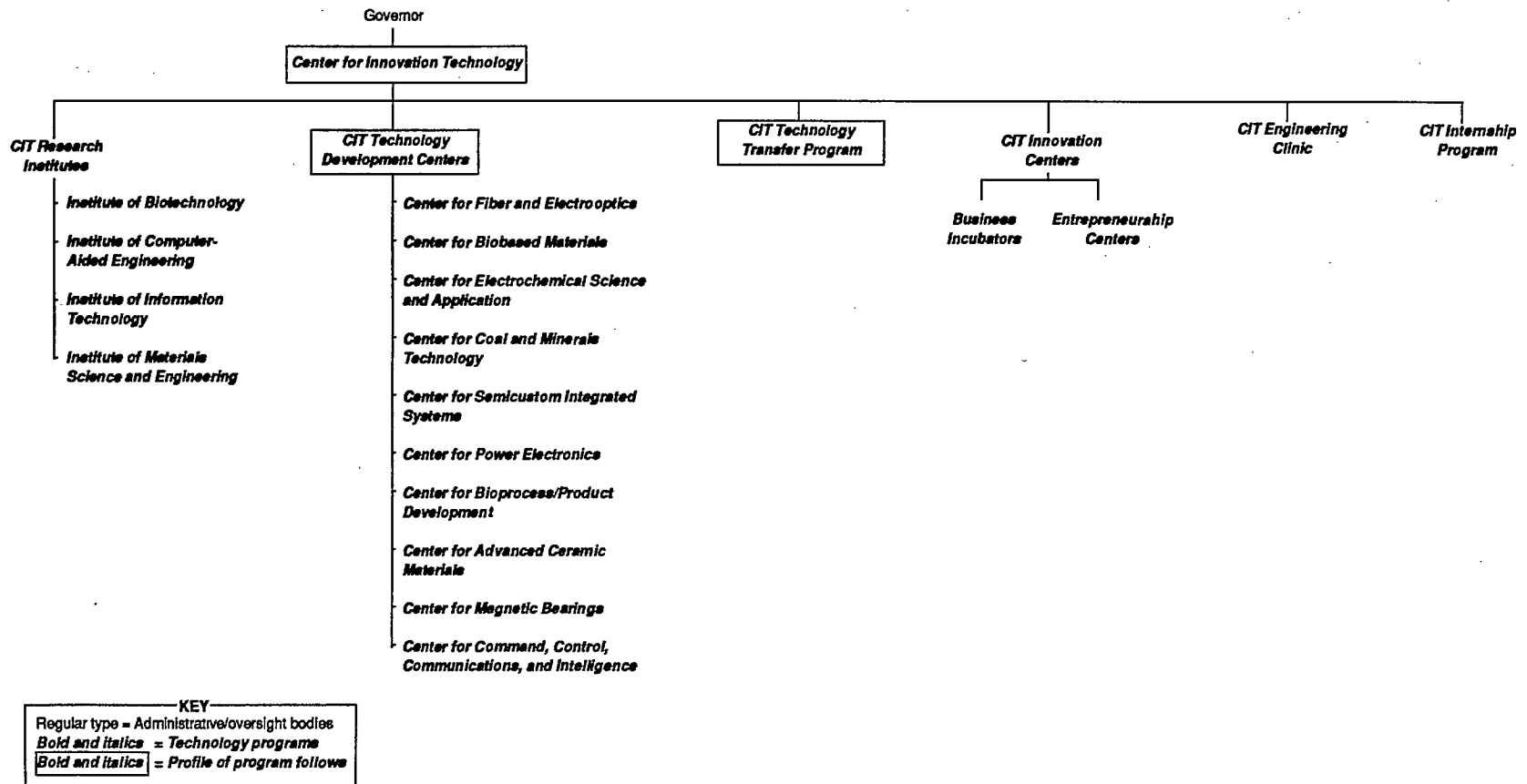


FIGURE 13 ORGANIZATIONAL CHART OF TECHNOLOGY PROGRAMS: VIRGINIA

Name of Program and Government Agency

- State: Virginia
- Program: Center for Innovative Technology

Program Purpose and Objectives

Virginia's Center for Innovative Technology (CIT) is a state-sponsored, nonprofit corporation established in 1984. CIT's mission is to promote economic development in the Commonwealth of Virginia through advancing, mobilizing, and transferring scientific, engineering, and technology resources. Since all of Virginia's state-sponsored science and technology programs are integrated into CIT, all 5 of CIT's research and technology development programs are profiled here together.

