# State and Local Initiatives on Productivity, Technology, and Innovation: Enhancing a National Resource for International Competitiveness

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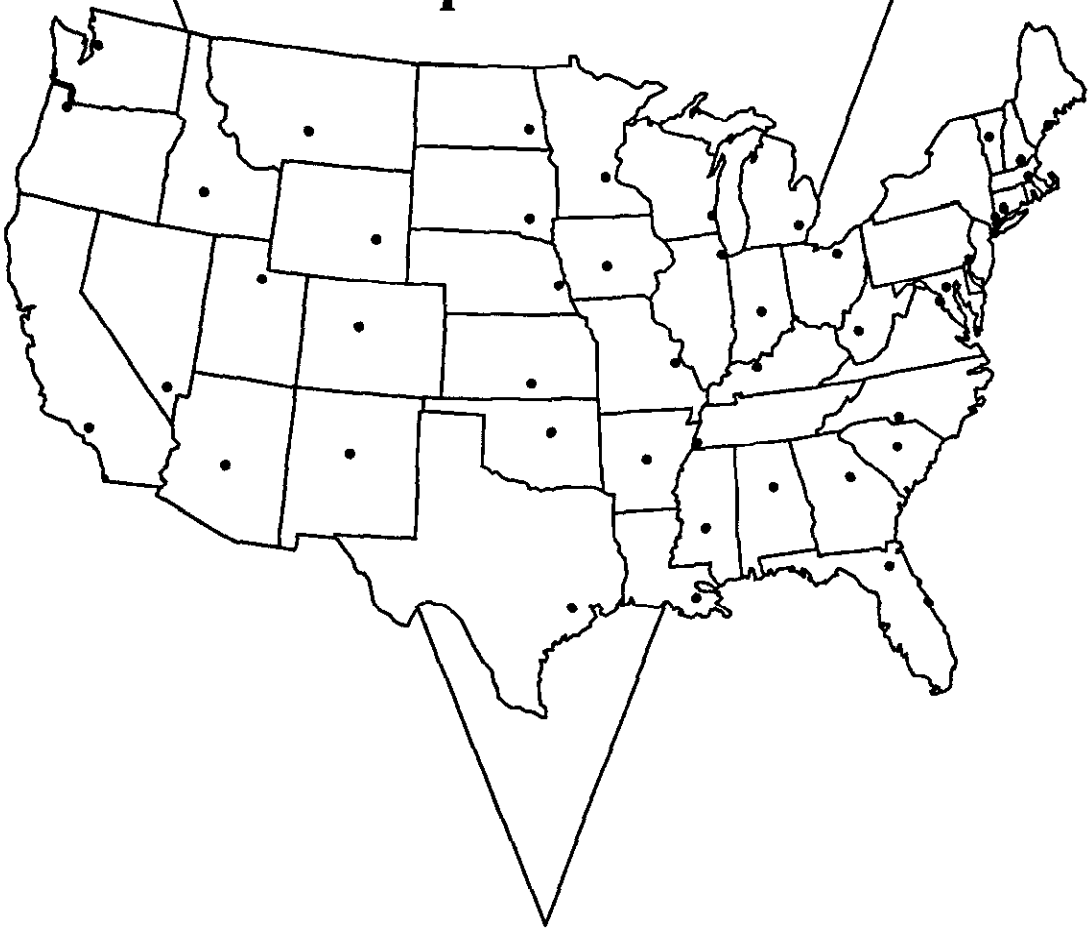
# State and Local Initiatives on Productivity, Technology, and Innovation: Enhancing a National Resource for International Competitiveness



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## Preface

The competitiveness of American business in the global economy has become a pervasive challenge to be reckoned with in policymaking by all governments in our federal system. As such, competitiveness has become a prominent motivator of innovations in state and local economic development programs.

The *Omnibus Trade and Competitiveness Act of 1988* (Section 5122) established a Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation in the U.S. Department of Commerce. In introducing this proposal, Sen. Dale Bumpers of Arkansas noted that many state and local governments are "acting boldly and pragmatically" to address the competitiveness issue. His proposal was a modest one to assist state and local governments in their efforts to enhance business competitiveness by spreading the word about the many creative steps being taken by those governments.

Because this new Clearinghouse needs to be connected closely to the activities of state and local governments, as well as to related activities of the federal government, the U.S. Department of Commerce concluded an interagency agreement with the Advisory Commission on Intergovernmental Relations to develop strong relationships with state and local governments and to assist in designing appropriate roles for the new Clearinghouse that would be of greatest support to state and local competitiveness initiatives.

The Commission staff conducted a year of research and consultation with state and local governments, appropriate federal agencies, and a range of private-sector organizations. On September 28, 1989, the Commission delivered to the Department of Commerce a report, based on these consultations and its own research, which recommended an overall design for the Clearinghouse and a series of priority activities.

The key finding of the research is that many of the functions envisioned for the Clearinghouse are being performed by a variety of state, local, and federal agencies, and by some private units. Thus, establishing a nonduplicating niche is essential for the new Clearinghouse.

Initial funding for the Clearinghouse is small ($250,000 per year), prospects for major increases are dim, and parallel activities exist. Therefore, the most effective contribution the new Clearinghouse can make will be to link the other actors together into a readily accessible and highly utilized network. The ACIR strategy urges implementation of such a network, with the new Clearinghouse serving to enhance the operations of the other actors.

The report prepared for the U.S. Department of Commerce provided a basis for Commission findings and recommendations, which were adopted by the Commission at its meeting on January 26, 1990.

***Robert B. Hawkins, Jr.***
***Chairman***

## Acknowledgments

Barbara J. Lipman was the Project Director and principal author of the report. She was assisted by ACIR staff members Marcia Carroll, Lori Coffel, Andree Reeves, and David Schaller.

The project resulted from an interagency agreement with the U.S. Department of Commerce. A Clearinghouse organization was established within the Department of Commerce by the *Omnibus Trade and Competitiveness Act of 1988* and was staffed by Thornton (Tip) Parker, Elizabeth Robertson, and Dick Johnson. Special thanks are expressed to Tip Parker for initiating contact with ACIR and providing steady guidance throughout the project. Others at the Department of Commerce who were helpful in this project were Bob Chapman, Larry Casey, David Edgerly, Mary Ann Knauss, Ted Lettes, Marci Levin, Carol Ann Mears, and Jack Williams.

A parallel project was undertaken by the National Governors' Association and the National Institute of Standards and Technology under the *Omnibus Trade and Competitiveness Act of 1988* to inventory state technology extension programs. Special thanks are expressed to Marianne Clarke and Tim Masanz of NGA for coordination with the Commission's project and access to NGA's committee of state science and technology advisors.

Thanks are expressed also to Marta Goldsmith, Edward Kelly, Louis Mogavero, Sally Rood, and Kenneth Susskind for preparing research papers on special topics of relevance to the Commission's work.

The Commission consulted with hundreds of individuals for the project in seven meetings at the Commission offices, by phone, and in person. Most of these individuals are listed in the *Guide to Professional Program Developers and Administrators* (page 144).

ACIR is grateful for the advice, materials, and criticisms offered throughout the project by all of those persons mentioned above. Full responsibility for the content of this report, however, lies with the Commission and its staff.

***John Kincaid***
***Executive Director***

***Bruce D. McDowell***
***Director, Government Policy Research***

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# ACIR Findings and Recommendations

## Findings

### 1. Internationally Competitive Businesses Must Be State of the Art, Highly Productive, Farsighted, and Wise to the Ways of International Markets

Many businesses achieve these characteristics on their own, but others need help in doing so. They may need help to acquire new technologies; install flexible manufacturing processes that can be more responsive to quickly changing markets; obtain favorable financing (whether it be seed capital, venture capital, or permanent capitalization); develop adequate management capacity; understand export markets; have access to trained labor pools, obtain space to expand; and enjoy good labor-management cooperation, a favorable business climate, and adequate patent protection. A business may need only one or a few types of assistance, but, in the aggregate, the business community—especially smaller businesses—is likely to need all of these forms of assistance to achieve its full potential for succeeding in increasingly demanding domestic and international markets.

### 2. Many Sources of Assistance Exist

Many state and local governments offer assistance through such programs as business incubators, venture capital, seed capital, foreign investment, research parks, export marketing services, vocational and technical training, higher education, and joint industry/academic research and development resources. At the same time, the federal government offers assistance in (1) commercializing federal research findings, (2) disseminating published federal research results, (3) making federal laboratories available for testing and for joint research and development projects with industry and academic institutions, and (4) supporting small business development.

Several national clearinghouses assist businesses in finding information about federal, state, and local initiatives for productivity and technology improvements. These include the NGA/NIST survey of state technology extension services, the joint information program of the National League of Cities and Public Technologies Incorporated, the NTIS Center for Utilization of Federal Technology, the Department of Commerce Productivity Center, the NASA technology utilization centers, the Federal Laboratories Consortium, the Small Business Development Centers, the Technology Applications Information System of the Strategic Defense Initiative Organization, and the *Catalog of Federal Domestic Assistance*.

One recent survey suggests that state governments have taken the lead in providing assistance to help U.S. manufacturers obtain and use technologies, modernize manufacturing processes, and improve productivity and profitability. Of the $620 million identified by the National Governors' Association and the National Institute of Standards and Technology as being spent on such programs in 1988, state governments provided 48 percent of the funding and the federal government provided 26 percent; the remaining 26 percent came from a combination of industry, university, and local government sources.

### 3. Three Types of Assistance Are Available from Existing Sources

Some sources of assistance provide only passive information dissemination. Examples are program catalogs and directories, passive clearinghouses, newsletters, and articles.

Other sources provide brokering services; that is, they attempt to match businesses with information and assistance related directly to identified needs. Examples include interactive clearinghouses, public economic development agencies, and private technology and management improvement brokers.

Still other sources of assistance provide hands-on help. Examples include federal laboratories, university research units, joint ventures among industries (including industry/federal and industry/university consortiums), business assistance offices, job training and education units, and financial institutions.

A business may need only one type of assistance, but it is important to have all three available for those that may need them.

### 4. Despite the Seeming Surfeit of Information Sources, Deficiencies Exist

Many businesses and the state, local, and federal officials attempting to serve them are unaware of the variety of resources available to them in the productivity, technology, and innovation field. Furthermore, it is not easy to obtain this information.

For example, an evaluation of 19 recently prepared directories of technology and productivity programs shows substantial information overlap, but also some gaps. In large part, these limitations reflect differences in objectives and targeted audiences. Some directories are designed primarily as "phone books." They list contact information for a broad array of programs, but provide little or no descriptive information. Other directories identify state programs within a particular category: for example, capital assistance programs or university-based technology centers. Still other directories review initiatives for a selected number of states. Although the directories taken as a whole provide a good picture of federal and state activities, few people have access to all of them. There is little information in these directories about local initiatives.

Another limitation of directories is that they become out-of-date quickly as states create new programs and dismantle or restructure old ones. State and local officials usually resist resurveys because of the administrative burdens. Such resistance is strongest when the survey comes from a far-off federal agency with little prospect of returning benefits to the respondent.

### 5. Technology and Productivity Innovations Have Not Been Analyzed Adequately

Most clearinghouses and directories of state, local, and federal initiatives on productivity, technology, and innovation are largely or completely descriptive. They give little guidance to a potential imitator as to what works best and the conditions under which success can be attained. Some of the best known programs have been evaluated,

and the National Conference of State Legislatures maintains a computerized file of program evaluations performed for legislative audit purposes, but there is relatively little agreement about how such programs should be evaluated and the validity of the evaluations. In addition, there has been little evaluation across groups of programs of similar types. Thus, it is difficult to advise the Congress, state legislatures, city and county governing bodies, and others about what works best, where, and under what conditions.

Although the *Omnibus Trade and Competitiveness Act of 1988* prohibits the Clearinghouse from evaluating individual state and local initiatives unless requested to do so by the program's sponsor, the Act clearly anticipates the Clearinghouse providing policy analysis that could help elected officials choose better programs for future support. This could be accomplished by peer reviews of groups of programs, focusing on a "lessons learned" approach rather than on comparisons and/or ratings of individual programs. To assist others in evaluating programs, the Clearinghouse could develop, through broad consultation processes, sound evaluation criteria to be applied sensitively by others to productivity and technology innovations.

### 6. Experiences of Earlier Clearinghouses Offer Lessons for Success

Some Clearinghouses that have emphasized the accumulation of large amounts of disparate information in a single data bank have become too difficult to maintain, too impersonal, and too remote from the sources of hands-on assistance that a business often needs to cope with specific problems. Often, requests for information are difficult to frame in terms that elicit an appropriate response from the system, and, frequently, the response produces much irrelevant information. Cooperation from data suppliers usually wanes after the initial start up, and maintenance costs grow too high. In short, smaller, decentralized, relatively specialized clearinghouses operating close to their information sources have proven to be more successful than the larger, more diffuse efforts.

### 7. Many Constituents Can Benefit from the Clearinghouse Established by the Omnibus Trade and Competitiveness Act of 1988

State and local governments want more timely information about each others' technology and productivity innovations, as well as analytical guidance about which ones work best under what conditions. In addition, they want information about sources of federal assistance to be more readily available. At the same time, federal agencies charged with responsibility for promoting the commercialization of federal research could use this Clearinghouse to help market their inventions and research findings more effectively to a broader range of state and local governments and businesses. The Congress expects assistance from the Clearinghouse in helping it to determine the best ways to reinforce state and local efforts to enhance the competitiveness of American businesses and stimulate the growth of the nation's economy.

## Recommendations

*Recommendation 1*

### Establishing the Clearinghouse Operation

The Commission finds that improving the ability of American business to compete successfully in world markets is an urgent national objective, and that state and local governments are well equipped to assist in achieving this objective. It is in the national interest, and relatively inexpensive, for the federal government to encourage and reinforce state and local initiatives toward this end by performing certain clearinghouse functions designed to interrelate activities and improve the effectiveness of any existing clearinghouses.

***The Commission recommends, therefore, that the U.S. Department of Commerce quickly put into operation an effective Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation in accordance with the* Omnibus Trade and Competitiveness Act of 1988, *and that the initial activities of this Clearinghouse include: (1) maximum utilization of existing information sources provided by the state, local, and federal governments; (2) promotion of and assistance for the efficient development of these existing sources of information about productivity, technology, and innovation; and (3) an analytical function that will help government officials involved in such activities identify and assess initiatives that work best.***

*Recommendation 2*

### Developing a Network of Affiliated Organizations

The Commission finds that many state, local, and federal officials, and private-sector organizations and individuals promote productivity, technology, and related innovations to help American businesses achieve greater competitiveness in international markets. These officials and their private-sector counterparts generally are eager to participate in national efforts to improve the success of their activities. In fact, many of them contributed substantially and enthusiastically to the Commission's study of appropriate designs for the Clearinghouse. Their expertise is a valuable resource that cannot be recreated by a national agency.

In particular, the Commission finds that a wide array of national clearinghouses are relevant to the role of the Clearinghouse established by the *Omnibus Trade and Competitiveness Act of 1988.* These clearinghouses perform useful tasks and have developed constituencies that are vital to accomplishing the goals established for the Clearinghouse by the Congress. Together, they possess resources far in excess of those available to the new Clearinghouse. Yet, their resources are stretched thin and there is duplication among them.

***The Commission recommends, therefore, that the U.S. Department of Commerce reach out to all relevant state, local, and federal officials, and others, including those in the business and the academic communities, to encourage their participation in the activities of the Clearinghouse. More particularly, the Commission recommends that the existing national clearinghouses in the field of productivity, technology, and innovation affiliate themselves with this new Clearinghouse in the U.S. Department of Commerce, and provide services in cooperation with the other clearinghouses in the network of affiliates.***

*Recommendation 3*

**Focusing Limited Federal Funding on Existing Clearinghouses**

The Commission finds that various federal agencies have contributed substantial resources for many years to national clearinghouses of information related to productivity, technology, and innovation. Prominent among agencies providing such funding are the Economic Development Administration, the National Institute of Standards and Technology, the federal laboratories of many agencies and departments, and the National Science Foundation. Nevertheless, federal resources for these purposes have become increasingly scarce in recent years. The resources available to the existing national clearinghouses in the productivity, technology, and innovation field, on which the new Clearinghouse must depend, are declining and are only marginally adequate at best.

***The Commission recommends, therefore, that appropriate federal agencies consider focusing the use of their funds for national clearinghouses on those that participate actively in the new Clearinghouse.***

*Recommendation 4*

**Reconsidering the Level of Federal Funding**

The Commission finds unanimous agreement among all the interests consulted that the current federal funding for the new Clearinghouse is inadequate to achieve full success even with the most noncentralized form of activity. At a minimum, the Clearinghouse needs a small core staff, a regular newsletter, a secretariat function to support a variety of working groups, an analytical capability, and a modest amount of seed money for enhancing the capacity of existing national clearinghouses and establishing one or more new ones to fill gaps in existing information sources, such as the relative scarcity of information about local initiatives.

***The Commission recommends, therefore, that the Congress and the Administration review the present funding available to the Clearinghouse carefully and increase it as the Clearinghouse demonstrates its ability to make effective use of its funding for the purposes recommended in this report. The President and the Congress should evaluate thoroughly the effectiveness and role of the Clearinghouse during its fifth year of operation to make sure that its reauthorization continues to be in the national interest.***

# Scope and Design of the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation

Submitted to the U.S. Department of Commerce
September 28, 1989

## Abstract

The *Omnibus Trade and Competitiveness Act of 1988* established the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation in the U.S. Department of Commerce. The Clearinghouse was intended to make available information on state and local efforts to help American businesses become more competitive in world markets. It also is concerned with federal policies and programs that encourage or inhibit state and local initiatives.

The primary purpose of the Clearinghouse is to create a nationwide awareness of these state and local initiatives and to assess their usefulness and the degree to which they can be replicated. An additional purpose of the Clearinghouse is to make available to state and local governments information about federal resources they can use to assist the business community.

Many of the individuals consulted about the Clearinghouse role are active either in planning or operating federal, state, and local initiatives, or in providing technical assistance, information, and support to those who do. A large number of national clearinghouses compile information about these activities.

These findings lead to the conclusion that the Clearinghouse should build on and enhance the efforts of other organizations. This can be accomplished by (1) identifying "who is doing what" and what organizations provide assistance to program managers and policymakers; (2) fostering resource and experience sharing among those who provide information and assistance to businesses; and (3) providing an analytical perspective on the variety and effectiveness of federal, state, and local initiatives and distilling lessons learned about "what works where."

Although it is difficult to predict precisely the specific questions that will be asked of the Clearinghouse, a number of issues likely will be of concern to its federal, state, and local constituents. These include examples or program models to assist in program design, methods for refining the operations of programs in place, and suggested criteria for measuring program effectiveness.

It is anticipated that most requests from businesses will continue to be directed to other clearinghouses, state and local governments, federal laboratories, and a wide range of technology brokers that already provide such assistance.

By focusing its efforts on those who assist businesses, by organizing these resources into an effective network, and by providing an analytical lens through which to develop a picture of "what works where," the Clearinghouse for State and Local Initiatives on Productivity, Technology and Innovation will make a significant contribution toward improving the international competitiveness of American businesses.

# Introduction

When Sen. Dale Bumpers introduced the legislation to establish a Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation, he cited the national concern about declining American competitiveness abroad—in both manufacturing and services—and the paucity of federal efforts to correct the problem. He pointed out that many of the boldest and most pragmatic strategies to counteract this trend are being pursued by state and local governments, where the effects of eroding competitiveness hit home, where necessity demands specific solutions to particular problems, and where ideological debates quickly become irrelevant.

Examples of state and local initiatives include an agency in California that guarantees 85 percent repayment on bank loans to small companies that develop new exports; the Arkansas Science and Technology Authority, which identifies and applies new technologies in partnership with industry; and joint university and private sector efforts in many states to educate and train workers in new manufacturing techniques.

Including the authorizing legislation for the Clearinghouse in the *Omnibus Trade and Competitiveness Act of 1988* highlights the sense of urgency and concern. The legislation also concerns the ways that existing federal initiatives impede or enhance state and local efforts. In fact, another section of the act creates a new state technology extension program, to be operated by the National Institute of Standards and Technology (NIST), to help transfer existing technologies to businesses.

## The Clearinghouse Legislation

Specifically, the Clearinghouse is intended to serve as a central mechanism for making available information on (1) the initiatives undertaken by state and local governments to enhance the competitiveness of American business through the stimulation of productivity, technology, and innovation; and (2) federal efforts to assist state and local governments to enhance competitiveness.

The legislation enables the Clearinghouse to establish working relationships with all governments; provide technical assistance; collect and disseminate information on the nature, extent, and effects of initiatives; disseminate information through conferences, handbooks, and seminars; enter into contracts for the collection of information; and develop evaluation methodologies. The Clearinghouse is prohibited from evaluating individual state and local programs unless specifically requested to do so by the state or locality.

The Clearinghouse was established by law at the U.S. Department of Commerce (see Exhibit 1 for the enabling legislation). Because of the emphasis on the relationship between federal, state, and local initiatives, the Department enlisted the assistance of the U.S. Advisory Commission on Intergovernmental Relations (ACIR) in designing an appropriate scope and role for the Clearinghouse and in developing an implementation plan.

## Fundamental Principles for the Clearinghouse Design and Operation

This report recommends an appropriate scope and role for the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. The recommendations in this report are based on consultations with a broad spectrum of public and private interests.

To a large extent, the purpose and mission of the Clearinghouse are mandated by the *Omnibus Trade and Competitiveness Act of 1988.* The Clearinghouse grew out of a concern for the declining competitiveness of American business. Recognizing that government initiatives to counteract this trend have been localized, varied, creative, and piecemeal, the Congress intended the Clearinghouse to serve as a central mechanism for making available information on (1) the initiatives of state and local governments to enhance the competitiveness of American business through the stimulation of productivity, technology, and innovation; and (2) federal efforts to assist state and local governments to enhance competitiveness.

ACIR and the Department of Commerce heard many suggestions and ideas for sharpening the focus of the Clearinghouse, refining its role, and guiding its operations. *Almost 200 organizations and individuals from the public, private, and nonprofit sectors; from federal, state, and local programs and perspectives; and from rural and urban localities were consulted.* Issue papers were commissioned from independent consultants, and special analyses of existing sources of federal, state, and local program information were undertaken by ACIR and the Department of Commerce.

Out of this process, several fundamental points about an appropriate scope and role for the Clearinghouse emerged:

- *A great deal of information* on federal, state, and, to a lesser extent, local initiatives on productivity, technology, and innovation is *collected and disseminated* by a variety of public and private organizations.
- Existing information is formatted in many ways for different purposes and different audiences. Some information is collected and updated systematically while some is gathered in an ad hoc and fragmented fashion. *There is considerable duplication of effort in some areas and considerable gaps in others where information is either unavailable or out-of-date.*
- Program managers familiar with one set of program experiences, personal contacts, or data sources tend to be unaware of many of the others. A surprising number of clearinghouses try to integrate information, but *many people do not know about the availability of these resources.* For example, state and local officials expressed the view that it is difficult to find information on federal initiatives to support their programs. There are, however, several readily available resources that compile federal program information.
- Although information is collected on the various *types* of federal, state, and local initiatives, little is known about "what works where." The little analysis that has been done in this area is scattered and

not obtained easily. Thus, *providing an analytical focus would be a unique niche for the Clearinghouse.*

- The Clearinghouse should not seek to be all things to all people. *Given its modest resources, it should phase in its operations gradually,* concentrating first on federal, state, and local government entities, and producing a few early and tangible products.
- Among the major players in the field, there is a reasonably high level of enthusiasm, tempered by realistic expectations about the resources available to the Clearinghouse. The Clearinghouse should continue the process of consultation it has started and build on this base of support by encouraging *continued participation of its constituents in the Clearinghouse agenda and affairs.*

The recommended scope and role for the Clearinghouse is, therefore, a restatement of the broader congressional intent. It is based on an important lesson learned in the course of consulting many potential constituents of the Clearinghouse: *The appropriate niche for the Clearinghouse is one that will build on the distinguished work of others, increase knowledge and contact among those trying to achieve complementary objectives, and fill the gaps in the understanding about which policies appear to be most effective where, when, and how.*

### Who the Clearinghouse Should Serve

**The primary constituents of the Clearinghouse should be federal, state, and local agencies, with other intermediaries phased in as resources permit.**

The consensus was that the primary constituents of the Clearinghouse should be the individuals and organizations that create and operate federal, state, and local initiatives that foster technology, productivity, and innovation. Given the modest resources of the Clearinghouse, this emphasis should be phased in by concentrating first on *federal, state, and local governmental initiatives.* Initial focus on government program managers and policymakers presents a clearly defined set of users who have at least a somewhat narrowed set of priorities and with whom the Clearinghouse can establish a rapport.

In addition to federal agencies, the *Congress* is an especially important national audience for information on state and local initiatives and the degree to which they are impeded or enhanced by federal programs, resources, and regulations.

Some private sector representatives agreed that this governmental focus is appropriate. Those businesses that are targeted by federal, state, and local programs, and that pay tax dollars to support those programs, stand to benefit from this early governmental emphasis as well.

In its day-to-day operations, the Clearinghouse can be wide ranging in terms of organizations with which it establishes linkages and resource sharing. There are many groups receiving private funding or only partial government funding that have much to offer in the way of helping federal, state, and local government program managers assist businesses.

### The Mission of the Clearinghouse

**The Clearinghouse should serve as a *repository* of "who is doing what" in the area of federal, state, and local initiatives to enhance competitiveness. As a part of its repository function, the Clearinghouse should locate existing directories, surveys, program guides, handbooks, and assessments and work to increase access to this material through existing organizations.**

Specific Clearinghouse activities should include:

- Maintaining a current contact list of individuals and organizations active in federal, state, and local initiatives;
- Ascertaining which organizations do a thorough job of producing or collecting information and making arrangements to coordinate activities;
- Producing bibliographic guides to publicize existing resources and making them available to federal, state, and local program managers and policymakers;
- Identifying topics for which information is not available or up to date and seeking to fill those gaps, either through its own efforts or by funding others.

**The Clearinghouse should serve as a *network,* fostering resource and experience sharing among those who provide information and assistance to help businesses become more competitive. It should build knowledge and foster contacts among those trying to achieve complementary objectives, encourage intergovernmental cooperation, and increase awareness of the data and information capacity of existing organizations.**

Specific Clearinghouse activities should include:

- "Keeping in touch" by establishing a continuing relationship with Clearinghouse constituents through an informal Operations Group;
- Setting up small, ad hoc working groups to address the issues and agenda items identified as priorities by members of the group and others;
- Contributing to the conferences and workshops held by other organizations to spread the word about projects and products.

**The Clearinghouse should serve as an *analytical institution* concerned with the variety and effectiveness of state, local, and federal initiatives. As part of this function, the Clearinghouse should develop an analytical framework for understanding the role that these initiatives play in enhancing the competitiveness of American business; document the different forms these initiatives take in achieving this objective; and investigate the lessons learned about "what works where."**

Specific Clearinghouse activities should include:

- Developing an analytical framework by which

to categorize federal, state, and local initiatives and using this framework to guide the agenda for Clearinghouse operations;

- Organizing comprehensive analyses or case studies by recognized experts on selected classes of initiatives in response to the needs and priorities of Clearinghouse constituents;
- Examining outside assessments and evaluations and producing a "state-of-the-art" report on the questions posed, methodologies employed, criteria used, conclusions reached, and current thinking in the field;
- Drawing on its pool of participating program managers and experts to validate and critique the analyses and case studies carried out as part of this effort.

### Administrative Aspects of the Clearinghouse

**The *credibility* of the Clearinghouse is its currency among federal, state, and local program managers and policymakers. The principles guiding the daily operations of the Clearinghouse, therefore, must develop and enhance this intangible but essential attribute.**

The Clearinghouse should operate by the following principles:

- Avoid setting an agenda that exceeds its limited resources.
- Build institutional knowledge on the part of Clearinghouse staff concerning federal, state, and local initiatives.
- Cultivate a "personal touch" in working with Clearinghouse constituents.
- Concentrate on organizing resources before marketing services.
- Solicit the internal support and resources of the new Technology Administration and the Department of Commerce as a whole.

### Clearinghouse Operations

#### THE REPOSITORY FUNCTION

**The Clearinghouse should serve as a *repository* of "who is doing what" in the area of federal, state, and local initiatives to enhance competitiveness. As part of this function, the Clearinghouse should locate directories, surveys, program guides, handbooks, and assessments, and work to increase access to this material through existing organizations.**

#### A Current List of Contacts

Many of the individuals consulted about the Clearinghouse role are active in planning or operating federal, state, and local initiatives, or in providing technical assistance, information, and support to those who do. Some play a passive role by disseminating information on request or by publishing newsletters and articles (such as the *Tech Notes*, distributed by the National Technical Information Service). Others take a more active "brokering" role by linking those requesting assistance with the appropriate information source (for example, linking up an entrepreneurial firm with a public agency). Still others render direct personalized assistance (as in the case of a federal laboratory employee providing outreach to a specific company). All of these mechanisms of transferring knowledge have strengths and limitations, and all have potential links to the Clearinghouse.

The planning process for the Clearinghouse has produced a pool of organizations and individuals that are experts in their respective areas and who are informed and enthusiastic about the Clearinghouse and its activities. They are candidates for sharing information with each other and with the Clearinghouse, serving on the Clearinghouse Operations Group to develop an agenda, and participating in working groups focusing on issues close to their area of expertise. These experts also act as sources of information about projects and programs for inclusion in Clearinghouse activities. They publicize these activities to those with whom they come in daily contact.

Therefore, *an early and useful product for the Clearinghouse is the list of contacts, and maintaining and expanding that list*. Two other important resources should be added to this basic list: (1) program managers and operators responding to the survey carried out by the National Institute of Standards and Technology and the National Governors' Association under part of the Trade Act, and (2) the 1989 Directory of Federal and State Assistance to New and Growing Companies, which contains the latest contact information for a variety of federal business assistance programs.

ACIR has provided all three items to the Department of Commerce. An early Clearinghouse task should be to categorize the individual contacts on this list according to the type of assistance they can provide either to businesses or to other public agencies.

#### Locate and Leverage Sources of Information

*The Clearinghouse should locate information on federal, state, and local initiatives and work with the organizations that have assembled this material to determine how it might be updated, maintained, and made available to federal, state, and local program managers and policymakers.*

It is difficult to predict precisely who will be in contact with the Clearinghouse and what they will ask. Still, if federal, state, and local government program managers and policymakers are the primary constituents, inquirers may come with questions such as: How does one go about setting up a revolving seed capital fund for developing prototypes of innovative products? What is the best way to design application materials for an incubator program for small technology-based manufacturers? How do we strengthen the linkages between our local university and industries to commercialize new technologies more quickly? How can we fine tune our export promotion initiative to target the firms we assist? Are there other criteria besides jobs creation that we should be using to judge the effectiveness of our technology commercialization efforts?

What is a proper mix of technology development and technical training programs? What initiatives are most appropriate for rural settings? Whom can I talk to who has done this before?

Obviously, different resources are required to answer these questions. The Clearinghouse has the means of linking its constituents with the network of organizations and individuals that have resources and experiences in many areas of program planning, design, operations, and assessment. As it builds its institutional knowledge, the Clearinghouse will be able to provide guidance to states and localities on the lessons learned about "what works where."

When the Clearinghouse receives inquiries about specific technologies or processes or particular advances in scientific research, it will refer these calls to the appropriate laboratory, university, or federal, state, or local agency. While the Clearinghouse will not solicit direct inquiries from individual firms, such calls will be referred to the appropriate public agency or other source of business assistance.

One of the first tasks confronting the Clearinghouse, therefore, is to develop the proper linkages with the many organizations that provide information on productivity, technology, and innovation.

Many public policy organizations representing state and local governments actively provide technical assistance and information to their members. A number of these organizations collect the same information and package it in different ways for their respective audiences. While different audiences may require particular emphases or unique formatting of information, there is some duplication of effort. The Clearinghouse needs to determine what it can do to encourage and coordinate the expansion and sharing of these resources.

For some organizations, the collection and provision of information to their members and to the public is a profit-making enterprise. For others, it is merely a service they are expected to provide. Now that many of these organizations have been identified through the Clearinghouse planning process, *an early task of the Clearinghouse will be to approach these groups individually and to find out what data collection services they want to provide, what they want to discontinue, what they want to keep proprietary, and what they are unable to maintain*. Based on this assessment, the Clearinghouse should enter into agreements to guarantee access to material and resources to a wider audience. Such agreements could include help with questionnaire development and surveying, in-kind contributions of computer and analysis time, or direct financial assistance.

**Bibliographies and Resource Guides**

*The Clearinghouse can perform a useful service simply by summarizing the kinds of resources available and publishing a bibliographic guide on what they contain and how to obtain them.*

Although there is no established annual or biennial census of state and local initiatives, some organizations have collected and assembled information on an ad hoc basis. Clearinghouse staff examined a number of directories of initiatives, including the Minnesota study of state science and technology programs, the Northeast-Midwest Governors case studies of economic development programs, two surveys by the National Association of State Development Agencies, and a directory of business assistance from the Small Business Administration.

Simply increasing awareness of these guides would be a low-cost way to fulfill part of the repository role of the Clearinghouse. The Clearinghouse can review these directories and produce a written guide to their usefulness: the type of information they contain, how they are indexed, when they were updated, and where to obtain them. ACIR has completed a guide to published resources, a guide to resources in clearinghouses, and a guide to program developers and administrators.

The guides also will serve to address the concerns expressed by state and local officials that *federal* program information is not easily accessible. In fact, a number of information sources on federal programs do exist, although they may not be well advertised or affordable. If the latter is the problem, the Clearinghouse should seek ways to lower the cost of producing these guides (through encouraging cooperative ventures) or to produce less expensive versions (by circulating the subset of information that is of greatest interest to Clearinghouse constituents).

The Department of Commerce is perhaps its own best resource of federal program information on innovation and competitiveness. For example, the National Technical Information Service (NTIS), publishes the Directory of Federal and State Assistance to New and Growing Companies, and distributes many other federal directories. The National Institute of Standards and Technology (NIST) is a direct provider of technical information and assistance to businesses. NIST's new activities under the same Trade Act that authorized the Clearinghouse include a joint survey with the National Governors' Association on state technology programs and a new federal initiative known as the State Technical Extension Program. These agencies are natural conduits for information that will be an integral part of the Clearinghouse's database on federal programs.

The Economic Development Administration (EDA) is another agency that has much to offer the Clearinghouse. EDA funds the production of a number of handbooks and guides for state and local economic development officials to help them plan, operate, and assess their programs.

**Identifying Gaps in Information**

*The Clearinghouse should identify gaps where information is not collected or current. Under the guidance of its constituents, the Clearinghouse should help develop an appropriate format for the information to be collected and the means to fill those gaps. This task should be connected closely to the other main functions of the Clearinghouse: networking and analysis.*

In establishing its repository of "who is doing what, where, and how" on federal, state, and local initiatives, the Clearinghouse is fortunate to be able to build on the distinguished work of others. Some of these program directories were examined by Clearinghouse staff and found to vary considerably in the type of programs covered and the scope of information provided (see Table 1). Some directories fo-

**Milestones for the Repository Role**

| Activity | Month to be Completed |
|---|---|
| **Internal Database** | |
| ACIR contact list on-line | *Completed* |
| NTIS federal and state assistance catalog on-line | *Completed* |
| NIST/NGA survey results on-line | *Completed* |
| Produce bibliography of guides to federal, state and local programs | *Completed* |
| Produce guide to clearinghouses | *Completed* |
| Begin to expand on-line listings | *November 1989 (on-going)* |
| **Establish Linkages** | |
| Analyze directories for gaps | *Completed* |
| Approach organizations individually for assessment of resource sharing | *January 1990* |
| Begin arrangements for new data collection | *February 1990 (on-going)* |
| Begin coordination arrangements with selected organizations | *March 1990 (on-going)* |

cus exclusively on technology development programs; others concentrate on a single aspect of economic development, such as access to finance; and still others include a broad array of state economic development programs.

The detail varies substantially among directories. A number of directories are essentially program listings with little descriptive information. Most directories provide brief program summaries that frequently include information on goals, services offered, and contacts. Only a few select a limited number of state programs and analyze them in detail. Finally, few directories provide information on local initiatives.

For the most part, individual directories do not provide a complete listing of all the economic development programs within a given state or all of the programs of a specific type across the nation. (Table 2, which classifies business development programs in the State of Massachusetts, illustrates the point.) This means that any effort to identify comprehensively a full set of programs must rely on a number of directories.

Recently, some efforts have been made to increase the comprehensiveness of available information. For example, besides the NIST/NGA survey of state technology programs, the National Science Foundation is completing a study on state research and development activities. The results of both will be made available to the Clearinghouse for the purpose of cataloging programs.

While useful, such surveys are only one mechanism for data collection, and they have limitations. For one thing, they are unlikely to capture the nuances of program design or to reveal the politics underlying a state or local initiative. Another problem is that survey information in the field of competitiveness—where things are changing quickly—means that the information collected soon becomes dated. The way to overcome both problems is to speak directly with program participants. The Clearinghouse contact list, and active participation by the Clearinghouse in workshops and conferences, can promote direct contact and information exchange among participants.

Another outgrowth of the Clearinghouse repository function is the collection (or access to a collection) of model programs that will be of interest to other states and localities. For this purpose, massive amounts of data for each state or for each of the 3,042 counties are less important than is highlighting good examples of a relatively few program types. Here, as part of its analytical function, the Clearinghouse may want to commission case studies to capture the kind of comprehensive information that Clearinghouse constituents will find useful.

Where the Clearinghouse is able to identify gaps in information, data collection efforts could be funded for organizations well positioned via expertise or membership to collect the needed material.

NETWORKING FUNCTION

**The Clearinghouse should serve as a *network*, fostering resource and experience sharing among those who provide information and assistance to businesses. It should build knowledge and promote contacts among those trying to achieve complementary objectives, encourage intergovernmental cooperation, and increase awareness of the data and information capacity of organizations.**

### The Case for Cooperation

The Clearinghouse will rely ultimately on the experience and expertise of those who plan, manage, and operate federal, state, and local initiatives, as well as on various other organizations involved in economic development. To promote the sharing of resources and experience, the Clearinghouse must forge an enduring and cooperative working relationship with these organizations.

Key among the organizations that should be affiliated with the Clearinghouse effort are:

Sources of information about local government initiatives (e.g., the joint information center of the National League of Cities and Public Technologies, Inc., plus the National Council on Urban Economic Development);

Sources of information about state government initiatives (e.g., the National Institute of Standards and Technology and the National Governors' Association, which recently completed the survey on state technology programs);

Sources of information about assistance to small businesses (e.g., the Small Business Development Centers);

Sources of information about initiatives targeted to rural areas (e.g., the National Rural Information Clearinghouse); and

Sources of information about federal government initiatives (e.g., the National Technical Information Service, the Federal Laboratory Consortium, and the Technology Utilization Centers of NASA).

*This cooperative approach will build on a process begun with the series of ACIR "Thinkers' Sessions."* In these sessions, potential Clearinghouse constituents and others played an integral role in developing a conceptual framework for the Clearinghouse and a workable plan for implementing it. Indeed, the Thinkers' Sessions have generated enthusiasm for and raised the expectation of continued involvement by constituents in the Clearinghouse operation.

Specifically, establishing an ongoing cooperative relationship between the Clearinghouse and its constituents would:

Allow the Clearinghouse to keep its finger on the pulse of its clientele and ensure that the Clearinghouse does not operate in a vacuum;

Leverage Clearinghouse resources by drawing on the experience of others;

Strengthen the Clearinghouse's credibility—especially critical during its early years—in the eyes of state and local governments;

Publicize Clearinghouse efforts; and

Engender realistic expectations among potential constituents concerning the kinds of activities that can be accomplished with Clearinghouse resources.

**Clearinghouse Operations Group**

*A Clearinghouse Operations Group composed of representative constituents should be established.* This group could meet on an as-needed basis to:

1) Recommend priorities for each year's activities;
2) Help the Clearinghouse staff identify gaps and outdated material in the Clearinghouse database;
3) Act as a sounding board to ensure the quality and relevance of Clearinghouse products; and
4) Suggest key issues that should be addressed in detail by working groups convened to assist with specific projects.

Two potential options exist for convening meetings of this Operations Group. *The first option would be for ACIR, or another intergovernmental organization, to act as convener. The second option would be for public policy groups that represent state and local interests to rotate as the convener of such meetings.* The reason for sharing responsibility for convening these meetings is to ensure active participation by a wide range of state and local public policy groups.

*The Operations Group should involve individuals who plan, manage, and operate federal, state, and local initiatives.* These program managers are direct beneficiaries of Clearinghouse information and have first-hand technical program experience. *Public policy organizations* representing state and local interests also should be included. The National Governors' Association, the National Conference of State Legislatures, the Council of State Governments, the National League of Cities, the U.S. Conference of Mayors, the International City Management Association, the National Association of Counties, the National Association of Towns and Townships, and the National Council for Urban Economic Development are some of the many public policy organizations that should be involved.

Given the Clearinghouse's unique analytical role, it also is important to include *recognized experts* in the fields of technology, economic development, and program assessment in these meetings.

Although *business interests* are not the primary audience for direct involvement in Clearinghouse activities, they are the ultimate beneficiaries of the information and programs administered and operated by Clearinghouse constituents. Therefore, they also should be involved.

These meetings on Clearinghouse operations should be large and varied enough to include key representatives of Clearinghouse constituents, but should not be so large as to make the group unwieldy and unfocused. A good place to begin the search for potential representatives is the contact list of organizations active in the ACIR Thinkers' Sessions.

**Participation in Conferences and Workshops**

The Clearinghouse should participate in and contribute to the conferences and workshops *held by other organizations* to publicize Clearinghouse projects and products and to keep the Clearinghouse current on the projects and products of others.

A vital networking tool for the Clearinghouse is attendance at the meetings, conferences, and workshops sponsored by national public policy organizations and intergovernmental groups to spread the word about Clearinghouse activities and to keep abreast of new initiatives and programs.