CIT has a 20-member Board of Directors, representing the industrial, business, and academic sectors. Directors are appointed by the governor and serve five-year staggered terms.

CIT's objectives are to:

- Increase Virginia's stature as a state which supports high quality research activities and encourages scientific and technological innovation.
- Improve economic development by mobilizing the state's scientific and technological resources to improve industrial productivity and foster an environment supportive of technology-related business activities.

Through a state-wide network of colleges, universities, and research institutions, CIT operationally supports organizations and projects at several stages of the innovation cycle: basic and applied research, technology development, technology transfer, and technology commercialization.

CIT operates five major research and technology development programs, the first two of which are research project oriented and the last three are assistance and service oriented:

- *Research Institutes Program:* Four Research Institutes, each centered at one of Virginia's research universities, serve as focal points for jointly sponsored industry/CIT projects. Research Institutes have been created in biotechnology, computer-aided engineering, information technology, and materials science and engineering. These Research Institutes identify, recommend, and administer cooperative R&D projects in strategic technology fields, that usually are supported for one year. Since 1985, about 500 partnerships between industry and the Research Institutes have been fostered and over two dollars in industry matching funds have been generated for each dollar of CIT grant support.
- *Technology Development Centers Program:* These Centers are located in university laboratories and conduct industrially oriented research in specific technologies which are

deemed to have economic potential for the state. Since 1987, 10 Centers have been created, each with five-year financial commitments from CIT to ensure self-sufficiency and to develop a critical mass of industrially-oriented research. Technology Development Centers have been created in the following fields: fiber and electrooptics, biobased materials, electrochemical science and application, coal and minerals technology, semicustom integrated systems, power electronics, bioprocess/product development, advanced ceramic materials, magnetic bearings, and command, control, communications, and intelligence.

- *Innovation Centers Program:* CIT has provided funding to nine universities to create a network of Entrepreneurship Centers and of Incubators. An Entrepreneurship Center provides outreach services in the form of technical, management, and financial advice to entrepreneurs. An Incubator offers similar assistance and, in addition, provides to start-up firms physical space and shared support services as well as access to university expertise, information, modern facilities, and equipment.
- *Technology Transfer Program:* CIT supports the Virginia Community College System to field technology transfer agents. These agents help established, small to medium-sized businesses solve technology-related problems and improve competitiveness, productivity, and profitability by maximizing new or improved technologies.
- *Commonwealth Technology Information Service (CTIS):* Operated by CIT itself, this Service provides information to businesses on the expertise and research interests of university, government, and industry research personnel, and on research facilities and equipment in the state. CIT also develops, markets, and licenses intellectual property on behalf of state agencies and institutions.

Industrial Sector

CIT's 5 major programs do not restrict their efforts to specific technologies and their targeted industry sectors, although individual Research Institute or Technology Development Centers focus their efforts in specific technological fields, and thus, to those industry sectors.

Classification of Objectives

CIT's Programs can be classified as follows:

- Research and development (with a range from basic research to commercialization of products and processes)
- Sectoral/industry development (with an emphasis on the technology field of each Institute or Center)
- Small and medium-sized business assistance (with an emphasis only in the Technology Transfer Program).

Ranking of Objectives

Other than research and development, the most important specified objective is sectoral/industry development, because only activities in a specified technology field can be supported in each Institute or Center. Of lesser importance is small and medium-sized business assistance, because these companies are emphasized in only one program.

Classification by R&D Type

CIT supports basic research, applied research, and development projects, some in specified technology fields. Because of the wide variety of its programs, the Center's research and development efforts are both generic in nature and specific to products and processes with commercial potential and industrial applications.

Level of R&D Focus

The Center's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate, since there is wide variety within its programs.

Program Beneficiaries

Research and technology-intensive entrepreneurial companies in the state that are related to the technology foci of the Research Institutes and Technology Development Centers are the ultimate program beneficiaries of CIT's two research oriented programs. All established and start-up manufacturing companies in the state are the intended targets for CIT's three assistance and services oriented programs.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the research organization, unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the strengthening of the research and development infrastructure in selected technologies as well as the development of new technology-based products and processes with

near term commercialization potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits may include: increased linkages between the private sector and research institutions not only for advice and assistance but also for collaborative research efforts or other arrangements

General or Targeted Benefits

The research and technology development programs of CIT are available generally to all technology research units of universities and research institutes as well as research and technology-intensive entrepreneurial companies in the state that engage in counterpart technologies. The assistance and services programs of CIT are available generally to all manufacturing firms in the state.

To the extent that research and technology development activities are undertaken by a university or research institute on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host research institution (that generally favor disclosure).

Program Duration and Permanence

CIT was established in 1984 as a state-sponsored, independent, nonprofit corporation. The basic approach of CIT, and the variety and mix of its programs and services, necessarily has evolved since its initiation to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Four of the 5 programs listed make grant awards, the recipients of which are research institutions. Two of these programs are for research and technology development and 2 for assistance and service by research institutions to private companies. The fifth program (CTIS) is a staff program operated by CIT itself.

Description of How Program is Funded/Amount of Funding

Over the 5-year period from FY86 through FY90, CIT made awards totalling about \$39.6 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

CIT does not directly attempt to recover its costs from either the research and technology development programs or assistance and services programs. The two applied research and technology development programs operate on a cost-sharing basis and a royalty or other arrangement also may be negotiated. However, since these research grants are for projects ranging from basic research to commercialization of products and processes, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The formal restriction on CIT's two research and technology development programs is that projects are undertaken only in the selected technology fields of the Research Institute and Technology Development Centers.

Program's Administration and Operation

CIT attempts to facilitate interaction between research institutions and industry that leads to business and economic development and job creation. As a nonprofit corporation positioned between the academic and private sectors, CIT is positioned to foster linkages between them.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of CIT has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Virginia
- Program: CIT Technology Development Centers Program

Program Purpose and Objectives

The CIT Technology Development Centers Program was established within Virginia's Center for Innovative Technology (CIT) in 1986. The objective of this Program is essentially the same as that of CIT as a whole: to promote economic development in the state through advancing, mobilizing, and transferring scientific, engineering, and technology resources.

To achieve this objective, the Program fosters the creation of Technology Development Centers within university laboratories each focused on a different technology (which is deemed to have economic potential for the state) and supports the conduct of industrially-oriented research in those selected technologies. A research project conducted at a Center under this Program is required to have sponsorship and co-support from one or more companies in the industrial sector related to the Center's technologies.

Since 1986, ten Technology Development Centers have been created at the three major state research universities in the following technology fields: fiber and electrooptics, biobased materials, electrochemical science and application, coal and minerals technology, semicustom integrated systems, power electronics, bioprocess/product development, advanced ceramic materials, magnetic bearings, and command, control, communications, and intelligence.

Each Center has received a five-year financial commitment from CIT in order to develop a critical mass of industrially-oriented research and, thereby, to ensure self-sufficiency. A typical Center receives about \$500,000 in its first and second year and about \$100,000 in its fifth year. Thus, with Centers at different stages of development, the budget for the Program ranges from \$2.0 to \$3.0 million.

Industrial Sector

The Program's funding to each Center is limited to the technology field of that Center and, thus, the Program restricts its efforts to the 10 specific technologies and their counterpart industry sectors.

Classification of Objectives

The Technology Development Centers Programs can be classified as follows:

- Research and development (with an emphasis on industrially oriented research)
- Sectoral/industry development (with an emphasis on the technology field of each Center).

Ranking of Objectives

Other than research and development, the only other specified objective is sectoral/industry development, because only activities in a different specified technology field can be supported in each Center.

Classification by R&D Type

The Program funds industrially relevant applied research and technology development in specified technology fields. The Centers' research and development efforts are generic in nature.

Level of R&D Focus

The Program supports research and development efforts which build on and expand existing R&D activities. Research projects at the Centers are directed toward joint industry-Center projects. Thus, they not only build on the existing R&D infrastructure but also create new kinds of applied R&D in new kinds of partnerships.

Program Beneficiaries

Research and technology-based entrepreneurial companies in the state that are related to the technology foci of the Technology Development Centers are the ultimate program beneficiaries of the Program.

To the extent intellectual property and other proprietary rights are involved, the assignment of these rights tends to follow the policies and procedures of the research organization, unless otherwise negotiated.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended

direct benefits are the strengthening of the research and development infrastructure in selected technologies as well as the development of new technology-based products and processes with commercialization potential. In theory, this would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits may include: increased linkages between the private sector and research institutions not only for advice and assistance but also for collaborative research efforts or other arrangements.