The Operations Group could help facilitate contacts with conference sponsors and suggest further networking efforts, such as *regular mailings* alerting potential constituents to Clearinghouse activities.

**Working Groups**

*The Clearinghouse, after consultation with potential constituents, should establish working groups to address specific issues in greater depth.* Working groups necessarily would have a more focused membership (i.e., individuals who have technical knowledge about a particular program or initiative type or who are trained in program evaluation and cost-benefit analysis). Such an approach would expand the body of expertise available to the Clearinghouse and increase the Clearinghouse's ability to gather program information and develop its credibility and usefulness.

Examples of issues that working groups could address would include: strategies for strengthening linkages among other national clearinghouses; analysis of federal efforts to commercialize federal technology; the extent to which states have used incubator facilities successfully to foster new firms; preparation of a state-of-the-art report on evaluations and studies of state and local technology initiatives; and development of methodological guidelines that program managers and policymakers could use in assessing their own programs.

Products of these Working Groups might include recommendations to the Congress concerning proposed legislation; recommendations to federal agencies on removing regulations that inhibit technology initiatives; reports on lessons learned from specific state and local initiatives and the degree to which such initiatives can be replicated in other states or localities; and meetings or conferences focused on particular topics.

A few examples of working group agendas follow.

*Working Group Example #1*
**Improving Linkages with Other National Clearinghouses**

**Issue:** How can cooperation and coordination be improved among the various national clearinghouses that provide information and assistance to states and localities on productivity, technology, and innovation?

**Background:** A range of federally sponsored and public interest clearinghouses provide information and technical assistance on economic development and technology transfer issues to states, localities, and private businesses. Because many of these clearinghouses compete with one another, there may be a natural reluctance to share information. Consequently, many clearinghouses gather essentially the same data, resulting in costly duplication of efforts and gaps in the aggregate database.

Such duplication and gaps could be avoided or minimized by better coordination among clearinghouses. Furthermore, many states and localities desiring assistance are unaware of the clearinghouses.

ACIR has produced a guide that identifies the national clearinghouses, and a digest that summarizes the information contained in 19 directories of federal, state, and local economic development initiatives.

**Tasks:** A working group of affiliated clearinghouses can be convened to focus on improving coordination and operating efficiencies.

Issues that could be addressed include: ways to overcome proprietary concerns and encourage information sharing; cost-effective ways to collect, organize, and disseminate information; identification of information gaps; ways to reduce duplication of efforts; agreements under which individual clearinghouses might specialize in specific areas; and potential funding mechanisms to support essential clearinghouse efforts.

**Suggested Organizations:** Community Information Exchange, National League of Cities' Local Exchange, National Conference of State Legislatures' LEGISNET, NGA State Technology Programs Information Base, Department of Education's ERIC Clearinghouse, Department of Agriculture's Rural Information Exchange, and Federal Laboratory Consortium Clearinghouse.

*Working Group Example #2*
**"State-of-the-Art" Review of Assessments of State Technology Programs**

**Issue:** To critique and validate a "state-of-the-art" report that identifies and reviews assessments and studies of the effectiveness of state technology programs.

**Background:** Many entities assess and evaluate state technology programs. States prepare program performance audits in response to sunset requirements and other legislative requirements. The National Conference of State Legislatures has compiled about 35 audits of economic and technology development programs in 19 states. In addition, academics, private consultants, and public interest groups have undertaken such assessments, often with public funding.

**Tasks:** The Clearinghouse could undertake or commission a report that identifies and reviews the various studies assessing and evaluating state technology programs. The report would review methodologies employed, criteria used, and lessons learned.

A working group could be convened to provide leads for locating evaluations and to suggest a program focus (e.g., state technology transfer initiatives, incubators, or financial assistance programs). Once the report has been drafted, the working group could review it before it is published and disseminated to Clearinghouse constituents. This state-of-the-art report could be the basis for formulating guidelines that states and localities might follow in assessing their own programs.

**Suggested Organizations:** National Conference of State Legislatures; Council for Urban Economic Development; National Governors' Association, and National Research Council; individual state program managers and authors of books examining state technology programs; the Economic Development Administration, which has commissioned handbooks and program assessment guides; and private consulting organizations, such as Battelle, The Urban Institute, and SRI, which have prepared assessments for states and localities.

**Milestones for the Networking Role**

| Activity | Month to be Completed |
|---|---|
| **Operations Group** | |
| Begin to identify representatives and a convener for Clearinghouse Operations Group | *October 1989* |
| **Conferences and Outreach** | |
| Coordinate with public interest groups to attend and participate in their scheduled conferences | *November 1989 (on-going)* |
| **Working Groups** | |
| Establish first working group on topic chosen by Clearinghouse constituents | *December 1989* |

*Working Group Example #3*
**Commercialization of Federal Technology**

**Issue:** How can federal efforts to promote the commercialization of federal technology be improved? More specifically, how can state and local programs better use the Federal Laboratory Consortium as a resource in assisting businesses?

**Background:** The *Stevenson-Wydler Technology Innovation Act* directs federal agencies and laboratories conducting research and development to identify technology having

potential commercial application and to take steps to encourage the transfer of this technology to the private sector.

For a variety of reasons, the private sector has not utilized fully the available federal technology and expertise. These reasons include a lack of awareness of federal technology resources on the part of business, a perception by businesses that federal technology is too complex for their needs, and a federal approach toward technology transfer that is largely random and uncoordinated rather than systematic.

**Tasks:** Building on the Clearinghouse research paper on the process of transferring federal technology (see Appendix A), the Working Group could focus on current mechanisms used by federal agencies to transfer technology to the private sector and, more specifically, recommend ways in which states can make better use of the Federal Laboratory Consortium as a resource in assisting businesses.

**Suggested Organizations:** Federal Laboratory Consortium; National Technical Information Service/Center for the Utilization of Federal Technology; program managers of specific state and local technology transfer programs; private-sector technology transfer experts; university-based technology centers; and one or two technology-based firms.

ANALYTICAL ROLE

**The Clearinghouse should serve as an *analytical institution* concerned with the variety and effectiveness of state, local, and federal initiatives. As part of this function, the Clearinghouse should develop an analytical framework for understanding the role that federal, state, and local initiatives play in enhancing the competitiveness of American business; document the different forms these initiatives take in achieving this objective; and investigate the lessons learned about "what works where."**

### Lessons Learned about Types of Initiatives

A careful and practical distinction can be made between evaluating a specific initiative and analyzing a category of program. *The Clearinghouse should take a "lessons learned" approach as opposed to evaluating and ranking individual programs.*

The legislation gives the Clearinghouse the green light to develop methodologies to examine the extent, nature, and effects of state and local programs. Many participants in the Clearinghouse planning process were enthusiastic about creating a role for the Clearinghouse in providing an analytical focus to descriptive material on state and local initiatives. *While recognizing that direct federal assessment is inappropriate, many of those presenting this viewpoint urged the Clearinghouse to work toward developing a framework for looking at initiatives and determining "lessons learned" about "what works where, when, and how."*

This sort of analysis could fill a definite need. Most of the guides to federal, state, and local programs are intended primarily as catalogs, not as tools for analysis. What is lacking from most of these sources is a hard look at the effectiveness of each initiative or strategy. They do not undertake a systematic analysis of the probable costs and benefits of one economic development tactic over another. Nor do they consider the portfolio of total state and local development activities and the appropriateness of this mix of activities to the geographic and economic context of the locale. Few of these directories address the issue of *why* the initiative was designed the way it was, and *why* any other locality might want to replicate it.

Moreover, in the Thinkers' Sessions, both policymakers with a national perspective and, significantly, state program managers expressed a desire to "operate by something more than the seat-of-the-pants." Because scarce resources are devoted to these experimental initiatives, there is much to be gained from the experiences of others who have gone before. From program design issues to the targeting of limited funds to the self-assessment of programs by managers, the lessons learned can provide a key to understanding what kinds of strategic investments are most promising and under what circumstances.

*The unique contribution of the Clearinghouse will be its national perspective.* It will be in a position to discern patterns among initiatives. It can document the overlap of programs within geographic areas and the regional variations among them. It can shed light on the extent to which similar programs in adjacent states complement each other or cancel each other out. And, it can examine the effect of federal programs and regulations on state and local programs, and work toward encouraging federal actions that foster state and local innovation and removing impediments that stifle grass roots creativity. Of particular importance to its mission and operation, the Clearinghouse can begin to examine the question of whether initiatives can be transferred and replicated successfully among states and localities?

To make this analytic process work, consider it a four-tier process, as depicted in Figure 1. Tiers 1 and 2 establish the analytic framework, as explained below. Tiers 3 and 4 refer to building the agenda around that framework.

### A Framework for Analysis

Recognizing that no single analytical framework can encompass all aspects of initiatives in productivity, technology, and innovation, *the Clearinghouse should adopt the analytical scheme that is deemed most useful in the eyes of Clearinghouse constituents and use this framework to flesh out its agenda for analysis.*

Although knowledgeable observers agree that there is no one way to view initiatives to enhance competitiveness, they also agree that so little work has been done in the area that analytical efforts are hampered by a lack of common definitions or even standardized categories of initiatives on which to base the analysis. Moreover, no single source provides generic descriptions of models to assist those designing programs. Admittedly, creating a common language among disparate audiences and activities is a difficult and daunting task beyond the resources of the Clearinghouse. However, the Clearinghouse could strive to develop a consistent framework as a basis on which to build its operations and as a part of its function as an analytical institution. If it proves useful, the framework might be adopted to guide the work of others outside the Clearinghouse.

**Milestones for the Analytical Role**

| Activity | Month to be Completed |
|---|---|
| **Understanding the Role of Initiatives** | |
| Designation of an appropriate framework for future activities (Tier 1) | *December 1989* |
| Begin categorizing initiative types (Tier 2) | *January 1990 (on-going)* |
| Choose priority initiatives for further study | *February 1990* |
| **Document Different Forms Initiatives Take** | |
| Assemble material on program models for selected initiatives (Tier 3) | *February 1990 (on-going)* |
| **Investigate "What Works Where"** | |
| Convene Working Group to identify studies for "state-of-the-art" report | *February 1990* |
| Commission or undertake study of program models for selected initiative (Tier 4) | *March 1990* |
| Begin disseminating to Congress and other federal agencies | *August 1990* |

Based on the discussions in the Thinkers' Sessions and a review of the typologies used in directories, there are several possibilities for adopting a framework. These include the steps in the technological innovation process, the industry life-cycle trend, and the flaws in economic conditions.

*Once the framework is selected, the generic types of federal, state and local initiatives—for example, a manufacturing modernization program, a venture capital fund, or a technical training program—can be arrayed against the framework. Then, based on the perceptions and priorities of Clearinghouse constituents, some of these can be singled out for more detailed studies.* These more detailed examinations would address such issues as: What are the two or three most common organizational forms? In what economic or political contexts do these forms tend to arise? What would be appropriate criteria for judging the effectiveness of these forms?

Figure 1 shows how this "tier system" would work and why it would be useful. It starts with the recognition that state and local programs such as modernizing manufacturing, risk financing, and technology training represent a departure from traditional local economic development strategies. These new initiatives seek to generate new jobs from the indigenous economic base, as opposed to attracting them from elsewhere in the region. The question is, how does this approach to economic development fit into the scheme of increased competitiveness?

Consider these initiatives from the perspective of the industry life cycle. Tier 1 in the diagram represents this chosen analytical framework. The life-cycle concept depicts the stages of growth of an industry, from conception and birth to emerging growth to development and diversification to maturity to death. Needs vary as the industry passes through the stages of the cycle. Firms in infant industries need assistance in research and development, or in the production of a prototype. Firms in an industry in the launching stage require help with marketing and manufacturing. Firms in mature industries may need both technical and financial assistance for adopting an automated manufacturing process.

Tier 2 in the diagram represents the arraying of general program types against the life cycle. Seed capital funds intervene at the emergence stage, for instance. Technology brokering programs seek to apply new processes to industries in the maturity stage. Technical training programs are likely to help firms in several phases, including early development and automation. Why is it useful to know this? Because by systematically laying out the goals of these programs against the natural process they are trying to influence one can begin to address questions about their design and effectiveness.

**Building the Research Agenda around the Analytical Framework**

With the advice of many program managers, policymakers, and experts, *the framework should be used to set the agenda and priorities for data collection, workshop convening, more complex analytical tasks, and the marketing of Clearinghouse services as a whole.*

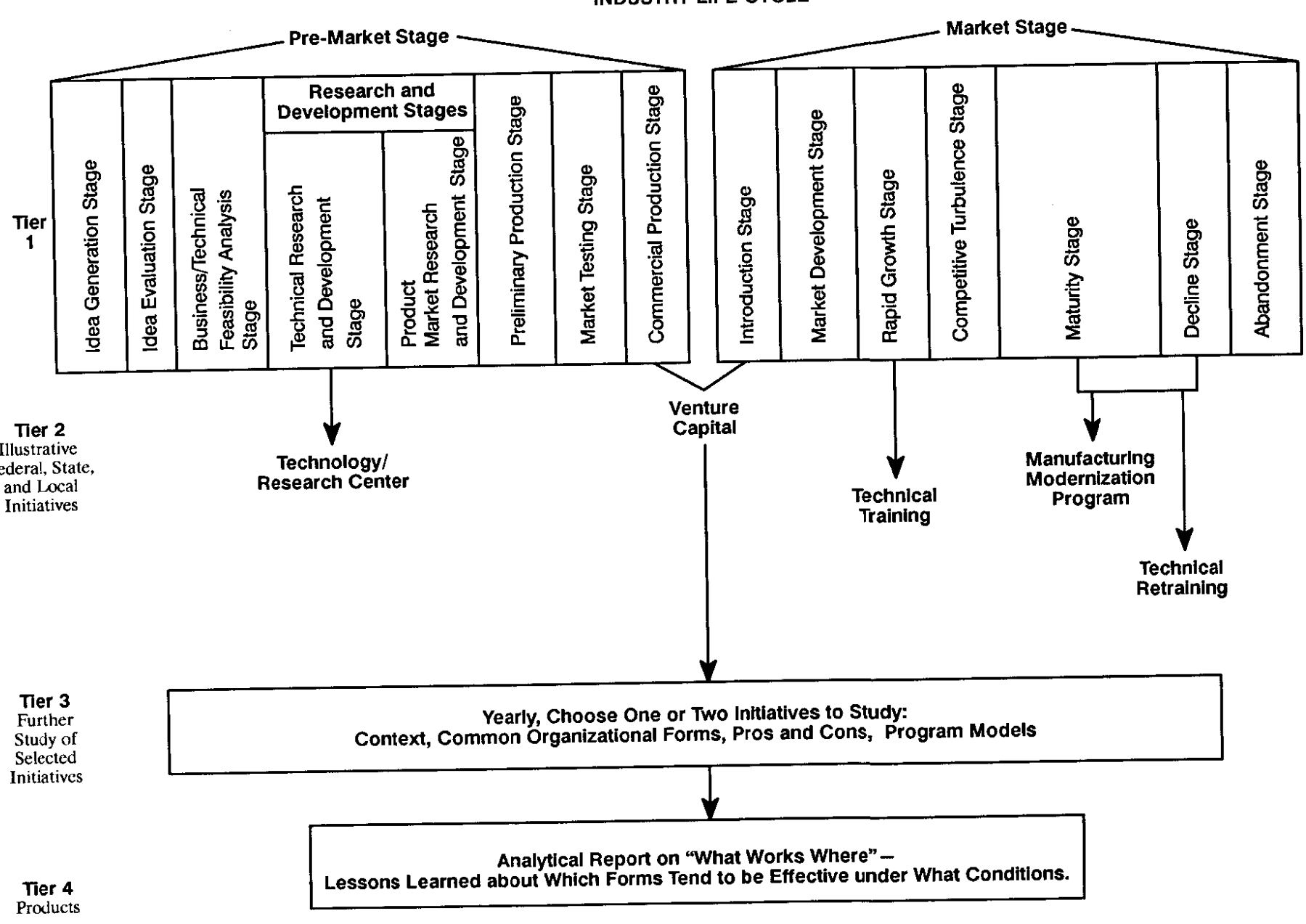
Based on an agenda growing out of the framework, the Clearinghouse should undertake or commission, in conjunction with other organizations, analytical work and case studies of program models and impacts. The priorities for further study should be developed in consultation with Clearinghouse constituents. In developing the agenda, there would be no lack of questions to be answered, only a lack of resources to answer them.

Tier 3 of Figure 1 addresses the concern that there is a lack of information available for generic program models, and no standardized way to categorize them. Taking the example of risk capital discussed above, the Clearinghouse could develop brief accounts of the various ways such programs are organized: as development credit corporations, loan programs, product development corporations, or pension fund pools. The write-ups could array the relative advantages and disadvantages of each and develop checklists for items to be considered in program design. Risk capital a particularly appropriate example to illustrate how such a framework could be developed. The U.S. Small Business Administration has done considerable work on this subject, and the Clearinghouse role would be to assemble information, incorporate it into the framework, and develop or commission material to fill in the gaps in knowledge.

Tier 4 arrives at the heart of the question about policy effectiveness. What lessons have been learned about which types of state and local risk capital funds tend to be most effective under what conditions? Tier 4 is tackled as Clearinghouse resources permit and as priorities are set. Here, the Clearinghouse can start by summarizing what is known about the effectiveness of risk financing programs. It can commission studies on specific questions, such as the conditions under which public venture capital funds substitute for private money, and the kinds of political and economic costs and benefits involved in committing resources to such a fund?

*Figure 1*

## Example of an Analytical Framework for Clearinghouse Activities



### A "State-of-the-Art" Report

In general, as part of its overall effort to understand "what works where and how," *the Clearinghouse should examine assessments and evaluations done by the states and by others, and produce or commission a "state-of-the-art" report giving an overview of the kinds of questions asked, the methodologies used to answer them, and the criteria commonly employed to assess success.*

The Clearinghouse should not strive to be a census taker, but rather to be a selective purveyor of information about noteworthy types and classes of state and local activities. *Its role is to act, not as a judge, but as a collector of information about the impact and effectiveness of these initiatives.* It can begin by collecting studies and assessments by program managers and legislative auditors. Studies by outside evaluators (often paid for with public funds) should be included as well because the development of methodologies is a goal explicit in the legislation, and some of these studies are in the forefront in this area.

The Clearinghouse should review how often these studies are done, who commissions them, the criteria commonly used, measurement techniques, lessons drawn, and the degree to which the studies are conclusive. Clearinghouse constituents could be involved in a continuous process of identifying noteworthy studies, focusing on key issues, and offering critiques of methodologies. This report—a kind of "state-of-the-art" review—could be disseminated to federal, state, and local program operators and policymakers and could serve as the basis for recommending changes in federal policy to facilitate state and local success.

## Administrative Aspects of the Clearinghouse

**The *credibility* of the Clearinghouse is its currency among federal, state, and local program managers and policymakers. The principles guiding the daily operations of the Clearinghouse therefore, must develop and enhance this intangible but essential attribute.**

### Operating Principles

The ACIR Thinkers' Sessions, extensive interviews with directors of operating and defunct clearinghouses, and a research paper commissioned by ACIR on the experience of previous clearinghouses, confirm that the most successful clearinghouses have followed these guidelines:

*The Clearinghouse must avoid setting an agenda that exceeds its limited resources.* Given its modest resources, it should *phase in its operations gradually*, and avoid unrealistic expectations and disappointments that would undermine its credibility.

*A knowledgeable staff is necessary if the Clearinghouse is to respond effectively to its constituents.* The staff must "know" where to look for information, whether in answering a question, providing a referral, or developing an analytical product. Moreover, the staff must be familiar with the types of initiatives being used. Attending conferences and workshops sponsored by other organizations and working with outside experts will assist the staff in this process. Undoubtedly, institutional knowledge will evolve over time, but an initial investment in staff education will pay off in the long run in terms of enhanced Clearinghouse credibility and usefulness.

*A "personal touch" is an essential ingredient for a useful and responsive Clearinghouse.* Clearly, there is a role for the computerization of certain kinds of information and indexation to provide access to it. Yet, state and local policymakers and program managers should be able to talk with a Clearinghouse staff person who can help refine their questions and locate an answer or another source that can provide the answer.

*The Clearinghouse should concentrate on organizing its resources before marketing its services.* During its initial months, the Clearinghouse should *not* undertake marketing efforts. After it has begun to develop its resources and expertise, *targeted* marketing efforts should be launched. Letters to state and local policymakers and program managers, especially those on the ACIR contact list, should be prepared. Columns for publication in newsletters of other organizations can alert potential constituents to current and future Clearinghouse activities. But it is important that the Clearinghouse not create unrealistic expectations among its potential constituents by overselling itself.

*The Clearinghouse should have the internal support and resources of the new Technology Administration and of the Department of Commerce as a whole.* There are several forms such support should take. First, the Clearinghouse should be assured of adequate staffing (a minimum of three full-time persons) and sufficient physical space for its operations. Second, the Clearinghouse should be provided with adequate discretionary travel funds. These funds should be used to ensure geographically mixed participation in its working groups. Travel funds also would permit Clearinghouse staff to attend regional conferences sponsored by a variety of groups as part of its outreach efforts. Third, the Clearinghouse should be integrated into the current activities of the new Technology Administration and promoted in the press releases and speeches of Department officials.

### Summary of Early "Products" by the Clearinghouse

- Four research papers that focus on (1) state policies and programs that encourage technology development, (2) national clearinghouses that provide technology and economic development information, (3) the process of transferring federal technology and, (4) sources of business assistance used by small, high-technology firms.
- An annotated guide to directories on federal, state, and local initiatives.
- An annotated guide to national clearinghouses that provide information and assistance to states and localities on productivity and technology.
- Categorization of the contact list by type of assistance, type of agency or organization, and geographic location.
- An on-line data base of federal and state programs, the NIST/NGA survey results, and contact information for individuals and organizations active in the ACIR Thinkers' Sessions for in-house use by Clearinghouse staff.
- Draft of general framework to classify federal, state, and local initiatives in productivity, technology, and innovation.
- Draft "state-of-the-art" review of assessments and evaluations of technology and innovation programs to be critiqued by working groups.

## CHOOSING AN ANALYTICAL FRAMEWORK
### Draft Discussion Points

Given that many recent federal, state, and local initiatives are technology oriented, some participants in the Thinkers' Sessions suggested that the process of innovation would be a useful format for organizing the kinds of initiatives that will be included in the Clearinghouse. The various kinds of state and local business assistance programs would be arrayed against the depiction of stages in the innovation process. One likely outcome of this exercise is that it would show the federal emphasis on the front end of the pipeline (basic research and development) and the relative importance of the other end (commercialization) to the design of state technology programs. This could be the basis for a recommendation to the Congress and other federal agencies that some federal resources be shifted toward commercialization.

The shortcomings of the innovation model are two-fold. First, it tends to emphasize new products and new firms. Although it does not exclude the introduction of new processes to products and firms, the model commonly is associated with "technological breakthroughs" rather than with incremental improvements in processes or techniques. Yet, it is the latter that has the potentially most far-reaching effect on America's competitiveness. Second, the heavy slant toward technology tends to relegate education and training initiatives to a second tier. Education, however, is precisely the area where states and localities have traditionally been most influential.

The industry life-cycle model extends the innovation process model and addresses some of these issues. It explicitly recognizes that the problems of the mature industry—in terms of both technology and human resources—are different from those of the emerging industry. Arraying initiative types against this model (see page 31 of text) would reveal the extent to which the mix of programs tends to be comprehensive. It could help answer questions such as, in State X, given the composition of industry, are programs disproportionately targeting new firms to the neglect of existing ones? Or, where along the industry life-cycle trend line do the bulk of federal programs reside?

The main argument against both the industry life-cycle framework and the innovation process model is that they abstract from the real life predicaments of program development. That is, the connection between the model and the programs may not be clear and direct to most people. State legislatures and program designers usually do not begin with a whole picture of industrial development and then proceed to the choice of a program that pinpoints a part of that process to influence. Instead, programs tend to arise from political and economic pressures and constraints, and from the need to develop a response to a critical or festering problem. That is not to say that some programs are not anticipatory and developed in the course of a strategic plan for a state or regional economy. As pointed out by public interest group representatives in the Thinkers' Sessions, many programs are ad hoc responses to immediate needs. And, in the rush to emulate other states and localities that have had apparent success, these ad hoc responses may not be the most appropriate ones.

Therefore, an alternative framework for analysis may be one that focuses explicitly on the economic and political imperfections that impede private sector adoption of technology and innovation. Such a typology was developed by David Osborne in his recent report on state technology programs for the Council of State Policy and Planning Agencies. For example, Osborne identifies as one problem the inadequate transfer of technological advances from research institutions, such as universities, to local corporations. Initiatives that fit into this category include awarding matching grants to university-industry research projects and creating broker/facilitator organizations to bring industry and university personnel and resources together. Another problem is insufficient deployment of new process technologies by manufacturers. Government industrial extension services are created to address this problem.

One problem with Osborne's typology is that it omits the human resource component (chiefly because it was outside the scope of his report). If the Clearinghouse were to use this framework, it would need to augment it by including initiatives in education and training.

Of course, these models are not mutually exclusive, and other possible frameworks need to be explored. Use of all three, or incorporation of several-in-one, is apt to be cumbersome and unwieldy. Therefore, selection of the one that is deemed most useful in the eyes of Clearinghouse constituents representing a variety of perspectives will ensure a useful contribution to our understanding of "what works where and how."

# Research Papers

**State Policies and Programs for Encouraging Innovation and Technology Development**
*Marta V. Goldsmith,* Urban Land Institute

**Federal Technology Transfer: Critical Perspectives**
*Louis Mogavero,* Trantek, Inc.
*Kenneth Susskind,* Space Commerce International
*Achmad M. Chadran,* Space Commerce International

**Review and Comparison of Clearinghouse-Type Initiatives**
*Sally A. Rood,* Systems Engineering & Management Associates, Inc.
*Edward T. Kelly,* Edward T. Kelly and Associates

**Sources of Technical and Managerial Information and Services Used by Technology-Based Small Business Firms**
*Edward T. Kelly,* Edward T. Kelly and Associates

# State Policies and Programs for Encouraging Innovation and Technology Development

*Marta V. Goldsmith*

## Introduction

David Osborne, in his book *Laboratories of Democracy*, suggests that two forces have transformed the United States economy in recent decades—technological innovation and global competitiveness. He points out that in 1960, only 20 percent of goods produced in the United States were in active competition with foreign products; by 1980, that percentage had reached 70. Because we must now compete with foreign producers, some of whom have much lower wage rates, our competitive advantage must lie in sophisticated new products and services that depend on advanced technologies and skilled workers.[1]

In 1988, the United States Congress enacted *The Omnibus Trade and Competitiveness Act*, the most sweeping trade bill of the decade. Responding to a growing national concern that the United States was falling behind in international competition, the Congress looked to all areas of public policy—immigration, education, training, and research and development, as well as more traditional trade policy—to find solutions. A critical concern in the development of that legislation was the degree to which American universities, private firms, and other research and development institutions are able to convert the results of their research into products to compete successfully in international markets. As Governor John McKernan, Jr., of Maine points out in a recent report issued by the National Governors' Association:

> Although the United States is still the match of any country in research and development of technology, our competitors have become more adept at turning those technologies into products and marketing them around the world.... America can tap the vast potential in technological innovation, but to do so we must recognize that the process of commercializing technology has changed. Research and development efforts must be more attuned to market needs; they must be driven by rapid technological innovation and consumer preferences. Speed, adaptability, and quality products are essential.[2]

Yet, the federal government's role in promoting civilian technological innovation and commercialization has been extremely limited. According to Walt Plosila, president of the Montgomery County (Maryland) High-Technology Council:

> The national government's role in technological innovation has in this decade focused on national defense matters; forming of multidisciplinary national engineering research centers and national supercomputer centers; and, to a more limited extent, small business innovation. While the mid-1980s witnessed an increased national government interest in international competitiveness, the Reagan Administration has had a decidedly non-interventionist approach, arguing that the free market will handle technology; that the federal role should be limited strictly to increased funding for basic research or science.[3]

Both Osborne and Plosila make the case that state governments have taken the lead in instituting programs that foster the innovation and commercialization so vital for economic growth in today's economy. Osborne refers to the states as "laboratories" of democracy, a term coined by Justice Louis Brandeis in 1932, to describe the activism with which states have undertaken a wide range of efforts to stimulate economic growth, particularly through the encouragement of innovation, technology development, and commercialization.

It was with this realization that Sen. Dale Bumpers introduced legislation, which became part of the 1988 trade bill, calling for a Clearinghouse to serve as a "central repository of information on initiatives by state and local governments to enhance the competitiveness of American business through the stimulation of productivity, technology and innovation . . ." (Section 5122, *Omnibus Trade and Competitiveness Act of 1988*, P.L. 100-418, August 24, 1988). The Clearinghouse, which is to be established within the Office of Productivity, Technology, and Innovation in the U.S. Department of Commerce, is authorized to establish relationships with state and local governments and regional and multistate organizations, collect and disseminate information on state and local initiatives, provide technical assistance and advice, study ways in which federal agencies are able to assist state and local governments and these organizations, make recommendations to federal agencies regarding modifications to federal policies and programs to improve federal assistance to state and local governments, and develop methodologies to evaluate state and local programs.

The purpose of this paper is to provide background and support to the Advisory Commission on Intergovernmental Relations, which has an interagency agreement with the Department of Commerce to design the Clearinghouse. The paper will review state policies and programs in technology development and report on the work of multistate organizations. The findings and conclusions contain general observations about the state of the art and suggestions on how federal agencies or other organizations interested in providing additional support to these programs might proceed.

The emphasis is on programs in "technology development," that is, those research, commercialization, education, technology transfer, and business assistance activities undertaken by a state to promote economic growth. In some places, other terms such as "science and technology" or "technological innovation" are used to refer to these programs. This is done generally to be consistent with a reference that is being cited. For the purposes of this paper, they usually mean the same thing.

## State Policies and Strategies to Promote Technology Development

### The State Role in Economic Development

Historically, the federal and state governments have played a role in promoting economic growth in the United States. In general, the federal government has taken the more macroeconomic approaches of monetary policy, tax policy, and fiscal policy. Although state policymakers also have used tax policy, they generally take more targeted approaches, such as management assistance, regulation, loans and loan subsidies, provision of infrastructure, education and training, and structuring labor-management relations.

According to Marianne Clarke of the National Governors' Association (NGA), states have three broad goals when setting policy to promote economic growth within their borders. States seek to: (1) create an environment for economic growth; (2) promote the state and its products; and (3) intervene in the marketplace. Based on a study conducted by the NGA in 1985, Clarke suggests that states are becoming more interventionist in these roles, targeting industries and geographic areas, and that the majority of states continue to further strategies in support of all three of these goals.[4]

### State Science and Technology Councils

In the 1960s, when science was viewed as a panacea for many of society's ills, numerous governors adopted science and technology policies, hoping to bring the benefits of scientific research and innovation to government. State science advisors were appointed and state science councils were empaneled to advise the governors on policies that would tap scientific resources for economic growth as well as for the improvement of public service delivery. These efforts were encouraged, in part, by the U.S. Department of Commerce, which made grants available through its State Technical Services (STS) program to build state capacity for technology transfer. Most of these state programs foundered late in the 1960s when the Department of Commerce discontinued the funding.

In the early 1970s, several federal agencies funded what Lynn Muchmore refers to as "intergovernmental science." The Intergovernmental Programs unit at the National Science Foundation (NSF) was a capacity-strengthening program to help governors and legislators better incorporate science and engineering expertise into public policy. The National Aeronautics and Space Administration promoted the use of satellite mapping techniques. Other agencies, such as the departments of Defense, Agriculture, and Commerce, offered different programs to encourage states to tap scientific research to meet public needs.[5] In 1977, the NSF initiated the State Science, Engineering, and Technology (SSET) program, which funded governors and legislators to study how state government could use science and technology to better meet its needs.[6] In general, these programs focused on applying scientific research to the traditional functions of government, met with limited success, and foundered as federal funding ceased.

### Technology Development for Economic Development

The basic premise of David Osborne's book is that in the last 10 to 20 years, our economy has evolved from one in which growth was generated through occasional major research breakthroughs and the expansion of assembly-line manufacturing in large stable firms to one in which growth is based on continuous innovation and rapid change. He suggests that state governments, in their economic development policies, have recognized this transition and have adapted their policies accordingly.

It was not until the late 1970s and into the early 1980s that most state governments began to incorporate scientific research and technology development into their overall economic development strategy. In 1983, the Congressional Office of Technology Assessment found 150 programs in 22 states to promote technology as a major sector of the state's economy. In the NGA survey conducted two years later, 40 states reported having technology development initiatives.[7] Some analysts suggest that these programs were initiated in response to the success of areas like Route 128 in Boston, Silicon Valley in California, and Research Triangle Park in North Carolina, where high-tech industries accumulated and grew, creating nonpolluting, high-paying jobs for hundreds of area residents.

In fact, the motivation behind state policies adopted in the last ten years to promote technology development and innovation were more complex and far-reaching in their origins and came about for several reasons.

First, state policymakers were responding to the economic recession of 1981-1982. Unlike earlier cyclical downturns, the duration and level of unemployment were so extensive that state policymakers realized that at least some of the problems were due to structural changes in the economy. They recognized that their development policies would have to be altered to respond to these permanent changes, particularly in terms of the increase in foreign competition and the increasing importance of technological innovation.

Second, policymakers realized that much of the state's opportunity for growth lay in the success of indigenous businesses and entrepreneurs, especially those that incorporated a high degree of technological innovation. They came to realize that firms already in the state were more likely to stay and that local entrepreneurs could create fast-growing companies with the potential to generate the kinds of jobs they sought. Policies directed at encouraging expansion and innovation could pay dividends in new job creation. By comparison, past practices designed to attract new manufacturing facilities from other areas were not going to be as successful as they had been in the past. There were fewer healthy large manufacturing facilities to draw from other areas of the country, the competition among states for these facilities had become much keener, and a company that would relocate into a state was very likely to move out again, to another state or overseas, in a relatively short period of time.

Third, state policymakers began to realize that incentives that had promoted economic development in the past—natural resources, cheap labor and land, low taxes—were not the primary attractions to growth firms of the future. The kinds of firms that were going to stay and grow in a state were looking for assets that would help them inno-

*Table 1*
**Science and Technology Offices**

| State | Office | Year Established |
|---|---|---|
| Arkansas | Arkansas Science and Technology Authority | 1983 |
| Florida | Florida High Technology and Industry Council | 1984 |
| Hawaii | Science and Technology Program<br>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<br>Department of Economic Development | |
| 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 | |
| Minnesota | Governor's Office of Science and Technology | 1983 |
| Missouri | Corporation for Science and Technology | 1983 |
| Montana | Montana Science and Technology Alliance<br>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<br>Ohio Department of Development | |
| Oklahoma | Oklahoma Center for the Advancement of Science and Technology | 1987 |
| Pennsylvania | Office of Technology Development<br>Pennsylvania Department of Commerce | 1983 |
| Rhole Island | Rhode Island Partnership for Science and Technology | 1985 |
| South Carolina | South Carolina Research Authority | 1983 |
| South Dakota | Office of Enterprise Initiation<br>Governor's Office of Economic Development | 1987 |
| Tennessee | High Technology Development<br>Department of Economic and Community Development | 1982 |
| Texas | Department of Commerce | 1986 |
| Utah | Utah Technology Finance Corporation | |
| Virginia | Center for Innovative Technology | |
| Wyoming | Wyoming Science, Technology and Energy Authority | 1987 |

* Replaced Kansas Advanced Technology Commission established in 1983.

Source: Marianne C. Clarke, "Recent State Initiatives: An Overview of State Science and Technology Policies and Programs," in Jurgen Schmandt and Robert Wilson, eds., *Growth Policy in the Age of High Technology* (Boston: Unwin Hyman), p. 6.

ate, be *flexible, and attract and retain a high-quality* orkforce. For all of these reasons, state governments egan to adopt technology development strategies as part f their overall economic development efforts.

### ate Technology Development Policies

One indication of the movement to incorporate technology development into economic development is the extent to which governors and legislators designated agencies to administer science and technology policies and rograms. The 1985 NGA survey found that 31 states aintained science and technology offices (see Table 1). ost other states had science and technology programs at were administered by other offices of economic development or by institutions of higher education. According to the enabling legislation for these programs, their primary goal was and continues to be economic development.[8]

In any state, the budget is probably the most relevant policy document. The recent report of the NGA Task Force on Research and Technology finds that in fiscal 1988, 44 states spent $550 million on their applied research and technology activities. How are these funds being used? The report suggests that they go to a variety of innovative programs, including research consortia, seed and venture capital funds, incubators, endowed university chairs, technology fellowships, and equipment subsidies.[9] These and other specific technology development programs will be reviewed later in the paper.

The strategies that states now pursue to promote economic development indicate an awareness of the changing economic climate. Osborne suggests nine categories of economic development policy reflective of this new emphasis on technological innovation, smaller and entrepreneurial indigenous businesses and more direct state involvement. Today, he says, states are focusing on:

- An intellectual infrastructure to provide support for research and commercialization;
- A skilled and educated workforce;
- An attractive quality of life;
- An entrepreneurial climate—one that provides support, capital, technical assistance, and other encouragement to new businesses;
- Availability of risk capital;
- A market for new products and processes;
- A commitment to industrial modernization—innovation and flexibility in traditional industries;
- A new industrial culture—more cooperation, continuous changes of products and processes and decentralization; and
- Better social organization—more opportunities for retraining, family support systems, and, when necessary, relocation.

Unlike state development activities 20 or even 10 years ago, which focused on attracting major assembly-line production plants, these initiatives are designed to create an environment, "a context in which innovation flourishes as a continuous, everyday process."[10] Today, state development activities directed toward technology development go far beyond efforts to attract "high-tech" industries. While attracting business remains part of many state strategies, most states are also incorporating policies to foster technical innovation in many different industries. They seek to create an environment in which innovation is continuous and widespread, leading to improvements in products and processes across industries, which, in turn, should result in more widespread economic growth.

### The Role of Multistate Organizations

Multistate organizations—public interest groups, regional councils, special purpose associations—can serve an important function in helping states with their technology development policies and programs. These organizations support states' efforts to determine their economic development needs, understand changing national economic trends, pursue federal assistance, learn from other states, and evaluate the success of their programs. A few of these organizations have undertaken science and technology activities. Fewer still have ongoing programs. This section of the paper looks at the science and technology programs of three organizations that are most active in this area.

#### The National Governors' Association

Probably the leading multistate organization in the area of science and technology development policies and programs is the National Governors' Association (NGA). NGA serves as an informal clearinghouse to help states exchange information and ideas, provides technical assistance to design and implement programs, and communicates the science and technology interests of states to the Congress and federal agencies. NGA has been involved in technological innovation and development since the early 1980s.

Much of NGA's work has been to survey the states and report on the nature of policies and programs for technological innovation for economic development. NGA's first major survey was done in 1982 when Governor Jim Thompson of Illinois, who was then chairman of the association, appointed a Task Force on Technological Innovation, chaired by then Governor Jim Hunt of North Carolina. The final report of the task force, entitled *Technology and Growth: State Initiatives in Technological Innovation*, was published in October 1983 with a grant from the Economic Development Administration of the U.S. Department of Commerce. In it, NGA reported:

> States have sought by a variety of means to foster cooperation and produce consensus among business, labor, government and academia on ways to promote technological and industrial innovation. Governors have (1) appointed special advisory commissions, councils and task forces; (2) established new partnerships; (3) broadened the mandates of existing state agencies; and (4) established nonprofit public corporations and university-affiliated institutions to promote technological research and development, improve education and training, and facilitate industrial expansion. . . . The vast majority of these state initiatives have been undertaken only within the last three years."[11]

In 1985, NGA surveyed the states regarding their overall economic development policies and programs and included questions about state technology development programs. In reporting on that survey, NGA identified three ways in which states promote technology development: (1) by investing in education; (2) by investing in research and development; and (3) by assisting in the commercialization process by offering both financial and nonfinancial assistance.[12] The report suggested that the states are emphasizing innovation rather than the development of high technology as a specific industry and that state strategies in this area are shifting from attracting high technology industries to encouraging the use of technological innovation to improve the products and production processes of all industries, including indigenous industries.[13]

Recently, NGA has collaborated with other organizations to broaden the scope of their state activities. In Fall 1986, NGA teamed up with The Conference Board, with support from the National Science Foundation, to survey industry, university, and state government officials on state and federal science and technology policies, especially with regard to how they are helping or hindering U.S. international competitiveness. In 1988, NGA collaborated with the Society of Research Administrators to study the structure and function of state science and technology offices. Currently, the association is working with the Na-

tional Institute for Standards and Technology on a survey of state technology extension services.

The National Governors' Association first adopted policy addressing technological innovation in 1984. The statement is far-reaching in terms of suggested federal actions, including increased priority for support for basic and applied research in the civilian sector, improving the tax climate for innovation, continuation of and flexibility in block grants and the SBIR program, enhancing the role of the federal labs in economic development, priority for support of university programs to train scientists and engineers, and modification of antitrust statutes. States are encouraged to continue to improve elementary and secondary education, provide training, encourage university/industry collaboration, and provide a range of assistance to new and growing businesses. The policy explicitly supports the establishment of a clearinghouse on state technology development programs as mandated in the omnibus trade bill.

Finally, NGA has, for the last four years, served, along with the state of Ohio, as convener for the Working Group on State Initiatives in Applied Research. Appointed by the governors, representatives to the working group generally have the lead responsibility for technology development programs in the their state. The working group convenes semiannually as a forum to exchange experiences and ideas among states and to consult with federal agencies on intergovernmental activities. Activities of the working group, on occasion, have been funded by the National Science Foundation through grants to NGA's Center for Policy Research.

### Southern Technology Council

The Southern Technology Council is a highly active and, according to many experts, the most effective multistate technology development organization in the country. Chartered in 1986, this public/private advisory body to the Southern Growth Policies Board was formed to "provide a regional forum for sharing ideas and strategies; study the internationalization of technology and suggest state and federal policies; inform and educate state legislatures, government agencies, and the public regarding the importance, value, and effects of new technology; and facilitate the transfer of ideas to the marketplace by bringing together innovators with venture capitalists and business people."