General or Targeted Benefits

The Program's investment resources in Centers are available generally to all technology research units of the three major public research universities in the state.

To the extent that research and technology development activities are undertaken by a Center on behalf of, or with, an individual client firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, negotiated agreements, and the policies and procedures of the host university (that generally favor disclosure).

Program Duration and Permanence

The CIT Technology Development Centers Program was created in FY 1986 and the only changes since that date have been the increase in the number of Centers.

Types of Potential Subsidy Intervention/Form of Funding

The Program makes awards in the form of grants to the host university on behalf of the Center.

Description of How Program is Funded/Amount of Funding

Over the four-year period from FY 1986 through FY 1990, the Program made awards totalling over \$15 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Program does not directly attempt to recover its costs from its grants to the Centers. The research projects undertaken by the Centers operate on a cost-sharing basis and a royalty or other arrangement also may be negotiated. However, since these research grants are for applied

research, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

The only formal restriction on the Program is that projects are undertaken by the Centers only in the selected technology fields.

Program's Administration and Operation

The Program operates within the Center for Innovative Technology, a state-sponsored, non-profit corporation established in 1984. CIT has a twenty-member Board of Directors, representing the industrial, business, and academic sectors.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Program has been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Virginia
- Program: CIT Technology Transfer Program

Program Purpose and Objectives

The CIT Technology Transfer Program was established in FY 1988 within Virginia's Center for Innovative Technology (CIT) and in partnership with the Virginia Community College System. The objective of this Program is essentially the same as that of CIT as a whole: to promote economic development in the state through advancing, mobilizing, and transferring scientific, engineering, and technology resources.

To achieve this end, the Program supports a network of technology transfer directors, with broad business backgrounds, working out of community colleges around the state. Currently, there are 11 technology transfer directors operating out of 15 community colleges. These technology transfer directors help established, small to medium-sized businesses improve their competitiveness, productivity, and profitability by maximizing their use of new or improved technologies to solve technology-related business problems and to take advantage of business opportunities.

The types of assistance available include: directly solving problems or determining the need for, identifying, and accessing other expertise, services, or technologies from the host community colleges, universities and federal laboratories in the state, and local private sector experts; finding appropriate technology-based equipment for clients to buy or lease; providing access to the latest scientific and technical information through computer searches; arranging for education and training courses.

Industrial Sector

The Program does not restrict the efforts of the technology transfer agents to specific industry sectors.

Classification of Objectives

The CIT Technology Transfer Program can be classified as follows:

- Research and development (with an emphasis on commercialization of products and processes)
- Small and medium-sized business assistance (with a restriction to such businesses).

Ranking of Objectives

Other than research and development, the only other specified objective is small and medium-sized business assistance.

Classification by R&D Type

Since the Program supports a network of field technology transfer agents in providing direct technical assistance and in locating other experts and resources, it can be implied that the Program supports generic research and development.

Level of R&D Focus

Since the Program's field representatives direct their technical assistance efforts toward the solution of technology-related problems, it builds on the existing R&D and assistance infrastructure, including the network of experts and resources and the Virginia Community College System.

Program Beneficiaries

All established and start-up manufacturing companies in the state are the intended targets for the Program.

Intellectual property and other proprietary rights are not likely to be involved in these assistance activities.

Direct or Indirect Benefits

No formal assessment of the Center's activities has been undertaken and, therefore, no identification of specific direct and/or indirect benefits or beneficiaries has taken place. The intended direct benefits are the improvement of the manufacturers' competitiveness, productivity, and profitability. In theory, this would imply the traditional benefits of jobs/firms created/retained. No indirect benefits have been identified.

General or Targeted Benefits

The assistance services provided by the technology transfer agents under this Program are available generally to all manufacturing companies in the state.

Program Duration and Permanence

The CIT Technology Transfer Program was established in FY 1988 and the only major change since that date has been the more systematic approach toward identifying and accessing back-up resources.

Types of Potential Subsidy Intervention/Form of Funding

The Program makes an award to the Virginia Community College System for the management of the network of field technology transfer agents. The award to each of the participating Community Colleges covers 80 to 90 percent of the operating costs, with the institution providing the remaining resources.

Description of How Program is Funded/Amount of Funding

Over the four year period from FY 1988 through FY 1990, the Program made awards totalling about \$3.0 million. All state funds are from state general tax revenue.

Provisions for Cost Recovery

The Program makes no attempt to recover its total costs for the field representatives and the network support through the Virginia Community College System. There is no fee for the technical services for initial screening, analysis, and assessment review and for the assistance in researching, evaluating, and implementing technology- and productivity-related solutions to a companies problems or improvements in their product or manufacturing processes. There is no charge either for the field representative or for the resource support network. Fees may be required for the follow-on assistance by consultants and organizations. It may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Program's support of assistance services by the field technology transfer agents.

Program's Administration and Operation

The Program operates within the Center for Innovative Technology, a state-sponsored, nonprofit corporation, established in 1984. CIT has a twenty-member Board of Directors, representing the industrial, business, and academic sectors.

Project Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Program have been undertaken and no information has been systematically collected documenting the program's impact.

Name of Program and Government Agency

- State: Virginia
- Metropolitan Region: Northern Virginia
- Program: George Mason University Entrepreneurship Center

Program Purpose and Objectives

The George Mason University Entrepreneurship Center is comprised of the Entrepreneurship Development Program (a Small Business Development Center) and a Business Incubator. Although the Center was formally created in 1988, some of the programs it administers had been at the university for several years.

The Center's programs are directed at established business and industrial firms as well as small and emerging companies based in the state or doing substantial business there. Drawing on a singular combination of university, private, state, and federal resources in northern Virginia, the Center, through its programs, acts as a broker to assist businesses in developing both their domestic and export activities. Through the local business and university communities, participants received guidance, advice, and counseling on starting, growing, and running a business.

The Entrepreneurship Development Program assist business growth by providing outreach services in the form of technical, management, and financial advice to entrepreneurs and by increasing access to financing and other strategic contacts. The Program services include informational materials and seminars as well as short- and long-term free managerial consulting by staff and business and industrial volunteers (e.g., SCORE and the leadership and employees of the 100 private firms in the region that form the Century Club). The program also operates a small business financial exchange database which will be used to help match companies with potential sources of funds. The Program also provides businesses access to the Commonwealth Technology Information Service, a state-of-the-art information system cataloging the state's technology and research resources. The program assists over 500 companies and entrepreneurs a year.

The Incubator Program provides direct assistance to selected companies in the start-up or early stage of development. It houses small technology-based companies in an environment conducive to their success at a moderate cost. In addition, it offers tenants access to shared common facilities, partially subsidized professional services, university resources (e.g., expertise, information, and modern facilities and equipment), financing and other business contacts.

Industrial Sector

The Center's programs do not restrict their efforts to specific industry sectors.

Classification of Objectives

The Center's provision of both incubator facilities and advisory services can be classified as: Research and development, regional development, and small and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the other two specified objectives would be approximately equal.

Classification by R&D Type

Incubator tenant firms are all technology based, a characteristic shared by a much smaller percentage of companies receiving technical, managerial, and financing services under the Entrepreneurship Development program. To the extent that technology-oriented companies are involved, the companies assisted by the Center's programs will tend to be undertaking applied research and technology development activities leading to a prototype. These activities will tend to range from generic research and development to those involving specific technologies leading to products and processes with commercial potential and industrial applications.

Level of R&D Focus

With the variety of organizations assisted by the Center's programs and the variety of activities they undertake, the client companies' research and development efforts will tend to build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

The near-term, direct beneficiaries of the Center's existence, its incubator facility and assistance services, and its location within a research university are the individual entrepreneurs, new firms, growing companies, and established businesses assisted as well as the state and region.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing, companies. This would imply the traditional benefits of jobs/firms created/retained as the longer term benefit.

General or Targeted Benefits

The facilities and services of the Center's programs are available generally to all industrial companies and business firms, although technology-intensive, start-ups or young, growing companies are the only ones eligible for the incubator facility.

Program Duration and Permanence

The Center was launched in 1988, although some of the programs it administers had been at the university for several years. The Center's approach has not changed since its initiation, although its programs evolve to address changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The Center's programs provide only incubator space and shared services to their incubator tenants and technical, managerial, and financing services and network brokering to business firms and industrial companies in the region.

Description of How Program is Funded/Amount of Funding

The Center's incubator is supported by a grant from Virginia's Center for Innovative Technology (CIT) through its Business Incubators program. The Center's technical, managerial, and financing assistance programs are supported by grants from CIT's Entrepreneurship Centers' program and the US SBA. The state funds are from state general tax revenue.