The council's membership is made up of two gubernatorial representatives from each of the 12 member states, two members selected by the executive committee of the Southern Legislative Conference and one member from each participating nongovernmental (business or education) entity. The council is chaired by a governor. Funding for the council's budget of approximately $1 million comes from member dues and grants from government agencies and foundations.

One of the council's current major initiatives is a Consortium for Manufacturing Competitiveness, which involves demonstration sites in community and technical colleges in 13 states in the region to enhance technology diffusion and provide skills assessment and training for small and rural firms. The council also has a Centers of Excellence project, in which it works through southern universities to establish model multistate research centers to improve the quality of research and development by building expertise. A third major effort of the council is the development of a Strategic Plan for Science and Technology for the South. The plan specifies what should be done and by whom to improve science and technological resources in the South. The plan was released at the annual meeting of the Southern Growth Policies Board in July 1989.

### Council of Great Lakes Governors

The Council of Great Lakes Governors has taken the lead on two initiatives in that region. The first, the Great Lakes Research and Development Compendium, collects information on the region's strengths in research and technology. The compendium is a tool for marketing the capabilities of the region to federal agencies and international businesses. The second is the Great Lakes Research Network, which is designed to help states identify multistate projects that have demonstrable benefits to industry and are of world-class stature. Once these projects are selected, the network will work with them to develop a strategy for leveraging federal funds.

### Western Research Application Center

The Western Research Application Center (WestRAC) is a business assistance and technology transfer center operated by the University of Southern California under a contract with the National Aeronautics and Space Administration (NASA). While not a multistate organization like the ones described above, it serves a multistate clientele and is worthwhile to consider as an example of the regional technology transfer programs funded by NASA. The primary program operated by the center is the NASA Industrial Applications Center, which supports technology transfer by (1) providing business clients with information retrieval services and access to federal and private data bases, (2) providing access to experts in federal laboratories and elsewhere, and (3) assisting business clients to develop relationships with federal laboratories such as NASA. WestRAC works through a network of state-supported business assistance centers in 16 western states. Most of these centers are the primary technology development organizations for their states. Future plans include expanding the network to other nonprofit business assistance organizations within the states. Funds for WestRAC come from NASA, the University of Southern California, and fees paid by clients. Large corporations access the center's resources on a direct fee basis. Nonprofits use the services on a subsidized fee basis.

### Other Organizations

Several other multistate organizations have undertaken technology development projects, but these have generally been single projects with little follow-up. The National Association of State Development Agencies (NASDA) commissioned a state-by-state survey of technology development programs. The National Conference of State Legislatures includes technology development in its annual survey of state legislative initiatives. Technology development issues are likely to be included on the agenda of the Committee for Economic Development. The Council of State Policy and Planning Agencies has commissioned a paper by David Osborne on "State Technology Programs: A Preliminary Analysis of Lessons Learned,"

which takes a first look at developing a methodology for assessing past experiences as a basis for the design and management of future programs. The Northeast-Midwest Institute, a regional organization for economic policy analysis formed by members of Congress from that region, has compiled *The Guide to State and Federal Resources for Economic Development*. The guide includes a chapter on cooperative research and technology centers, describing the objectives of and models for these centers and the role they play in overall economic development. Case studies are presented for programs in Ohio, Pennsylvania, and Rhode Island, along with very brief summaries of cooperative research and technology centers in other states.

### Typologies of State Programs

Several analysts have developed typologies of state technology development programs in an effort to better understand the state of the art and to draw some general conclusions about what states are doing. Some of these are based on surveys of state programs, while others evolved out of working with and observing the programs over time. A review of these typologies is helpful in reaching a better understanding of what activities states undertake and how they have changed. This information can also be useful in deciding how best to structure programs undertaken by federal agencies or multistate organizations to provide additional support to state programs.

#### State Technology Programs in the United States: A Report by the Minnesota Office of Science and Technology

Probably the most frequently cited source of information on state technology programs is *State Technology Programs in the United States, 1988,* prepared by the Office of Science and Technology in the Minnesota Department of Trade and Economic Development. The publication, which updates a 1986 edition, reports the findings of a state-by-state survey conducted in November 1987. Active programs that have received state funds are described and categorized into 11 types. Information is also provided on funding sources and amounts for specific programs as well as total and per capita state funding for technology initiatives. The findings are summarized in an overview, and a contact list is included for each state.

The 11 program types that the report covers are:

- Technology offices (36 states);
- Technology research centers (29 states);
- Research grants (25 states);
- Research parks (11 states);
- Incubators (18 states);
- Technology transfer (26 states);
- Technical/managerial assistance (30 states);
- Seed/venture capital (10 states);
- Technical training (10 states);
- Information/networking (15 states); and
- Equity/royalty investment (2 states).

Each state section begins with a description of offices, boards, or commissions that may set policy, advise the governor or legislature, administer programs, or provide information services. Other programs are described under the categories listed above. Relationships among programs and between technology programs and other state agencies are described briefly for some states. Program descriptions include services provided, technologies targeted, and, in some cases, funding sources.

#### State Technology Development Programs: A Report for the National Association of State Development Agencies

Concurrent with the Minnesota survey, Robert Atkinson conducted a survey of technology development programs in Fall 1987 for the National Association of State Development Agencies. The survey was intended in part to update the 1986 Minnesota survey, and although there are many similarities with the 1988 Minnesota report there also are differences. Minnesota reports that $550 million was allocated for science and technology initiatives for FY 1988, while Atkinson reports a 1987 total of close to $400 million. Rather than indicate a substantial increase in spending from one year to the next, the differences are more likely to result from different treatment of multiyear appropriations spent out of bond issues.

Atkinson also uses slightly different categories of programs than the Minnesota study. He divides programs into six categories and then subdivides four of the categories: His report includes:

**Programs to Stimulate Research**

- University Research Centers
- University Research Grants
- Business Research Grants

**Programs to Support Capital Acquisition**

- Loan Programs
- Equity Programs

**Programs to Assist Management**

- Management Assistance Programs
- Incubators
- Technical Assistance

**Programs to Introduce Technology into Firms**

- Technology Transfer
- Diffusion of Technology
- Research Parks
- R&D Tax Credits or Deduction

**Programs to Train Labor**

**Policy Development**

This kind of breakout is helpful when designing a new program offering information about different approaches to providing a specific type of assistance.

Atkinson provides more in-depth analysis in the overview, while providing less information in the state-by-state program descriptions. The overview includes regional trends, per capita expenditures, and organizational patterns of state programs. His program descriptions include information on program type, organization name, program

name, year established, annual funding, technologies supported and very short program descriptions.

**Recent State Initiatives: An Overview of State Science and Technology Policies and Programs**

In a chapter written for a forthcoming book entitled *Growth Policy in the Age of High Technology*, Marianne Clarke, Senior Research Associate at the National Governors' Association, suggests a typology for state initiatives in science and technology that covers a wider range of activities than those that evolved out of the surveys described above. Clarke divides state initiatives into three categories, each of which is subdivided. She includes:

**Investing in Education**

Investing in Facilities and Equipment
Upgrading Faculty and Students
Training Technicians and Other Technical Workers
Improving Science and Mathematics Education

**Supporting Research and Development**

Research and Development Grant Programs
Technology Research Centers

**Commercialization Assistance**

Facilitating Information Exchange
Assisting Business and Entrepreneurs
Financial Assistance

This approach is useful because its emphasis on education is important to states and is not included, to this extent, in other typologies. It might be worthwhile for organizations seeking to support state programs to give more attention to a broader range of education programs as a way to better serve the interests of states.

**State Technology Programs: A Preliminary Analysis of Lessons Learned— A Paper for the Council of State Policy and Planning Agencies**

David Osborne, in a paper prepared for the Council of State Policy and Planning Agencies, takes a more analytical approach to classifying technology development programs. Osborne cites Lou Tornatzky of the Center for Social and Economic Issues at the Industrial Technology Institute in Michigan and other observers in saying that the time has come to begin to evaluate the technology development programs that states have instituted. His paper is an attempt to "push [that] process forward . . . by raising questions and drawing tentative conclusions."[14]

In an effort to set the stage for this evaluation, Osborne organizes a typology of state programs around the problems that they are designed to address. He defines four problems and then looks at from four to eight technology development strategies states used to respond to them. The problems are:

1. A research base that is too small to stimulate the commercial development of new technologies in the regional economies;
2. Inadequate transfer of technological advances from research institutions, such as universities, to local corporations;
3. Insufficient support for new enterprise development, as a means to commercialize new technologies; and
4. Insufficient deployment of new process technologies by existing manufacturers.

In reviewing the state strategies to address these problems, Osborne makes tentative but useful observations about their effectiveness. For example, he outlines four strategies states use to respond to problem 3—insufficient support for new enterprise development as a means to commercialize new technologies. The first strategy is "ensuring an adequate supply of risk capital." After describing several states' approaches in this area he concludes:

> After a decade of innovation, in development finance, the record is quite mixed. The primary objective of state intervention should not be to create public organizations that will add a few dozen loans or equity investments to the marketplace, but to change the very nature of that marketplace—so private firms begin making the kinds of investments needed to commercialize new technologies. More often than not, however, states still create small public funds rather than seeking to change the marketplace. They *retail* money, rather than using it to *wholesale*—to change private investment patterns."[15]

In the third section of his paper, Osborne takes on an important subject that other typologies fail to consider—the need for states to take a multidimensional, comprehensive approach to technology development. "Getting the mix right," says Osborne, "is as important as providing one or two of the elements that are missing. Hence, programs that focus on the entire mix—programs that are comprehensive in nature—are often the most effective."[16] He cites the Ben Franklin Partnership in Pennsylvania and, to a lesser extent, the New York Science and Technology Foundation and the Ohio Thomas Edison Program as examples of successfully integrated state programs.

Finally, Osborne outlines lessons learned from talking with program administrators and observing their programs, and draws some general conclusions. His lessons fall into three categories—policy, design, and political. In general, they are simple and straightforward. For example, one of his policy lessons is "dictate ends, not means."[17] His conclusions cite what most states are doing wrong, for example, "Too many state technology dollars have gone into physical infrastructure—new buildings, new laboratories, new research parks—rather than intellectual infrastructure."[18]

As Osborne admits, his analysis is preliminary. But his problem-solving orientation, emphasis on evaluation and lessons learned, and recognition of the multidimensional nature of state programs is constructive and offers much food for thought to state policymakers and program designers as well as to those working to support program development and management.

**Organization of State Programs**

Both Robert Atkinson, in his survey of state programs, and the National Governors' Association, in a study con-

*Table 2*

**Administrative Responsibilities of State Science and Technology Offices[1]**

| | Direct Responsibility | Indirect Responsibility | Oversight | Total States Reporting Responsibility |
|---|---|---|---|---|
| Program budget preparation | 24 | 7 | 3 | 29 |
| Program budget approval | 10 | 10 | 3 | 22 |
| Drafting legislation | 16 | 13 | 4 | 30 |
| Program development | 26 | 3 | 3 | 30 |
| Program management | 27 | 3 | 4 | 29 |
| Intrastate communications networks | 18 | 5 | 3 | 20 |
| Interstate communications networks | 15 | 2 | 1 | 16 |

[1] Thirty states responding.
[2] Sum may exceed total as some states reported both direct or indirect responsibility and oversight responsibility for a single function.

Source: NGA/SRA Survey of State Science and Technology Offices, September 1987. Updated July 1988. Published in National Governors' Association, *Capital Ideas,* September 1, 1988, p. 5.

ducted in conjunction with the Society of Research Administrators, addressed the question of how states have organized their technology development programs. In summarizing his findings, Atkinson states:

> States differ in the way they have organized their programs. Many of the most active states have developed independent science and technology boards which often develop innovation policies and administer many of the state's programs. At least 14 states have established a formal technology development organization. Other states, while not developing formal umbrella technology development organizations, operate many of 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.[19]

The results of the NGA study, published in the September 1988 edition of *Capital Ideas*, a newsletter published by the NGA Center for Policy Research, was more specific.[20] According to that report, 38 states maintain science and technology offices, only three of which were established before 1982. About half of these offices are divisions of larger state offices. The other half are independent agencies, quasi-public corporations, or private nonprofit corporations.

The enabling legislation for these offices generally states that their primary purpose is to stimulate and support economic development through supporting research and development and technology-based businesses. In some cases, building closer ties among government, education, and industry, and/or encouraging and promoting excellence in scientific and technological education, are also mentioned.

The survey also asked about the functions of the offices surveyed. Twenty-seven states (out of 30 responding) reported that they had direct responsibility for program management, 26 reported direct responsibility for program development, and 24 reported direct responsibility for program budget preparation. Ten states have direct responsibility for program budget approval, and 16 offices reported responsibilities for drafting legislation (see Table 2).[21]

**Funding for State Technology Programs**

According to the Minnesota study, state expenditures from science and technology programs range from zero to over $76 million per state. In general, the manufacturing states of the Northeast and Midwest spend the most, while Western states spend the least. Most of the money comes from state general funds. Other sources include bond issues, state lottery funds, pari-mutuel gambling receipts, and state employee pension funds (see Table 3).[22]

The Atkinson and Minnesota reports contain summary data on state expenditures by program. Atkinson reports 1987 expenditures; the Minnesota study contains 1988 and 1986 expenditures. While some of their findings are comparable, there are also some disparities.

Both reports put spending for research centers between 41 and 42 percent. However, while the Minnesota study shows the next largest category to be research grants at 27.3 percent, Atkinson reports equity programs second at 21.4 percent, and research grants (business and university combined) third at 17.1 percent. The Minnesota report places capital programs (seed and venture combined) much lower on the list at 6.8 percent (Table 4 and Figure 1).[23] Some of these differences may be due to variations in data collection and program definitions.

**Technologies Targeted**

According to Atkinson, most states target specific industries on which to focus technology development activities. He identifies 64 technologies that states hope to develop, from robotics to food processing to welding, and groups them into seven categories with summaries of those targeted most frequently.

Not surprisingly, computers and computer-related technology are the most popular, with advanced manufacturing technologies a close second. Other popular technol-

*Table 3*

**1988 Fiscal Funding for Technology Initiatives**

| State | Total State Funding | State General Funds | Initial State Funding | Bond Issue | Miscellaneous* Funding Source |
|---|---|---|---|---|---|
| Alabama | $2,855,205 | 1,055,205 | | | 1,800,000[a] |
| 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 | | | | |
| Illinois | 13,540,000 | 12,540,000 | | 1,000,000 | |
| Indiana | 10,637,500 | 10,637,500 | | | |
| Iowa | 4,895,000 | 1,395,000 | | | 3,500,000b |
| Kansas | 3,550,000 | 3,425,000 | | | 125,000[c] |
| Kentucky (FY89) | 560,000 | 560,000 | | | |
| Louisiana | 0 | | | | |
| Maine | 184,280 | 184,280 | | | |
| Maryland | 7,365,750 | 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 | 28,466,000 | 100,000 | | |
| Montana | 3,550,000 | 3,550.000 | | | |
| Nebraska | 858,500 | 858,500 | | | |
| Nevada | 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 | 2,214,000 | | | | 2,215,000[d] |
| Pennsylvania | 49,050,000 | 49,050,000 | | | |
| Rhode Island | 2,000,000 | 2,000,000 | | | |
| South Carolina | 0 | | | | |
| South Dakota | 3,050,000 | | | | 3,050,000[e] |
| Tennessee | 13,109,400 | 13,109,400 | | | |
| Texas | 60,690,000 | 60,690,000 | | | |
| Utah | 5,187,000 | 5,187,000 | | | |
| Vermont | 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 | 18,987,000 | | | |
| Wyoming | 0 | | | | |

* Miscellaneous Funds:
[a]State Trust Funds [b]State Lottery [c]State Gaming Funds [d]State Lottery [e]Future Fund

Source: Office of Science and Technology, *State Technology Programs in the United States, 1988*, (St. Paul: Minnesota Department of Trade and Economic Development, July 1988), p. 8.

*Table 4*

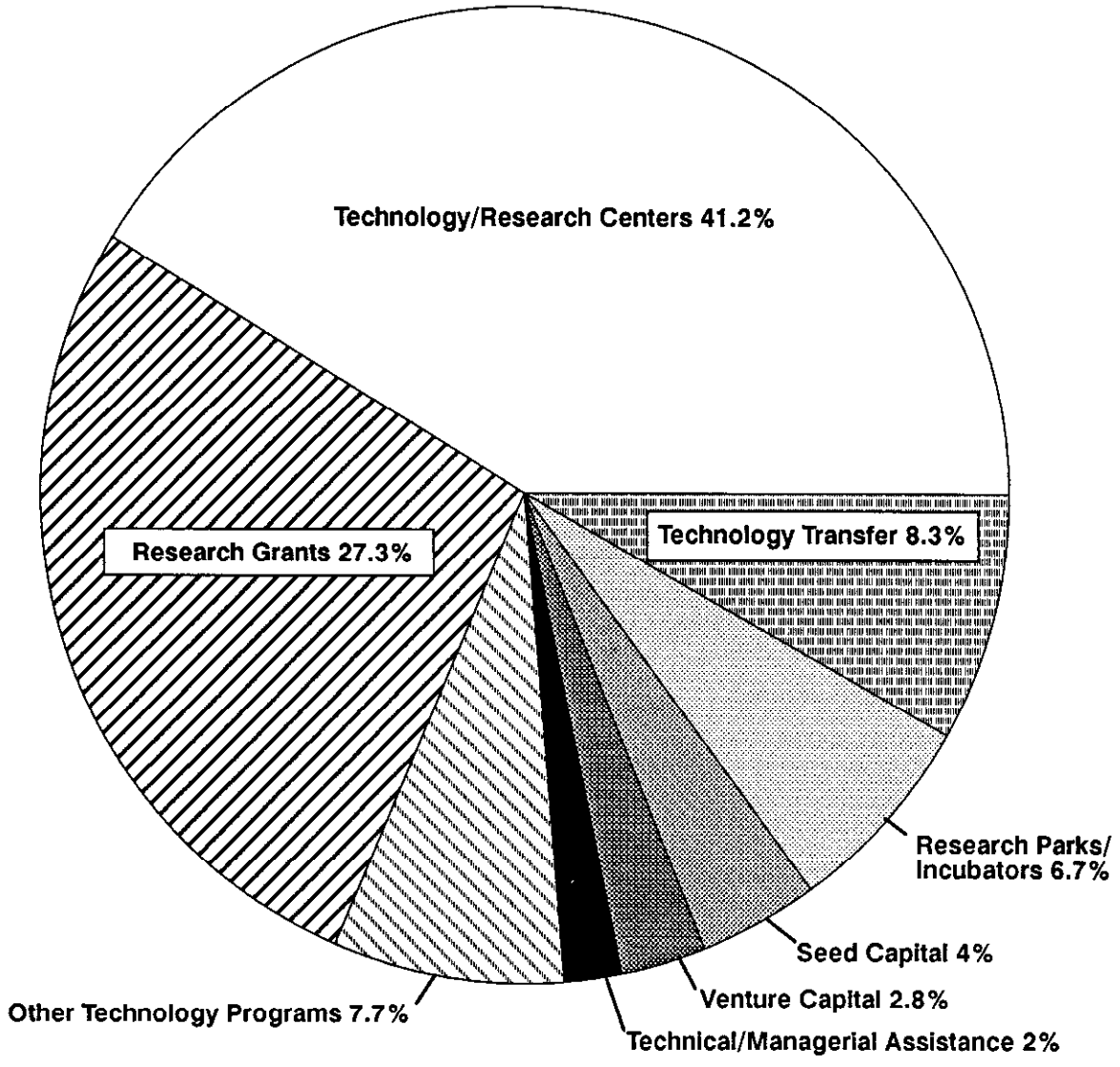
**State Expenditures by Program Type**

| Program Type | Amount | Percent | Program Type | Amount | Percent |
|---|---|---|---|---|---|
| University Research Centers | $166,779,421 | 41.9 | Technical Assistance | 9,381,845 | 2.4 |
| Equity Programs | 85,037,348 | 21.4 | Management Assistance | 8,933,050 | 2.3 |
| University Research Grants | 51,170,425 | 12.9 | Training | 8,597,300 | 2.2 |
| Business Research Grants | 16,886,457 | 4.2 | Loan Programs | 4,070,000 | 1.0 |
| Incubators | 15,440,459 | 3.9 | Policy Development | 2,470,900 | .6 |
| Diffusion of Technology | 15,057,174 | 3.8 | R&D Tax Credits or Deductions | N/A | N/A |
| Technology Transfer | 12,395,000 | 3.1 | | | |
| Research Parks | 12,120,000 | 3.0 | **Total Expenditures** | $397,617,209 | 100.0 |

Source: Robert D. Atkinson, *State Technology Programs (A State-by-State Listing)* (Washington, DC: National Association of State Development Agencies, March 1988), p. 4.

*Figure 1*

**Science and Technology Initiatives**
**Distribution of State Expenditures in the U.S., Fiscal Year 1988**




Source: Office of Science and Technology, *State Technology Programs in the United States, 1988* (St. Paul: Minnesota Department of Trade and Economic Development, July 1988), p. 7.

*Table 5*
**Technologies Targeted by States**

| | |
|---|---|
| Computers and Computer Related Technology | 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: Robert D. Atkinson, *State Technology Programs (A State-by-State Listing)* (Washington, DC: National Assocaition of State Development Agencies, March 1988), pp. 5, 6.

ogy categories include biotechnology, miscellaneous advanced technologies, and natural resources. Table 5 indicates, on a percentage basis, the popularity of each technology category.

### Patterns and Trends in State Programs

While there are trends and patterns in state technology development programs, it is important to note that, on the whole, these programs are characterized by unusual diversity. Perhaps because they originate out of unique local economic conditions and are designed to capitalize on local advantage rather than in response to federal mandates, they vary greatly in their organization, their clientele, the industries they target, and their relationship to the education community.

This diversity is a fertile ground for innovation and is necessary to be most responsive to any particular state setting. However, it can create problems in classifying information so that it is easily retrievable and most useful for states looking to start or improve their own programs. This variety also makes it more difficult for federal policymakers to decide how best to structure their own programs to be most supportive. There are some discernible trends among the states, which have been outlined here.

#### Trends in Policy

According to several observers, states are becoming much more activist in their approach to economic development, and their technology development efforts are on the cutting edge of this activism. Whereas states previously confined their programs to the more passive public posture of taxes, infrastructure, and general marketing of the state as a good place to do business, state economic development initiatives now include strategic plans, loans to and equity positions in private enterprises, targeted training for specific firms and industries, and active marketing of products and services of individual businesses. State development officials are finding ways to influence the market more directly and shape economic output within their boundaries.[24]

As explained earlier, many state officials, in responding to a changing economy, are shifting their strategies from stimulating basic research and attracting high technology companies to creating an environment in which companies are more inclined to use innovation to improve products and processes. Hand in hand with this has come an increased emphasis on smaller and newer firms, indigenous to the state, with high-growth potential.

Almost without exception, state initiatives in technology development have incorporated, as a matter of policy, a wide variety of education programs, including business/university partnerships, university research centers or grants, fellowships, university chairs, increased funding in graduate studies in science and engineering, more mathematics and science in the elementary and secondary curriculum, or targeted training. While the program mix varies from state to state, education policy will very likely continue to play a major role in the promotion of technology development in almost all states. This trend coincides with the broader educational reforms that most governors and legislatures across the country have instituted. In response to many of the same concerns—international competition, changes in the economic base, the need to integrate the disadvantaged into the economic mainstream—states are pursuing education and technology development policies in tandem as a strategy for economic growth.

#### Expenditure Trends

Some of the variation in expenditure data reported by Atkinson and the Minnesota Office of Science and Technology may be attributable to differences in accounting procedures for the studies. The differences also may indicate changes in state priorities. The Minnesota study reports that between 1986 and 1988, "Financing of technology/research centers remains very strong as states seek to develop new technologies through applied research. At the same time, there appears to be a marked decrease in spending for venture capital programs, and a shift in emphasis toward research grants, technical and managerial assistance, and information network systems."[25] The Minnesota report goes on to suggest that these shifts in expenditures indicate that states are relying more heavily on the private sector for less risky venture funding while continuing to provide seed capital. Further comparisons of the two years indicate that states are increasing their funding for technology training and information networks while spending less on technology transfer.

#### Regional Trends

Although states in all regions of the country have instituted technology development programs, regional variations are evident. Robert Atkinson, in his report for the National Association of State Development Agencies, notes that because states tend to target technologies that will enhance their existing economic base many of them may continue to focus on traditional sectors in their technology development programs. That focus is coupled with strategies targeted to industries that may not be part of the existing base but may be able to take advantage of assets the state has to offer. For example, in Atkinson's survey, states in the Midwest and South tend to focus on advanced manufacturing technologies that build on a history of large manufacturing facilities. The western states focus heavily

*Table 6*
**Targeting of Technology by Region**

| Technology | North-east | Mid-west | South | West |
|---|---|---|---|---|
| Biotechnology | 13% | 22% | 10% | 19% |
| Computers | 18% | 22% | 17% | 28% |
| Miscellaneous | 16% | 12% | 15% | 11% |
| Advanced Manufacturing | 18% | 23% | 25% | 11% |
| Materials | 11% | 9% | 10% | 9% |
| Medical | 11% | 3% | 15% | 5% |
| Natural Resources | 13% | 9% | 8% | 26% |

Source: Robert D. Atkinson, *State Technology Programs (A State-by-State Listing)* (Washington, DC: National Assocaition of State Development Agencies, March 1988), pp. 5, 6.

on natural resources, while biotechnology also ranked high. In the northeastern states, where educational levels tend to be higher and the resource base more diverse, targeted technologies were more varied, including biotechnology, miscellaneous, and natural resources. Computers and computer-related technologies rank high in all regions (see Table 6).[26]

Regional variations also can be seen in state expenditure levels. The states that spend the most in absolute dollars on science and technology are generally in the Northeast and Midwest, forming a band from New Jersey north and west to Minnesota. The one state outside this region that falls into the highest spending category is North Carolina (see Figure 2).[27] On a per capita basis, in 1987, the Northeast led the nation, spending $2.15 per capita. Midwestern states spent an average of $1.98 per person, the South spent $1.48, and the West, $1.00. The national average was $1.69 per capita (see Figure 3).[28]

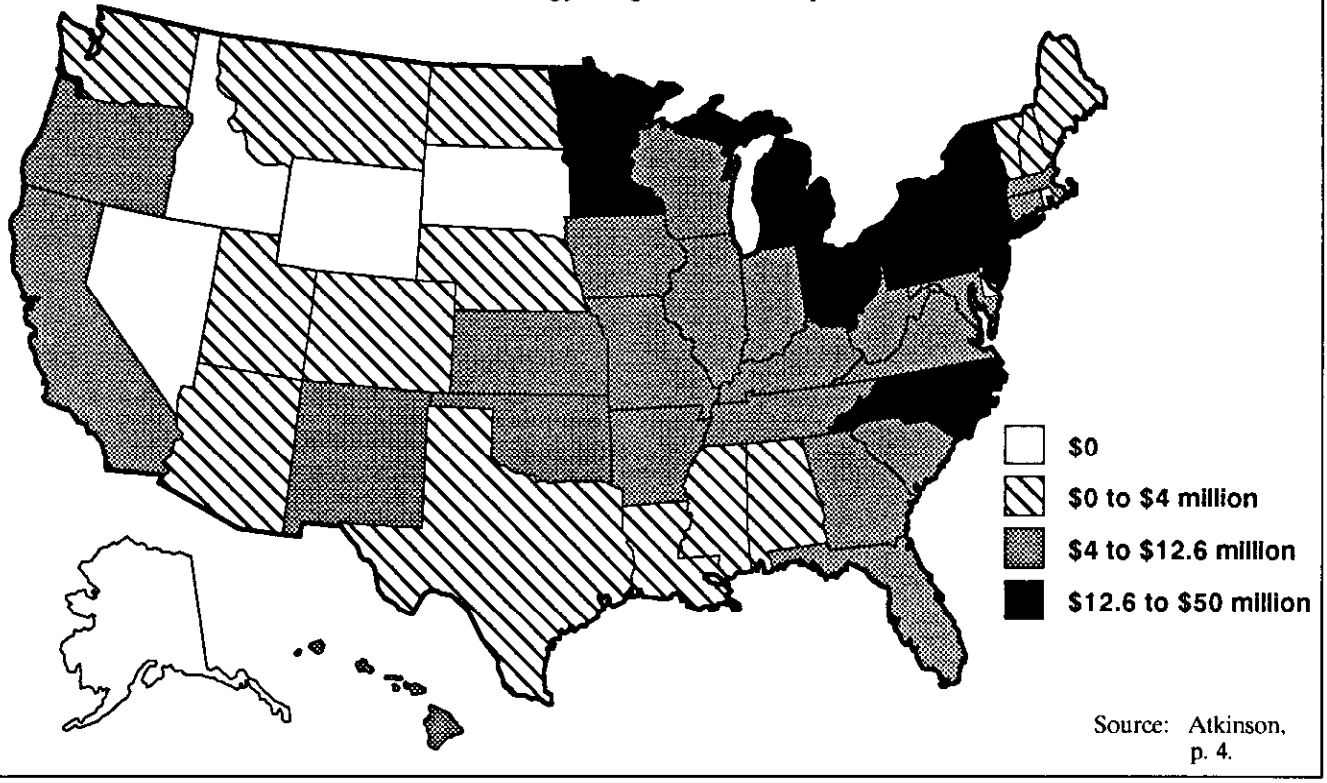
Expenditures on types of programs varied by region, as well. Southern states spent the highest percentage (almost 69 percent) of their total 1987 expenditures on university related programs. The Midwest and West spent more on capital programs than did other regions. The Northeast spent more than other regions of the country on training workers and diffusing existing technology to manufacturing firms (see Table 7).[29]

**Analysis and Assessment**

Several experts indicate that states are placing a growing emphasis on program analysis and assessment. Although none of the surveys reviewed for this paper included assessment, other readings and discussions with practitioners indicate that this is a growing interest among policymakers and program managers. While most of these programs are less than ten years old, and economic growth is not an overnight proposition, many of these initiatives have been in operation long enough to have measurable outcomes. At the same time, as public resources become more scarce, policymakers are looking for reliable measures to ensure that their dollars are being spent in a worthwhile manner.

In 1987, the National Governors' Association, the National Research Council and the Government-Universi-

*Figure 2*
**State Technology Programs Total Expenditures**




Source: Atkinson, p. 4.

*Table 7*

**Expenditures on Programs by Region**

(in percent)

| Program Type | Northeast | Midwest | South | West |
|---|---|---|---|---|
| Research Centers | 54.0 | 36.0 | 49.9 | 28.3 |
| University Research Grants | 4.9 | 13.6 | 18.8 | 18.1 |
| Business Research Grants | 6.6 | 2.4 | 2.2 | 10.8 |
| Loan Programs | 1.5 | .1 | 0 | 5.3 |
| Equity Programs | 6.2 | 21.3 | 11.0 | 23.8 |
| Management Assistance | 1.6 | 3.4 | 2.7 | .5 |
| Incubators | 5.0 | 7.0 | 1.5 | 1.4 |
| Technical Assistance | 0 | 5.9 | 2.0 | .2 |
| Technology Transfer | 1.9 | 3.7 | 4.6 | 1.6 |
| Diffusion of Technology | 12.4 | .7 | 1.7 | 0 |
| Research Parks | 0 | 4.5 | 2.7 | 8.0 |
| R&D Tax Credits | N/A | N/A | N/A | N/A |
| Training | 5.5 | .9 | 1.8 | 0 |
| Policy Development | .2 | .5 | .7 | 1.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

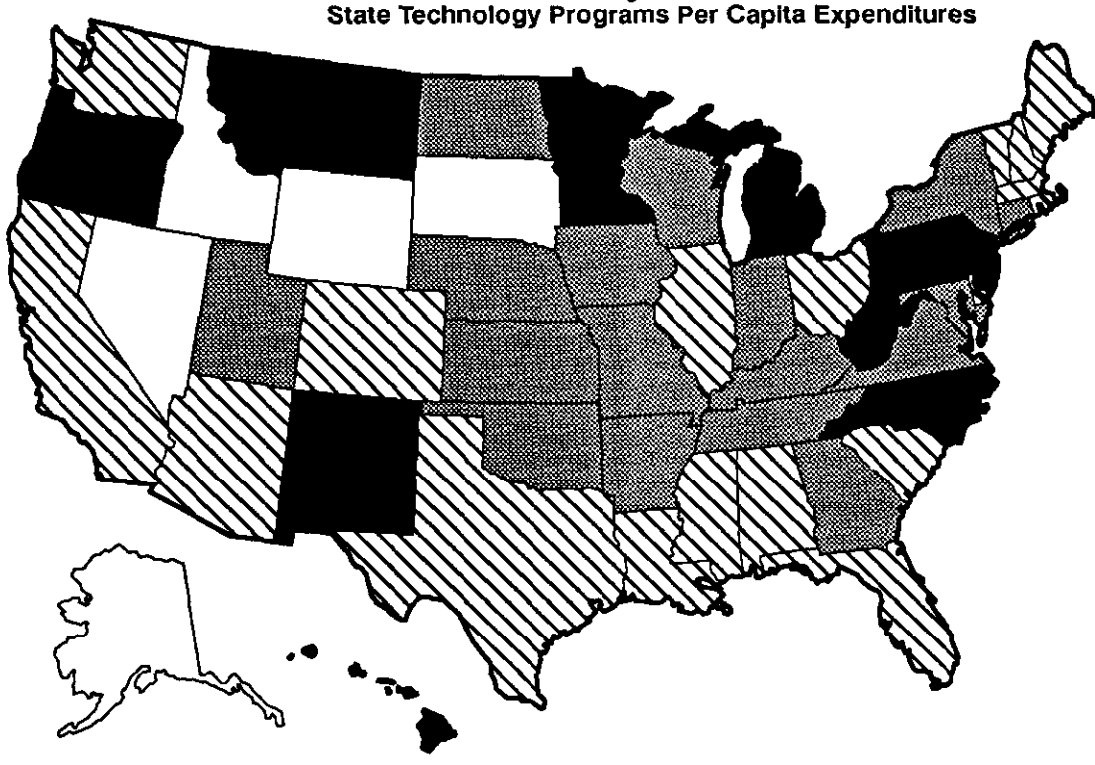
Source: Robert D. Atkinson, *State Technology Programs (A State-by-State Listing)* (Washington, DC: National Association of State Development Agencies, March 1988), p. 9.

ty-Industry Research Roundtable hosted a workshop entitled "State Government Strategies for Self-Assessment of Science and Technology Programs for Economic Development." Workshop participants discussed how state officials could address two key assessment questions: (1) Is the program a worthwhile investment, considering all of the other demands for state money? and (2) Is the program structured most effectively?[30] Several points raised in that workshop are instructive in thinking about state analysis and self-assessment strategies.

First, the participants agreed that science and technology programs are "long-term initiatives" not expected to yield results for five to ten years. Second, state programs have both ultimate goals, in terms of economic growth, and proximate goals, such as strengthening graduate education, producing new industrial processes, and improving

*Figure 3*

**State Technology Programs Per Capita Expenditures**




Source: Atkinson, p. 4.

the transfer of knowledge and expertise into commercial applications. Third is the recognition that self-assessments have at least two audiences—those who fund the programs and those who run them. Finally, the point was made that it is easier to assess a program if its goals and purposes are articulated clearly from the beginning.[31] As state programs mature, more policymakers and program operators are likely to undertake self-assessments as part of their ongoing efforts to improve the design and effectiveness of state technology development programs.

## Findings and Conclusions

There is much that federal agencies, multistate organizations, and others interested in assisting states to improve their technology development programs can learn from what is being done and from the wealth of analysis and writing that has gone before. This section summarizes some general observations made as a result of the research done for this paper and draws some conclusions about what would be most useful to help states improve their programs.

### Findings

1. Most states have programs to promote technological innovation and development. These programs vary in size, scope, funding level, and sophistication. In almost all cases, these programs are developed and implemented as part of a state economic development program and are institutionally linked to the state office of economic development.

2. Programs to promote technological innovation and development are substantially different from traditional economic development programs and appear to be designed in response to changes in the national and international economic environment. More traditional programs rely on tax incentives, regulation, and business recruitment. Programs to encourage technological innovation and development include research, education, provision of capital, technology transfer, and training.

3. There is wide diversity in state programs to promote technological innovation and development. State program managers design their programs to respond to local economic and political conditions and to take advantage of existing industries or technologies in which state policymakers feel the state has a competitive advantage and which hold potential for development. As a result, there is wide variation among state programs in structure, relationship to state government, clientele, and services.

4. There is a fairly strong informal network among state program managers and others who support their work. There is an ongoing exchange of experiences and ideas, albeit in a fairly unstructured manner. However, there continues to be a need for more detailed, current, and complete information about these programs, the conditions under which they operate and, especially, their outcomes. There also seems to be a desire on the part of many program managers to have more opportunities to consult, both with one another and with academics and others studying these programs, on a more structured basis. State associations, especially the NGA Working Group on State Initiatives in Applied Research, provide this forum to some extent, but more of this kind of interaction may be needed.

5. Summary information on most state programs has already been collected and categorized. In the Minnesota report, Robert Atkinson's report for NASDA, several NGA surveys, and other sources, state program data has been compiled on a nationwide basis. This information is limited, according to most observers, because it does not cover all state programs, is superficial, is outdated almost as soon as it is published and collected, and is categorized in ways that frequently result in the loss of valuable information.

6. The work of the multistate organizations in the area of technology development is, in general, limited, although valuable. The National Governors' Association and the Southern Technology Council have the most extensive programs. Their activities include surveys, technical assistance, task forces, and ongoing communication with federal agencies. A few other organizations—the National Association of State Development Agencies, the Council of Great Lakes Governors, the Northeast-Midwest Institute, the National Conference of State Legislatures—have either included technology development in their overall economic development activities or have undertaken a one-time project with little or no follow-up. This may be attributed to the absence of federal funds in this area, for the states themselves as well as for the organizations that serve them.

### Conclusions

***There is a continuous need for accurate, current, complete information about state programs.***

All experts consulted, including state program directors, agree that there is a need to have quality, current information on what policies and programs states are implementing. This information serves several purposes. State program managers use the information to develop and improve their own programs. Federal officials use it to make federal programs more responsive to state initiatives. Multistate organizations use the information in targeting the assistance they provide to states and in representing the interests of the states to federal agencies. Information about state policies and programs is also used by academics to track changes and trends over time and conduct other research necessary to improve the practice. Finally, university and industry people use information about state policies and programs to structure their participation in collaborative efforts.

State officials are willing to share information about their policies and programs, but they would also like to have an intermediary who can respond to the most common and time-consuming inquiries. They are looking for an information source that could take some of the burden of responding to inquiries from their shoulders while providing them with more in-depth information than is currently available.

One suggested model was the funding of several ombudsman positions. These officials would become extremely knowledgeable about state programs and have regular contact with key people in the state. They could call on a com-

puterized data base, but would be able to go much further in responding to inquiries because they could analyze the problem that the "client" was trying to address, synthesize the information on file, be current on changes in state initiatives and be able to provide a more tailored response.

***The diversity among state programs in technology development creates a special problem in terms of collecting and categorizing information.***

State technology development programs are extremely varied. Because they are designed to respond to local economic and political conditions and they involve so many different players—government, universities, private firms, quasi-private organizations—each program has unique characteristics. These programs may vary from one another more than other types of state programs, because they were not designed in response to a federal mandate or grant program and they involve so many different kinds of players. Whatever the reason, it is this diversity—the innovation in technological innovation programs, so to speak—that makes information sharing even more rich and valuable.

It is this diversity that also makes it difficult to collect information about programs and even more difficult to organize the information in a way that it can be retrieved. Frequently, the names of programs are similar, but they provide very different services. Other times, similar programs have different names. How can information about state programs be collected and maintained so as not to lose valuable information, but still be able to respond to categorical questions?

One approach to this dilemma is the ombudsman role mentioned above. Someone who knew the particulars of a state program in more depth than the written or computerized information and could understand the linkages between an inquiry and an existing program could be more helpful than the data base alone. Another important consideration is how the data are collected in the first place. Much of the information that has been collected about all state programs to date has been done through a survey instrument designed to "force" the information collected into descriptions that can be compared and summarized to produce a national picture. This approach has its merits and purposes. However, if the primary purpose of collecting information about state programs is to help other states learn from earlier experiences, a more open-ended description not geared toward summary and comparisons might be of more use. Case studies on many of the best programs in the country exist as models for collecting this kind of information. But many programs have not been documented in this way. Studies of these programs could also be highly instructive.

A third approach to collecting and categorizing information about state programs is to follow the example set by David Osborne in the paper prepared for the Council of State Policy and Planning Agencies. Designed around "problem-solving," this approach to categorization might be more responsive to the kinds of questions that a client poses.

In whatever form the information is organized, several experts suggest that it be collected through a self-reporting system that is maintained on a computer base. If possible, updates would be sent in electronically when there are changes in the program. In addition, every year or so, the information would be sent to program managers who would be asked to make changes or corrections that may not have been made during the year.

***There is a need for better assembling and coordination of information on federal programs for technology development.***

Several individuals interviewed suggested that there is a need to have some organization or agency take overall responsibility for identifying and coordinating information on federal programs. States could then access this source when looking for federal assistance or programs to integrate with their technology development activities. Although there are few if any federal programs that help states plan or implement technology development programs, there are economic development assistance programs that can be used, in some cases, to support technology development activities. There also are many more federal R & D and business assistance programs that could be used in conjunction with state technology development programs if state development officials had complete and current information on them.

There is presently no place where complete and current information on these programs exists, much less any staff to help states find ways to integrate them with their own initiatives. The same agency that assumes responsibility for maintaining this data base and contacts list also could sponsor seminars and technical assistance sessions for state program managers to help in integrating federal and state programs.