Provisions for Cost Recovery

Since awards to the Center are grants, the state makes no provision for cost recovery. However, it may be implied that the state expects to recover its investment costs over the long term through increased personal and corporate taxes and reduced unemployment, welfare, or other transfer payments.

Discrimination/Conditionality

There are no formal or informal restrictions on the Center's operation of the incubator or its provision of assistance and services, except that the programs are limited to entrepreneurs and companies in the state.

Program's Administration and Operation

The Center has a governing board, representing the private and academic sectors, that sets policy for its operations.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Center's incubator/assistance services program effort has been undertaken and only limited information has been systematically collected documenting its impact.

Name of Program and Government Agency

- State: Virginia
- Metropolitan Region: Blacksburg
- Program: Virginia Tech Corporate Research Center

Program Purpose and Objectives

The Virginia Tech Corporate Research Center, organized in 1985 as a wholly-owned subsidiary of the Virginia Tech Foundation, is intended to strengthen the R&D and educational linkages between the university and private sector firms.

Located on 120 acres adjacent to the main campus and university airport, the Center provides building sites for lease to companies that wish to develop or expand a research relationship with the university. An innovation center provides facilities for start-up companies requiring the support and expertise of university programs. A variety of network services (telephone and data), video services (satellite facilities and video production), and media services are offered the Center's tenants through the University's communications utility network.

The Foundation purchased and deeded over to the Center the land and assisted the Center in obtaining federally guaranteed bonds for four buildings. In addition, the Foundation guaranteed, if needed, \$4.2 million of operating capital over ten years. To date, approximately \$13.5 million in capital improvements have been made to the research park.

Over 500 people are employed by companies and organizations in four Center Buildings that total over 100,000 square feet of space.

Industrial Sector

The Center does not restrict its occupant companies to specific industry sectors.

Classification of Objectives

The Center's overall objectives can be classified as: Research and development, regional development, and small- and medium-sized business assistance.

Ranking of Objectives

Other than research and development, the most important specified objective would be regional development with small and medium-sized business assistance of lesser importance.

Classification by R&D Type

The private and academic research organizations located at the Center undertake basic and applied research as well as technology development. They support projects ranging from generic research and development to those involving specific technologies.

Level of R&D Focus

With the variety of organizations at the Center and the variety of activities they undertake, the Center's occupants' research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

The near-term, direct beneficiaries of the Center's existence, its facilities and services, and its location adjacent to a research university are the research facilities of the private and academic organizations at the Center itself as well as the state and region to the extent such organizations were recruited from outside the state.

Direct or Indirect Benefits

The intended direct benefits are the development or recruitment of new, or expansion of existing, research-intensive or technology-based private and academic organizations. This would imply the traditional benefits of jobs/firms created/retained as well as personal, property, and business taxes paid.

General or Targeted Benefits

The facilities and services of the Center are available generally to all research-intensive or technology-based private, academic, and government sector organizations, although laboratories and other research facilities are encouraged.

Program Duration and Permanence

The Center was established in 1985 and its concept has not changed since its initiation. The Center's future plans include developing and implementing strategies for increasing the size of the research park, constructing new buildings, and bringing in new corporate and government tenants. Particular attention is being given to locating large corporate tenants in the Center. In

addition, the Center intends to work with current tenants, helping them to grow, identify new markets, and adapt new technologies.

Types of Potential Subsidy Intervention/Form of Funding

Not applicable. The Center only leases land and building space and provides some shared services and access to university expertise. The Center received the basic support for its development from the Foundation which is a nonprofit corporation, in but not of the university.

Description of How Program is Funded/Amount of Funding

The Center received no direct funds from the state or federal government, although the bonds for its buildings are guaranteed by the federal government and the capital for its operations is guaranteed by the Foundation for ten years. From the lease of land and other Park services, the Research Triangle Foundation is expected eventually to become self-supporting.

Provisions for Cost Recovery

To the extent that costs are recovered by the Foundation, they occur through the leases of land and charges for other services.

Discrimination/Conditionality

There are no formal or informal restrictions on the research and other activities conducted by organizations at the Center.

Program's Administration and Operation

The Center has a Board of Directors, representing the private and academic sectors, that sets policy for its operations.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations of the Center have been undertaken and information has been systematically collected documenting the program's impact in such terms as numbers and types of organizations located in the Center and their number of employees.

Name of Program and Government Agency

- State: Virginia
- Metropolitan Region: Charlottesville
- Program: The Institute of Computer-Aided Engineering

Program Purpose and Objectives

The Institute of Computer-Aided Engineering, headquartered at the campus of the University of Virginia, was created in FY85 as one of the four Research Institutes of Virginia's Center for Innovative technology (CIT). The Institute builds upon two decades of research work in industrial automation and computer-aided engineering at the University.

The objective of the Institute is to facilitate the Research, development, and ultimate commercialization of improved design and manufacturing techniques using computer-aided engineering technologies. These techniques have direct applications in design automation, robotics/automated manufacturing, visual and tactile sensors for automation, very large scale integrated (VLSI) electronic circuits, and manufacturing processes.

In order to achieve this objective, the Institute solicits, reviews, makes recommendations on funding, and administers projects at all the state's universities for joint industry/university research and development efforts, technology transfer to industry, and collaboration between industrial and academic organizations. To this end, the Institute operates as a "Center Without Walls," that is, that is essentially the administrative arm of CIT in the field of computer-aided engineering.

The funded projects, usually for one year's duration and conducted at universities, complement the research capabilities of the universities in computer-aided engineering and expand their existing efforts. The Institute provides many benefits to the firms co-supporting the projects by creating a mechanism by which companies interested in computer-aided design and manufacturing techniques can interact with university researchers. The companies have the opportunity to build relationships with universities possessing the expertise to develop and transfer practical applications of research into the marketplace. Through the funded projects, the companies have access to specialized material, equipment, and laboratory space.

Industrial Sector

The Institute does not restrict its efforts to specific industry sectors, although industrial sectors with a need for computer-aided engineering technologies are more likely to avail themselves of the services of the Institute.

Classification of Objectives

The Institute's program can be classified as: research and development and regional development.

Ranking of Objectives

Other than research and development, regional development would be the only important objective.

Classification By R&D Type

The Institute supports the undertaking of applied research and development projects in computer-aided engineering technology that have potential for commercialization.

Level of R&D Focus

The Institute's research and development efforts build on and expand existing R&D activities as well as establish new R&D activities as appropriate.

Program Beneficiaries

All design and manufacturing companies in the region and the state that seek to improve their productivity are the primary intended beneficiaries.

To the extent intellectual property and other proprietary rights are involved, the participating research universities retain these rights unless otherwise negotiated.

Direct or Indirect Benefits

The intended direct benefits are the development of new or improved design and manufacturing techniques and technologies with near-term commercialization potential. This would imply the traditional benefits of jobs/firms created/retained. Implied indirect benefits include increased linkages between the private sector and the participating research institutions for collaborative research efforts or other arrangements and assistance.

General or Targeted Benefits

The sponsorship of the joint industry/university research and development projects supported through the Institute are available generally to design and manufacturing companies in the region and the state. To the extent that research and technology development activities are undertaken on behalf of, or with, an individual sponsoring firm or consortia thereof, the results may or may not be available publicly at all or on a timely basis, depending upon the general type of the project, its proprietary nature, and negotiated agreements.

Program Duration and Permanence

The Institute was established in 1985. Its basic approach has not changed since its initiation and the variety and mix of its activities have evolved to meet changing needs and opportunities.

Types of Potential Subsidy Intervention/Form of Funding

The Institute supports joint industry/university research and development projects at research universities throughout the state. Projects recommended for grant funding and administered by the Institute are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners. The remaining funds of the Institute come from an annual grant provided under CIT's Research Institutes program.

Description of How Program Is Funded/Amount of Funding

Funding for the Institute's project grants is provided through CIT's Research Institutes program. All state funds are from state general tax revenue.

Provisions for Cost Recovery

Neither the Institute nor the state directly attempt to recover all their costs from the research and development projects. Except for certain core staff activities related to proposal and project administration, all research projects supported through the Institute are industry-driven with one or more industrial partners and with at least half of its support coming from those participating industrial partners.

Discrimination/Conditionality

The only formal restriction on the Institute's research and development activities is that projects are undertaken only in the computer-aided engineering technology field.

Summary of Program's Administration and Operation

The Institute has a scientific advisory group with both industry and university members that recommends projects for final CIT approval.

Program Impact and Lessons

No formal, publicly-available, third-party evaluations, legislative reports, or internal self evaluations of the Institute has been undertaken and no information has been systematically collected documenting its impact.

VIRGINIA

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