***There is a need for and interest in developing and conducting more and better program analysis and self-assessments.***

Probably the most frequently mentioned and the most sensitive area in which states could use assistance is in program analysis and self-assessment. Many state programs have been in place long enough for program funders, policymakers and program managers to expect measurable results. A few states have conducted self-assessments or hired outside consultants to analyze or evaluate their programs. In addition, some assessments of programs and practices have been undertaken by academic institutions interested in the field. In general, however, analysis and assessment have been anecdotal or preliminary.

Many observers indicated that states could benefit from a comprehensive assembling and documenting of the analyses and assessments of state programs, both anecdotal information and comprehensive assessments. State and local officials also need assistance in developing methodologies to measure the progress and success of their own efforts. This assistance could be provided in a variety of ways, including from peers; from academics who study programs, develop methodologies, and conduct assessments; or in seminars for state and local officials to discuss the issues and questions surrounding analyses and self-assessments.

In conclusion, many states have instituted technology development programs. The programs are as varied as the economic and political environments in which they operate. States have found informal ways to share information and learn from each other, as well as the more formal collaboration that occurs through multistate organizations. But there are still many things that could be done to increase and en-

*rich that interaction to the benefit of state programs and* overall economic growth throughout the nation.

## Notes

[1] David Osborne, *Laboratories of Democracy: A New Breed of Governor Creates Models for National Growth* (Boston: Harvard Business School Press, 1988), pp. 3-4.

[2] *America in Transition: Report of the Task Force on Research and Technology* (Washington, DC: National Governors' Association, 1989), pp. vi-vii.

[3] Walter H. Plosila, "Science Engineering and Technology Centers: Experience at the State and Local Level." A paper presented to the Montgomery County (Maryland) High Technology Council, 1988, p. 10.

[4] Marianne C. Clarke, *Revitalizing State Economies: A Review of State Economic Development Policies and Programs* (Washington, DC: Center for Policy Research and Analysis, National Governors' Association, 1986), p. 1.

[5] Daniel B. Garry, ed., *Gubernatorial Policy Making through Science Advice* (Washington, DC: Office of State Services, National Governors' Association, 1982), p. 2.

[6] Marianne C. Clarke, "Recent State Initiatives: A Preview of State Science and Technology Policies and Programs." Prepared for Jurgen Schmandt and Robert Wilson, eds., *Growth Policy in the Age of High Technology* (Boston: Unwin Hyman, Ltd.).

[7] Clarke, *Revitalizing State Economies*, p. 57.

[8] Clarke, "Recent State Initiatives," pp. 4-5.

[9] *America in Transition*, pp. 20-21.

[10] Osborne, *Laboratories of Democracy*, p. 4.

[11] Task Force on Technological Innovation, *Technology and Growth: State Initiatives in Technological Innovations* (Washington, DC: National Governors' Association, 1983), p. 12.

[12] Clarke, *Revitalizing State Economies*, p. 58.

[13] Ibid., p. 57.

[14] David Osborne, "State Technology Programs: A Preliminary Analysis of Lessons Learned." Unpublished paper prepared for the National Association of State Policy and Planning Agencies. January 1989, pp. 2-3.

[15] Ibid., p. 42.

[16] Ibid., p. 66.

[17] Ibid., p. 77.

[18] Ibid., p. 100.

[19] Robert D. Atkinson, *State Technology Development Programs (A Summary and State-by-State Listing)* (Washington, DC: National Association of State Development Agencies, 1988), p. 6.

[20] "The Structure and Function of State Science and Technology Offices," *Capital Ideas* (Washington, DC: Center for Policy Research, National Governors' Association), September 1, 1988, pp. 1-6.

[21] Ibid., p. 4.

[22] *State Technology Programs in the United States, 1988* (St. Paul: Office of Science and Technology, Minnesota Department of Trade and Economic Development, 1988), p. 3.

[23] Ibid., p. 7.

[24] Jonathan Rauch, "Stateside Strategizing," *National Journal*, May 27, 1989, pp. 1294-1297.

[25] *State Technology Programs in the United States*, 1988, p. 2.

[26] Atkinson, *State Technology Development Programs*, p. 5.

[27] Ibid., p. 4.

[28] Ibid., p. 3.

[29] Ibid., p. 9.

[30] *State Government Strategies for Self-Assessment of Science and Technology Programs for Economic Development.* A report from a workshop jointly sponsored by the National Governors' Association, the Government-University-Industry Research Roundtable and the National Research Council, April 10, 1987 (Washington, DC: National Academy Press, 1987), p. 1.

[31] Ibid., pp. 3-13.

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# Federal Technology Transfer: Critical Perspectives

*Louis Mogavero*
*Kenneth R. Susskind*
*Achmad M. Chadran*

## Introduction

This paper outlines critical perspectives of key entities involved in the transfer of federally funded technology to the private sector. The intent is to provide added insight to the technology transfer process through lessons learned by these entities and gained through actual experience, be it from the perspective of a business, broker, or technologist. Space Commerce International, Ltd. (SCI) and Trantek, Inc. have been involved in various issues pertaining to technology transfer and utilization activities. Our experiences, combined with the perceptions and misconceptions of key players in the technology transfer process, will form the basis for conclusions that are intended to serve as useful inputs for a Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation.

SCI specializes in providing technical support, technology transfer, and marketing services. Trantek specializes in transferring technology between companies and between governments and industry, domestically and overseas. A review of relevant literature was conducted in the course of developing the ideas which follow, although this research serves chiefly to support the invaluable primary research and hands-on experience that are at the core of this paper.

## Background

The federal government spends more than $62 billion annually on research and development.[1] These funds are allocated each year to programs developed by the departments of Commerce, Defense, Energy, Agriculture, and Health and Human Services, and NASA, National Science Foundation, and other government agencies. This constitutes an extensive resource base of technologies and innovations, a great many of which have commercial applications.

While federal technology transfer efforts have existed for a long time, beginning with the Department of Agriculture's extension activities and, more recently, NASA's Technology Utilization program, its promotion on a government-wide basis began when the Stevenson-Wydler *Technology Innovation Act* was passed in 1980. The act mandated the transfer of non-sensitive technologies by federal departments and agencies to the private sector and state and local governments.

In 1986, the act was amended by the *Federal Technology Transfer Act*. Among the provisions of the latter act was a means for facilitating cooperative R&D agreements between private industry, universities, and federal laboratories.

In 1987, President Ronald Reagan issued Executive Order 12591, "Facilitating Access to Science and Technology," which sought to promote further cooperation between private industry and the federal laboratories by allowing the laboratories to license, assign, or waive their rights to technological innovations. Private companies were now free to pursue the commercial applications for technologies they helped develop for national missions.

In August 1988, President Reagan signed the *Omnibus Trade and Competitiveness Act of 1988*. The new act redesignated the National Bureau of Standards as the National Institute of Standards and Technology, established a new Undersecretary for Technology, and created a new Technology Administration within the Department of Commerce. It is this new act which contains provisions for the establishment of a Clearinghouse, within the Department of Commerce, which will serve as a central repository of information on federal, state, and local initiatives on productivity, technology, and innovation.

## Objectives of Technology Transfer

In any discussion of the potential role, design, and operation of the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation, it is important that we understand that the basic motivation of any business is to maximize profits in order to remain competitive. Therefore, any application of external forces that help achieve this goal should be energetically pursued.

The predominant objectives of these forces are to: (1) *reduce costs* (make an existing product or service less expensive), (2) *improve quality* (make the product or service more reliable), and (3) *develop new products or services*. When one or more of these aims are accomplished, the business is better positioned to increase sales volume or to create a market for new or improved products or services, thereby increasing profits.

The three major sources of external assistance are: (1) infusion of capital, (2) increased manpower, and (3) introduction of new technology. Of the three, this discussion will focus on the introduction of new technology, specifically, *federally funded* technology, to achieve the goal of improved competitiveness.

Both foreign and domestic studies related to the cost-benefits of government-sponsored technology transfer efforts reflect positive ratios. In some cases, the benefits result in a significant return on the investment. One study conducted by Mathematica, Inc., showed the overall benefit-cost ratio of one federally funded technology transfer program to be as high as 6 to 1. Another study, conducted by A.D. Little, Inc., found benefit-cost ratios of at least 3 to 1 for firms participating in the three or four most successful State Technical Services (STS) programs in each state.[2] One may conclude that any program that enhances the transfer process and ultimately increases competitiveness should make a positive contribution to the economic health of the country.

The method by which this process may be undertaken, however, is currently a source of a great deal of discussion. Many different solutions have been proposed to increase the rate of technology transfer and successful utilization, as witnessed by the establishment of a Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. A central concept of this paper is that the perspectives of all of the key entities involved in the technology transfer process are inevitable factors that have an impact on the successful operation of such programs. Therefore, a sensitivity to these perspectives is crucial to the design, implementation, and operation of any new initiatives.

## Perpsectives of Key Players

The players actively involved in technology transfer activities may be grouped into four major categories: business end-users, technology brokers, federal technologists, and mechanism developers. An on-going program to promote successful technology transfer depends on a careful consideration of all of these perspectives. The end-users are the ultimate beneficiaries of any well designed technology transfer program; naturally, their needs, experiences, and perceptions are most important. Without the input of the technology brokers, federal technologists, and mechanism developers, however, it would be difficult to design and implement a technology or innovation initiative sensitive to end-user needs.

The purpose of this section is to establish a common basis for understanding the general nature of technology transfer and the role of innovation, in particular, on the transfer process. This section will describe the activities undertaken by key players involved in technology transfer, their differing motivations, and the nature of their interaction.

### Business End-Users

The business end-users of federal technology resources are comprised of those companies that seek competitive advantage through the application of new technologies. As described above, this group is motivated by the overriding goal of increasing competitiveness and, ultimately, profits. Beyond this goal, however, there may be great differences in the way new technology is perceived by different companies.

One might assume that the federal laboratories are deluged by people asking for assistance, but this does not necessarily happen. There are factors linked to corporate perceptions, such as a reluctance to expose proprietary information, an aversion to dealing with the federal system, and a hesitation to invest time and money to travel to the source of information, that serve to keep the number of inquiries relatively low. In addition, it seems as though private R&D technologists fear that this type of technology search might reflect negatively on their own innovative ability. Below are a few of the end-users' key perceptions that affect their access of technology information.

***Perceived Sophistication of Technology.*** *One reason* some business end-users do not attempt to access federal technology data is that there is frequently a misconception of the sophistication of the technologies involved. For example, technology transfer agents, in interviews at the University of Southern California, University of Oklahoma, and Stanford Research Institute, reported that when corporate technologists were queried about their reasons for not searching for federally developed technologies, a significant number believed that these technologies were too sophisticated for their needs. The companies these technologists worked for were usually at the small business end of the spectrum, but the perception was found in large companies as well. They were conditioned to believe that NASA was involved with work in the "hard sciences" needed for space exploration; the Department of Defense with massive, complex weapons systems; the Department of Energy with intricate energy generating plants; etc. All too often, they feel technologically inferior and intimidated by the vast amounts of R&D being conducted in areas of their interest.

**Short-Term Focus.** Another factor limiting a firm's incentive to seek federal technologies is the current tendency to seek near-term solutions. The prevailing tendency is to solve problems within a one- to two-year time period, thereby shifting the focus from long-term new product design to short-term product improvement. During an interview with a Fortune 500 company president, he remarked that, "If I don't come up with a new product and show an increase in our profits in the next two years, I'll be fired," and this is not an isolated example. The net result of this tendency is to shift the focus of the search strategy from *research* to *development* technologies. When this shift occurs, there is little incentive to seek out federal government technology.

**"Not Invented Here."** Technology transfer to the private sector may be hindered by the commonly observed "not invented here" (NIH) syndrome.[3] This is the mindset that precludes from application any technology or innovation generated outside the firm. The NIH syndrome may be attributable to a need to protect annual R&D budgets, to a real or perceived stigma within the firm against externally developed technologies, or to a simple mistrust of other people's work. A case in point is our experience with a client, one of the largest food processing companies in the United States, that requested contacts with federal technologists working on unique membrane technologies. During our discussions, the vice president for R&D became somewhat hostile, and when asked his reasons for his sudden change in attitude, he responded, "My credibility is being called into question by my subordinates because it appears that I can't handle my job and need external help!"

***Large Companies.*** *In general, large companies can* gain much advantage by acquiring federal technology. These companies usually have large technical staffs that can more easily assimilate the federal technology into their current programs. They generally have well developed information management systems, as well. In some extreme cases, certain companies have learned that their current R&D programs could be curtailed or redirected. This happens because there is a greater exchange of information between company technologists and their counterparts in the federal laboratories.

The interpersonal exchange of information between large firms' technical staffs and federal technologists often

allows the firms to bypass formal technology transfer channels.[4] However, a lack of awareness does exist among these technical staffs as well, which may leave many federal technology resources untapped. Where these resources are actively sought out, it is usually for specific information. Corporate technologists are often referred to federal technical information informally, through their peer networks, and, not surprisingly, through the use of a simple research tool—the telephone.

The preference among large corporations is usually for technical data as provided by a passive data base or publishing mechanism. For proprietary reasons, large firms seldom seek technology extension services or other active technology transfer mechanisms. These mechanisms usually require in-depth discussions of the problems at hand, and are perceived to threaten corporate security.

**Small Companies.** For small companies or individual entrepreneurs, a different pattern exists. First of all, by their very nature, small businesses are even more short-term oriented than large companies. They have much less resilience to dramatic changes in financial performance, and so cannot afford to invest heavily in R&D. Second, small companies seldom have the technical staffs needed to interpret technical literature. Rarely do they have a staff dedicated solely to devising solutions to technical problems. Third, current technology transfer programs, for the most part, have not adequately addressed the particular needs of small businesses. Many agencies have only begun to implement the *1986 Technology Transfer Act* and the 1987 Executive Order with respect to increased attention to small businesses.[5] The small business community is a ready target for technology transfer efforts, but they do not have the resources to work with any but the most active mechanisms.

The primary obstacle to technology utilization on the part of small businesses is a lack of awareness of available programs. Ironically, their need and willingness to seek out such programs, once identified, is often greater than that of large firms. Here, proprietary information may not be a critical issue, and small businesses therefore could benefit from more comprehensive assistance, such as may be provided by technology extension or broker services.

**Mission Requirements and Private-Sector Applications.** In the final analysis, the great majority of most successful transfers occur when a personal relationship is developed between the federal technologist and the information seeker. With the exception of those technologies that are developed for specific private-sector applications, such as environmental science, transportation, and medical technologies, much of the R&D conducted at the federal level is generated for the purpose of satisfying mission-related requirements for agencies like NASA and DOD. The R&D conducted for these agencies is performed with little or no thought about possible private sector spinoff applications.

Any application of these technologies to other problems usually requires additional research, development, and product engineering. Requestors know what they are after, but often do not fully understand the technology they are seeking. Conversely, technologists understand the technologies they develop, but know little or nothing about the requestors' problems or about their own technologies' possible applications.

Additionally, mission-oriented research is not generally guided or restricted by rigid cost pressures. It is usually guided more by safety and reliability considerations, so that even when technologies are related more directly to the requestors' requirements, further development and product engineering have to be conducted. Therefore, there is an ongoing, unfortunate struggle between access and the benefit of personal interaction with the technologists, on the one hand, and the mission requirements that the technologists ultimately must satisfy, on the other.

**Perceived Cost of Technology.** An interesting phenomenon we have observed is that little value is placed on free technology. An experiment was conducted at the University of Pittsburgh's Industrial Application Center, in which technology information was distributed under three different cost schemes. Information seekers in one group were given the information completely free of charge, a second group was charged half the cost of providing the information, and a third group paid the full cost for the materials. In follow-up studies conducted within a year after distribution, it was found that the group that bore the full cost of the information had the highest rate of successful utilization of the technology. When technology is made available at no cost to the user, the motivation to make certain it is *used* is apparently lessened. When charged for the technology—that is, charged for the *effort* to get it to the user—the user's application efforts increase in direct relation to the charges.

**Technologies vs. Solutions.** Our work in technology brokering has shown that most information seekers are not looking for technology as much as they are trying to get help to solve problems. More often than not, it has been our experience that when a technology is identified to solve a particular problem, that technology is not the one originally sought out by the client. In their quest to apply technological solutions to their problems, entrepreneurs lean heavily on the federal technicians to find ways to apply the technology to their specific purposes. Technologists, on the other hand, attempt to understand the problem and offer possible uses of the technology. Some middle ground is often sought between the two, wherein both attempt to understand the other's needs and expertise. It is during the course of these discussions that application breakthroughs usually occur.

## Summary

The motivation to seek (or shun) federal technologies differs between large and small companies. By most accounts, the primary motivation to acquire these technologies, and thereby gain the competitive advantage, is there. This is tempered, however, by attitudinal and practical constraints.

These differences are pronounced enough to merit specialized attention to small and large businesses. While there is a solid foundation of work in transferring technology to large corporations—indeed, most discussions of technology transfer are limited to this aspect alone—very little research has been conducted on small-business technology transfer. Any programs that are planned by state

and local initiatives or federal agencies should therefore be prepared to accommodate the differing needs of these two constituent groups, or else to accept targeting one or the other group exclusively.

Part of the information that any new technology transfer initiative will need to disseminate to its potential users is some idea of the amount of investment one will likely need to make, in terms of both time and money, in order to successfully utilize a given federal technology. This information would be especially helpful for the small-business owner or entrepreneur, whose budgets are already restricted. Any potential end-user will be better prepared to decide whether to seek federal technology if such investment is provided.

### Technology Brokers

There is an overwhelming variety of sources of federally funded technology, including publications, seminars, laboratory technicians, and computerized data banks. Few people even know of their existence, let alone are familiar with the intricacies of extracting the information. These intricacies result in a void between those seeking new technologies and those who wish to provide it. In many cases, this void is filled by technology brokers.

Technology brokers are agents who specialize in matching sources of technology with potential end-users. This breed of entrepreneur operates between the user and the technologist. They function as intermediaries—trying to understand the users' problems and to match them with the appropriate technology and/or technologist. In effect, they fit into a mode which may be described as somewhere between active and passive. They are referred to as brokers because they neither solve the problem nor generate the technology, but narrow the search field for both sides to high potential marriages of the two.

**Time Value of Brokers.** The value of technology brokers is in keeping current with ongoing R&D in government and industry, and in understanding the needs of the client. Obviously, no one person can keep current with all ongoing R&D, but the broker usually has developed a network of enough contacts to get to the appropriate technology in a relatively short time. Therein lies the technology broker's value: *saving time*.

The value of technology brokers to their clients lies in their talent to analyze and understand quickly the technology requirements of the problem at hand, and their subsequent ability to identify rapidly the relevant technology and its location. Users are confronted with a basic choice. They may choose to identify a *source* of information independently , search for the information, acquire the information, understand the information, identify the innovator, and, finally, arrange a contact. Alternatively, they may choose to enlist the assistance of a broker to do it for them. It is usually more cost effective to let the broker make the connection because of the time involved in learning where to go and how to get the information.

Some large technically oriented companies, appreciating the value of the technical broker, have developed their own in-house counterparts to perform this function. These companies have full-time resident brokers who specialize in seeking those technologies having a potential impact not only on current product lines, but also on future product development.

### Summary

Technology brokering developed in response to the needs of both information seekers and technologists. Information seekers are ordinarily faced with an enormous task in order to find an appropriate technology, if such exists. Technologists would like to assist information seekers, but often do not understand their problems, or cannot set aside their primary mission-oriented responsibilities.

### Federal Technologists

Federal technologists, as defined here, include the bench scientists who work on mission-related technologies and the managing scientists who supervise their work. They are responsible for pioneering technology innovations, bringing these innovations to the attention of brokers or technology transfer agents, and furnishing potential users with further assistance. This assistance can be structured in many forms, ranging from simple explanations of the technology to hands-on help in re-engineering the technology for a specific application. Following are some key perspectives involving technology transfer, as they relate to federal technologists.

**Conflicting Priorities.** When called on to help the requestor, a number of questions present themselves to the technologist. Foremost is, "Why should I take time from my regular work to help this person?" In practice, our sources have shown that very few have refused to spend a few moments to send additional information or briefly explain some of the subtleties of the technology at hand. Federal technologists generally have a personal interest in the application of their innovations either within the scope of their research project or in a spinoff in the private sector. Beyond that, we find a wide range in the level of assistance being offered, depending on the state of mind of the technologists and/or the policies of their management. To support this statement, NASA commissioned the American Institute of Aeronautics and Astronautics (AIAA) to conduct a technology transfer project for Fortune 500 non-aerospace companies. When the people who conducted this multiyear study, both within NASA and the AIAA, were asked questions regarding the cooperative attitudes of the federal technologists toward the non-aerospace engineers and scientists, not one instance of uncooperative behavior was identified. It must be noted, however, that this project had the complete support of the NASA Administrator and the laboratory directors, which indicates that when encouraged by top management, cooperative attitudes result.

This important observation is not meant to reflect negatively on the professionalism, qualifications, or dedication of federal technologists for their primary mission assignment. It is merely intended to focus attention on the reality of the technologists' position, having to divert attention from their primary responsibility, unless encouraged to do so by laboratory managers.

No firm rules have been developed to *force* the technologist to spend time with the requestor. The performance of government technologists is not being evaluated on their ability to help non-government requests for assis-

tance. Performance evaluation, the key to pay increases and promotions, is based on the technologist's ability to enhance the agency's mission, not on the aptitude to help in the solution of non-mission problems.

No doubt much may be said in opposition to this statement, citing rules, regulations, policies, and recently enacted laws to the contrary. Years of experience with this process, however, have shown that, in practice, any assistance given by federal technologists is directly related to their *supervisor's acquiescence* and willingness to allow time to be taken from mission-related work and applied to non-mission problems. One incredible event occurred when a supervisor told one of his outstanding federal technologists not to spend any more time on technology transfer because the supervisor was overwhelmed with requests for his subordinate to speak at various technical functions.

**Management-Level Considerations.** From a purely pragmatic viewpoint, the technologists' supervisors are put in a position of trying to serve two masters. On the one hand, they have an obligation to apply all of their resources to the missions at hand, with their performance being evaluated on how well that is accomplished. On the other hand, they are obligated to set aside some portion of their resources to transfer activities.

Our experience indicates that only a very small percentage of technologists have been promoted to higher levels of responsibility based on work in technology transfer. In fact, there are cases where bench technicians have been penalized for spending what their superiors considered as "too much time on outside business," while working to transfer technology.

It should, therefore, come as no surprise that few technologists view work in technology transfer as a path leading to promotions *within their technical career field*—that is, the discipline in which they were educated, trained, and, in most cases, hired.

On the other hand, we have observed that most supervisors have a sense of responsibility to help the taxpayer, from which all their resources flow, particularly if it enhances the economic health of the nation. But this service is always supplied on a non-interference basis, and rightfully so.

**Technologist-Level Considerations.** Much can be said for the incentive of the laboratory technical innovators—the technologists. Most laboratory technologists work on esoteric research, and all technologists live with the hope of seeing the results of their labor applied to their agency's mission, or at least applied to the solution of a private sector problem. Therefore, a greater degree of cooperation is found at the bench level in federal laboratories than at the management levels.

Here, technologists help with the expectation that they will see their work applied to something more immediate and thereby gain immediate gratification. Laboratory specialists are driven more by a desire to see the results of their labor *put to use* than by any other consideration, including cash awards. Such awards may bring with them a degree of public recognition but are usually not large enough to stimulate dedication to technology transfer.

**Summary**

Lacking a formal structure to assist in the technology transfer process, federal technologists are hard pressed to fulfill their roles as technology transfer agents under current legislation. The focus on how to get more assistance from the technologist should be aimed at the federal laboratory management level in order to have a defined level-of-effort set aside for this purpose. As an example, Langley Research Center developed a special time charge code for technology transfer projects. All time expended on this type of activity could be collected, analyzed, and used as budget bargaining tool.

Therefore, an examination of the incentive systems already in place in the nation's federal laboratories serves to provide useful insight into the successes and constraints of technology transfer activities. If these incentives are determined to be insufficient to reward technology assistance, then the burden of assistance must fall back onto other entities or programs, such as state and local initiatives.

**Mechanism Developers**

Technology transfer mechanism developers are those federal government policymakers responsible for the design and implementation of technology transfer processes and programs.

Notwithstanding the great progress made in the federal government's efforts to transfer technology, this field is still a vast, uncharted territory that government employees are commissioned to explore. Still, the fact remains in almost all cases that the training and occupational conditioning of these employees teaches them to concentrate on *developing* technology, not *transferring* it.

In fact, it was not until recently that formal courses in technology transfer were offered at educational institutions. This highlights the fact that, historically, this discipline was acquired only through on-the-job training. Understanding the motivation of private sector entrepreneurs was not a prerequisite for the job.

Therefore, it was difficult at first for the technology transfer mechanism developers to understand why all this wonderful, sophisticated, highly acclaimed technology was languishing in the warehouse in spite of their herculean efforts. As one manager put it, "Here we are all dressed up for a party and we haven't received an invitation!" Below, we cite some examples why.

**Understanding Consumer Needs.** Technology transfer mechanism developers learned quickly what their counterparts in industrial R&D learned: you have to know who your customers are and what their needs are. To quote a well known travelling salesman's idiom, "You have to know the territory." This is a difficult transition for the federal technologist to make, having been accustomed to responding to mission requirements rather than consumer needs.

To their credit, these mechanism developers soon adapted to the marketplace and learned to consult with the people who required the technology. This provided NASA with guidelines for the selection of the mechanism most beneficial to the user and the manner in which the technology should be "packaged" to sustain the user's interest. A case in point is the development of the popular *NASA Tech*

*Brief Journal*, which won national acclaim for its composition and format. In its original form, technical descriptions were disseminated individually (one for each innovation), on a multi-page format, and were written using technical terminology. Reader comments were solicited, which later led to the conclusion that in order to make the technology more easily read, the descriptions should be couched in lay terms and include diagrams whenever possible. Also, to improve the "shelf life" of the information, it was decided to limit the descriptions to one page and package them in book form, that is, provide a journal of descriptions, issued periodically, with a continuing index, so that each description could be referred to at some later date. For an in-depth understanding of the cost/benefits of various transfer mechanisms, the reader is directed to a study conducted by the Industrial Economics Division of the Denver Research Institute titled "A Summary of Cost-Benefit Studies."

An additional example of how experience provided guidelines for the selection of mechanisms most beneficial to the user was the establishment of NASA's Industrial Applications Centers (IAC). These centers, located throughout the country, encouraged the IAC technologists to interact personally with the information seekers in an attempt to better understand the seeker's needs, requirements, and motivations. The intent here was to gain useful, ongoing feedback on how best to design and update NASA's Technology Utilization program. From this feedback, many adjustments were made, which included innovative advertising techniques, modified interviewing procedures (of the information seeker to gain a better insight to his problem) and follow-up strategies.

**Funding Mechanisms.** As in all government-supported services, funding considerations exert a major influence on the concept and implementation of well meaning projects. Thus, technology transfer mechanisms were not always optimal or cost effective, given the objectives and budgetary constraints. A specific example of how one transfer mechanism was substituted for another given funding constraints is as follows: A project developed jointly between NASA and Computer Aided Manufacturing International, an industry association, attempted to bridge the gap between engineering design and manufacturing by using a computer program. This gap is generally referred to as "production planning." The concept held much promise, but required considerable mock-up and testing. Neither organization had sufficient funds to underwrite the proof-of-concept prototype, so rather than have this innovative idea languish in a reference file for lack of development funds, it was decided to resort to the passive transfer mode and publish it in a technical journal. Subsequently, an aerospace company decided to introduce the technology into its process planning operations.

### Summary

From the perspective of mechanism developers, the *primary obstacle to transferring technology* has been, and still is, the *limited understanding of the requirements, motivations, and experiences of the end-users*. As these factors began to have an impact on the design of later technology transfer mechanisms, more attention was focused on the funding required to support the more active programs. The increased responsiveness to the business user came with a price. Designers of new technology transfer initiatives would be well advised to work closely with mechanism developers who have benefited from their work during the early years of technology transfer programs. Their methodologies for targeting end-users, analyzing their specific needs, and responding to new and changing demands were developed through many years of practice and experimentation. These mechanism developers understand the limiting parameters of the operation of technology transfer programs, as well as the trade-offs between price and performance. The information they provide, and the actual lessons they have learned from hands-on experience, provide extremely beneficial insight for both new technology transfer program development and existing program assessment.

### Technology Transfer Mechanisms

The purpose of this section is to categorize and describe three basic approaches to transferring federal technology to the private sector. The particular advantages and disadvantages of each approach are identified and described, and the specific conditions under which they may be most effective are highlighted. In order to develop a national Clearinghouse structured to assist effectively in the communication of information on technology and innovation initiatives, it is necessary to understand the transfer mechanisms currently in operation in various government agencies. We can then make effective use of the lessons learned and avoid repeating mistakes.

During the formative years of the federal technology transfer movement—that is, the decision to make a concerted effort to bring federally developed technology to bear on private sector problems—the phrase "search before research" was used extensively by NASA's Technology Utilization program to convey to the public the notion that solutions to their problems may exist and may be available on request.

As logical as this phrase sounded, however, it soon became apparent that more work would be required to motivate the general public to seek solutions in the federal data repositories. Doors were opened, and the "Welcome" sign hung in conspicuous places, but still the reservoir of knowledge remained virtually untapped. It is ironic that so little interest was being expressed by private companies in acquiring the technology for which they had already paid in federal taxes.

Federal government agencies in both executive and legislative branches, including the Office of Management and Budget, the Department of Defense, the Department of Energy, the Department of Commerce, and the staffs of both House and Senate oversight committees, were pressed to find answers to this perplexing problem. This resulted in the development of a number of approaches to rectify the apparent lack of public interest.

A concerted effort led to extensive advertising and publicity through direct-mail campaigns, national magazines, television and radio programs, and newspapers. Concurrent with this external media venture, three different approaches to more active federal participation with the technology transfer process were formulated.

The mechanisms that resulted may be divided into three categories: passive, semi-active and active. While the general trend in technology transfer programs has been (and continues to be) toward active mechanisms, there are niches which each type may successfully occupy.

**Passive Mechanisms**

Initially, it seemed that the quickest way to start the ball rolling was simply to *make technology information available*. This was the major thrust of most technology transfer mechanisms at the outset, due in large part to budgetary constraints, lack of understanding of the needs of a nebulous target audience, and a further lack of organized mechanisms to implement short-range plans.

The primary aim of the passive type of transfer activity is to reach as many people as possible within a limited budget. The most common ways for accomplishing this include publications, data bases, seminars, technical meetings, and other methods geared to reach large numbers of people. All of these methods are relatively inexpensive and easy to manage.

Examples of successful passive mechanisms for technology transfer include NASA's published abstracts of technologies, *Tech Briefs*, the Department of Defense's Defense Technical Information Service, and a newsletter published by the Department of Interior's Bureau of Mines. The National Technical Information Service (NTIS), maintained by the Department of Commerce, is the federal government's largest technology data base. In addition, the Office of Technology Assessment reports that passive technology transfer programs are supported by as many as 35 other government agencies.[6]

What all of these methods have in common is that they are indeed passive. In other words, there is no involvement with the *solution* of any specific problem. Data are collected, collated, and distributed to mass audiences. Identities of the recipients are limited to names and addresses. To what use the requestor may put the information is not known. Furthermore, it may not even be deemed necessary, given that this technology transfer procedure was intended to be passive.

For precisely these reasons, it is difficult to measure the success of this type of transfer endeavor, at least in terms of the ultimate application or *use* of the technology. If the program's success is based on the number of people reached, then the passive route is, with minor exceptions, the most effective and economical. However, the people who operate this type of mechanism know little of the end-users' problems or of the success of the applications without extensive (and expensive) follow-up.

Passive mechanisms, nonetheless, may be ideal for large firms with full-time technical and information management staffs. In these cases, the anonymity with which a researcher can obtain information may be viewed as a competitive advantage. As illustrated earlier, federal technology information is often accessed with the help of a technologist's peer network, thereby minimizing the search process.

**Semi-Active Mechanisms**

In semi-active technology transfer mechanisms, a *technology broker*, rather than the entrepreneur, does the searching for appropriate technology. These mechanisms involve searching for an appropriate technology, but do not involve the actual application of that technology. The broker thus leads the requestor to the technology, but is not required to assist in the application of the accessed technology to the problem.

Perhaps the best known of these is NASA's Technology Utilization (TU) program, which was initiated in 1962. While the TU program began as an R&D publishing and distributing operation, the quest for a greater success rate in applications led to the exploration of a brokering type of activity. By 1971, NASA had gone even further, developing a network of regional broker programs now known as Industrial Application Centers.

In this case, due to a close association with the entrepreneur, the technology broker gains an insight into the requestor's objective and the problem at hand, and has a preconceived idea of one or more technologies that may potentially provide a solution. Although the broker may not be completely taken into the confidence of the information seeker, some knowledge of the problem is gained through personal contacts and an exchange of information. This may be conceptualized as a basic technology search service with "value-added" aspects.

Having some knowledge of the requestor's problem, the added value comes from the ability of the technology broker to reduce the volumes of possible technical candidates to only those having a high degree of possible application. The broker's specialty is knowing where to search and how to get access to information sources, thereby saving the requestor considerable time and money in dead-end pursuits.

Federal technology brokers appear to be most useful and productive for small or medium-sized business constituents who do not have full-time technical staffs. Because brokers do not specialize in the application of technology, and because incidences of misdirected searches are frequent, some degree of technical proficiency on the part of the businesses is an important prerequisite. This is particularly true for small businesses, whose problems may often extend beyond technical issues and into areas of management and operations.

**Active Mechanisms**

As the technology transfer process became more sophisticated, and as more pressure was applied to show the fruits of federal funding in transfer activities, mechanisms became more involved with the application of the technology. Systems started to become more "active." More attention was now focused on how the technology was to be applied to specific problems.

At the most active end of the spectrum, there is total involvement with the actual application of the technology. Briefly, these methods may involve identifying the appropriate technology required to solve a problem, re-engineering the technology to fit the application, conducting market analyses to determine the size and character of the potential market, providing feedback to refine the technical approach, and doing whatever is necessary to bring the end product to the marketplace.

At the federal level, the best known of the programs that use active mechanisms is the Department of Agricul-

ture's Cooperative Extension Service, a portion of whose activities is devoted to technology transfer. At the state level, an exemplary program is the Pennsylvania Technical Assistance Program (PENNTAP), an industrial extension program modeled largely after Agriculture's Cooperative Extension Service.

With active technology transfer mechanisms, more resources are devoted to the total transfer process. Therefore, technology agents must focus on fewer problems. Although this method may not be as cost effective as the dissemination mode, the rate of successful applications is very high, due in large part to the selection process. Another major advantage from the viewpoint of the transfer agent is the ability to remain constantly involved and, therefore, better able to track the transfer process and final application.

In the course of the active technology transfer process, much is learned about the transfer mechanism, such as how and why it works and does not work. This information, in turn, leads to constant iterations and, hopefully, to improvements to the system.

Further, one must consider the advantage gained by providing visual proof to the funding authorities in both the legislative and executive branches of the government that their investment in the transfer process has resulted in demonstrable applications. This advantage is possible only with active technology transfer mechanisms.

Technology extension and other active mechanisms seem tailor made for small businesses and entrepreneurships. The only limiting factor in their overall impact is the cost of providing the services. For example, in fiscal year 1984, the USDA's extension budget was $334 million. In contrast, NASA's entire technology transfer budget in fiscal year 1983 was $9 million.[7] Cost considerations aside, the close interaction between agents and end-users helps to minimize the possibility of technology mismatches, and allows much needed guidance in management and other related areas of technology utilization.

### Lessons Learned

The preceding discussion suggests some central points about transferring technology to the private sector. These may be summarized as follows:

1. Federally funded technologies may be an important resource for companies seeking increased competitiveness by reducing costs, improving the quality of their product or service offerings, or developing new products or services.
2. The benefits of effective technology transfer programs often result in significant returns on investment in the programs' operation, both for participating businesses and in terms of productivity, job creation, and tax income.
3. Federal technology transfer programs are valuable resources for business, reducing the need for large internal R&D budgets and accelerating the natural process of innovation.
4. The successful transfer of federally funded technologies is a complex process, involving the creativity and hard work of four key entities: business end-users, technology brokers, federal technologists, and mechanism developers. Each has a unique set of motivations, perceptions, and values that provide important insight into the technology transfer process and which are based on hands-on experiences.
5. Potential business end-users of federal government technologies are often hindered by a lack of awareness of federal resources, a tendency toward short-term planning, and the "not invented here" syndrome.
6. Large companies that are aware of federal technology resources often bypass formal channels of technology transfer by making use of interpersonal methods such as technologist peer networks, which minimize the search process by helping to identify specific technologies with high promise.
7. Small and medium-sized companies rarely have the human resources that large firms have to collect, interpret, and apply technologies or technical information to their operations. Their technical problems are often accompanied, or overshadowed, by other business-related problems, such as financing or management capability.
8. Technology transfer should be viewed as problem solving, rather than simply a technology search exercise. Brokers and other technology agents consistently find that a targeted technology is not always the most appropriate one for the problem being looked at.
9. Technology brokers provide valuable intermediary assistance by matching business end-users with appropriate federal technologists. These entities also can provide useful input to the Clearinghouse based on personal experiences.
10. Federal technologists have a personal desire to assist in the application of mission-oriented technologies to private-sector problems, but usually do not have the time or authorization to provide this assistance.
11. Technology transfer mechanism developers are charged with the difficult responsibility of implementing programs based on requirements that are highly specialized, depending on the target audience and on processes that are only recently being understood and analyzed for assessment.
12. Technology transfer mechanisms may be categorized in one of three ways: passive, semi-active, and active.
13. Passive mechanisms often involve published technical information or data base services, with little or no consideration for outreach, assistance, or feedback. They are generally best suited for large corporate technology end-users.
14. Semi-active mechanisms involve technology brokers, who lead corporate researchers to federal technologists, but do little to assist in the actual application of the technology. They are especially valuable to small or medium-sized business end-users with some degree of technical proficiency.

15. *Active mechanisms incorporate outreach techniques with a high level of interaction and feedback between the technology agent and the business* end-user. They are most valuable for small businesses and entrepreneurs. Active mechanisms are also, unfortunately, the most costly to implement successfully and fully.

16. Valuable, practical information exists from "the field," and it should be made available to entities seeking analytical support for new program development and/or assessment in the area of technology transfer and utilization. This information is derived from crucial, hands-on experiences and the collective perspectives of the key entities involved in existing technology transfer programs. It would be advisable for any entity to gain an accurate understanding of the "lessons learned" by these entities prior to embarking on new initiatives in involving technology transfer.

**Conclusions—Implications for the Clearinghouse**

Having reviewed critical perspectives of key entities involved in federal technology transfer programs, we now direct our attention to the implications these perspectives may have for the design and operations of a Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. We also have the second issues paper by the Advisory Commission on Intergovernmental Relations (ACIR), proposing a draft plan for the Clearinghouse. Briefly, the second issues paper proposes that the Clearinghouse's initial target audience be federal, state, and local agencies, and that its offered services be analytical support for self-assessment by these entities when considering technology transfer initiatives. With this understanding in mind, we propose that the following points be considered by the Clearinghouse:

1. Any initiative on productivity, technology, and innovation, be it federal, state, or local, faces a difficult task when defining its missions and audiences at the outset, quantifying its funding levels, staffing, and other operating parameters. Drawing on the experiences of prior technology transfer programs would be a useful starting point for consideration. Some examples are: The services provided by the National Technical Information Service, an excellent passive technology transfer mechanism; the National Institute for Science and Technology, which employs the active mechanism to great advantage; and the Federal Laboratory Consortium, which has considerable experience with all types of mechanisms. The reader is strongly urged to draw on their experiences. Special attention must be given by designers of these initiatives to the potential advantages and disadvantages of duplicating the efforts of existing programs. If the Clearinghouse can provide guidance along these lines, its work will be highly valuable and possibly catalytic in nature, multiplying in productivity the work of existing technology transfer programs.

2. The hands-on work of entities currently involved in the field of technology transfer, both in the government and in the private sector, form a substantial foundation on which to build a "data base" based on practical experiences that can be made available by the Clearinghouse to its clientele. The experiences, perceptions, and findings of technology transfer experts who have in the past assisted in conceiving, implementing, and operating successful technology transfer programs should be considered carefully as an important asset to the Clearinghouse and can be of real value to its clientele and, ultimately, to U.S. productivity.

3. Of equal importance to planning the Clearinghouse is a clear understanding of the intended user base and the specific goals and objectives of the proposed technology transfer program. Similarly, the means by which the success of the program will be measured must be considered. This will have a significant bearing on the initiative's final design. For example, success may be measured in terms of the number of people reached annually, the frequency of returning information seekers, or the total number of successful transfers. These criteria are inextricably linked to the program's overall goals, and to the anticipated measurable success.

4. In addition to cataloging and disseminating existing information on technology transfer programs, the Clearinghouse has the unique opportunity to act as an impartial analytical body and, based on its national perspective, to be in a position to develop methodologies to assess the effectiveness, uniqueness, and replicability of program types currently operating at the local, state, and federal levels. This added value function is much needed and currently lacking. To house this capability in a centrally located organization or Clearinghouse will benefit many users who currently suffer from not knowing where to look and what examples exist that may help in their own technology transfer program design process.

5. In its recommendations regarding initiatives on technology transfer, the Clearinghouse should particularly examine active or semi-active mechanisms currently in effect. Our sources have indicated the importance of interpersonal contact in any technology transfer activity. This is true for any size business. Furthermore, as correctly acknowledged by ACIR, there is value that can be added to the various federal government data base and catalog services in existence, particularly those of NTIS and NIST. This value is found in the analytical aspects that can accompany this data. The Clearinghouse should acknowledge that the NTIS Center for Utilization of Federal Technologies (CUFT), which will incorporate active identification and assessment of R&D projects, with the intent to help state and local governments identify innovations of particular utility to their private sectors, is attempting this same function. This is a prime example of how a technology transfer ini-

tiative may add value through the implementation of an active mechanism, and is applauded by many in the industry.

6. The successes of technology brokering techniques may serve as useful inputs for the Clearinghouse. As brokering developed to fill a niche between existing technologists and information-seekers, so the Clearinghouse has announced its intention to coordinate and operate among existing technology transfer programs. The "value-added" concept is also valid as it relates to the mission of the Clearinghouse. Ideally, the Clearinghouse will increase the effectiveness of existing programs, and, based on "lessons learned," allow access to information on ways to duplicate successful programs.

7. Finally, when we consider that small businesses constitute approximately 95 percent of the nation's employers,[8] it might be advantageous to consider the special needs of technology transfer initiatives that address this important and growing segment of the nation's economy. It is anticipated that small businesses, an important constituency of state and local concerns, will be the prime benefactors of proposed business and technical assistance programs being looked at by these concerns.

Given the above conclusions we have formed from our experiences in technology transfer activities and those of others outlined in this paper, as well as the issues presented by ACIR, the following role and activities emerge as likely candidates for the Clearinghouse. Although some of the following recommended Clearinghouse roles and activities may deviate slightly from the positions taken by the authors of this paper, and those attending the ACIR "thinker session," we believe that they present what realistically can be achieved, given the expected funding and political constraints raised at the "thinker sessions."

8. When we consider the number of competing federal and state technology transfer programs, it would seem that the only missing link between these services and potential users is a method by which the users are made aware of the existence of, and access protocols for, technology assistance programs. Somewhat analogous to a travel agency, the Clearinghouse could be a very effective mechanism by offering to the user preferred routes to a destination. This will require a minimum amount of added value on the part of the Clearinghouse personnel. The user decides where to go, and the Clearinghouse determines the options that are available to get there.

9. A choice of mechanisms depends to a great degree on a number of variables, not the least of which is funding. Two viable sources of funding for this activity are the private sector and government allocations from state and federal levels. Our experience with both these options leads us to recommend that government sources are the most realistic from which to expect support for this program. Private sector funding, mostly in the form of "pay for services," would be very difficult to obtain, given the number of no-cost options that are available if the user has the time and energy to locate them. It comes down to cost versus time. We believe cost will deter the user in this case. Therefore, government funding seems to be the more realistic option for the Clearinghouse concept as it is now envisioned. If this proves to be the case, funding limitations will dictate that the Clearinghouse would elect to base it's program on the passive mode, that is, to act exclusively as a referral service.

10. Regarding the question often raised concerning the target audience, that is, federal, state, and local government and/or the private sector, we believe that any publicly funded technology transfer program should be structured to serve the people who supported the development of the technology—the *taxpayer*. The Clearinghouse could best serve the public by targeting *all* sectors of the national economy, both public and private. We believe that the primary goal of the Clearinghouse should be to provide the widest possible dissemination of publicly funded research similar to the instructions provided in the Space Act that created NASA.

11. Among the many operational options available, we believe the Clearinghouse should consider seriously the use of: publications, telephone referral services, and personal computers. Each of these options is being used by transfer programs, such as NTIS (publications), NASA's IACs (telephone), DOD (computers), and we believe that ample data are available for the Clearinghouse program designers to use in their deliberations.

12. Given our recommendation that the Clearinghouse operate in the passive mode, the problem most cited by transfer agents we interviewed (who also operate in the passive mode) is the lack of public knowledge of the availability of their services. Among the various tools available to the Clearinghouse are media advertising (such as newspaper advertising, television and radio commercials, magazines, etc.), direct mail programs, technical meetings, and telephone solicitations. These methods have been proven consistently to be cost effective and have evolved into sophisticated instruments for reaching that segment of the public most likely to use services such as the Clearinghouse proposes. Studies conducted by the School of Business at the University of Pittsburgh support these recommendations.

13. Finally, and we believe one of the most important recommendations to the Clearinghouse, is the need to establish a comprehensive follow-up program to measure the efficiency of the effort and provide feedback to keep the program current and responsive to it's clients needs. We reemphasize the importance of determining at the outset what evaluation procedures will be used and what is intended to be measured before attempting to design an "effective" Clearinghouse mechanism.

In summary, we suggest that the Clearinghouse:

- Be structured to provide options to the information seeker, as opposed to recommending a single information source;
- Operate in the passive mode, without being involved in problem solving;
- Provide its services to all U.S. citizens, not just government agencies;
- Investigate the advantages of using publications, telephone services, and the personal computer for delivering its product;
- Institute an aggressive publicity program by adopting one or more of the media vehicles to propagate the availability of its services; and
- Provide a comprehensive follow-up effort.

## Notes

[1] From an opening statement made by Hon. Doug Walgren (D-PA), Chairman, Subcommittee on Science, Research and Technology, Field Hearing on Economic Development through Technology Transfer, State Capitol Building, Denver, Colorado, February 5, 1988.

[2] A.D. Little, Inc., *Program Evaluation of the Office of State Technical Services*, prepared for the Department of Commerce, Office of Program Planning, Contract No. 9-35335, October 1969, pp. 17, 24, 29, as cited in *Technology, Innovation, and Regional Economic Development* (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-STI-238, July 1984).

[3] See Science and Public Policy Program, University of Oklahoma, *Final Report, Improving the Transfer and Use of Scientific and Technical Information: The Federal Role*, Volume II, "Problems and Issues in the Transfer and Use of STI," November 1986, pp. 2-14, 2-15.

[4] Ibid., pp. 2-12, 2-13.

[5] See U.S. General Accounting Office, *Small Business Involvement in Federal Research and Development*, Briefing Report to the Chairman, Subcommittee on Innovation, Technology, and Productivity, Committee on Small Business, U.S. Senate, February 1988, p. 1.

[6] *Technology, Innovation, and Regional Economic Development* (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-STI-238, July 1984), p. 79.

[7] Ibid., p. 80.

[8] According to statistics maintained by the U.S. Small Business Administration, small businesses being defined as those with fewer than 500 employees.

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# Review and Comparison of Clearinghouse Systems: Implications for the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation

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## Introduction

This report reviews previous or ongoing federal, state, and local initiatives to provide access to information on technology-based innovations that might improve state or local government operations or improve regional economies.

The report covers: (1) typical approaches; (2) examples of each approach; (3) lessons learned; and (4) implications for a U.S. Department of Commerce Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation created by the *Omnibus Trade and Competitiveness Act of 1988*.

### Methodology

Individuals working with the clearinghouses discussed in this paper were interviewed about the organizations' nature and operations (not available from secondary sources) and about their view of the lessons learned (both positive and negative) from implementing the clearinghouses. Existing program evaluation reports, where available, also were reviewed. Finally, the interview responses and evaluation report findings were analyzed and compiled.

### Organization of This Report

The authors present an overview of approaches to clearinghouses that have served the state and local government community, as well as related users in the private sector. These include: on-line databases; publication and report clearinghouses; inquiry and referral sources; user-driven research and technology networks; and hybrid systems.

Examples are presented for each approach, with tables showing selected characteristics of the clearinghouses. Some are current; others no longer exist. The sponsors of the clearinghouses have included the federal government, public interest associations, other nonprofit organizations, and the private sector. Some clearinghouses have had multi-institutional sponsors.

Summaries of the lessons learned from each of the clearinghouses examined are categorized by related issue areas. This is followed by a discussion of the implications of this study for the U.S. Department of Commerce Clearinghouse.

Detailed descriptions of the clearinghouses are contained in the Appendix.

## CLEARINGHOUSE APPROACHES

### Introduction

The design and development of the Department of Commerce Clearinghouse for State and Local Initiatives on Productivity, Technolog, and Innovation will be determined largely by the content and format of related clearinghouses. Several different approaches are being employed that can be grouped into five broad categories:

- On-line data bases;
- Publication and report clearinghouses;
- Inquiry and referral services;
- User-driven research and technology (R&T) networks; and
- Hybrid Systems.

A sixth category of clearinghouse—in which information is provided predominantly in the form of one-to-one technical assistance—does not exist at the national level. Such assistance may be provided as part of the clearinghouse organization's overall activities, however, or may be provided by member institutions, such as a state agency or individual laboratory or university center. Each of the five clearinghouse approaches is described below in more detail.

### On-Line Data Bases

In general, on-line data bases are accessible directly by users who have a computer and modem and have been issued a password. On-line data bases that are accessible only by the administrator and staff are covered in the other approaches. On-line data bases tend to be menu and key word driven, have multiple files or subsets, and contain bibliographic citations and/or abstracts and contact points. They may also provide access or references to other on-line data bases.

Users generally receive manuals and/or a customer service number (either "800" or a toll call), and perhaps a computer-based tutorial or other training program.

All but one of the on-line data bases reviewed here have subscriber or other usage fees in addition to long-distance access charges. This is the case whether the clearinghouse is part of a federal agency, a state or local government association, another intermediary organization, or a for-profit organization. The data base may have had some federal or private support in its start-up phase.

In many cases, the information in the data base is also available in hard copy (the only difference being that the on-line version is updated more often). This is particularly true for the state and local associations.

Only three of the six on-line clearinghouses contain information on research and technology developments, and these are all federally sponsored. The other three contain economic and business development information.

By definition, on-line clearinghouses tend not to produce original publications or to provide other products and services, with the exception of electronic mail messaging and inquiry-response services. However, where such clearinghouses are part of state and local associations or other in-

termediaries, the organizations usually develop publications and provide services independently of the clearinghouse.

The six on-line data bases can be subdivided further into those that provide an electronic mail inquiry-response feature and those that do not. This feature provides the user with an additional information source. It also indicates to the data base administrator that a topic is not being addressed by the data base, which is particularly important with regard to new and emerging issues. Typically, if a response to the inquiry appears through the electronic mail feature, this information is reviewed for inclusion in the data base. In addition, the inquiry may lead the administrator to initiate a special effort to locate documents or other materials in that field in order to establish a new category within the data base.

The six representative on-line data bases reviewed in this paper are:

- Without electronic mail inquiry/response feature:
  - National Alliance of Business (NAB) Clearinghouse;
  - Federal Research in Progress (FEDRIP) Data Base of the National Technical Information Service (NTIS);
  - Federal Applied Technology Data Base (FATD) and Federal and State Business Assistance (FSBA) Data Base of the Center for the Utilization of Federal Technology (CUFT) within NTIS; and
  - Technology Applications Information System (TAIS) of the Department of Defense's Strategic Defense Initiative (SDI).
- With electronic mail inquiry/response feature:
  - Local Exchange (LEX) of the National League of Cities et al.;
  - LOGIN of the William Norris Institute (Control Data Corporation).

**Publication and Report Clearinghouses**

Publication and report clearinghouses provide access to the source documents referenced by the bibliographic citations and/or abstracts contained in data bases.

The data bases of these clearinghouses may or may not be directly accessible by the user on an on-line basis. Whatever the case, the user calls or writes the clearinghouse to borrow or obtain a permanent copy of needed document(s) by mail or FAX.

The four representative publication and report clearinghouses covered in this paper are:

- On-line to user:
  - National Legislative Network (LEGISNET) of the National Conference of State Legislatures (NCSL); and
  - Integrated State Information System (ISIS) of the Council of State Governments (CSG).
- Not on-line to user:
  - Management Information System (MIS) of the International City Management Association (ICMA);
  - National Council for Urban Economic Development (CUED) Clearinghouse.

**Inquiry and Referral Services**

Inquiry and referral services operate as brokerage mechanisms to find individuals who can provide necessary information or assistance. In publication and report clearinghouses, the contact point is the source of the document needed. With inquiry and referral services, the contact point is the individual (or organization) identified as an expert who provides assistance directly to the user.

As with publication and report clearinghouses, inquiry and referral services may or may not be provided on-line. Two of the four inquiry and referral services reviewed here are not automated; two are automated, but accessible on-line only by the staff; the fifth is being developed and will be accessible on-line.

Only one of the five inquiry and referral services charges fees. A for-profit firm, it has a yearly subscriber charge for unlimited use of the expert network. Another is operated by a private firm on behalf of a federal agency, but has no service charges. The other three are operated by intermediary organizations, one representing state governments and the other two representing providers of technical and business assistance. One of the latter group has federal operating support.

In general, inquiry and referral services do not produce publications or provide other products and services, although the state government association has received federal funds to prepare and disseminate several publications drawing on the programs related to the data base.

Regarding subject areas, three of the inquiry and referral services provide information on economic and business development, and three provide information on research and technology development.

The five representative inquiry and referral services are:

- Not on-line to user:
  - Data base not automated:
    - State Technical Programs Information Base of the National Governors' Association (NGA); and
    - National Association of Management and Technical Assistance Centers (NAMTAC).
  - Data base automated:
    - Federal Laboratory Consortium Clearinghouse (FLC).
- On-line to user:
  - SBDC Connection and Teltech.

**User-Driven Research and Technology Networks**

These research and technology (R&T) networks are characterized by strong "user pull"—that is, the collection and distribution of information follows the research agenda established by the network members. The on-line data bases and publication and report clearinghouses discussed earlier are repositories of information on existing research and technologies and other business and economic development initiatives.

The two user-driven R&T networks representative of this category are no longer in existence. One involved research resulting from by the energy crisis of the 1970s; the other was the victim of federal budget cuts by the sponsor-

ing agency. One network was operated by a public interest association; the other was a consortium of nonprofit intermediary organizations representing local governments.

Because of the specificity of the subject matter of such networks, federal sponsorship appears to be necessary, either in the start-up phase or permanently. Both networks were funded entirely with federal support and, as noted, the activities were largely terminated when the federal funding stopped.

One of the two network-type clearinghouses had its information automated; neither was accessible on-line by the state and local government users. In both cases, the user community contributed most of the information; thus, the networks involved shared information available without additional fees.

The two representative user-driven R&T networks are:

- Energy Research for Governors Data Base of NGA; and
- National Innovation Network (NIN) sponsored by the National Science Foundation.

**Hybrid Systems**

Hybrid systems, in the context of this paper, are clearinghouses that combine several of the approaches of the more specific categories noted above.

Some of the clearinghouses discussed under the other four categories could, in conjunction with the larger organizations of which they are a part, be considered hybrid systems. NTIS/CUFT is one example. NTIS has among its many components the NTIS Bibliographic Data Base; FEDRIP; the CUFT Office of Applied Technology with its FATD and FSBA data bases; and the Office of Federal Patent Licensing, which evaluates and promotes federal technology with commercial potential.

The obvious "model" for a hybrid system is the agricultural extension system approach. It:

Involves an extensive variety of data bases;

Provides publication and report clearinghouses;

Provides inquiry and referral services;

Involves research and technical assistance; and

Features technology push and pull, in that it is driven by user needs and scientific breakthroughs.

However, the agriculture extension system is not directly relevant here for several reasons. First, although the agricultural extension system has evolved essentially into a technical assistance service for nonmetropolitan areas, its research focus is still heavily on agriculture. Second, with extension agents all the way down to the county level and spread geographically across the country, the service is more extensive and diverse than required for the purposes of this study. Finally, the system is too expensive to be useful—even more so than the expensive NASA technology transfer system.

NASA's Technology Utilization (TU) program is another representative hybrid system. This program also has many components, including data bases, publications, applications teams, and inquiry/response and referral capabilities.

Although the TU effort is intended to transfer aerospace technology for commercial applications, it actually serves a variety of users, including:

- State and local governments seeking technology-driven solutions to their problems;
- Private sector firms looking for assistance with technology development;
- Technical and business assistance providers looking for additional information to help their clients; and
- Researchers looking for scientific advances and technological breakthroughs.

The TU program is federally funded and operates through NASA facilities and NASA-supported organizations, especially academic institutions.

**Summing Up**

The five clearinghouse approaches described in this section are intended to be all-inclusive. They are not mutually exclusive, however; as noted, some of the 18 representative clearinghouses have aspects of more than one approach, even though they tend to portray one dominant approach. Hybrid systems, by definition, combine aspects of each approach.

The major features of the 18 clearinghouses are presented in tables in the next section. They are detailed further —using a standardized series of questions—in the Appendix.

## CLEARINGHOUSE EXAMPLES: SELECTED CHARACTERISTICS

This authors examine in detail 18 clearinghouses oriented toward state and local government or technology development. They are:

National Alliance of Business (NAB) Clearinghouse

National Technical Information Service (NTIS) Federal Research In Progress (FEDRIP) Database

Center for the Utilization of Federal Technology (CUFT) Federal Applied Technology Database (FATD)

Strategic Defense Initiative's Technology Applications Information System (TAIS)

National League of Cities' Local Exchange

International City Management Association's Management Information Service (MIS)

LOGIN

National Conference of State Legislatures' (NCSL) National Legislative Network (LEGISNET)

National Council for Urban Economic Development (CUED) Clearinghouse

Council of State Governments' Integrated State Information System (ISIS)

National Governors' Association State Technology Programs Information Base

National Association of Management and Technical Assistance Centers (NAMTAC)

Federal Laboratory Consortium (FLC) Clearinghouse

Small Business Administration's SBDC Connection

Teltech

National Governors' Association (NGA) Energy Research for Governors Database

NSF's National Innovation Network (NIN)

NASA Technology Utilization (TU) Program

The clearinghouse descriptions appear in the Appendix. For each clearinghouses, the following questions were asked of staff members in face-to-face or telephone interviews:

- What organization(s) operates the clearinghouse?
- What organization(s) funds the clearinghouse?
- What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development) and what is the extent of its listings?
- How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?
- Does the clearinghouse produce publications?
- Does the clearinghouse offer other products and services (e.g., technical assistance)?
- If the clearinghouse offers technical assistance, what type of expertise is available?
- How big is the clearinghouse staff?
- What are examples of questions the clearinghouse can be expected to answer?
- Who uses the clearinghouse?
- How often is the clearinghouse accessed?
- How is the clearinghouse accessed and searched (e.g., is a computer needed)?
- What kind of help is provided in accessing the clearinghouse?
- Is there a fee for accessing the clearinghouse, or particular products and services?
- What is the clearinghouse history and legislative and/or programmatic background?
- What are the lessons learned from this clearinghouse?

The answers to the first 15 questions are listed in the Appendix. Answers to the last question are analyzed in the next section on Lessons Learned."

This section presents a tabular summary of selected characteristics of the 18 clearinghouses, including:

Mode of Accessing Clearinghouse
Clearinghouse Operators
Clearinghouse Funding and Fees
Types of Information Provided
Sources of Information Provided
Other Products and Services Provided
Clearinghouse Users

This table and related topics are discussed below. Factual data about clearinghouse staffing is contained in the Appendix. While it might have been revealing to have cross compared the responses on staffing, this was difficult to do because of incomplete data or unrelated variables. In some cases, the information on the size of the staff was proprietary and, therefore, not available. In other cases, the clearinghouse preferred to be judged on performance rather than number of staff, so the figures disclosed in the interview were vague, although not incorrect. It would have been particularly interesting—yet it turned out to be particularly difficult—to analyze the number of client responses per full-time-equivalent staff year. In addition to the inconsistencies already noted, however, some clearinghouses were newer than others and staff was still being hired and trained and/or the data base was still being developed. Similarly, the user clients had not all been reached by marketing information; therefore, the user data was premature.

**Mode of Accessing Clearinghouse**

Nine of the 18 clearinghouses are on-line to the user. Four of these also offer staff assistance with their on-line service. Another five clearinghouses are automated but not on-line to the user. Four clearinghouses are not on-line or automated.

**Clearinghouse Operators**

Five of the clearinghouses are operated by a federal agency and/or federal contractor. Seven clearinghouses are operated by state or local government interest associations, and four are operated by other types of intermediary organizations. Two of the 18 clearinghouses are privately operated.

**Clearinghouse Funding and Fees**

Half of the 18 clearinghouses are free of charge. Four of them operate on a subscriber basis, and five charge fees for specific services.

In terms of funding, half of the clearinghouses operate in whole or in part with federal funding. Five are funded in-house, that is, from the operating organization's budget. Seven are supported through the dues and fees paid by subscribers and users.

**Types of Information Provided**

Nine of the clearinghouses offer information related to state or local government policy, management, operations, and service delivery in general. Thirteen offer information related to economic and business development programs. Nine clearinghouses offer information on research and technology development programs. Ten of them offer access to network contacts and person-to-person expertise.

**Sources of Information Used by the Clearinghouses**

Fourteen of the clearinghouses obtain information from within the organization or through the organization's network of constituents or clients. Twelve clearinghouses obtain information from users. Seven of them provide information through other data bases or clearinghouses. Nine of the clearinghouses develop information through federally funded projects on specific topics. Another nine offer information provided by federal sources.

**Other Products and Services**

Nine of the clearinghouses provide person-to-person contact referral services. Three of them provide a "bulletin board" inquiry-response service. Seven of the clearinghouses provide publications and reports from a variety of

sources; ten provide in-house publications and reports. Three of the clearinghouses provide technical assistance to outside ("external") users, and 13 provide technical assistance to members or subscribers only.

### Clearinghouse Users

The clearinghouses have as users technical, management, and business assistance providers (10), research and technology sources (7), small and large businesses (7), the operating organization's staff (8), state and local governments (8), and federal government officials (12).

### Patterns in the Table

A readily discernible pattern is that the four publication/report clearinghouses are operated by public interest associations. This approach also appears to correlate with the types of information provided (i.e., policy/administrative/management information; operations and service delivery information; economic and business development information; and provision of network contacts).

With only one exception, the on-line clearinghouses are not free. The inquiry and referral types of clearinghouses appear to tap the widest range of information sources. The publication/report types of clearinghouses do not tend to be oriented to users in research and technology sources and small and large businesses. Moreover, in terms of other products and services offered, they tend to focus on technical assistance to their own network of members or constituents.

### Summing Up

The clearinghouses examined represent a wide variety of users, operators, funding sources, fee structures, types and sources of information provided, additional products and services, and modes of access. Just as there is no single approach to setting up a clearinghouse, there do not appear to be any major patterns among the clearinghouse characteristics as they relate to each approach.

## LESSONS LEARNED

From the perspective of the administrators of the clearinghouses discussed in this report, several major lessons have been learned from their operations. (For the defunct clearinghouses, persons who had been involved in their operation were consulted and evaluation reports were located.)

The lessons are a compilation from the clearinghouses examined, and are not intended to be interpreted as broad generalizations drawn from rigorously developed samples of data. As can be expected, a number of the clearinghouses have lessons in common, which have been grouped into seven broad categories or "common denominators": institutional issues, components of approaches, planning, design, clearinghouse activities, financial issues, and miscellaneous lessons.

### Institutional Issues

#### Institutional Barriers Related to Central Repositories

There tend to be many institutional barriers to establishing a central repository—or "super data base"—of information to serve clients such as state and local governments. One such barrier is the "turf" problem. Many organizations and agencies serve this audience, and it follows that each will tend to look out for its own interests throughout the process of collecting or distributing information. Turf problems exist both among and within organizations.

**Institutional Barriers and the Public Interest Associations.** The experience of the defunct LINUS system provides documentation of the turf problem in establishing one repository for a group of associations. LINUS was the predecessor to the current Local Exchange. It involved the National League of Cities, International City Management Association, Public Technology, Inc., and other such organizations, and it was plagued by a lack of cooperation.

There are several good reasons why the state and local government associations may not cooperate with each other on developing a central repository. First, each organization likes to provide services directly to its members and, more important, to get credit for doing so. Second, there may be an opportunity for each either to sell information to nonmembers or to recruit additional members for the association. This is not to imply that these associations will not work together in generating, sharing, and distributing information.

**Institutional Barriers in Federal Agencies.** NASA was one of the first federal agencies to practice technology transfer and disseminate scientific and technical information for purposes other than agency mission. Because it competes for overall agency support while not directly relating to the agency's mission, the NASA Technology Utilization (TU) program confronts more barriers than another program might (e.g., the Agricultural Extension Service, which is more in line with the Agriculture Department's objectives).

#### Overlaps among Related Organizations and Clearinghouses

There is substantial overlap in the work of the clearinghouses. Collection and organization of information related to state technology development programs is one example. Several people and organizations gather essentially the same data, and there is a great need for coordination, for the organizations to share or exchange their information and/or act as pointer/brokers to one another. Clearinghouses are more likely to be successful when they work with other organizations serving the same clients. This way, each will have different roles and services, although there may be a certain amount of overlap. LOGIN, for example, may be an independent provider and distributor of information, but, at the same time, it can bolster the local government interest associations in doing their jobs.

#### The Need for Federal Leadership and Funding

If an issue is nationwide in its impact and deemed critical enough (e.g., the significance of the energy issue of the 1970s), state and local governments have made immediate commitments of funds and personnel—even if only small amounts of money are involved—to develop data bases and information clearinghouses through their intermediary associations. The size of these activities, however, as well as the length of time in operation may be heavily dependent on federal support. The intermediary associations will work with the federal government to find a common ground for integrating activities for their mutual benefit if

each government is flexible in approach. The NGA Energy Research Projects Information Base provides evidence of this. Additional evidence is provided by the NGA state technology development information base, the NSF-funded local government networks, and the NAB Clearinghouse.

From the beginning, there has been a need to automate the NGA profiles of state economic and technology development, but NGA was never able to devote internal funds to do so. Without a sustained effort, each report in this area becomes a one-time effort, and for every new report, work has to be started over again. Recently, NIST provided funds for a survey of selected state programs and for automating that information. However, updating the data base, adding more details, and/or expanding it to provide comparable program descriptions across states in other areas is not likely to be achieved without additional external support.

In the 1970s, NSF's local government networking program developed momentum through simultaneous support of national, state, and regional activities. The federal grants stimulated a commitment by some local governments. When federal participation was cut back in the early 1980s, many of the networking activities were discontinued.

Some parties involved with the NAB Clearinghouse had envisioned a self-supporting system. When the federal funding ended, however, it was found that the on-line data base service did not generate sufficient revenue to survive without continued outside funding. For example, no additional users responded to the discount pricing plan offered by NAB early in 1987. This demonstrates the problem with data bases that have a limited focus and, thus, a limited number of potential users.

### System Evolution

Each of the clearinghouses examined has evolved over time. That is, when they began operation, they were essentially different entities than they became several years later.

For example, at start-up, the Local Exchange was primarily an electronic mail network for local officials, with limited data base offerings. More case studies have been added, and it is intended that the Exchange will continue to build itself and that users will submit information. In fact, new data bases and bulletin boards are being added and others are in the planning stage.

Other types of clearinghouses also have evolved over time. For example, the National Association of Management and Technical Centers (NAMTAC), a networking clearinghouse, evolved from being an Economic Development Administration university centers organization to include Small Business Development Centers and NASA's Industrial Application Centers. Given this expansion in focus, NAMTAC has been redefining its role to incorporate the views of a variety of federal agencies on how to provide business and technical assistance.

## Components of Approaches

### Consideration with On-Line Data Bases

The major reason for having an on-line data base appears to be a more productive allocation of clearinghouse resources, especially where there are repeat users.

Being on-line is a challenge. One must consider whether the intended users are ready to do their own searching (after initial training). A government interest association like the National Conference of State Legislatures, which is perceived as a "personal" service organization by its members, finds it difficult to switch to an on-line system and have its members regularly use it. The process is slow and evolutionary and requires marketing and education before a sizable proportion of the users is willing and able to go on-line.

Thus, ease of use of on-line data bases is critical. Whether one uses an existing system as host (e.g., GTE-Telenet for the Local Exchange) or devises a new one, the concept of "user friendliness" cannot be overstated.

In summary, there appear to be three reasons for not offering a data base on-line:

1) The likely users may not access the system frequently, and might require assistance in doing so each time.
2) The historical "culture" of the organization may be so oriented toward personal service that the users may not feel comfortable with an on-line, depersonalized system.
3) Since the user must contact the clearinghouse staff to request specific documents, an on-line data base may not be perceived as necessary.

### Mix of On-Line and Staff Response

In order for an on-line data base to be self-supporting or even profitable, as in the case of private clearinghouses, it should be able to answer a substantial percentage of the inquiries. The remaining inquiries could be handled through the electronic mail inquiry/response component of the clearinghouse or addressed by a staff member (either from personal knowledge, after contacting an expert, or by accessing another data base). LOGIN's director refers to this as the "80/20 rule," a reference to the percentage split for his data base.

### Benefits of Electronic Mail Feature

An electronic mail inquiry/response feature provides the user with an additional source of potential information and indicates to the data base administrator that a topic is not being addressed by the data base. This is particularly important with regard to new and emerging issue areas. The Integrated State Information System (ISIS) found this feature necessary to identify emerging issues and those of current critical importance to the states.

### Considerations in Brokering Technical Resources

An information system alone rarely will provide the total solution to a problem or need, although a document search can be a useful prelude to contacting experts (in some cases the authors of the documents). Successful transfer often requires follow-up beyond identification through a data base. Additional dissemination efforts, such as fact sheets and other printed matter, still may not be sufficient.

There are opportunities and difficulties associated with linking users or intermediaries in state and local governments with various scientific and technical and/or business assistance resources. For example, the staff at the

nter for the Utilization of Federal Technology (CUFT) ted that their reports describing business assistance initives may not be useful if the staff of the business assisice organizations are not helpful. This indicates that the ality of referrals may be difficult to control.

The Federal Laboratory Consortium Clearinghouse C), a pointer/broker type system, can perform its role t when the user's request is stated as specifically as posle. In fact, the FLC Clearinghouse has been most effece when answering specific problems.

With pointer/broker type clearinghouses, a key issue be the proximity of the technology resource to the r. It is also suggested that it is better to initiate an inquidirectly with a laboratory if the user is located near a lab, ecially if the issue relates to an industry in the area.

### nsiderations in Networking Arrangements

A networking type clearinghouse is a useful framework identifying common needs, locating appropriate technol-, and adapting and applying it. A networking arrangement vides an environment for risk taking otherwise less attaine at the state and local level; thus, a network-type clearhouse can perform the role of market aggregation.

Networks engage both in quick-fix solutions and in veloping generic approaches that can be applied oss the board. Such generic approaches rarely can be nsferred intact; adaptation is almost always required. rthermore, developing generic approaches is a diffit and slow process, sometimes taking up to five years m concept to development.

Special leadership is needed to initiate a network—n more so than for the other types of clearinghouses. A working clearinghouse must have a strong operating ncy (e.g., Public Technology, Inc., was referred to as the ue that holds the Urban Consortium together"). The ors involved also should be fairly innovative or at least receptive to new approaches and improvements.

## Planning

### aringhouse Planning and Start-Up

Proper planning is essential to avoid failure. The plang activities depend largely on the clearinghouse apach. For example:

- The NSF networks demonstrated that a needs assessment is an important initial activity for a networking clearinghouse in order to establish a common agenda.
- For a subscriber-based on-line system, some sort of early market analysis of potential users is crucial.
- The planning phase for a pointer/broker clearinghouse would involve identifying not only the constituency but also the technical resources to be used.

Establishing a new institution for disseminating and/brokering information generally appears to require a nning phase of six months to a year, and a "gearing up" iod. Three to seven years were needed to develop fully ny of the mechanisms examined for this paper.

### Clearinghouse Staffing

All clearinghouses commented on adequacy of staffing. In terms of the number of staff members, ISIS reported that more users can be serviced with about the same level of staff as a greater percentage of users access the system on-line.

In the 1970s, state and local officials were concerned with solving their own problems. Now, their focus goes beyond that to state and local economic development. These problems and opportunities require scientific and engineering expertise to a greater extent than the previous set of issues. Among the reported benefits of Teltech, for example—which is oriented toward scientists and engineers in high tech companies—are quick resolution of technical problems, accelerated new product commercialization, and substantial increases in engineering productivity.

To be effective, the clearinghouse staff must be perceived as credible by the users. For example, data bases geared toward research and technology development, such as Federal Research in Progress (FEDRIP) in the National Technical Information Service and the Technology Applications Information System (TAIS) of the Strategic Defense Initiative Organization, may need a variety of backgrounds among staff members (e.g., writers to edit abstracts and develop key words, technologists to assess technology content, marketing personnel to assess commercial potential, and outreach staff to alert audiences to availability).

### Networking Technology Agents

The technology agents that were part of the NSF-funded networks found that full-time technology agents could provide in-depth services to local governments; circuit riding technology agents could raise awareness of many local governments, but with lower levels of service.

Technology agents providing technical assistance should have a scientific or technological background. Ideally, this would be combined with business or public administration experience.

## Design

### People-to-People Interaction

Almost all of the clearinghouses examined offered lessons regarding the need for people-to-people interaction, whether they were electronically based systems, brokers, or networks. For example, the electronically based TAIS does not just provide information in response to inquiries by users, it also encourages the scientist or engineer to contact the person requesting the information. In this manner, TAIS serves as a two-way technology assistance broker for problem definition and problem solving.

The document-based Management Information Service (MIS) service also offers peer-to-peer exchange. In addition to receiving a document, users receive the name, address, and phone number of a contact person in the locality to which the document pertains. The same person-to-person interaction is part of LEGISNET and ISIS. CUFT offers both data bases and documents. In fact, CUFT is the only program at the National Technical Information Service (NTIS) that develops original products, and these products are among the service's most popular. It has been suggested, however, that although the CUFT

on-line data bases and related reports are very thorough in their coverage, they may not offer the solution if the user needs direct assistance from a scientist or an individual with business expertise.

The FLC "Clearinghouse" is actually a technology brokerage service between the user and scientist/engineer. In addition to the FLC Clearinghouse, the total FLC network includes regional coordinators and technical specialists who are vital factors in responding directly to users.

It is said that the real strength of NAMTAC lies in the networking that takes place among members at the NAMTAC meetings, which often leads to future correspondence.

The experience of the NSF-funded networks was that the single most important ingredient in transferring technology successfully to the public sector was the role played by people in the process.

### The Need for Variety

LOGIN demonstrates that a clearinghouse needs a broad range of types of information as well as formats to be a complete resource to its users—the data base should not be narrowly focused. As such, pointer/broker resource directories, for example, would be only one component of a clearinghouse (albeit a crucial component, as noted above).

In its long history of transferring technologies, the NASA TU program has provided information in many formats, thus offering an example for other agencies seeking to have similar successes in this area.

### Clearinghouse Content

The MIS experience indicates that information should be practical and case study oriented. Thus, it should not contain theoretical studies on solid waste, but how to collect or dispose of it. MIS users also want the information to be in a useful form. They do not want extensive studies or textbook responses. In the case of local government information, the clearinghouse should contain ordinances, regulations, budgets, manuals, handbooks, and the like. From brief abstracts of available documents, the users want to select one or several they believe most appropriate. They want to apply (i.e., adapt not adopt) the selected information directly to their problem.

The respondents to a 1984 survey regarding the National Alliance of Business Clearinghouse (NAB) said they needed to know why one program worked better than another, not just a description of various program components. A follow-up 1986 survey indicated that many respondents felt the information was oriented too much toward long-term planning. The NAB staff, on the other hand, felt potential users were relating use of the data base to research work rather than to ways in which the information could be used to assist in day-to-day activities.

### Relation of the Data Base Structure to the Clearinghouse Market

Organizing clearinghouse information on a comprehensive basis covering all state/local government issues, rather than on a more limited client need basis, provides opportunities for eventually marketing the same database to more groups of clients. The LOGIN operators, for example, have found that many of the subject areas in LOGIN are of interest to the private sector as well as to its primary audience of local government officials.

Similarly, because the TAIS data base structure is organized according to the standardized Militarily Critical Technologies List, it has features common to other federal agencies that use the same technology categories in their programs. For example, the congressionally mandated export control program is administered jointly by the departments of Defense and Commerce. Additional agencies, such as NASA, and the departments of Justice and State, are involved in export control of sensitive military and space technologies.

### Collecting and Evaluating Information

A major issue for a clearinghouse like MIS is finding information that is timely and relevant. One approach that MIS uses is to write letters to a number of International City Management Association (ICMA) members each month asking for their help on any issue they feel would be relevant to their colleagues. In effect, ICMA is capitalizing on the level of commitment of members of a professional society to that profession (as well as on the staff's contacts). Although many of the members may underestimate the value of their contributions to MIS, the contributions are, in fact, quite useful, in part because they are practical and appropriate to most local government environments.

In collecting information from members, the state/local and public interest associations are confronted with an awkward situation. For example, governmental intermediary organizations by their nature represent all jurisdictions. Their staffs cannot be expected to assess the efficacy of any jurisdiction's programs or program areas; it is recognized that the appropriateness of any specific program is unique to the circumstances of that jurisdiction at a given time.

### Adding Value to Information

LEGISNET indicates that a clearinghouse should provide some major value added for the users, such as data analysis or assessment. For example, LIS reviews each report for mentions of all states cited in the report and these names are added to a field that can be accessed by users. Similarly, the Energy Research for Governors project added a field containing the phone number of the research director.

### Timeliness of Information and Updating

For the Local Exchange, timeliness of the data is difficult to maintain. This is the case not only for on-line data bases but also for document providers and referral services. The MIS experience also indicates that the information in a clearinghouse must be up to date and, thus, systematically purged.

There is always an initial surge in collecting the data, and the resources generally are there to accomplish it. The problem is having the resources to keep the data fresh and relevant by purging out-of-date information and adding new information on a regular basis.

The TAIS method of user response sets up an efficient way to update the system. For example, on an annual basis, a letter is sent to all the principal investigators of research projects listed in the system. This correspondence requests an update on recent technological advances, spinoff activity, and/or changes to their projects.

### Data Base Search Capabilities

LEGISNET indicates that full text search is more desirable than an abstract, preferably using a proximity search rather than only an adjacency search. (An adjacency search looks for words next to each other; a proximity search looks for words within the same sentence, paragraph, page, or general area of the text.)

### Accessing External Clearinghouses

The NASA IACs each perform a clearinghouse function, and have recently expanded to include information from many other federal and non-federal sources, including commercial data bases. Furthermore, a couple of years ago, the IAC network established cooperative agreements with many state-sponsored technical assistance centers.

## Clearinghouse Activities

### The Need for Market Analysis

The NAB Clearinghouse indicates that it is important to know the intended audience, their information needs, and how they want to receive the information. The NAB Clearinghouse users were not ready for or comfortable with the on-line medium. The NAB staff users did not have the time, the training, or even the necessary equipment in many cases. Even when NAB marketed the system for direct access, the users did not have the proper equipment and NAB did not have the necessary interface capability. Some of the two dozen subscribers contacted in a 1986 survey had not used the NAB Clearinghouse at all. The respondents said most frequently that there was a lack of time to use the data base.

Users may need to be educated, although this may be somewhat less true today than during the mid-1980s when the NAB Clearinghouse was in full operation.

### Promoting a Clearinghouse

Use of a given clearinghouse is highly dependent on creating awareness and on outreach to promote its availability. For example, although TAIS is accessible by more than 13,000 firms and virtually any federal agency, many of these qualified users are not aware that they can use the system. There is a noticeable increase in use following journal publications or workshop presentations on TAIS. As a result, the TAIS staff recently initiated a more aggressive outreach effort. A built-in statistics capability allows the targeting of specific technology users in public relations efforts, a feature of the system that shows much promise for future promotional efforts.

It has been suggested that NAB's clearinghouse did not succeed because the marketing activities were not sufficient to recruit the intended audience. When NAB opened the clearinghouse for direct access by outside subscribers (not just the NAB staff), it was felt that this would shift the research burden to the questioner, reducing the staff time required to respond to inquiries. Not many direct access accounts were opened. Furthermore, it was discovered that even more staff time was required to market the data base in order to generate and maintain subscribers.

The Council of State Governments' ISIS offers another example of the importance of generating additional use. ISIS shows that an automated inquiry-response system should be cost-effective on a per unit basis. Thus, activities need to be undertaken to market the system in states with relatively low usage.

Teltech illustrates that, although a service may be fast, real-time, and convenient, current organizational culture often operates against using it. The Teltech management suggests the need to work at raising awareness of the potential of information services. Because information gathering by individuals and organizations does not occur naturally, training, point-of-use promotion, and follow-up is required.

### Do Not Oversell

The NSF-funded networks taught that during the early phases of a network or clearinghouse it is important not to create unrealistically high expectations in either the state and local government users or the potential technology suppliers. In the first phases, early success stories are helpful to create the desired impression.

### Need for User Statistics and Follow-Up Evaluations

User statistics are important elements of a clearinghouse. They provide data on user trend analysis (who is accessing, what is being accessed) and on the usefulness of the clearinghouse information/contacts. It is one thing to know who uses a clearinghouse and what subject areas are being tapped; it is clearly another to know if and how the information is being used and what the results are. Therefore, it is expensive and difficult to evaluate clearinghouse operations. A private sector clearinghouse finds that these are even more critical concerns.

The LEGISNET and FLC approach to evaluation is to have a good user group that will provide timely feedback without being asked. Critical to the success of some of the clearinghouses (e.g., the NSF networks), has been the active participation of an advisory board dominated by users.

The use of built-in system capabilities makes evaluation easy and productive for both ISIS and TAIS. With ISIS, the recording of inquiries (what and who) is built into its inquiry-response system. The staff suggests that this should be the case, whether automated or manual, because it is useful documentation for the system's continued operation. It is also necessary in order to refine the system's format and content, accessibility, and complementary services.

The TAIS user response method provides a record for automatically evaluating the system's viability. For example, within 60 days of an inquiry, a follow-up letter and questionnaire is generated and mailed to the user. The information providers are queried systematically every six months so as not to overload them. The letter asks about the adequacy of the information received and any activities that ensued as a result of the contacts established, and offers further assistance if necessary.

## Financial Issues

### Considerations in Subscriber Charges

The decision whether to charge association members for a clearinghouse service is important. This might include subscriber fees and/or computer time charges. On

the one hand, members of associations may perceive that the clearinghouse data base is just an extension of services being provided. On the other hand, services provided free within the overall membership dues (as opposed to a separate subscriber fee) may be perceived as not very valuable ("too cheap," "worth what you pay for it").

LOGIN shows us that one of the barriers to the use of fee-based clearinghouses is the so-called "library mentality" that information is free. This barrier was reinforced by federal support of data bases and clearinghouses in the late 1960s and 1970s. Users do not always differentiate between access to information and facilitating finding the information needed. One might use DIALOG to find a reference to an article, but determine that the article is available in a local public or university library. Organization of the knowledge and facilitating access is what is being paid for, although clearinghouses also tend to have information not available elsewhere.

### The Question of Affordability

CUFT has found that state and local users, with their limited budgets, cannot afford to purchase some of the CUFT publications. Although this audience is targeted for timely coverage, the effort is irrelevant if the publications are out of their price range. Congress requires that CUFT be essentially self-supporting, which has an impact on the range of services it can afford to provide.

If entrepreneurs and small businesses are the intended audience, it has been noted that free access to a clearinghouse is essential (that is, they will pay only for the phone call). High or even moderate charges discourage use and are prohibitive for small businesses.

The issue of charges may need to be viewed in a state versus local perspective. Obviously, there are more potential local government users than state government users. Specifically, there are 39,000 units of general local governments, whereas there are only 50 states (and seven territories and other instrumentalities that are members of the state government associations). Thus, the potential market is larger when focusing on local government, and a state-oriented clearinghouse would probably be more expensive to operate on a per user basis.

Obviously, there are economic issues unique to a clearinghouse operated by a for-profit organization. The viability of such a clearinghouse is contingent on a critical mass of users and the associated fees to cover the fixed costs. However, the number of users is not the issue in and of itself, but merely an indicator. Diversification by the organization into more services within a clearinghouse is also important (for example, there may be fees for accessing the clearinghouse, reports/publications, or technical services).

## Miscellaneous Lessons

### Ensuring Help to Domestic Firms

Certain of the clearinghouses have security provisions and provide lessons regarding limiting access to users in the United States, a desirable feature in terms of competitiveness. For example, as a result of federal legislation, access to certain FEDRIP data on DOE and NASA is limited to domestic users.

TAIS security provisions are reliance on militarily critical technology certification and limitations on time and number of accesses per day. These safeguards have been accepted as satisfactory by the Department of Defense community for security purposes, while not discouraging users from accessing the system.

### Learning from an Initial Demonstration

It is possible to test the viability of a clearinghouse, early on, using a limited test audience. For example, a demonstration could experiment with a sample of users in one region. A regional demonstration project was initiated for the NAB Clearinghouse in 1987 with the cooperation of the U.S. Department of Labor's Employment and Training Administration office in Region IV. The project was to operate for a year, but was terminated early to refocus the overall NAB Clearinghouse services.

On the other hand, the FLC Clearinghouse evolved out of a demonstration project undertaken in the Far West Region of the FLC at the beginning of the decade.

# IMPLICATIONS FOR THE COMMERCE CLEARINGHOUSE

## Introduction

The implications of the analysis of the 18 representative clearinghouses for the design and operations of the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation are based on assumptions regarding the roles of the federal government in stimulating innovative activities by state and local governments, as well as the organizations to which they turn for information and assistance (especially the public interest associations).

The discussions at the five "thinkers' sessions" convened by the Advisory Commission on Intergovernmental Relations (ACIR)—especially the consensus that appeared to evolve—provided additional context to this section. This consensus refers, in particular, to the issue of Clearinghouse audience and subject focus.

There are other sources of implications for the Clearinghouse that are beyond the scope of this paper, but that, ultimately, will help shape the Clearinghouse design and operations. This would include the other papers commissioned by ACIR, and any imperatives within the Department of Commerce that are not apparent at this time.

## Assumptions

### Role of the Federal Government

The Clearinghouse obviously does not exist in a vacuum. The issue of R&T-based business and economic development is of concern to all governments, and all have development initiatives. Associations representing state and local governments are increasingly active in this area. These associations and other intermediary organizations provide services and operate clearinghouses devoted entirely or in part to this topic.

Therefore, the appropriate roles of the federal gov-

ernment, operating through the Department of Commerce and its Clearinghouse, need to be examined within this context. The authors posit that these roles come under the generic heading of stimulating and facilitating activities by others rather than undertaking them directly.

This assumption suggests four broad appropriate roles, given the overall goal of the Clearinghouse and the context and institutional environment at the federal, state, and local levels within which it will operate:

1) Strengthening the institutional capacity of the intermediary organizations that operate clearinghouses and provide other services (particularly the state and local government associations);
2) Systematizing and accelerating the development and diffusion of knowledge and experience regarding federal, state, and local initiatives;
3) Identifying and filling the gaps in this knowledge and experience and in the existing clearinghouses; and
4) Networking the operators of the existing clearinghouses serving federal agencies and state and local governments to foster the sharing of resources and cross-fertilization of activities.

**Audience for the Clearinghouse**

With the exception of the first thinkers' session, a consensus appeared to evolve that the Clearinghouse existed to serve federal agencies and state and local governments (and their intermediaries). They are to be both the audience and the users.

A distinction was made between users and beneficiaries. Ultimately, the beneficiaries are large corporations and small firms, which could benefit from new technology-based products, new materials, and better manufacturing process technologies. Other beneficiaries are scientific researchers, developers of technologies, providers of technical and business assistance, and the intermediary organizations that represent each of them. In the context of the legislation and the consensus, these individuals and organizations benefit in the long term from the federal, state, and local initiatives and are the whole reason for such initiatives. But they are not the near-term and direct users of the Clearinghouse.

**Subject Focus of the Clearinghouse**

The same legislative context and emerging consensus applies to the subject matter for the Clearinghouse. The focus is to be on program initiatives, not scientific advances and technological breakthroughs; on data bases of federal, state, and local activities, not data bases of research in progress, research results, technological developments, and technologies available for licensing; on program contact names, not scientists, engineers, and business experts.

An additional idea for subject focus, which emerged most clearly at the fifth session, was the desirability of reexamining the technology development and commercialization process. Using the process of a commissioned paper and a small (20-25 person) meeting of experts for review and comment, the resultant state-of-knowledge (research) and state-of-practice (case examples) would be provided to each clearinghouse serving state and local governments.

**Funds of the Clearinghouse**

In the absence of information to the contrary, it is assumed that the existing budget level ($250,000/year) is not fixed, and might be increased if a strong programmatic case should be made. It has been assumed further that the percentage mix of intramural expenditures for staff salaries and related staff expenses and of extramural grants and contracts also is not fixed. Again, this might be changed if a strong case should be made.

**Special Niche for the Clearinghouse**

Based on these assumptions and the analysis of the 18 clearinghouses, there is an extremely important special niche for the Clearinghouse to contribute to the nation's economic health and international competitiveness. This niche is the composite of the stimulating and facilitating activities organized under the four roles noted above.

Of particular importance in suggesting this niche is the recognition that the public interest associations and the other intermediary organizations representing state and local governments have a number of clearinghouses devoted entirely or in part to technology-based business and economic development initiatives. Centralizing such databases in a meta-clearinghouse in the Department of Commerce would be duplicative and have no value added (in fact, there would likely be a diminution of value based in part on lessened credibility of the federal government as the provider of state and local program information).

**Strengthening Institutional Capacity.** There are several mechanisms to disseminate information to state and local governments on improving management and service delivery and on economic development, in general. There are not as many mechanisms that focus on state and local technology development efforts within the realm of economic development.

There has been a clear shift in focus for these clearinghouses from the role of scientific and technological information and expertise for improving policy development, government operations, and service delivery in general toward economic development specifically. This has positive implications for the Clearinghouse in the 1990s.

The economic development-related clearinghouses that do exist are underfunded, do not have complete information (either not all programs are included or not all desired information has been collected on each program), and may not have the information automated (much less accessible on-line).

In addition, the information collected by one organization may overlap that collected by another. Finally, there is no commonality of categories of information collected by each organization among both state or local programs and, thus, analysis of program initiatives across governments is extremely difficult.

The specific implications for the Clearinghouse would include:

- Provision of the Clearinghouse's extramural funds to support enhanced data collection, organization, and automation by public interest associations, including selected information on all state and local programs, more detailed case examples, and evaluation/assessment studies; and

- Use of convening power and "bully-pulpit" to work with the public interest associations and other intermediaries to reduce overlap in collecting data, and to increase commonality in selected categories of information collected on each state and local program initiative—providing, in effect, a "crosswalk" among data bases.

**Systematizing and Accelerating the Development and Diffusion of Knowledge and Experience.** As a result of the termination of one of the extramural research programs at NSF, there is currently no federal agency responsible for research on the technology development and commercialization process. Agencies support research on some parts of the process (e.g., Economic Development Administration, Small Business Administration, NASA), but no one has taken the oversight role on behalf of the federal interest.

Two examples of parts of the technology development process arose in the fifth thinkers session: seed capital and flexible manufacturing. The issue is not what is currently known about each subject (state of knowledge), or examples of successful use or application (state of experience); this is necessary, but not sufficient.

Rather, the issue is what state and local governments are doing to promote the development and use of seed capital and to promote the development and application of flexible manufacturing (in both instances, given the state of academic knowledge and practical experience). State and local governments need such information, and their clearinghouses do not have it.

The specific implications for the Clearinghouse would include:

- Determination of the availability of federal funds from other agencies to update the research and analysis effort on the technology and commercialization process, and attempt to persuade such agencies to support specific components of such an effort;
- Use of the Clearinghouse's own funds to support specific priority components of such an effort;
- Provision of the Clearinghouse's extramural funds to ensure that the results of such ongoing efforts (probably over several years) are included in the clearinghouses of public interest associations and other intermediaries serving state and local governments; and
- Identification, documentation, and dissemination of federal programs and activities that complement state and local program initiatives in this area.

**Identifying and Filling Gaps in this Knowledge and Experience.** There appear to be major and minor gaps in information about state and local programs. For example, one major issue noted by representatives of all the clearinghouses operated by state public interest associations is the lack of program assessments.

Some assessments do exist; some of these are self-assessments, some are legislatively conducted, and some are performed by academic researchers. In addition, various assessment indicators are used: jobs created or retained; businesses created, expanded, or retained; taxes paid; firm sales; and corporate investments.

There is limited agreement on appropriate evaluation methodologies. State and local governments could use information on this and similar areas, and their clearinghouses do not have this type of information. It is a gap that needs to be addressed to ensure the productive use of public resources.

The specific implications for the Clearinghouse would include:

- Determination of the availability of federal funds from other agencies to fill such gaps as appropriate evaluation methodologies and attempt to persuade such agencies to support specific gap-filling efforts;
- Use of the Clearinghouse's own funds to support specific priority gap-filling efforts; and
- Provision of the Clearinghouse's extramural funds to ensure that the results of such ongoing efforts (probably over several years) are included in the clearinghouses of public interest associations and other intermediaries serving state and local governments.

**Networking Clearinghouse Operators.** In addition to concerns about the data bases and their content (i.e., reducing overlap and filling gaps in the collection of data and increasing commonality in selected data categories), there appears to be a lack of ongoing communication and cooperation among the operators of the clearinghouses. This is particularly apparent among clearinghouses that operate within different governments.

Communication and cooperation clearly exist on an ad hoc basis to compile information or to address a specific issue. What is missing is an ongoing and systematic cross-fertilization among all these clearinghouses on federal programs and on state and local initiatives.

The clearinghouses could share resources as well as data base content. They could share experiences on lessons learned in operating clearinghouses and in providing a variety of products and services (e.g., data and information, publications and reports, technical services). This is another gap that needs to be addressed to maximize the potential of public expenditures.

The specific implications for the Clearinghouse include:

- Use of convening power and "bully-pulpit" to work with the operators of the clearinghouses and with the federal agencies:
  - To share resources to the extent possible given the varying nature of the clearinghouses and the organizations that house them;
  - To develop and share lessons learned in designing and operating clearinghouses and in determining the mix of products and services to be provided members or subscribers; and
  - To foster networking among members/subscribers of each clearinghouse and across clearinghouses.

**External Coordination**

The success of the Clearinghouse in its niche is dependent on coordination and cooperation with other

federal agencies and with the state and local government interest groups.

**Interagency Coordination.** The Clearinghouse must be committed to working closely with other line agencies having similar missions involving technology development. This includes agencies both within and outside of the Department of Commerce's Technology Administration (e.g., NASA). It will help to ensure a comprehensive and complementary federal response to the state and local community and its program initiatives.

**Coordination with State and Local Interest Groups.** The Clearinghouse must be willing to work constructively with the state and local interest groups. It is more likely to succeed if, at a minimum, it attempts to coordinate its efforts through such existing groups and (preferably) has available funding to solicit their support. A strong commitment to the Clearinghouse will be needed by the leaders of the user community—state and local governments.

### Clearinghouse Design and Administration

Certain desirable characteristics need to be built into the Clearinghouse design and administration. Administrative flexibility should characterize future planning and implementation. Ideally, the Clearinghouse should be planned and implemented in phases; this way, as circumstances and experiences change, provisions can be made for amending plans.

The planning phase would involve working with the user community of state and local governments (preferably through their intermediary organizations) to assess their priority needs and topics of high interest within the framework of the Clearinghouse's mission and its roles noted above. Such an assessment need not involve long drawn-out procedures. The process can range from regular, informal brainstorming to rigorous analysis of widely distributed survey forms. For the Clearinghouse, the former may be more appropriate.

Early success stories are important; the Clearinghouse can build on them. Options for consideration might include:

- Packaging of information on a priority issue area across governments (e.g., seed capital) by commissioning a paper and convening a review session by experts from the research and practitioner communities (including all governments); and
- Development of a multigroup network of individuals in a specific topic of high interest (e.g., flexible manufacturing and the roles of governments in developing and promoting it) through a conference sponsored by several federal agencies, the state and local interest groups, and other intermediaries representing providers of technical and business assistance (such as university centers and trade associations).

Success, however, is not likely to be measured by the number of products issued by the Clearinghouse, but rather by products supported by the Clearinghouse and issued by organizations (such as public interest associations) that have greater credibility with the audience of state and local governments.

Similarly, success is not likely to be measured by the number of conferences convened by the Clearinghouse, but rather by such meetings supported and co-sponsored by the Clearinghouse and the intermediary organizations.

The dissemination of information should be built around existing credible communications channels. If a new communications node (such as the Clearinghouse) is added to existing channels of communication, there should be a concern not to proliferate institutions, but to concentrate on using existing resources more effectively. For example, since the primary audience is state and local officials, respected channels of communications such as state and local government associations should be involved to the extent possible. This helps to overcome resistance to change and lessens suspicion of new players. Thus, the Clearinghouse would not become an added channel, but would facilitate and strengthen the capacity for communication.

Similarly, the repository of information should be built around existing, credible clearinghouses. Clearly, housing a centrally available clearinghouse at any one of the existing public interest associations is inappropriate. The state/local dichotomy means that local governments might not have easy access to the state-oriented program information, and vice versa.

However, through the convening power and strategic investment roles of the Clearinghouse, such a central repository is neither necessary nor appropriate. Each public interest association needs to know only the categories of programs and the kinds of information about each program in the other associations' data bases (i.e., their structure). With that information, each association can act as an inquiry/referral service for its members to any other association.

It might be argued that each association would prefer not to receive additional requests from federal agencies or from the other associations and their members, particularly if from a different level of government. Thus, downloading the information into a centrally available Clearinghouse would prove desirable.

Three lessons learned from the study of the 18 clearinghouses are relevant here. First, there is the "turf" issue of not giving up one's information in order to demonstrate an organization's utility to its membership. Second, the information provided by the trusted intermediary is more credible. Third, if the information was downloaded, it would have been automated, and automating the information in some of the existing clearinghouses would allow more inquiries to be answered on-line, freeing up staff time for the additional requests. This is particularly relevant with the state interest associations, because the number of potential new inquirers (from thousands of local governments) is large compared to the number of jurisdictions now served (57).

### Clearinghouse Staffing

The foregoing implications for the Clearinghouse regarding roles and special niche, coordination, and design and administration have, in turn, implications for the staffing of the Clearinghouse.

By the nature of the users directly served, it is obvious that the Clearinghouse staff must demonstrate, and must

be perceived as demonstrating, an understanding of the roles and responsibilities of state and local governments and an awareness of the importance of state and local initiatives in promoting technology development by industry. While state and local governments over the past three decades have returned to being true partners with the federal government in facilitating technology-based business and economic development, this has not necessarily been appreciated by all federal agencies and their representatives.

In addition, by the very fact that it is establishing a new entity, the Clearinghouse staff will need to be entrepreneurial in its vision. The Clearinghouse management has provided leadership in this regard by the use of ACIR, focus groups, and commissioned papers for its development process. It has reached outside the federal establishment and has brought together representatives of many different affected communities who had not heretofore worked together to achieve common aims. The strategic thinking already undertaken in this development process provides a broad framework within which entrepreneurial tactical steps can be taken by the staff.

### Summing Up

By definition, the Commerce Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation does not fall into any one of the five clearinghouse approaches discussed. Rather, it represents a "clearinghouse of clearinghouses."

The potential for the Clearinghouse is necessarily limited in the near term by the staff and financial resources made available to it directly and leveraged indirectly from other agencies to achieve mutual objectives. The limitation in the legislation regarding the user community of state and local as well as federal government provides a focus for a phased implementation of the operations of the Clearinghouse. When successful, the Clearinghouse could then consider asking for authority and resources to expand its audience to the next category—the nongovernmental providers of technical and business information and services and their intermediaries (e.g., nonprofit, private, university based). As with the focus in state and local as well as federal programs and initiatives, the ultimate beneficiaries remain—the large corporations and small firms that provide the country's economic future and its place in the global economy.

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# Clearinghouse Descriptions

## National Alliance of Business Clearinghouse (NAB)

**What organization(s) operates the clearinghouse?**

The National Alliance of Business (NAB) Clearinghouse has operated in various formats and with various inputs since 1979. It has focused primarily on providing information on the federal government's job training and employment programs created through the *Job Training Partnership Act* (JTPA) of 1982 and its predecessor, the *Comprehensive Employment and Training Act*. Because the JTPA performance criteria are strictly defined, those in the field have a need to know about successful local programs.

**What organization(s) funds the clearinghouse?**

NAB traditionally has been sustained through federal funding (mostly from the Employment and Training Administration of the U.S. Department of Labor) and corporate contributions. Individual memberships were offered beginning in 1989.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development) and what is the extent of the clearinghouse listings?**

The NAB database contains four kinds of files:

- Model Program File—descriptions of 700 programs that can be replicated, collected in seven years of program research;
- Program Leads File—900 new and innovative project profiles according to location, key project characteristics, funding sources and amounts, target populations and occupations, types of training, business involvement, and a contact person;
- Reference File—an on-line bibliographic data base which abstracted over 2,800 valuable policy reports and how-to publications; and
- Contacts and Services File—described helpful organizations to put the user in touch with a network of national, regional, state, and local sources of information and technical assistance.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does the clearinghouse access external data bases?**

The projects supported by federal and corporate funding generate case studies and other information, which becomes the basis of the data base.

In 1986, the U.S. Economic Development Administration supported joint projects between NAB and the National Council for Urban Economic Development (CUED), the National Association of Regional Councils (NARC), and the National Association of State Development Agencies (NASDA). The focus of the two-year efforts was the linkage between job training and economic development. Activities included documenting case examples of successful state, regional, and local activities, identifying needs in this area, and conducting a National Leadership Conference on the subject at the end of the project. Thus, EDA did not support the three organizations to develop entries for the data base, per se; rather, the results of the joint efforts were entered into the data base.

**Does the clearinghouse produce publications?**

NAB produces numerous other publications that are not part of the computerized data base. In addition to its data base and library, NAB publications include:

- Bulletins—easy-to-read studies of successful programs outlining the essential information needed to plan, budget, and manage model projects;
- "WorkAmerica"—NAB's monthly newspaper featuring model programs, interviews, and "Washington news" about the employment and training system nationwide;
- "Economic Development Briefs"—a free quarterly newsletter on economic development trends throughout the nation;
- "Business Currents"—a biweekly newsletter analyzing legislative, administrative, and regulatory actions that affect employment, training, and education policies; and
- Special Reports—indexed in NAB Publications List.

**Does the clearinghouse offer other products and services (eg., technical assistance)?**

In 1988, the data base was converted to an in-house system and revitalized as a Special Research Library. The NAB staff has access to the computerized information as well as to the Library, which provides a traditional collection of materials on employment, training, business/education partnerships, economic and human resource development. The NAB staff may borrow books, but non-NAB personnel must schedule an appointment to use the library's resources; and they cannot check out books. Related clearinghouse services include periodicals circulation, book ordering, fact finding, and research services (eg., survey research or assistance with research and questionnaire design are provided on a contract basis).

Through its familiarity with the library collection and skill in locating information, clearinghouse staff is able to track down information quickly. While the clearinghouse is responsive and helpful to the general public, activities now are driven by NAB staff needs. Services include:

- Quick answer service (locating facts, studies, and appropriate experts);
- Information searches (compiling information packages from a variety of sources); and
- Literature searches and bibliography preparation.

At this time, because of limited staff, NAB is comput-

erizing only citations for books added to the NAB library. Information on programs is filed in paper subject files instead of a data base.

**How big is the clearinghouse staff?**

As part of the NAB Special Research Library, the NAB Clearinghouse services are now provided by one full-time staff person. The Library has four full-time staff persons to cover each of four functions: periodicals circulation, book ordering, fact finding through the Clearinghouse, and research services.

During the 1982-1985 period, when the research projects were ongoing, the Clearinghouse staff included two full-time persons.

**What are examples of questions the clearinghouse can be expected to answer?**

The NAB Clearinghouse has provided answers to inquiries on employment, job training, and economic development. In addition to JTPA-related information, this has included such topics as entrepreneurship, worker dislocation, business-school partnerships for education, tax incentives, on-the-job training, business attraction and retention strategies, incubators, and small business development.

**Who uses the clearinghouse?**

Until 1984, the data base files were used to respond to inquiries from the NAB staff and the public (educators, business people, and federal, state, and local government officials, community-based persons, and consultants).

From 1985 to 1988, direct access to the data base was marketed to members of the "JTPA system"—primarily Private Industry Councils and state Job Training Boards. Brochures were designed and distributed, and demonstrations were performed at conferences.

Since 1988, when the Clearinghouse was revitalized as a Special Research Library, the NAB staff has been using the information in performance of its own duties.

**How often is the clearinghouse accessed?**

Until 1986, the data base had just over 40 subscribers. In 1986, economic development agencies were targeted and, within a year, the number of subscribers had increased to about 80.

Direct access was terminated in June 1988. By this time, the data base had half its original number of subscribers, in spite of intensified subscriber support services from 1986 to 1987 (guidebook, quick reference guide, newsletters, telephone assistance, and training) and stepped up subscription expiration notices.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

During the direct access phase, data base users required a computer, modem, and NAB's user manual.

Information in the data base was organized (and could be searched) by funding source (e.g., JTPA), type of program operator (e.g., private industry council), industry, occupation, location, training type (e.g., on-the-job), and target group (e.g., dislocated workers).

For those users without a computer and modem, the staff searched the data base and other resources. Modest fees helped to defray these information dissemination costs.

**What kind of help is provided in accessing the clearinghouse?**

Special one-on-one, how-to training sessions for accessing the system were provided at an additional cost.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Users paid only for actual search time ($60 per hour or $1 per minute), discounted for frequent users and for prepayment packages. There was also a $15 minimum usage fee during each monthly billing period, unless the data base was not accessed at all in that period of time.

The user manual, "Guide to Searching the NAB Data base," cost $30 at the time the user opened an account and received an individual access code.

**What is the clearinghouse history, legislative, and/or programmatic background?**

The NAB Clearinghouse had its origins a decade ago; the information was gradually computerized over several years. Until 1984, the data base files were used to respond to inquiries from the NAB staff and the public. In 1985, NAB introduced direct access to the data base. In 1986, EDA supported two-year joint projects between NAB, NASDA, CUED, and NARC, which provided input for the data base. Surveys of subscribers were conducted in 1984 and 1986, and two new pricing plans were offered in 1987. Also in 1987, a regional Clearinghouse demonstration project was initiated. In 1988, the Clearinghouse was revitalized as a library primarily for the NAB staff.

### Federal Research in Progress Data Base (FEDRIP)

**What organization(s) operates the clearinghouse?**

As the U.S. government's central scientific, technical, and engineering information service, the U.S. Department of Commerce's National Technical Information Service (NTIS) is responsible for providing access to summaries of current and ongoing projects via the Federal Research in Progress Data Base (FEDRIP).

FEDRIP's uniqueness lies in its structure; it is a nonbibliographic source of research in progress (as opposed to the well-known NTIS Bibliographic Data Base; once research is completed, the resulting final reports, etc., become listed in the NTIS Bibliographic Data base).

**What organization(s) funds the clearinghouse?**

Agencies pay NTIS per project provided; users also pay NTIS via an arrangement with DIALOG Information Services.

NTIS is required by law to be a self-sustaining agency. The costs of NTIS salaries, marketing, postage, and all other operating costs are paid for by the sales revenues from its products. Costs are not covered by tax-supported congressional appropriations.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its list-**

**ings? Also, how is information generated for inclusion in the clearinghouse and/or evaluated?**

The FEDRIP Data Base contains more than 93,000 citations about ongoing federally funded research projects in the physical sciences, engineering, and life sciences. Most research projects are described by an abstract or summary of the basis of the research, its objectives, and, sometimes, intermediate findings.

FEDRIP is a compilation of input from nine government agencies, which accounts for its varied subject coverage. The data bases in FEDRIP, their source, and the number of active projects are:

- AGRIC, U.S. Department of Agriculture—16,900, annual update;
- CRISP, Public Health Service—40,000, monthly update;
- ENRGY, Department of Energy—7,500, semiannual update;
- NASA—600, annual update;
- NBS, National Institute of Standards and Technology—80, annual update;
- NSF, National Science Foundation—8,500, semiannual update;
- TRANS, Transportation Research Board, National Academy of Sciences—4,000, annual update;
- USGS, Water Resources Division, U.S. Geological Survey—300, semiannual update; and
- VA, Department of Veterans Affairs—14,900, monthly update.

**Does the clearinghouse produce publications?**

No.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

No.

**How big is the clearinghouse staff?**

An NTIS Product Manager acts as a part-time liaison with the other federal agencies that forward magnetic tapes containing the data. The Commerce Department Computer Center converts the tapes to a standard format used by NTIS.

**What are examples of questions the clearinghouse can be expected to answer?**

Like the Federal Applied Technology Data Base described below under the section on CUFT, FEDRIP was not created as a inquiry/response service. However, users may access this large and multidisciplinary data base in a variety of subject areas. The areas of health and medicine are most prominent as a result of the input received from the Public Health Service and Department of Veterans Affairs. Other major subjects include agriculture, energy, and transportation.

**Who uses the clearinghouse?**

Researchers access FEDRIP to avoid duplication, locate sources of support, identify leads in the literature, stimulate ideas for planning, identify gaps in areas of investigation, locate individuals with expertise, and complement searches of completed research.

**How often is the clearinghouse accessed?**

Because only one private vendor—DIALOG Information Services, Inc.—makes FEDRIP available on-line to the public, the usage data is proprietary; if there were several vendors, the usage data from each firm could be aggregated and made available.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

FEDRIP is available on-line through DIALOG.

The information in FEDRIP can be searched primarily by subject and by organization name (including the organization performing the research and the sponsoring/funding federal agency). Additional searching is by principal investigators, dates, geographic location, etc.

FEDRIP also is available from NERAC, Inc., which performs customized searches.

**What kind of help is provided in accessing the clearinghouse?**

Available free from NTIS is the "Search Guide to the Federal Research in Progress Data Base—FEDRIP" a 60-page publication that includes data base coverage, field hints, and searching specifics.

NTIS also offers on-line training and presentations to groups. These sessions include a presentation of the specifics of the data base (format, content, etc.); an explanation of searching strategies and systems commands; and, if appropriate, a "hands-on" sessions.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Connect time to DIALOG is $48 per hour. The off-line print rate is 20 cents for a full record; on-line type is 20 cents per line.

**What is the clearinghouse history and legislative and/or programmatic background?**

Until the early 1980s, the Smithsonian Science Information Exchange (SSIE) was the major record of all government-funded R&D in progress. The SSIE provided project summaries by subjects, principal investigators, dates, and funding amounts. In the early 1980s, SSIE was folded into NTIS and continued as FEDRIP.

### Federal Applied Technology Data Base (FATD)

**What organization(s) operates the clearinghouse?**

The Federal Applied Technology Data Base (FATD) is one of a number of information products offered by the Center for the Utilization of Federal Technology (CUFT) at the National Technical Information Service (NTIS).

What distinguishes CUFT from FEDRIP is that CUFT products focus on special opportunities for utilizing the technologies produced from federally sponsored research. As such, CUFT is not just in the business of selling publications, but in transferring technologies.

CUFT consists of two main divisions: the Office of

Applied Technology and the Office of Federal Patent Licensing. The activities of the Office of Applied Technology most closely relate to the clearinghouse concept.

**What organization(s) funds the clearinghouse?**

Since CUFT is part of NTIS, the Congress requires that CUFT be self-sustaining.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic, research/technology development), and what is the extent of its listings?**

FATD is a technology transfer resource linking U.S. companies and other users with federal laboratory technologies, know-how, and other resources. The data base provides electronic access to all of CUFT's information, such as the hard copy reports noted below. There are three types of information entries in the FATD:

- More than 900 federal laboratory resources searchable by the following four types:

  Expertise in an applied area;

  Facilities (equipment available for sharing);

  More than 90 technical information centers focused on specific subjects (e.g., fuels, toxicology, pesticides, etc.); and

  Services (special services for supplying R&D samples and supplies).
- Technology fact sheets on those having "better-than-average potential" (including the *NASA Tech Briefs* and the 1,400 yearly *NTIS Tech Notes*).
- U.S. government-owned inventions (descriptions of technologies companies can use to develop new products and processes drawn from more than 700 patents and 900 patent application descriptions entries yearly).

The data base contains names, telephone numbers, and sources of backup information for many of these entries. As of 1988, FATD's six-year coverage includes more than 14,000 records.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The information contained in FATD is the same as that collected for the printed reports described below. Some of the information in FATD, *Tech Notes* and *Government Inventions*, specifically, are also available through the NTIS Bibliographic Data Base.

FATD is updated biweekly.

**Does the clearinghouse produce publications?**

CUFT's Office of Applied Technology publishes a number of publications on a regular basis, including:

- *Tech Notes*, a monthly subscription format covering current technological advances considered to have potential commercial or practical application (includes new processes, equipment, materials, software, and techniques);
- *Federal Technology Catalog*, an annual publication summarizing the prior year's *Tech Notes* in 23 subject headings;
- *Government Inventions for Licensing Abstract Newsletter*, weekly bulletins covering inventions from all federal agencies, which alert businesses and entrepreneurs to opportunities for licensing and marketing government-owned inventions (frequently on an exclusive basis);
- *Catalog of Government Inventions for Licensing*, an annual summary of the weekly bulletins on the same topic, which announce more than 1,200 inventions annually and bring more than 60 promising inventions to market each year;
- *Directory of Federal Laboratory and Technology Resources—A Guide to Services, Facilities, and Expertise*, a convenient, easy-to-use biennial reference for large and small technology-oriented businesses to locate scientific and technical resources provided by federal agencies and their labs (it describes not only federal labs, but also more than 90 technical information centers that have been noted as untapped resources);
- *Directory of Federal and State Business Assistance—A Guide for New and Growing Companies*, a biennial publication describing more than 180 federal and 400 state business assistance programs; and
- *Small Business Guide to Federal R&D Funding Opportunities*, CUFT's newest publication, with special emphasis on the SBIR program.

Other products are available (e.g., "Evaluating R&D and New Product Development Ventures," etc.), but they will not be described here.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

CUFT's Office of Federal Patent Licensing (OFPL) provides industry a one-stop source of information on patents available for licensing from a number of federal agencies, including the National Institutes of Health, U.S. Department of Agriculture, and National Institute of Standards and Technology. As part of CUFT, OFPL also is expected to be self-sustaining. It generates income from the service fees charged those agencies, which essentially are paid through royalties from licensing agreements.

**If the clearinghouse offers technical assistance, what type of expertise is available?**

The OFPL staff evaluates federal technologies for their commercial potential. Expertise is technical and legal.

**What are examples of questions the clearinghouse can be expected to answer?**

The following examples of typical questions are provided in a descriptive brochure about FATD:

- A small manufacturing company needed to know what ceramic technology has been developed for possible engine use; and
- An architect needed technical help in the use of daylight for office lighting.

FATD does not have a formal inquiry or response capability. Answers are obtained through the sources of ex-

pertise and citations available from searching the data base or through the mailing of printed reports noted above at specified charges.

**How big is the clearinghouse staff?**

An NTIS Product Manager compiles and abstracts the data. Government contractors (including technical specialists such as chemists, etc.) index and key the data, as needed, on a part-time basis.

**Who uses the clearinghouse?**

CUFT users are from industry; universities; and federal, state, and local government; as well as individual scientists and engineers. CUFT's Office of Applied Technology has identified state technical assistance centers and state economic development programs to provide them with timely information through special flyers and other mailings.

**How often is the clearinghouse accessed?**

Because until recently only one private vendor—BRS Information Technologies—had made the FATD available on-line to the public, the usage data has been proprietary. In the future, usage data from each of the two firms now offering FATD can be aggregated and made available.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Access to FATD is through two commercial on-line information services, BRS Information Technologies and NewsNet via TELENET and TYMNET. Menu-driven searching is accomplished by dialing an 800 telephone number through a modem and computer terminal.

All records in FATD are assigned searchable codes representing broad subject disciplines such as chemical analysis, air pollution, etc. These categories can be refined and searched through specific subject subsets.

**What kind of help is provided in accessing the clearinghouse?**

Available free from NTIS is the booklet "Online Access to Business and Technology Assistance: A Searcher's Guide to the FATD on BRS," a 35-page publication that includes access procedures, searching techniques, and data base descriptions.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

BRS charges are $60 per hour during "prime time" (6am-6pm local time, Monday-Friday), or $50 per hour for non-prime time.

The fees associated for CUFT publications are:

- *Tech Notes*—$157 per year;
- *Federal Technology Catalogs*—current year, $36 (other annual editions are less) or free to *Tech Notes* subscribers;
- *Government Inventions for Licensing Abstract Newsletter*—$225 per year;
- *Catalog of Government Inventions for Licensing*—current year, $45 (other annual editions are less) or free to the Abstract Newsletter subscribers;
- *Directory of Federal Laboratory and Technology Resources*—$36;
- *Directory of Federal and State Business Assistance*—$29; and
- *Small Business Guide*—$12.50.

**What is the clearinghouse history and legislative and/or programmatic background?**

CUFT was established in 1982 in response to the 1980 *Stevenson-Wydler Technology Innovation Act* to serve as a clearinghouse for:

- Collecting and disseminating information on federally funded R&D;
- Acting as a referral agent to the federal laboratory system; and
- Providing additional assistance, as needed, to complete the transfer of federal technology.

Under the 1986 *Federal Technology Transfer Act*, CUFT was formally subsumed into NTIS.

As of 1987, most of the above products had been published through NTIS's Office of Program and Product Management, although still largely developed by CUFT staff.

Until recently, a Federal and State Business Assistance (FSBA) data base was also offered by CUFT. FSBA was comprised of two types of entries: more than 180 federal business assistance programs and about 400 state programs. The data base contained "quick glance" descriptive phrases as well as detailed information, contacts, and phone numbers. The following are sample questions that were addressed by using the data base:

- How to get funding for a company's R&D;
- Where to get mail lists of potential overseas business buyers; and
- What federal and state contacts offer free management and procurement consulting.

The FSBA is no longer available on-line from BRS because it did not generate sufficient commercial use; however, the FSBA information is still available in hard copy, as noted above, and has been a "best seller" for CUFT and NTIS.

### Technology Applications Information System (TAIS)

**What organization(s) operates and funds the clearinghouse?**

The Strategic Defense Initiative Organization (SDIO) in the Department of Defense established an Office of Technology Applications in 1987 to make SDI technologies available to other federal agencies and the U.S. private sector.

The SDIO Technology Applications office developed the Technology Applications Information System (TAIS) based on several principles, including:

- Putting the right people together (e.g., inventors and technology developers) easily and quickly; and
- Linking people within restraints established for the protection of sensitive technology and intellectual property rights.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

The main purpose of TAIS is to place those seeking to commercialize technology in touch with inventors of new technologies so that business negotiations, license agreements, and royalty arrangements can be expedited. The system provides:

- 1,200 technology abstracts for technical and non-technical users—unclassified summaries of available technologies containing some information on patent matters, a contact point (principal investigator), and a listing of key words;
- Updated requirements and closing dates for proposals to SDI:

  Small Business Innovative Research (SBIR) program (15 research topics); and

  Innovative Science and Technology (IST) program (43 research topics in six broad research areas);
- Listings of 14 other on-line federal data bases of technology information (NASA, NTIS, etc.); and
- Descriptions of more than 180 federal and 400 state business assistance programs.

**What are examples of questions the clearinghouse can be expected to answer?**

Users access TAIS primarily to learn about available technologies. The technologies that have been most popular, as measured by the number of requests for further information, are:

- Software design generator expert system;
- Graphic computer-aided software engineering package;
- Coated carbon and graphite-reinforced ceramics;
- Attentive associative memory;
- Miniature, radiation-hardened accelerometers;
- Process for coating surfaces with thin layers of diamond crystals;
- Infrared sensors; and
- Distributed computing design system.

TAIS also can indicate the proposal due dates for SDI research funding, as well as places where firms can go for business assistance.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

Approximately 50 percent of the technology abstracts are descriptions of SDI's SBIR projects and projects sponsored by SDI's IST program, which is open to both small and large firms as well as to researchers in universities and other public and private institutions. Both of these research programs use a peer review mechanism for identifying fundable projects. The remaining technology abstracts are from laboratory and industry R&D programs. The sources of information include contract documents, technical reports, conference presentations, news articles, etc.

In order to assist in the identification of further spinoff potential for the technologies described in TAIS, the SDI Technology Applications office has established a network of more than 50 voluntary scientific/technical advisors. Meetings of these advisors are held on a regular basis to review promising technological advances and breakthroughs. They are based at universities, federal laboratories, private research institutes, large corporations, and professional associations.

**Does the clearinghouse produce publications?**

In order to promote its services, the Technology Applications office produces an annual report, brochures, press releases, and a press kit containing fact sheets.

**Does the clearinghouse offer other products and services or sponsor other activities?**

TAIS has built-in capability to track users and, thus, can automatically generate targeted mailing lists for conferences, surveys, and the like.

**How big is the clearinghouse staff?**

The system currently has one full-time administrator and a number of part-time support staff, including two programmers, two scientists/engineers who can analyze and communicate the technology abstracts, a technical writer, a data loader, and an "outreach" person.

**Who uses the clearinghouse?**

TAIS is accessed by technology developers in U.S. corporations and small businesses, as well as in DOD and other federal agencies. The list of users who have accessed the system includes such well-known corporations as Grumman Corporation, McDonnell Douglas, Motorola, Northrup, Rolls Royce, SAIC, TRW, Teledyne, UNISYS, etc. (It is assumed that many of the less well-known firms on the user list are small businesses.) The federal users have ranged from NASA and the Air Force to the Customs Service and Department of the Treasury.

TAIS information on the SDI Innovative Science and Technology program is of interest to high-tech firms generally; information on SDI's SBIR program is primarily of interest to small firms. Economic development offices are interested in both the SBIR and IST program information in order to increase the awareness of local firms about federal procurement opportunities.

Information in TAIS is used also by university and laboratory researchers to share information. Universities currently using TAIS include the University of Tennessee, University of Colorado, and University of Texas.

**How is the clearinghouse accessed and searched?**

TAIS is accessible via computer modem by any U.S. corporation or citizen who has completed a Militarily Critical Technology (MCT) Data Agreement and has been certified as eligible for access by the Defense Logistics Agency. More than 13,000 American corporations and small businesses are MCT-certified at this time. Federal agency representatives may obtain access certification by addressing a request on official letterhead to the SDIO Technology Applications Office (approximately 325 have done so thus far).

Users may browse TAIS' largest data base, the technology abstracts, by using one of four search methodologies: technology hierarchy, key word, application area, or industrial classification. The technology categories are based on the categories used in the government's Militarily Critical Technologies List, which is established for export controls of militarily sensitive technologies and, thus, is used by a number of federal agencies.

When a TAIS user finds a technology abstract of interest, a request may be made by computer for additional information. When such a request is made, the Technology Applications office responds to that user by mail—the letter is automatically generated that describes the technology and contact point for additional information. (The reason for responding by mail is to ensure that the MCT-certified user receives the information.)

The office simultaneously informs the principal investigator/contact point that a specific user has an interest in additional information. The royalty incentives created by the 1986 technology transfer legislation serve to encourage a response by the scientist.

**How often is the clearinghouse accessed?**

TAIS has had 2,154 log-ons in 78 weeks, which averages 5.5 people logging on per day in a given work week. This is interesting because for security reasons the system limits the number of accesses per day per user, as well as the amount of time the user may log onto the system.

In terms of requests for further information, the system has averaged 7.2 requests per week.

**What kind of help is provided in accessing the clearinghouse?**

The office has a phone number (non toll-free) to call for assistance in accessing the TAIS.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

There is no charge for accessing TAIS, only for the long distance telephone access charge.

**What is the clearinghouse history and legislative and/or programmatic background?**

TAIS was established in response to the *Stevenson-Wydler Technology Innovative Act of 1980*, the cooperative provisions of the 1986 *Federal Technology Transfer Act*, and the 1987 Executive Order on Facilitating Access to Federal Science and Technology. It was established also in response to the *Department of Defense Authorization Acts of 1986 and 1987*, and the DOD Fiscal Year 1989 appropriations language. TAIS was opened in conjunction with the directive to the Secretary of Defense contained in the 1987 Executive Order requiring a response in six months on technology available through DOD.

### The Local Exchange (LEX)

**What organization(s) operates the clearinghouse?**

Local Exchange, an electronic network for local government officials developed in partnership with GTE Education Service, provides subscribers access to information compiled by the National League of Cities (NLC), International City Management Association (ICMA), Government Finance Officers' Association (GFOA), and Public Technology, Inc. (PTI).

**What organization(s) funds the clearinghouse?**

The Local Exchange is self-supporting through subscriber fees.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

Exchange data bases include:

- NLC's *Urban Affairs Abstracts*—weekly abstracting service of articles from more than 400 municipally oriented national and regional periodicals (includes 5,000 bibliographic citations going back 2.5 years);
- Local Government Solutions—more than 2,000 case studies collected by NLC, PTI, and ICMA that document innovative and effective solutions to problems and needs in urban and rural communities (it is anticipated that NACo will be adding its Innovations Program case studies to this data base);
- NLC's *Economic Development Dispatches*—100 files downloaded from the economic development Bulletin Board containing case studies, publications, and news about upcoming conferences;
- PTI's and ICMA's Microlink—a Bulletin Board with information about microcomputer applications, product announcements, and networking issues;
- NLC's Legislative News—100 to 200 files downloaded from a Bulletin Board with updated legislative and regulatory news from NLC's Office of Federal Relations;
- GFOA's GF-Net, which currently has two components:

  Government Finance Abstracts, a file of 350 abstracts of publications of interest to finance officers that appear in GFOA's monthly publication *Government Finance Review*; and

  Financial news updated several times daily from the Dow Jones Capital Markets Wire (e.g., information on municipal bonds, CD rates, news from the Federal Reserve, etc.);
- ICMA's *Jobs*, an up-to-date listing of about 150 job opportunities in local governments; and
- User Directory, a listing of all Local Exchange users, including addresses and telephone numbers (450-500 files).

Also planned for near future is a data base, NLC's Telecom Trends, on cable television and telecommunications issues facing local governments. It will be downloaded from a Bulletin Board and include items from *NATOA News*, as well.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

Most of the information found in the data base is the same information that is available in hard copy format to members of the involved organizations. It is the same type of information they have been providing for years.

Through the Local Exchange, subscribers can also access such commercial data bases as News Grid, the Official Airline Guide, and stock information services at rates set by the information provider.

**Does the clearinghouse produce publications?**

The Local Exchange does not produce original publications. However, as noted above, the organizations involved produce a great number of technical assistance publications in a wide variety of areas of interest to state and local governments.

The Local Exchange provides access to research services for members and subscribers of the sponsoring organizations. The research services are NLC's Municipal Reference Service, ICMA's Management Information Service, and PTI's ANSWER. Using Local Exchange, members/subscribers may submit inquiries and obtain responses to questions from the staffs.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

The Local Exchange includes messaging and electronic mail bulletin boards, whereby users can post questions and announcements for other subscribers. The following are available:

- Econ.Development (providing economic development information);
- Univ.Communities (providing information on university communities);
- Small.Communities (providing small cities news);
- Updates (legislative and regulatory news from NLC);
- Quest.ADM (questions and answers on administrative topics such as finance and personnel);
- Quest.CED (community, economic development, planning);
- Quest.PS (public safety, police, fire, emergency services);
- Quest.PW (public works; transportation); and
- Quest.General (questions and answers on other topics).

The Local Exchange also offers the opportunity to conduct on-line workshops on specific topics on specified days and times or over several days.

Users also can generate questionnaire forms, conference registration forms, and other types of forms on-line. This allows subscribers to provide information to other organizations in an easily usable form that facilitates the exchange of information.

**How big is the clearinghouse staff?**

The Local Exchange itself is operated by a vendor using GTE Telenet as the host system. The participating public interest associations in the aggregate have about 1.5-2 full-time-equivalent staff members devoted to this effort.

**What are examples of questions the clearinghouse can be expected to answer?**

From the data base, a user might request abstracts of the latest articles on the subject of liability.

Similarly, a user might scan the economic development data base for:

- Case studies of specific city programs;
- Descriptions of federal economic development funding programs;
- Information about notable economic development strategies and trends; or
- Notices about economic development conferences and publications.

Sample queries on the bulletin board have requested information on the following topics:

- Programs for latchkey children in libraries, and local policies regarding parent supervision;
- Ordinances, resolutions, or legislation that would require an individual or property owner to bear the expense of site improvement as a result of migratory birds or animals; and
- Whether, when, and how jurisdictions codify ordinances.

**Who uses the clearinghouse?**

Local elected officials can use the clearinghouse for policy development ideas. City and county administrators can research management issues. Local government department staff can find information on operational concerns. Local finance and budget directors can access up-to-the-minute information to aid them in financial decisions.

**How often is the clearinghouse accessed?**

The Local Exchange started operation in October 1988. Meaningful aggregate data is not yet available. Anecdotal evidence indicates that some subscribers access the Exchange three to four times per week every week.

**How is the clearinghouse accessed and searched (e.g., is a computer necessary)?**

Once a data base has been selected through the system's main menu, the user types in the word or words on the topic of interest and begins a search.

Local governments without computer modems may send and receive electronic mail messages via a FAX machine.

**What kind of help is provided in accessing the clearinghouse?**

New subscribers receive a user's manual. They also have access to an 800 customer service telephone number, a computer-based tutorial, and a training program.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Fees are based on the population of the subscribing jurisdiction. For example, cities and counties with popula-

tions over 100,000 pay a basic price of $700 for 7 sign-on IDs; between 25,000 and 100,000, $500 for 5 IDs; under 25,000, $300 for 3 IDs; state municipal leagues, $400 for 3 IDs. (Additional IDs may be obtained for $45). In addition, there are hourly connect charges and transmission charges.

Packaged subscriptions allow the jurisdiction to pay the annual fee and connect charges in advance. The subscriber receives a monthly invoice for service hours used and an indication of the remaining balance of the prepayment. There are four prepayment options ranging from $900 to $3,900.

**What is the clearinghouse history and legislative and/or programmatic background?**

Over the past decade, several of the involved organizations have experimented with other on-line information systems. For example, the predecessor to the Local Exchange at NLC was called LINUS. At one time, LINUS was tied into Control Data Corporation's LOGIN (described in more detail below), which also incorporated other local government associations, such as the U.S. Conference of Mayors and National Association of Counties. LINUS was created in 1986 because LOGIN, by its very nature, could not provide the exact mix of clearinghouse information and inquiry/response services desired by the local government interest associations.

### Local Government Information Network (LOGIN)

**What organization(s) operates the clearinghouse?**

The Local Government Information Network (LOGIN Information Services) is owned and operated by the William Norris Institute, a nonprofit subsidiary of Control Data Corporation (CDC).

**What organization(s) funds the clearinghouse?**

LOGIN is a for-profit venture, whose operations are supported by subscriber fees. CDC provided the original start-up costs.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

The LOGIN data base is composed of some 40,000-50,000 articles, program descriptions and other information units. The units, which are searchable by key words, include a subject line, a three-four line brief, the text, and a contact person with address and phone number.

The information in the data base covers a whole range of issues relevant to local governments—from solid waste disposal issues to descriptions of city arts and cultural initiatives. The types of information in the LOGIN data base include:

- Case studies of innovative local government programs, projects, policies, and practices;
- Announcements of new federal loans and grants and federal program changes;
- Updates and news briefs about pending legislation and other important changing events in Washington, DC;
- Innovations and developments in local government finance;
- Approaches for serving the elderly, the homeless, and victims of domestic violence;
- Urban technologies from other countries;
- Examples of private-sector initiatives and public-private cooperation;
- Syndicated articles on state and local issues;
- Case studies of economic and community development; and
- Approaches and educational resources for improving productivity in government.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does the clearinghouse access external data bases?**

*The information comes from a variety of organizations* that serve local government, such as the U.S. Conference of Mayors, National League of Cities, League of California Cities, Academy for State and Local Government, Harvard University's John F. Kennedy School of Government, National Center for Public Productivity, National Institute of Justice, HUD and DOE.

In addition, LOGIN offers on-line the Greenwood Press *Index to Current Urban Documents*—more than 3,500 citations listed annually of the reports generated by local governments in the U.S. LOGIN's on-line version includes access to all volumes of the Index produced since 1985. There is a separate charge for the Index (see below).

**Does the clearinghouse produce publications?**

LOGIN does not produce publications. Copies of the documents cited in the Greenwood Press Index can be ordered through LOGIN; a microfiche version of the documents is supplied by mail within approximately 10 days.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

LOGIN's electronic mail has a feature that makes every user's questions and any answers part of the data base.

**How big is the clearinghouse staff?**

LOGIN has approximately 14-15 full-time-equivalent staff for this effort. There are 10 full-time staffers and 10 additional consultants and part-time staff, whose role is to develop responses to inquiries in their fields of expertise.

**What are examples of questions the clearinghouse can be expected to answer?**

Examples include:

Q: How can we deal with the growth of satellite dishes, which are causing complaints and zoning problems?

A: A small New Jersey town adopted an ordinance on dish antennas.

Q: How can we curb drug traffic, gambling, and prostitution?

A: A large Oregon city passed an ordinance allowing city officials to close down buildings that are bases of illegal activity.

Q: How can we be better prepared for cleanup of hazardous waste spills?

A: A New York county created a hazardous materials response team to respond to emergencies.

Q: How can we attract new businesses and retain those we have?

A: A medium-sized Montana community initiated efforts to improve entrepreneurship.

Q: How can we find out the number of homeless people in our county?

A: A nonprofit Arizona organization developed a methodology for counting the number of homeless in a community.

Q: We need a personnel policy on AIDS. Have any cities already developed one?

A: A large Minnesota city established a policy on AIDS in the Workplace.

**Who uses the clearinghouse?**

LOGIN is currently available to city and county governments, councils of governments and regional planning associations, state municipal leagues and county associations, state and federal agencies, and nonprofit organizations serving local government.

Private sector organizations and individuals may not purchase full subscriptions to LOGIN.

**How often is the clearinghouse accessed?**

LOGIN has about 250 subscriber organizations (mostly cities). Since most subscribers have multiple access IDs, there are approximately 750 separate users with IDs. In addition, some subscriber organizations centralize their access to LOGIN, for example, through a municipal reference library. Thus, it is not possible to determine at this time how many individuals use LOGIN indirectly. Based on names of individuals that appear in the electronic mail component of LOGIN either asking or answering questions, there are about 1,200 individuals using LOGIN directly. It is interesting to note that some of these non-ID individuals inquiring or responding are among the most active in the system.

These LOGIN participants tapped the system more than 45,000 times last year for information or to communicate with each other, a small increase over the previous year. Most inquiries are satisfied by the information in the system. In the past two years, however, LOGIN'S electronic mail feature responded to more than 8,000 questions.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Accessing LOGIN is through a computer and modem via one of more than 400 access ports across the country (in many cases this is a local call). The user signs on and types a password.

Some subscribing local governments that use LOGIN regularly have a central coordinator who serves as a focal point for electronic mail data base searches.

**What kind of help is provided in accessing the clearinghouse?**

New subscribers receive a user manual and reference guide. Users can also call the LOGIN toll-free (800) hotline for assistance.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

LOGIN is available by annual subscription membership packages, as follows:

- Package A ($2,975) offers 2 electronic mail IDs, up to 7 hours per month on-line usage, up to $1,500 subscription credit, and an on-site training seminar at a rate of $300.
- Package B ($4,295) offers 4 electronic mail IDs, up to 11 hours per month on-line usage, up to $2,400 subscription credit, and one free on-site training seminar.
- Package C ($5,800) offers up to 6 electronic mail IDs, up to 16 hours per month on-line usage, up to $3,500 subscription credit, and one free on-site training seminar.

Special membership packages are available for smaller jurisdictions, based on population. For example:

- Jurisdictions under 10,000 population, 875, including 3 hours of on-line time per month; and
- Jurisdictions with populations 10,000 to 25,000, $1,100 to $2,600 for 1-2 IDs and 3-5 hours of on-line time per month.

With all packages, additional hours are $35 and additional IDs are $250.

LOGIN members may subscribe to the on-line version of the Greenwood Press Index as an add-on to their regular LOGIN subscription at reduced rates. Normally $1,000, LOGIN subscribers can access the Index for an annual fee of $495. With this, subscribers get quarterly hard copy updates, an annual clothbound cumulative volume, and access to previous year's listings.

Members may offset up to 50 percent of their renewal fee by participating in the Subscription Credit Program. Through this program, users who have undertaken a special project or solved a local problem may write up this information and send it to the LOGIN staff to be considered for inclusion in the local innovations data base. If accepted, this is counted as credit toward the cost of the subscription according to the amount of information units provided.

**What is the clearinghouse history and legislative and/or programmatic background?**

The concept behind LOGIN began in the late 1970s, when William Norris decided that CDC should develop a number of data bases to move information through computers. Data bases were created in agriculture, solar energy, renewable energy, and appropriate technology for the third world. None of these data bases were expected to be self-supporting.

A local government data base also was created (LOGIN). This data base was based on two aspects of the PLATO model: first, new knowledge bases would be created or

existing ones would be integrated within it; second, computers would be the mode of access. LOGIN was different from the other CDC systems in that it was intended from the start to be self-supporting after a start-up phase.

LOGIN began operation in 1981 within CDC. It was transferred to the William Norris Institute in January 1988.

### Management Information Service (MIS)

**What organization(s) operates the clearinghouse?**

The Management Information Service (MIS), operated by the International City Management Association (ICMA), is essentially an inquiry/response service. It consists of a bibliographic reference service as well as a source of the references selected and of reports from several of ICMA's regularly issued series.

**What organization(s) funds the clearinghouse?**

MIS is self-supporting through subscriber fees.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

MIS contains information on more than 16,000 documents. About 2,000 are added annually, and documents that become outdated are systematically eliminated. Approximately 12,000 of these documents cover background information and case studies about what local governments are doing and generally are in the form of reports and articles. Another 5,000 of them are in the form of manuals, handbooks, ordinances, budgets, videos, and technical specifications.

Each document in the MIS data base has the appropriate bibliographic citation and key words (including localities mentioned in the document) as well as a short (10-line) abstract. For the period since 1985, these abstracts follow a consistent content protocol; abstracts produced before that time and still in the data base may not have the same information.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The reports cited in MIS are generated by local governments, ICMA research and program staff, providers of services to local governments, as well as print and electronic media (newspapers, magazines, videos).

No external data bases are accessed. However, if a response cannot be provided, MIS staff point inquirers to other organizations (usually representing local governments or functional units within them, e.g., police chiefs). These organizations may have their own data bases.

**Does the clearinghouse produce publications?**

MIS produces *Data Base Update*, a quarterly report highlighting new materials, generally containing about 30 articles.

In addition to documents identified in the inquiry/response service, MIS subscribers get a number of ICMA's series publications:

- *MIS Reports*—monthly reports on critical issues of common concern to local government officials selected through annual subscriber surveys;
- *MIS Bulletin*—regularly issued newsletter reporting on recent inquiries and new contributions to the MIS data base;
- Info Packs—semiannual packets of materials, compiled from the MIS data base, on an issue of major importance to local officials, e.g., personnel policies, AIDS policies, city council manuals;
- *Public Management*—ICMA's monthly magazine; and
- *Municipal Yearbook*—annual publication providing analyses of the changing roles and functions of local governments and local government officials and highlighting major national and state legislation that affects local governments.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

None, other than the "Data Base Update" noted above.

**How big is the clearinghouse staff?**

MIS is operated predominantly by student interns who work 30 to 40 hours a week. There are five full-time interns in a staff that ranges from 5 to 8 full-time-equivalent MIS staff.

**What are examples of questions the clearinghouse can be expected to answer?**

- How does one consolidate city and county governments?
- Are there examples of consolidating fire and police departments into a public safety department?
- Are there examples of localities instituting drug free policies for facilities and/or for personnel?
- Are there ordinances on teenage "cruising"?

**Who uses the clearinghouse?**

The primary users are local governments. Any local government official of a subscribing local government jurisdiction is authorized to use MIS on an unlimited basis.

**How often is the clearinghouse accessed?**

MIS responds to about 200 inquiries a month.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

MIS is a fully automated electronic data base, accessible on-line only by staff. An Inquiry Service user calls or writes MIS. The MIS researcher discusses each inquiry with the user, so that the material received is complete and appropriate. Since entries in the data base include the population and geographic location of the jurisdiction providing the material, information from places not compatible with the inquirer's jurisdiction can be screened out.

A response is mailed to the inquirer within 24 hours or can be sent by FAX. The response consists of bibliographic references to help the inquirer select the item(s) of most interest and appropriateness. Full text documents and videos are provided on loan once a selection is made by the

inquirer. In approximately 95 percent of the inquiries, one or more sample documents are sent to the inquirer.

**What kind of help is provided in accessing the clearinghouse?**

MIS researchers discuss each inquiry fully with the user.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

MIS is a subscriber service with an annual fee based on the size of the jurisdiction. For one annual fee, any staff members of the locality can use the inquiry service on an unlimited basis. The number of copies of ICMA's regularly issued report series included in the subscription varies by the size of the jurisdiction.

**What is the clearinghouse history and legislative and/or programmatic background?**

MIS began about 40 years ago, when local governments became aware of the need to communicate among themselves about what worked and did not work in their management and operations. Since ICMA was in existence, it was called on to provide such a service. MIS has become increasingly formalized, systematically organized, and finally automated.

### National Legislative Network (LEGISNET)

**What organization(s) operates the clearinghouse?**

The National Legislative Network (LEGISNET) is essentially a research tool of the National Conference of State Legislatures (NCSL) in support of its inquiry/response system and research activities.

**What organization(s) funds the clearinghouse?**

NCSL operates LEGISNET from its regular budget (ie., state legislative contributions).

**What kind of information does the clearinghouse offer (eg., service delivery, economic development, research/technology development), and what is the extent of its listings?**

LEGISNET consists of the following databases:

- Legislative Information Service (LIS)—more than 12,000 report abstracts;
- Uniform and Model Acts—will be expanded to about 150 files after testing with new files added as new Acts are developed;
- On-line Index—the system's thesaurus, with about 3,000 entries.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The reports cited in the LIS data base are abstracted by NCSL staff. The reports are generated primarily by state legislatures (generally research office and committee staffs) and NCSL program staff. The LIS data base also contains some reports generated by other entities, e.g., state executive branch agencies, other state government interest associations, private associations and research institutes, and the federal government.

The LIS data base is moving incrementally to full-text input and full-text searches, beginning with NCSL reports.

DIALOG is the only external data base accessed by LEGISNET.

**Does the clearinghouse produce publications or offer other products and services (e.g., technical assistance)?**

LEGISNET does not produce any publications and does not provide any technical assistance or other services.

**How big is the clearinghouse staff?**

NCSL has approximately 4 to 5 full-time-equivalent staff assigned to this effort.

**What are examples of questions the clearinghouse can be expected to answer?**

The range of subjects covered by the abstracts in LEGISNET is limited only by the range of issues of interest to state legislatures.

**Who uses the clearinghouse?**

The primary users of LEGISNET are state legislative staffers, although, increasingly, state legislators are using the system by direct access from PCs. NCSL research and program staff use LEGISNET as one information resource in their work program activities.

**How often is the clearinghouse accessed?**

In 1988, there were over 1,000 connect hours to the system, representing over 2,600 separate sessions from the states. This is a 30 percent increase over 1987. These figures do not include access by NCSL staff.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

LEGISNET is a fully automated electronic data base directly accessible on-line by external users. LEGISNET distributed approximately 3,800 documents in 1988 in response to the selections made by the inquirers. Most were copies of reports, abstracts, acts, cases, and the like, for the permanent use of the inquirers, although some were made available only on loan.

**What kind of help is provided in accessing the clearinghouse?**

Once users become familiar with the system, there is limited need to contact the LEGISNET support staff, except to request specific reports or printouts of information from the data base. However, manual scanning services are provided by LEGISNET operations staff.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Since the operating costs of LEGISNET are part of regular NCSL budget, no fee is charged for its use. The only costs to the state legislative users are the telephone line charges.

**What is the clearinghouse history and legislative and/or programmatic background?**

LEGISNET has been operated by NCSL as an integrated system since 1985. Its antecedents, however, go back to the early 1970s.

LEGISNET evolved out of two concurrent activities of NCSL in the mid-1970s: its inquiry/response system and the Model Interstate Scientific and Technical Information Clearinghouse (MISTIC). When NCSL was formed in 1975 (from two legislative organizations), it recognized the need for a clearinghouse of state legislative reports. The activity was minimal at first because it involved the manual use of cards with the information. This inquiry/response service was automated in 1979 as the Legislative Information Service. From 1977 through 1981, almost $220,000 was provided by NSF's Intergovernmental Science and Technology Program to support the operations of LIS.

MISTIC was created in 1975 to assist state legislators and their staffs in addressing issues with scientific and technical components. MISTIC comprised several activities:

- The operation of an information inquiry/response service drawing on MISTIC's own compilation of S&T reports, the LIS, and state and federal agencies and other resources;
- A resource directory of state, federal, university, industry, and scientific and engineering society S&T resource contacts; and
- A monthly newsletter (Science and Technology for the Legislatures) reporting on current legislative issues with S&T components, selected reports from state and federal governments, and status of state S&T activities.

MISTIC also promoted interstate communication on S&T issues through:

- The preparation of issue briefs (for a Legislator's Handbook on S&T Issues);
- The organization of seminars and briefings; and
- The conduct of teleconferences and experimental computer conferencing.

Technical services were provided through NCSL's Office of Science and Technology staff. In addition, MISTIC communicated to federal agencies the needs of state legislatures for S&T information and priority research needs. Finally, MISTIC began identifying future S&T issues that legislatures would be confronting.

MISTIC received financial support (totalling about $625,000) from eight federal agencies operating through NSF's Intergovernmental Science and Technology Program (NSF, DOT, EPA, ERDA, HUD, NASA, NBS, and NOAA). When federal funding ended for MISTIC and for the Office of Science and Technology, all activities were eliminated or reduced significantly, except for the reports that were integrated into LIS.

### Integrated State Information System (ISIS)

**What organization(s) operates the clearinghouse?**

The Integrated State Information System (ISIS) is operated by the Council of State Governments (CSG) through its States Information Center.

**What organization(s) funds the clearinghouse?**

CSG operates ISIS as part of its regular budget (i.e., state membership contributions).

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

ISIS is a data base of 15,000 report abstracts and bibliographic citations. From 2,000 to 3,000 of the 15,000 entries are report abstracts; the remaining 13,000 entries are bibliographic citations with appropriate key words.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

On-line access to ISIS is limited to state officials who have been given a password. The only other requirement is a modem.

**What kind of help is provided in accessing the clearinghouse?**

Although ISIS is an on-line system, only about 20 percent of the state requests are generated that way. About 80 percent of the inquiries are telephoned to the Center.

There appear to be two reasons for this low percentage of on-line usage: the on-line system has been in existence for only two years; and the Council and the Center have the historical reputation of being service-oriented to CSG's state members.

This "organizational culture" perception is likely to evolve, albeit slowly.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does the clearinghouse access external data bases?**

The sources of the reports cited in the ISIS data base are:

- Predominantly state agencies and CSG research and program staff (e.g., the state reports include the state submissions to the CSG Innovations Program);
- Some federal agencies; and
- Other state public interest associations.

The reports are abstracted by the States Information Center staff or by CSG's research or program staff (or an abstract may be included in the report).

**Does the clearinghouse produce publications or offer other products and services (e.g., technical assistance)?**

The Center produces "Backgrounders," which provide brief synopses of all the reports in ISIS on subjects of current high interest to the states.

In addition to responding to specific inquiries, the States Information Center loans documents identified in the search process through CSG's Interstate Loan Library.

**What are examples of questions the clearinghouse can be expected to answer?**

The reports cited or abstracted in ISIS cover the full range of subjects of interest to state governments.

**How often is the clearinghouse accessed?**

The Center received about 7,500 to 8,000 inquiries in 1988, which was about 30 percent over the previous year and about double the 3,000 to 4,000 inquiries of the early 1980s.

**Who uses the clearinghouse?**

Users represent the broad range of CSG membership (all staff and line entities at all levels of all three branches of state government). The modal group of users, however, is from the legislative branch (i.e., legislative libraries, research office and committee staffs, and legislators). CSG research and program staff use ISIS in their own work.

About 70 percent of the inquiries are from the states, and the remainder from within CSG (including its regional offices).

**How big is the clearinghouse's staff?**

The operation of the Center and ISIS is undertaken by about 2.5 full-time-equivalent staffers. The Center is able to provide an appropriate response to about half the inquiries it receives.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Since the services of the Center and of ISIS are operated as part of the CSG budget, no fee is charged for their use. The only costs to the state users are the telephone line charges, whether on-line access or staff time is involved.

**What is the clearinghouse history and legislative and/or programmatic background?**

ISIS evolved out of CSG's ongoing inquiry/response service—responding to internal and external inquiries—that had been in existence essentially since the founding of its library (virtually throughout CSG's existence).

During the 1960s and 1970s, when substantial federal support was provided for a number of research and program activities, those staffs supplemented the library effort.

Ultimately, the States Information Center was created. The concept of automating information on state and CSG reports was begun in the early 1980s. ISIS began operation as an on-line system in February 1987.

### National Council for Urban Economic Development Clearinghouse (CUED)

**What organization(s) operates the clearinghouse?**

The National Council for Urban Economic Development operates the CUED Clearinghouse.

**What organization(s) funds the clearinghouse?**

CUED membership dues, which range from $265 to $575 annually, support the operation of the CUED Clearinghouse.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

Information is provided on economic development programs and strategies around the country, including, for example, enterprise zones or education/economic development linkages.

Listings include books, periodicals, government reports, papers and clippings of relevant articles, as well as CUED publications.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

Information is received from members who are involved in economic development projects and send reports from their communities. Staff research and technical assistance projects generate further information. Materials are also obtained through subscriptions and publications exchange.

Access to outside data bases is not provided.

**Does the clearinghouse produce publications?**

CUED produces research publications, which are filed in the Clearinghouse. These include:

- *Developments*, a newsletter published 22 times a year;
- *Commentary*, a quarterly journal presenting in-depth articles about successful economic development programs;
- *Economic Development Abroad*, a bimonthly global view of the field;
- Information Service (IS) Reports, which provide an in-depth focus on practical technical topics such as innovations in state and local development, entrepreneurial development, or working capital for small business;
- Annual reviews of the economic development field and the federal budget;
- A series of legislative updates; and
- "How-to" guidebooks and manuals that spotlight, for example: establishing an incubator, assessing local competitive advantage, operating a private development organization, or coordinating public and private resources.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

The Clearinghouse does not offer other services. However, through its Technical Advisory Service (and for a nominal fee), CUED sends teams of expert advisors to communities to provide on-site advice and recommendations on the best development strategies, followed-up by a written report.

CUED also dispenses information through conferences, workshops and meetings like the other state and local interest associations.

**How big is the clearinghouse staff?**

A Clearinghouse coordinator is assigned from the CUED research staff. There is also occasional intern assistance.

**What are examples of questions the clearinghouse can be expected to answer?**

Examples of questions the Clearinghouse might be expected to answer include:

- What are cities doing to strengthen their existing business base and promote new business development?
- What real estate financing techniques work in today's economic climate?

The Clearinghouse can also provide examples of orga-

nizations involved in business or real estate development projects, or communities using strategies such as enterprise zones, business retention, research parks, incubators, or commercial revitalization.

**Who uses the clearinghouse?**

CUED staff and members. CUED members represent all facets of economic development, including state and local development professionals, elected local officials, community organization leaders, chamber of commerce directors, entrepreneurs, developers, public utility executives, and academicians.

**How often is the clearinghouse accessed?**

Member inquiries are received at a rate of approximately one per day. Staff access is on a regular basis.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

The Clearinghouse is accessed via telephone inquiries or letters from members; there is no computer access. The CUED staff perform manual searches of files.

**What kind of help is provided in accessing the clearinghouse?**

All inquiries are made through contact with the CUED staff.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Staff time and copying costs are charged for CUED members' requests requiring extensive research, and for all non-members requests. There is a nominal charge to members for CUED publications (such as *IS Reports*) and a somewhat higher charge to nonmembers. CUED newsletters and journals are provided as part of the membership package.

**What is the clearinghouse history and legislative and/or programmatic background?**

CUED was founded in 1967 by a handful of economic development practitioners. The Clearinghouse has emerged as one of CUED's ongoing mechanisms for disseminating information to its members, and is touted as "the single most extensive national clearinghouse in the field."

### State Technology Programs Information Base

**What organization(s) operates the clearinghouse?**

As part of its role as a state intermediary organization, the National Governors' Association—through its Center for Policy Research and Analysis—has been collecting and organizing information, and responding to inquiries related to research and technology development and commercialization.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

The clearinghouse offers information on states to promote R&D-based economic development, business development, and job creation. Through its ongoing information collection process, NGA staff has developed and refined categories of state strategies, policies, and programs in this area.

**What are examples of questions the clearinghouse can be expected to answer?**

NGA has become a repository for the states to tap as they assess their own strategies and initiate development of new approaches. In addition to information on the state programs, NGA staff provides an appropriate contact for each state program.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Over the years, the staff has organized its information on state programs into state-based resource files. Searches have been done manually in response to telephone and mail inquiries and to compile special reports.

Through federally supported projects, funds recently have become available to begin to create an electronic data base for easier accessibility. However, full comparability across states of desired and detailed program descriptions or characteristics is not likely to be achieved without additional external support.

**How is information generated for inclusion in the clearinghouse and/or evaluated?**

Information gathering is both systematic and ad hoc. For example, as part of its ongoing contacts with state officials, NGA staff gathers information about specific new state approaches and collects individual state reports and policies.

Furthermore, the NGA staff is on the mailing list of state agencies and offices that operate these programs. Thus, NGA receives newsletters, annual reports, notices of meetings and conferences, and other publications from the states.

For specific reports supported by federal funds, existing files are reviewed and telephone or mail surveys conducted.

**Does the clearinghouse access external data bases?**

The National Association of State Development Agencies (NASDA) has a data base of state technology development programs similar to NGA's resource base for its inquiry-response activities in this area. While NASDA's orientation is in the direction of economic development, NGA's orientation is toward research and technology development and commercialization. Consequently, the NGA staff refers some inquiries to the NASDA staff, and vice versa.

The NASDA data base, which was compiled on a one-time basis by a NASDA intern as part of a dissertation, includes a brief description of each state program as well as several standardized program descriptors (e.g., program type, sponsoring organization, year established, and annual funding).

**Does the clearinghouse produce publications?**

Since 1982, NGA has produced a number of publications that aggregate, summarize and analyze information on specific state research and technology development and commercialization activities.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

Technical assistance beyond the provision of information tends to be provided more by state officials to other states than by NGA staff. This type of information exchange is promoted by NGA, which helps identify appropriate officials to provide this assistance.

**Who uses the clearinghouse?**

The primary users of this information are governors' offices, state S&T offices, state policy development offices, and economic development agencies. Other users include researchers, academics and consultants, other public interest associations, and the federal government.

**How often is the clearinghouse accessed?**

Calls are received by the NGA staff every week for information from outside users of the NGA resource base.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

No fees are charged to either state or nonstate users.

### *What organization(s) funds the clearinghouse?*

Support has been provided by three federal agencies for the purpose of producing the special publications noted above: DOC (both EDA and NIST), NSF (through two offices), and SBA.

**How big is the clearinghouse staff?**

Since the early 1980s, the NGA staff devoted to this effort has been limited (approximately one full-time-equivalent person per year).

**What kind of help is provided in accessing the clearinghouse?**

Because the clearinghouse has provided only traditional access, assistance has not been necessary.

**What is the clearinghouse's history and legislative and/or programmatic background?**

As noted, the NGA staff has been collecting and organizing information and responding to inquiries as part of its role as a state intermediary organization. It is anticipated that new state programs and new approaches will evolve over time. The NGA staff anticipates continuing its role in information collection and dissemination similar to the way it previously has been done. And, as in the past, most of the special reports will probably need to be supported by federal or other external funds.

## National Association of Management and Technical Assistance Centers (NAMTAC)

**What organization(s) operates the clearinghouse?**

The National Association of Management and Technical Assistance Centers (NAMTAC) is an organization of university agencies that provide management, technical, and economic development assistance to businesses and communities.

NAMTAC helps its members serve their clients by keeping its membership informed about developments in the professional field.

**What organization(s) funds the clearinghouse?**

NAMTAC is funded by membership dues and conference registration fees.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

Conferences are NAMTAC's primary vehicle for keeping its membership informed. NAMTAC's two-day annual conference is held in the fall, normally in October, in the Washington, D.C., area. Seminars and workshops during the conference spotlight the latest developments in the field, as well as the issues with which members must concern themselves. Typical subjects around which sessions are conducted include:

- Entrepreneurship and new ventures;
- Turning basic university research into marketable products;
- Developing international markets;
- Dealing with the dislocation of plant closings; and
- University's role in statewide economic development.

NAMTAC also sponsors eastern and western regional conferences in the spring of each year.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

"Project-of-the-Year" awards are NAMTAC's way of providing incentives to its membership for sharing successful experiences. These awards recognize the accomplishments of members in supporting the economic development of the regions they serve.

In recent years, nine awards have been made each year, for first, second, and third place in each of the three categories of assistance that NAMTAC members provide. Some of the projects that have received awards include:

- Providing highly technical information to a small manufacturer of products relating to vidicon tubes that has resulted in lower costs and increased hiring;
- Helping a manufacturer of construction equipment modernize its plant and install state-of-the-art manufacturing methods;
- Helping the inventors of new equipment for the restaurant trade find financing and marketing assistance; and
- Preventing a business from closing by finding a buyer and helping the new buyer reorganize and improve productivity.

**Does the clearinghouse produce publications?**

The *NAMTAC Newsletter* is published monthly. It contains items of news about the association and keeps members informed on the progress of legislation and other developments.

NAMTAC also publishes a *Resource Guide*, a loose-leaf notebook that describes the programs of all members. NAMTAC also provides a compilation of the Evaluation Forms used by members. A list of members' publications may be obtained or borrowed by other members.

**Does the clearinghouse offer other products and services (e.g., technical assistance)? If the clearinghouse offers technical assistance, what type of expertise is available?**

NAMTAC encourages its more experienced members to visit the operations of less experienced members to advise on organization, administration, and programs.

**How big is the clearinghouse staff?**

NAMTAC has a half-time Executive Secretary who maintains an office for the organization in Washington, DC.

**What are examples of questions the clearinghouse can be expected to answer?**

The primary type of information available through NAMTAC is information on administrative, programmatic, and policy issues related to operating a university-based management and technical assistance center.

**Who uses the clearinghouse?**

NAMTAC members comprise a wide variety of types of organizations, from large universities with extensive academic and research facilities to smaller institutions providing services to relatively poor, rural communities.

**How often is the clearinghouse accessed?**

Members call or write for assistance or information, although the number of calls received is not prohibitive—about ten a week.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

No.

**What kind of help is provided in accessing the clearinghouse?**

Help is not needed in accessing the NAMTAC office.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

Organizational, associate (nonprofit), and affiliate membership in NAMTAC is $250 per year. Individual membership (for individuals working in NAMTAC constituency organizations) is $50 per year; all other individuals, $250.

**What is the clearinghouse history and legislative and/or programmatic background?**

NAMTAC started out as an organization for EDA Centers. It now also has as members SBA Small Business Development Centers, NASA Industrial Applications Centers, and independent state-funded organizations. Currently, NAMTAC has over 150 members.

### Federal Laboratory Consortium Clearinghouse (FLC)

**What organization(s) operates the clearinghouse?**

The Federal Laboratory Consortium for Technology Transfer (FLC) was institutionalized by the Federal Technology Transfer Act of 1986, although it had existed informally since some Naval laboratories began communicating with each other regarding their technologies in the late 1960s.

The FLC Clearinghouse is one component of the total FLC network response system. It operates as a technology brokerage service to help users access the appropriate necessary expertise and research capabilities of federal laboratories.

**What organization(s) funds the clearinghouse?**

The FLC membership consists of individual participating laboratories from 12 agencies—currently, 137 agency representatives (as defined in the 1986 legislation), representing approximately 400 federal lab facilities and centers. It is estimated by the FLC Administrator that these 400 represent more than 85 percent of the resources of the total 600 to 800 federal R&D establishments.

The 1986 legislation requires each agency to provide the FLC with an amount equal to .005 percent of its laboratories' R&D budgets from fiscal year 1987 to 1991. This should provide about $900,000 annually to the FLC for all its activities, including the Clearinghouse.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

The Clearinghouse, through its brokerage role, has the capability to provide information on all technologies being developed in member federal laboratories (excluding selected DOD technologies). Such technologies might be used to develop or improve a product, make a manufacturing process more productive, increase service efficiency, or address policy and program needs in the state and local government sector, including economic and business development.

Examples of technologies that have been transferred include:

- An innovative procedure for the analysis of sulfite content in a wide variety of foods;
- A tiny microdryer to keep electronic and other water-sensitive materials free of moisture;
- A computerized method of determining a building's energy performance and peak loads; and
- A small linear induction accelerator to serve as a relatively inexpensive treatment source for food processing and preservation.

The FLC Clearinghouse specializes in technology inquiries and availabilities that are not easily satisfied with existing printed matter or data bases. The strength of the Clearinghouse is the ability to put the inquirer or potential user in contact with a federal laboratory expert in the specific area of interest. Thus, the Clearinghouse has been developing a resource directory data base, identifying the technology expertise of individual laboratory scientists and engineers. This resource directory now covers the scientists and engineers in over one-third of the laboratories and centers.

Thirty-five major technology areas have been identified by the Clearinghouse, and technical specialists have been designated for each of them. These technical specialists are expected to be knowledgeable about scientific ad-

*vances and technology breakthroughs in their specialities and to be conversant with the leading scientists and engineers in their field, wherever they may be found (federal, university, industrial, or nonprofit laboratories).*

***How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?***

The Clearinghouse service searches its own data base for appropriate technical resources in the laboratories. In addition, the Clearinghouse acts as a pointer by accessing other data bases from NTIS, NASA and elsewhere (including even university resource directories) for answers to user inquiries.

**Does the clearinghouse produce publications?**

The Clearinghouse produces no reports. The FLC has publications about itself and the Clearinghouse (e.g., annual reports, "Putting Technology to Work").

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

The FLC Clearinghouse is designed to:

(1) Identify primary and secondary laboratory technical resources and FLC representatives capable of responding to specific requests;

(2) Assist in the identification of applicable FLC proven technology and technology assessments;

(3) Utilize the FLC Technical Specialist System to complement resource directory searches;

(4) Monitor status of laboratory and other responses; and

(5) Obtain user feedback and evaluation.

Once the linkage is made with a laboratory representative, the arrangements for the technical exchange are between the user and the lab. The exchange can be through available material, technical advice, or collaborative research.

The Clearinghouse will work with industry groups to identify potential laboratory staff and help create a special technology interest group or "common interest group" (CIG) as it has done for the building industry.

The Clearinghouse is working with LOGIN to develop a mechanism to channel needs of local governments and to serve as an additional information resource for LOGIN.

**How big is the clearinghouse staff?**

The Clearinghouse has four full-time-equivalent personnel devoted to its continued development, operations, and marketing. As a technology broker service, the Clearinghouse represents a small component of the overall FLC response system. It is the individual scientists and engineers in the laboratories and the technical specialists who provide the expertise in the specific areas of interest of the inquirers.

**If the clearinghouse offers technical assistance, what type of expertise is available?**

The Clearinghouse offers no technical assistance. Such assistance is provided by the laboratory personnel.

***What are examples of questions the clearinghouse can be expected to answer?***

How can the temperature of a high pressure furnace be measured without opening the furnace door? (The inquiry included information on what the firm had done but found inadequate).

How can certain types of mail (e.g., ballots, order forms, prize entries) be automatically read without individually opening the envelope by hand or machine and reading the enclosure personally or hand inserting it into a scanner?

**Who uses the clearinghouse?**

Users are from large corporations, small firms, local governments, and universities.

**How often is the clearinghouse accessed?**

Of the 600 inquiries received by the Clearinghouse from June 1988 to June 1989, 42 percent were from small firms; 35 percent were from large companies; and the balance was generally from universities and state and local governments. The current rate is about 100 inquiries per month.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

A Clearinghouse technical request form is provided for submitting users' requests and for initiating the transfer process. In addition to the requestor's name, affiliation, address, etc., the form requires a problem abstract, including definition, desired results, action to date, "what you can expect from the lab," and schedule/date needed. The intention is for the user to identify parameters such as constraints, deadlines, problems areas, and intended use.

Some inquiries are "shopping lists," requesting anything in a number of listed technologies or even product fields, which may be broad or narrow. Others are very specific. The latter is necessary in order to ensure a response. A review of the inquiry often results in the identification of five or six laboratories that may have the expertise appropriate for a response.

The Clearinghouse sends the inquiry to the appropriate lab(s) by phone, mail, electronic mail, or FAX. Most of the responses in its first year of operation were sent by mail, although an increasing number are being relayed by electronic mail.

**What kind of help is provided in accessing the clearinghouse?**

Since the Clearinghouse is a broker or pointer service, it is important that the problem or need be specified in sufficient detail to identify the most appropriate expert(s) and to ensure their response. The Clearinghouse provides assistance to inquirers in framing or refining their questions if the descriptions on the Technology Request Form are inadequate.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

The information and linkages provided by the FLC Clearinghouse are free.

**What is the clearinghouse history and legislative and/or programmatic background?**

In the late 1960s, several Naval laboratories began informally to exchange information on technologies that might be of use in addressing problems of society. This period coincided with the increased emphasis within NASA to use NASA technology and technical expertise to solve the problems of state and especially local governments, and with the creation of NSF's Intergovernmental Science and Technology Program.

In late 1971, an engineer from one of these Naval laboratories was detailed to NSF to serve as the coordinator of their interests in reaching beyond their research and technology development missions. Laboratory technologies and personnel were beginning to assist state and local governments; attempts were being made to increase commercialization of laboratory-produced technologies; and laboratories themselves were interested in learning about to process of problem solving in state and local governments and of technology transfer and commercialization. Moreover, laboratories began to call on one another for assistance if they could not handle an inquiry from a state or local government or the private sector. This voluntary network of laboratories expanded to all DOD services and agencies and soon to laboratories throughout the federal government. In 1974, this network was formalized as the FLC.

By the end of the 1970s, the number of participating laboratories in the Consortium had grown to well over a hundred. A more systematic approach was needed to improve network communication and to respond to external inquiries. An electronic mail system had not proven to be as effective as hoped.

At the beginning of this decade, a demonstration project was undertaken in the Far West region of the FLC. From this demonstration grew the FLC Clearinghouse. The *Federal Technology Transfer Act of 1986* not only institutionalized the FLC, it also mandated that the FLC provide a clearinghouse for technology user requests. The policy of the FLC has been, and remains, to support member laboratory technology transfer in the widest sense for domestic application.

After a period of development of its inquiry/response, tracking, and monitoring structure, the Clearinghouse began operation in mid-1988. Operating modules are being tested. New data base components are being added as needed.

## The SBDC Connection

**What organization(s) operates the clearinghouse?**

The U.S. Small Business Administration (SBA), in cooperation with the Association of Small Business Development Centers, has established the "SBDC Connection," a nationwide data base for SBDCs. SBA's SBDC program was initiated to further economic development through the provision of management and technical assistance to small businesses. The SBDC Connection provides a one-office, point-of-contact information locator for SBDCs around the country. These centers generally are located in state or local governments, and academic institutions, such as colleges, universities, community colleges, and vocational schools. They also may be located in chambers of commerce or economic development corporations.

**What organization(s) funds the clearinghouse?**

SBA has entered into a contract with the Small Business Development Center (SBDC) at the University of Georgia to develop the Connection.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

SBDCs, nationwide, provide counseling, training, and research assistance regarding small business management. SBDC services range from help with financial, marketing, production, organization, engineering, and technical problems to the development of feasibility studies.

The Connection is being established to provide information to SBDCs on the above business-related topics and to answer inquiries.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The information and experiences relayed through the data base are provided by SBDC directors and the SBA. The materials are evaluated by the SBDC Connection staff before incorporation into the data base.

The Connection has access to many external data bases.

**Does the clearinghouse produce publications?**

The Connection does not produce publications, but is designed to share SBDC materials and resources as well as SBA program information. Needed documents may be borrowed and returned to the Connection.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

No.

**How big is the clearinghouse staff?**

The clearinghouse employs four full-time persons plus an administrative secretary. A number of paid student assistants also are employed.

**What are examples of questions the clearinghouse can be expected to answer?**

SBDCs provide services to inventors with patentable products, "how-to" export and import advice, guidance on business law, procurement matching assistance, venture capital formation, and small business incubators.

**Who uses the clearinghouse?**

The Connection is accessible only by the 54 SBDCs in 47 states, Puerto Rico, and the Virgin Islands. However, in each of these 47 states, a lead SBDC coordinates the services offered through a network of subcenters; therefore, the total SBDC network comprises more than 600 service locations. Each SBDC has a director, staff members, and a cadre of volunteers such as retired executives, part-time personnel, and consultants to assist clients requiring specialized expertise.

**How often is the clearinghouse accessed?**

In the clearinghouse's first quarter of operation (April-June 1989), it received more than 250 inquiries; these figures can be subdivided further into 43 literature searches, 123 referrals, and 143 document deliveries (some inquiries involved more than one type of response). By the end of the second quarter, the number of inquiries had increased to 600.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

The Connection is accessible through an 800 number, via mail correspondence, and by FAX. In the future, it is anticipated that it will include modem accessibility and electronic mail.

**What kind of help is provided in accessing the clearinghouse?**

Help is not necessary.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

If it is necessary to copy six pages or more, a small fee is charged on a cost recovery basis. Postage fees are also charged. In addition, if an inquiry is detailed, computer search time is charged. The fees are billed through an SBDC account.

**What is the clearinghouse history and legislative and/or programmatic background?**

Public Law 96-302 required that SBA's SBDC program establish and maintain a clearinghouse. As a result, the SBDC Connection began service in April 1989.

### Teltech

**What organization(s) operates and funds the clearinghouse?**

Teltech is a privately owned and operated for-profit clearinghouse and technical consulting service.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings**

Teltech's mission is to help scientists and engineers who are facing questions in new or unfamiliar technical areas. There are three facets to the Teltech service:

- A network of technical experts;
- An interactive literature searching capability; and
- Training courses.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

A network of 6,000 technical experts is available for telephone consulting, drawn from universities, federal laboratories, consulting groups, private industry and the ranks of outstanding retired scientists and engineers. Typically, the print material provided by Teltech builds background understanding while the experts provide real-time insights.

Teltech mainly provides access to external data bases. A partial listing of the 1,000 data base systems available through Teltech are:

- DIALOG—widest array of data bases covering science and technology, business, and current affairs;
- Dow Jones—including the *Wall Street Journal* and *Barrons*;
- Datatimes—U.S. Newspapers, newswires, and international newspapers;
- Newsnet—industry newsletters;
- MEDLARS—concentrations in medicine and toxicity;
- ORBIT—dealing with patents, petroleum, packaging, and materials;
- World Patents Index; and
- U.S. Patents.

**Does the clearinghouse produce publications?**

No.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

Teltech offers professional development courses on video tape. Subjects range from engineering and science to manufacturing and management.

**If the clearinghouse offers technical assistance, what type of expertise is available?**

Telephone consultation is available in more than 1,400 areas of science and technology. Print material access using the more than 1,000 data bases covers technical information as well as general business information, such as marketing.

**How big is the clearinghouse staff?**

Information on the size of the Teltech staff is proprietary.

**What are examples of questions the clearinghouse can be expected to answer?**

Among the potential uses for the Teltech literature search service are:

- Identifying new materials and vendors;
- Tracking competitive activity (financial and non-financial status of a company, patent information and technical papers);
- Monitoring market trends and evolution of technologies;
- Searching patent availability and keeping tabs on patent activity;
- Exploring market size and application requirements for proposed or evolving new products;
- Backgrounding in unfamiliar technical areas;
- Acquiring technical knowledge needed to solve product performance or manufacturing problems; and
- Reviewing pertinent codes and regulations.

**Who uses the clearinghouse?**

Teltech's growing list of more than 130 Fortune 500 clients and hundreds of small and medium-sized manufac-

turers nationwide includes: American National Can Company, Bell & Howell, Briggs and Stratton, Cray Research, Dow Chemical, and Honeywell Avionics. Most of them have annual sales volumes of over $25 million.

**How often is the clearinghouse accessed?**

Teltech subscribers now tap the service (that is, contact the network or use the interactive literature search capability) about 21,000 times annually.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Teltech is accessible through Compuserve. An experienced information specialist will search the unmatched bank of electronic files accessible through Teltech, while the user watches on his or her computer screen and comments by phone, pinpointing the documents needed. Teltech coordinates delivery of printed materials.

Two facets of Teltech's service—its network of experts and its interactive literature searching capability—rely in whole or in part on on-line systems. However, actual contact between Teltech's end user clients and the members of its network is via telephone.

**What kind of help is provided in accessing the clearinghouse?**

The Teltech literature search process begins with a toll-free telephone call to one of Teltech's literature search specialists, who acts as a personal guide through the search procedure.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

A yearly subscription charge gives a company unlimited use of the expert network and literature search. Since the service is customized, the first year annual fees range from $6,000 to $30,000 annually. Service agreement provisions include unlimited access to the literature search system without additional cost. (Document delivery costs, as well as those incurred by supplying large numbers of records from a search, are not included in the subscription fee.) Thus, frequent use is encouraged.

While the subscription fees allow the client unlimited access to the network, the Clearinghouse pays the specialist a fee for each interaction with end users.

Course work charges are independent of the subscription fee and vary with course selection.

**What is the clearinghouse history and legislative and/or programmatic background?**

Teltech was founded in 1984 by Joe Shuster, who conceived of the networking service concept while building a custom engineering firm and attempting to leapfrog the competition's technology. Eventually, the engineering firm was so successful that it was bought out by Beatrice Corporation. At that time, Shuster developed the cornerstone for the initial Teltech network of 435 experts and the software and hardware for the literature searching and expert networking capabilities. The company began on a regional basis and went national in 1987. It now has nationwide sales representation and a strong growth rate—it has doubled in both revenues and clients every year.

## Energy Research for Governors Data Base

**What organization(s) operates the clearinghouse?**

The Energy Research for Governors data base was operated by the National Governors' Association (and its predecessor the National Governors' Conference) during the energy crisis of the 1970s.

**What organization(s) funds the clearinghouse?**

The data base was part of the Governors' Energy Project, which from 1973 through 1979 received significant financial support from six federal agencies operating through NSF's Intergovernmental Science and Technology Program (AEC, DOI, ERDA, FEA, NRC, and NSF).

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

Hundreds of state-sponsored energy-related research and demonstration projects were identified.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The purpose of the Energy Research data base was to collect and organize research in progress or completed by state agencies for which no federal funds were involved. Federal agencies were required to notify the Smithsonian Science Information Exchange (SSIE) of research projects they were funding and to place copies of reports of completed projects in the National Technical Information Service (NTIS).

However, there was no repository of notices of research in progress or of final reports if no federal funds were involved. During the energy crisis of the 1970s, states were supporting many research and demonstration efforts entirely with their own funds, and there was a need for other states to learn from these efforts.

**Does the clearinghouse produce publications or offer other products and services (e.g., technical assistance)?**

In addition to developing the NGA research agenda and research reports, the NGA staff also used the information to prepare policy reports.

**How big is the clearinghouse staff?**

The actual staff time devoted by NGA to the effort was very small (less than a half-person year annually). Since each state had an energy contact for NGA-related activities, the process of dealing with the individual states was simplified.

However, the staff time devoted by individual states to the collection effort was much larger. The collection of information about wholly state-funded research projects within each state by the state contact was significantly more difficult.

**What are examples of questions the clearinghouse can be expected to answer?**

Inquiries related to the state-sponsored research and demonstration projects covered such issues as time-of-day pricing and other load-levelling approaches, energy efficiency studies, energy conservation approaches, and utility generation, distribution, and pricing modelling.

**Who uses the clearinghouse?**

The NGA energy data base was accessible only by the NGA energy project staff to respond to inquiries from states, to develop its research agenda, to prepare its research and policy reports, and to make suggestions to federal agencies about research and demonstration priorities from the states' perspective.

Since agreements were made with SSIE and NTIS for the information to be entered into their data bases, a researcher or policy analyst was able to obtain information on both state and federally funded energy projects by accessing SSIE and NTIS.

**How often is the clearinghouse accessed?**

It is not clear how often the clearinghouse was accessed. First, a dozen years have passed since its inception. Second, users also could tap SSIE/NTIS; thus, any data would be misleading.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

The information on the state projects was computerized with a 200-word abstract, key words, and using the existing SSIE/NTIS formats and identifiers (e.g., principal investigator, organization).

**What kind of help is provided in accessing the clearinghouse?**

Since the data base was accessible only by the NGA staff, assistance was not necessary for helping outside users access the system.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

No fee was charged any user (state or federal official, energy researcher) because the project of which the data base was part was funded by the federal government.

**What is the clearinghouse history and legislative and/or programmatic background?**

When the state and federal governments and private sector response to the energy crisis reached a "steady state," the emphasis of the Governors' Energy Project shifted almost entirely to technical services to the states and exchanges of information on state policies and programs.

At the same time, the federal government was increasing both research and program activities, and states were decreasing their research investments and increasing their program expenditures.

For these reasons, the significance of a state energy research projects data base ultimately declined and NGA resources were directed elsewhere.

### National Innovation Network (NIN)

**What organization(s) operates the clearinghouse?**

The Intergovernmental Science and Technology Program of the National Science Foundation had the objective of strengthening public management capacity by facilitating the integration of scientific and technical resources into the policy development, management, and operations of state and local government.

The local government element of this program used a "networking" concept as one way to achieve its objective, which stressed administrative management and program operations issues. Networking operated on the premise of problem solving—that is, identifying problems or needs common to many local governments, implementing innovative solutions, and sharing the results of the efforts among participating local governments.

The institutional framework for carrying out this problem solving approach included three national networks of local governments and a series of similar regional, state, or substate networks (called Innovation Groups). These local governments were pace-setting cities and counties willing to experiment with advanced state-of-the-art solutions.

The national networks, for example, were the Urban Consortium, the Urban Technology System, and the Community Technology Initiatives Program. Each was composed of about 30 cities and counties grouped by size, as follows:

- The Urban Consortium consisted of the nation's 35 largest and most urban cities and counties (over 500,000);
- The Urban Technology System was a network of 27 medium-sized jurisdictions (between 50,000 and 500,000); and
- The Community Technology Initiatives Program involved small cities and townships (under 50,000).

Examples of the regional and state networks were the New England Innovation Group and the Alabama Innovation Group.

**What organization(s) funds the clearinghouse?**

NSF was the primary funder of the networks, although they were administered by existing organizations with other activities; therefore, they often had other financial support, as well.

The three national networks received additional federal support outside of NSF to focus on specific problems. For example, the Urban Consortium received funding from six different federal agencies by its third year of operation.

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

The networks focused on the problems confronting local governments, such as housing, transportation, environment, and law enforcement.

Once common problems were identified through a needs assessment and priority-setting process, the top priority problems then formed an agenda for R&D efforts and the network served as a common base for mobilizing resources to respond to those needs. The network provided the "test bed" for developing and implementating innovative solutions. Once the solutions were proven practical, they were given wide dissemination.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

Sometimes, answers or solutions were readily available from untapped resources; other times, they needed to be developed or adapted from existing technologies.

The resources tapped included federal agencies, especially their laboratories, universities, land grant colleges, private industry, and research institutes.

**Does the clearinghouse produce publications?**

As noted above, once the solutions were proven practical, they were given wide dissemination. This often involved information bulletins and fact sheets, news coverage in the journals of the local government associations, handbooks, and other dissemination vehicles.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

Urban Technology System network of medium-sized jurisdictions placed a technology agent in each jurisdiction and each had a technical "back-up" site such as a university or lab.

The Community Technology Initiatives Program used a cadre of federal laboratory personnel as "circuit riding" technology agents. Each serviced several communities within one large geographic region.

Several substate networks assembled councils of volunteers to provide technical advice to local governments.

In addition to this technical assistance supported by the individual networks, NSF sponsored national conferences to bring together the networking community to share ideas and solutions.

**How big is the clearinghouse staff?**

Staff support for all three national networks was through Public Technology, Inc., a nonprofit R&D organization created by the local government interest associations, which served as the secretariat. Each network had a staff director and several full-time staff persons.

The regional, state, and substate networks were organized through a variety of institutions: state community affairs agencies, universities, municipal leagues, urban observatories, nonprofit corporations, regional councils, mayors' offices, or professional engineering societies. The decision of which framework to use was a local one.

**If the clearinghouse offers technical assistance, what type of expertise is available?**

In addition to the technology agents placed in or assigned to certain jurisdictions through their networks, the networks also served as contact points for identifying available resources for their member jurisdictions.

The national networks tended to link the local governments with resources most technically suited for the problem at hand; the subnational networks, on the other hand, attempted to link them with physically closer resources in their own region.

As noted above, each of the technology agents of the Urban Technology System had a technical back-up site. At one point, this network attempted a mix of back-up sites in terms of their geographic proximity in order to test whether this affected the success of linkages.

**What are examples of questions the clearinghouse can be expected to answer?**

Examples of innovations that were developed through the networks included:

- Police manpower deployment models;
- Refuse collection route models;
- Lightweight body armor;
- Infrared electronic distance meters; and
- Disaster warning systems.

**Who uses the clearinghouse?**

The networks were designed as a tool for local government managers/administrators and their staff offices and line departments.

**How often is the clearinghouse accessed?**

Membership in a network was an ongoing process that involved, among other things, attendance at meetings of the network policy bodies. The networks did receive calls from non-member jurisdictions; however, there is no accurate record of the level of these calls.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Some of the innovation networks experimented with an Electronic Information System called EIES. However, this system, primarily a computer conferencing system, did not succeed partly due to lack of use.

**What kind of help is provided in accessing the clearinghouse?**

NSF provided grants to ICMA, USCM, NLC, and NACo to promote involvement in the networks. They were chosen for their local government contacts and capabilities for communicating with their constituencies.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

For many of the networks, there was a fee for the locality, which varied according to many factors. More importantly, participating jurisdictions were expected to fund some or all of the operating cost of implementing the innovative solution in their locality.

**What is the clearinghouse history and legislative and/or programmatic background?**

In the 1960s and 1970s, local governments were beset by increasingly complex problems such as sprawling land development, deteriorating downtowns, environmental pollution, and rising crime. During the same time period, the costs of providing public services rose alarmingly due to inflation, collective bargaining, mandated programs, and rising citizen demands for government action.

During the 1960s, many federal agency programs for addressing these issues were designed along functional lines, i.e., community development, wastewater treatment, etc. In the 1970s, the NSF responded by initiating a program to contribute to comprehensive problem solving at the local level that was interdisciplinary, intergovernmental, and innovative. It sought to create of new local government linkages with outside technical resources so that new ideas for improving service delivery might emerge.

The progenitor of the NSF science and technology networks was the California Four Cities Program, established in 1971 by a grant from NSF to the Jet Propulsion Laboratory

(via NASA) to pair four cities with four high tech firms so that they could apply their managerial and technical skills to city problems. This evolved into the California Innovation Group, a state network like the ones described above.

In establishing its networks, NSF's procedure was to award a small planning grant to formulate the network concept for the region or state, identify key players, and develop potential strategies and activities. Operational efforts followed the successful development of a plan.

NSF's Intergovernmental Science and Technology Program ceased providing operating grants to these networks in the early 1980s when its budget was drastically reduced. Several networks and Innovation Groups survived, but in significantly altered forms.

## NASA Technology Utilization Program (TU)

**What organization(s) operates the clearinghouse?**

The National Aeronautics and Space Administration (NASA) Technology Utilization (TU) program employs a variety of mechanisms to broaden and accelerate the transfer of aerospace technology to other sectors of the economy.

**What organization(s) funds the clearinghouse?**

The TU program is a line item in the NASA budget. The program also receives funds from other departments and agencies to solve problems of mutual interest and produce spinoffs (e.g., the Fire Protection Agency helped to fund a fireman's breathing unit; DOT helped to fund an aerodynamic shield for trucks). Finally, the program also charges for advertising in *Tech Briefs* (see below).

**What kind of information does the clearinghouse offer (e.g., service delivery, economic development, research/technology development), and what is the extent of its listings?**

Through its Industrial Application Centers, clients of the combined NASA TU network have access to about a million documents contained in the NASA data bank and more than 400 other computerized data bases. The NASA data bank includes the continually updated selected contents of some 15,000 scientific and technical journals.

Thus, the TU program provides information on research/technology development and also provides information on state and local government service delivery.

**How is information generated for inclusion in the clearinghouse and/or evaluated? Does it access external data bases?**

The Scientific and Technical Information Facility (STIF) at the Baltimore-Washington Airport contains the results of all NASA R&D contracts. Each of the nine NASA Field Centers has a TU officer charged with the responsibility of screening those research results and determining whether they should be included in *Tech Briefs*.

**Does the clearinghouse produce publications?**

The TU program's primary publication for disseminating information is *Tech Briefs*, published since the program's inception. Ten issues are produced each year. *Tech Briefs* includes information on:

- Newly developed products and processes;
- Advances in basic and applied research;
- Improvements in shop and laboratory techniques;
- Sources of technical data and computer programs; and
- Other innovations with commercial potential originating at NASA field centers, or at the facilities of NASA contractors.

Firms interested in particular innovations noted in *Tech Briefs* may get more detailed information by requesting a "Technical Support Package."

The TU program also produces *Spinoff*, an annual volume to heighten awareness of the technology available for transfer and its potential for economic and social benefit.

**Does the clearinghouse offer other products and services (e.g., technical assistance)?**

In addition to publications, the client-driven mechanisms employed by the NASA TU program include:

- TU Officers, as noted above, who serve as regional program managers for the TU program;
- Industrial Application Centers, ten user assistance centers affiliated with universities that provide both public and private information retrieval services and technical help to government and industry clients, (and not just regarding aerospace technologies);
- Industrial Application Center Affiliates, state-sponsored business or technical assistance centers in 29 states that provide access to NASA's technology transfer network;
- Applications Team working on engineering projects to solve both public and private sector problems through the application of pertinent aerospace technology; and
- Computer Software Management and Information Center (COSMIC) that provides computer programs adaptable to secondary use by industry and government clients.

In addition, there are support teams which, with seed funding, develop prototype hardware to prove applicability of technology to problems; furthermore, applications project contractors write, edit and publish *Tech Briefs*.

**How big is the clearinghouse staff?**

The TU program encompasses a massive network of professionals across the country. As noted above, there are TU officers and their assistants at each of the NASA field centers. Each IAC has a director and staff ranging in size from 5 to 40. The Applications Team at Research Triangle Institute in North Carolina has some 8 to 10 persons. COSMIC at the University of Georgia at Athens has another 20 permanent employees, plus 9 part-time student employees. There also are support teams and contractors such as those who produce *Tech Briefs*.

**If the clearinghouse offers technical assistance, what type of expertise is available?**

The NASA TU program covers a wide range of scientific and technical disciplines.

**What are examples of questions the clearinghouse can be expected to answer?**

Where can I find technology within NASA to help me solve my problem?

How can I get hands-on assistance to solve my problem?

**Who uses the clearinghouse?**

*Tech Briefs* is distributed to over 100,000 industry scientists, engineers, and business executives, as well as government users.

**How often is the clearinghouse accessed?**

More than 100,000 requests for Technical Support Packages are generated every year. In addition, a large number of users access the IACs every day.

**How is the clearinghouse accessed and searched (e.g., is a computer needed)?**

Users have access to NASA data and information through a remote interactive search system called RECON. The IACs are accessed by telephone, mail, or person-to- person meetings; the IAC staffs, in turn, may use the computerized RECON data base to search for information for a client.

**What kind of help is provided in accessing the clearinghouse?**

The NASA headquarters library can help users gain access to RECON. Users may also contact STIF for help.

**Is there a fee for accessing the clearinghouse, or particular products and services?**

There are charges for computer searches and major charges for project services provided by the IACs.

**What is the clearinghouse history and legislative and/or programmatic background?**

NASA has conducted technology transfer since its creation in 1958 by the *National Space Act* with the mandate to widely disseminate scientific and technical information resulting from the space program. The TU program, which is part of the NASA Office of Commercial Programs at headquarters, has been in existence since 1962. It has evolved into a nationwide network to provide technology and business assistance. Early on, the network was entirely NASA funded; more recently, many of the IACs are becoming almost self-supporting.

*Table 1*

**Clearinghouse Characteristics**

| | On-Line Data Bases | | | | | | Publications/Reports | | | | Inquiry/Referral Serv. | | | | | Res./Tech-Driv. Networks | | Hybrid System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NAB Clearinghouse | NTIS FEDRIP | CUFT FATD etc. | SDIO TAIS | NLC et al. LEX | LOGIN | ICMA MIS | NCSL LEGISNET | CSG ISIS | CUED Clearinghouse | NGA State Tech Progr. | NAMTAC | FLC Clearinghouse | SBDC Connection | Teltech | NGA Energy Research | NSF NIN | NASA TU |
| **Mode of Accessing Clearinghouse** | | | | | | | | | | | | | | | | | | |
| On-Line | • | • | • | • | • | • | | • | • | | | | | | • | | | |
| On-Line with Staff Assistance | • | | | | | | | • | • | | | | | | • | | | |
| Not On-Line Automated | | | | | | | • | | | | | | • | • | | • | | • |
| Not On-Line Not Automated | | | | | | | | | | • | • | • | | | | | • | |
| **Clearinghouse Operators** | | | | | | | | | | | | | | | | | | |
| Federal Agency | | • | • | | | | | | | | | | | | | | | • |
| Federal Contractor | | | | • | | | | | | | | | • | | | | | • |
| Public Interest Association | | | | | • | | • | • | • | • | • | | | | | • | | |
| Other Intermediate Organization | • | | | | | | | | | | | • | | • | | | • | |
| Private Firm | | | | | | • | | | | | | | | | • | | | |
| **Funding** | | | | | | | | | | | | | | | | | | |
| Organization | | | | | | | | • | • | • | • | • | | | | | | |
| Users/Subscribers | • | • | • | | • | • | • | | | | | | | | • | | | |
| Federal Support | | • | • | • | | | | | | | • | | • | • | | • | • | • |
| **Fees** | | | | | | | | | | | | | | | | | | |
| Free | | | | • | | | | • | • | • | • | • | • | | | • | • | |
| Subscription | | | | | • | • | • | | | | | | | | • | | | |
| User Charges | • | • | • | | | | | | | | | | | • | | | | • |
| **Types of Information Provided** | | | | | | | | | | | | | | | | | | |
| Policy and Administrative Management | | | | | • | • | • | • | • | • | | | | | | | | • |
| Operations and Service Delivery | • | | | | • | • | • | • | • | • | | | | | | | • | • |
| Economic and Business Development Programs | • | | • | • | • | • | • | • | • | • | • | • | | • | | | | • |
| Research and Technology Development | | • | • | • | | | | | | | | • | • | | • | • | • | • |
| Network Contacts | • | | | • | | | • | • | | • | • | • | • | • | • | | | |

| | On-Line Data Bases | | | | | | Publications/Reports | | | | Inquiry/Referral Serv. | | | | | Res./Tech-Driv. Networks | | Hybrid System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NAB Clearinghouse | NTIS FEDRIP | CUFT FATD etc. | SDIO TAIS | NLC et al. LEX | LOGIN | ICMA MIS | NCSL LEGISNET | CSG ISIS | CUED Clearinghouse | NGA State Tech Progr. | NAMTAC | FLC Clearinghouse | SBDC Connection | Teltech | NGA Energy Research | NSF NIN | NASA TU |
| **Source of Information Provided** | | | | | | | | | | | | | | | | | | |
| Organization Itself | • | | | | • | • | • | • | • | • | • | • | | • | • | | | |
| Own Network | • | | | | • | | | | • | • | • | • | • | • | • | | • | • |
| Users | • | | | | • | • | • | • | • | • | • | • | | • | | • | • | |
| Other Data Bases | | | | • | • | • | | • | | | | | • | | • | | | • |
| Federal Projects | • | | | | • | | • | • | • | • | • | | | • | | | • | |
| Federal Agency | | • | • | • | | • | | | | | | • | • | • | | | • | • |
| **Other Products and Services Provided** | | | | | | | | | | | | | | | | | | |
| Contact Referral Service | | | | | | | • | | | • | • | • | • | • | • | | • | • |
| Bulletin Board | | | | | • | • | | | | | | | • | | | | | |
| Publications and Reports | | | • | | | | • | • | • | | • | | | | • | | • | |
| Organizational Publications and Reports | • | | | • | • | | • | • | • | • | • | | | • | | • | | |
| External Technical Assistance | | | | | | | | | | | • | | | | | | • | • |
| Member and Organization Technical Assistance | • | | | • | • | | • | • | • | • | • | • | • | • | • | • | | |
| **Clearinghouse Users** | | | | | | | | | | | | | | | | | | |
| Technical, Management, and Business Assistance Providers | • | | • | | • | | • | | | • | • | • | • | • | | | | • |
| Research and Technology Sources | | • | • | • | | | | | | | | | • | | • | • | | • |
| Small and Large Business | • | • | • | • | | | | | | | | | • | | • | | | • |
| Organization's Own Staff | • | | | | • | | • | • | • | • | • | | | | | • | | |
| End-User State-Local Agencies | | | | | • | • | • | • | • | | | | • | | | • | • | |
| Federal Government Officials | • | | | | • | • | • | • | • | | • | | • | • | | • | • | • |

# Technical and Managerial Information and Services Used by Small Technology-Based Firms: Implications for Federal Research and Program Initiatives

*Edward T. Kelly*

## INTRODUCTION

### The American Economy—Mixed Signals

Over the past two decades, there has been a decline in U.S. technology development in relation to the nation's history and to the rest of the world (52, 57, 63, 64, 79, 114). Researchers have estimated that about 80 to 90 percent of U.S. productivity growth in the 75-year period before 1940 was attributed directly or indirectly to innovation and technology development, a rate that declined to 40 to 60 percent in the post-1945 period (23, 84, 103, 140).

This relative decline is not unexpected, since the United States was starting from such a high base, the nature of economic activity was undergoing structural changes, the economies of individual countries were being melded into a global economy, and other nations were increasing their participation in the total global economy.

Other forces at work in society began to affect the U.S. economic environment (45, 52, 57, 79, 114, 140). Demographic changes were impacting the size, composition, and rate of growth both of the work force and of domestic markets (82). International competition was having many impacts across industrial sectors, particularly in mass-produced products (55). Many traditional, mature industries were underinvesting in plant, equipment, and R&D (102). Industrial R&D was still growing overall, but that of major corporations appeared not to be keeping pace with inflation—a situation that may be reinforced by increasing mergers and acquisitions (19, 34, 47, 138). New "knowledge-based" industries were emerging, particularly in areas of the country with current or historic defense, space, or health-related research investments (21). There was a move to an increasing service economy, which was proving not to be the panacea many expected (10).

Within this context, some of the signals at the national level have been exceptionally positive (15). The past decade has seen an unprecedented economic expansion and job growth, although there has been a recent slowing of economic activity. Inflation and interest rates have declined to a relatively low level. Overall unemployment rates have come down, although there are significant variations across the country, especially where natural resource economies exist. The negative indicators have proved more intractable (12, 15, 57, 71). The U.S. budget deficit grew to unprecedented heights, with the aggregate deficit increasing over two-and-a-half times in the 1980s. Although the annual deficit is slowly diminishing, the aggregate deficit has an impact on the value of the dollar and foreign investments in the U.S.

While the U.S. merchandise trade balance moved into a deficit pattern in the early 1970s, the manufacturing component remained in a surplus position until 1982 (12, 15, 115). The manufacturing deficit grew from $13 billion that year to ten times that amount four years later ($138 billion in 1986). Even the high technology industrial component, which produced a trade surplus of $27 billion in 1980, produced a deficit of about $2 billion in 1986. By 1985, it was estimated that 70 percent of domestic goods faced competition from imports. As a result, the nation moved from being the largest net creditor nation to the largest net debtor nation during the 1980s.

### Federal Research and Technology Development Environment

In addition to this broader macro-economic environment, there were mixed signals in the research and technology development (R&TD) environment of the federal government (53, 57, 77, 79, 86, 87, 88, 93, 99, 110, 111, 114). During the 1980s, there emerged a sharper division between the roles of the federal government and the private sector. The federal government was seen as the most appropriate entity to support research, with its distributed benefits and the industrial sector to develop and commercialize technologies flowing from this research. This would produce the desired business and job growth and generate the profits and taxes. This led to an increased orientation toward tax expenditures rather than program expenditures at the federal level to stimulate technology development and commercialization.

In addition to the elimination or reduction in some technology- development-oriented programs, research expenditures also were affected (64, 65 66, 71). While federal obligations for all R&D from 1980 to 1987 increased 36 percent in constant dollars, that for non-defense R&D declined 9 percent in constant dollars. However, virtually all of this decline came from non-defense applied research and development, as well as from S&E plant and equipment in universities.

One set of programs that was not reduced involved technical and managerial information and services. The federal government's role in supporting active knowledge transfer goes back to the agricultural extension system (43). The first program directed at providing technical services for economic development dates from the 1960s, with the short-lived State Technical Services Program of the Department of Commerce. PENNTAP at Pennsylvania State University and the Engineering Extension Program at Georgia Tech are the major residual activities from that program.

The array of federally supported programs that include technical or managerial information and services is broad and covers many agencies (112, 113, 121, 122, 127). Some programs are operated by the federal government directly or through subcontractors. These include the Federal Laboratory Consortium Clearinghouse, the Federal Research in Progress database and the Federal Applied Technology Database, both within the National Technical Information Service of the Department of Commerce (22, 27, 28, 83, 123, 124).

Other programs are supported by the federal government through grants and contracts to provider organizations. These include NASA's Technology Utilization Program with its Industrial Applications Centers and SBA's Small Business Development Centers. Technology centers (e.g., the Manufacturing Technology Centers of the Department of Commerce) and research centers (e.g., the Engineering Research Centers and the Industry-University Cooperative Research Centers of NSF) generally include a component for providing technical information and services, but these activities may or may not be limited to participating industrial partners in the center (56, 67, 69, 70, 89).

Over the past decade, the federal government has increased significantly the potential for technology transfer and commercialization of federally supported research, whether in the government's own laboratories or in other research institutions (6, 25, 46, 80, 88, 104, 105, 106, 107, 108, 109, 110, 112, 113, 126). From the *Stevenson-Wydler Act of 1980* to the *Federal Technology Transfer Act of 1986* and, finally, to the *Omnibus Trade and Competitiveness Act of 1988*, many changes were made. Offices of research and technology application were created in federal laboratories or agency research headquarters; patent and other intellectual property rights were assigned to the innovator-researcher; and cooperative research efforts involving federal laboratories were encouraged.

The Department of Commerce was the agency most changed by all this legislation: a Technology Administration was created; the National Institute for Standards and Technology replaced the National Bureau of Standards and was given greater responsibilities; the Manufacturing Technology Centers program became operative; and the Clearinghouse for State and Local Initiatives in Productivity, Technology, and Innovation was established.

### Industrial Research and Technology Development Environment

The industrial environment of the 1980s has continued many of the trends of the past, but often at a rate of change that provides warning signs for technology development, economic growth, and international competitiveness. This situation has affected the issues incorporated in the 1988 Act, as well as the response of state governments in their R&TD-based economic and business development strategies.

The generally ascribed risk-adversive culture of large corporations and their apparently increasing emphasis on short-term indicators seems to have been exacerbated by the increased merger and acquisition activity of the 1980s (19, 34, 47, 138). The rate of total industrial R&D expenditures in the four-year period 1976 to 1980 increased by 5 percent per year in constant dollars, and in the five-year period 1980 to 1985, about 7 percent per year (partly attributed to the R&D tax credit). However, in the two-year period 1985 to 1987, this rate rose only about 0.5 percent per year (64, 71). Preliminary indications are that R&D spending by major corporations is decreasing somewhat and that these corporations are buying other firms, increasing licensing activities, or entering into cooperative arrangements rather than developing their own technologies.

The situation with technology-based small firms is somewhat different. There has been a ten-fold growth in such firms over the past 25 years, and there are estimated to be 40,000 to 50,000 such firms in this country (13).

For the purposes of this paper, a small business is one which, including its affiliates, has a maximum of 500 employees. This definition is essentially consistent with that of the Small Business Administration and is used in the Small Business Innovation Research Program (133).

Many definitions are used for determining technology-based firms. Some studies, including several cited in this report, use specific percentages of scientific, engineering, and technical employees' and/or R&TD expenditures relative to sales. Other studies use a Standard Industrial Classification code to identify technology-based firms. For this report, a broader and more simplified approach is used: a technology-based small firm is a small business engaged in the research, development, and/or manufacture of a product or process with a technology-intensive focus.

Small businesses as a group are very important to this country's economy (5, 57, 97, 103, 128, 130). They constitute about 50 percent of private sector employment and about 40 percent of gross domestic product (and 50 percent of private, nonfarm gross domestic product). In addition, they provide 60 percent to 80 percent of all new jobs and, from 1976 to 1986, over 100 percent of net new jobs in manufacturing industries. During half of the decade, 1981 to 1986, the Fortune 500 companies lost 2.8 million jobs.

Small businesses contribute disproportionately to technology development growth (1, 5, 24, 35, 39, 42, 48, 57, 63, 64, 130). Technology-based small firms generate over half of the innovations among all business firms and the number of R&D scientists and engineers per million employees nationally for both small firms and large corporations is about equal. Yet, these small firms generate twice as many innovations per employee or per R&D dollar as large firms. Moreover, they commercialize innovations at a significantly lower cost than larger firms. For all sized companies, the number of products produced per dollar of R&D or per dollar of net sales increases uniformly as company size decreases.

Despite the innovation productivity of technology-based small firms, they are underrepresented in the nation's R&TD enterprise (90, 97, 133, 134). The National Science Foundation notes that federal support to small businesses for R&D has dropped by a third in the 1980s, despite the existence of the Small Business Innovation Research Program. Using another data set, the Small Business Administration reports that the small business share of federal R&D, as measured by R&D procurement over $25,000, declined from 7.8 percent in 1975 to 6.8 percent in 1980 to 4.8 percent in 1983 and rose again to 6.9 percent in 1987. However, excluding the mandatory SBIR program, which began in the 1983 fiscal year, the figures would be less: 4.5 percent in 1983 and only 5.7 percent in 1987.

Geographic distribution of federal R&D monies is of great importance to state governments and affects the selection and design of many state programs (29, 44, 65). In total obligations for R&D, the top 15 states received 85 percent of the monies in 1985; for R&D procurement, they received 88 percent in the same period; and for small business R&D pro-

curement, they received 92 percent. For the SBIR program, the 1983-1987 total shows a similar concentration, with the top 15 states receiving 82 percent of the funds. In each case, the top 15 states were not necessarily the same.

### State Government Response

Over the past 30 years, state governments had begun to evolve into true partners with the federal government in the governance of this country, particularly as it relates to R&TD-based economic and business development. During the 1960s, state governments began to come into their own with the increased managerial capacity of governors and the increased professionalism of state staffs (11, 17, 73, 85, 95). During the 1970s, state governments increasingly were asked by their citizens or the federal government to take on issues with scientific and technological components, e.g., energy, environment, and health. Their response, with federal assistance, was to strengthen the capacity of their gubernatorial and legislative policy management processes to address these issues (16, 26, 31, 32, 36, 54, 99, 100, 137). In the 1980s, the issues and state policy response mechanisms and programs had evolved to include, as one of the highest priorities, R&TD-based economic and business development.

During the last decade, state governments began to change their understanding of, and approach to, state economic and business development strategies (18, 60, 75, 93). States had been concerned with attracting or keeping manufacturing industries, and developed tax policies and other incentives to achieve that end. The assumption made by the states had been that such industries were important for jobs and taxes and that they placed priorities on states with low taxes, low wages, and developed transportation and utility infrastructures. During the middle to late 1970s, it became increasingly apparent that, with the exception of major foreign investments or federal facilities (e.g., superconducting super collider), "smokestack chasing" or its emerging equivalent, "chip chasing," was not a cost-effective strategy across all the states (14, 38).

The response from the states to the major forces at work impacting the economy was a shift in their economic development strategies and in the mix of their policies and programs to stimulate business and economic growth. States continued to address the need to retain and expand existing industries, particularly where revitalization of lagging industrial sectors caused additional pressures. More importantly, states began to nurture indigenous emerging industries, especially those based on scientific advances and technological breakthroughs. Finally, states began to fill the technology development gap left by the federal government between government-supported basic research and industry-supported technology commercialization. All states have some programs covering these three areas. (Numerous reports have been issued in the past decade documenting state activities; more than two dozen are cited in the appendix: 2, 7, 8, 9, 41, 44, 58, 59, 61, 62, 72, 78, 84, 92, 94, 98, 116, 118, 119, 121, 129, 131, 132, 135, 136, 139).

Billions of dollars have been spent by the states since the beginning of the decade on new or expanded programs in economic development, some of which are devoted in whole or in part to R&TD-based components. These programs include but are not limited to: education, training, and retraining; mitigation of plant closings and dislocations; loans and grants for industrial revitalization and for companies and products in emerging industries; R&D infrastructure investment; and information and technical services to technology-based and other industrial firms. Some state programs are run by state agencies, some by existing nonstate institutions receiving state funds, and some by new organizations created for that purpose. States have tended to direct their efforts toward the most innovative and entrepreneurial sector of the economy: indigenous technology-based small firms.

Emphasis has tended to be more on the requirements and opportunities of technology-based firms, especially in the newer or emerging "high-tech" sectors, than on linking technology advances to traditional mature industries in which advanced manufacturing fabrication and processing technologies are needed (e.g., 76). This is particularly significant because it is estimated that at the end of the next decade only about 14 percent of the workforce will be in the technology-based, emerging industrial sectors (82). Fortunately, states have begun to recognize that "high-technology" processes are as important as "high-technology" products in the nation's economy and that "high-technology" processes also are needed for "high-technology" industries. Thus, they are increasing their technology information and assistance programs toward the traditional mature industries (139).

State governments play pivotal roles in facilitating economic and business development: their investments complement federal investments. They make antecedent investments in the R&D infrastructure at academic institutions to attract federal research and technology-development funds. States make post-federal investments to foster commercialization of technologies evolving from federal research and to facilitate technical and managerial information and assistance services, using in part the expertise developed through federal research and technology development support.

States' R&TD program efforts can be divided into categories in many ways. A review of the published literature on state RT&D policies and programs demonstrates that there are as many typologies of state programs as there are reports. For the purposes of this paper, four broad categories of state investments of money or people are used: leadership/convening, information and services, financial assistance, and R&D infrastructure. Details on these categories and subcategories are found in Appendix A. It is estimated that states have spent over $1.5 billion of new funds over the last five years just in R&TD-based programs.

Traditionally, state and local governments supported technical and managerial information and services through public academic institutions. Engineering extension and industrial extension programs were adjuncts of engineering schools. Management assistance tended to be provided through business schools, although some services were provided by state and local economic development agencies. There tended to be limited integration or mutu-

ally reinforcing activities between these technical and managerial services.

Two trends began to emerge in the 1980s. First, there was increased interaction between these two types of services, either through referrals and joint activities or through the creation of one-stop, multiservice centers. Second, support for these service providing units, which traditionally had come through the university or college system, is now also being provided in some states by the central funding organization responsible for implementing all or some of the state's R&TD-based economic and business development strategy. This has the potential for changing the emphasis of the service providing unit from the collective education-research-service objective of the academic institution to a more economic development oriented one.

### Local Government Response

The response of local governments in this changing economic and industrial environment has some parallels to that of state governments' response, but, necessarily, there also are some differences. The differences may be attributed in large part to the variations in roles of the approximately 39,000 units of general purpose local government. This implies a much greater variance in capacity to meet these changing environments than among state governments. Among the most innovative local governments, however, and those with the most professional management capacity, the response appears to be on about the same level as that among the leading states, given the differences in roles.

Clearly, what is not equal among these governments is the documentation about their policy and program initiatives. The National Governors' Association, through its Center for Policy Research and Analysis, has undertaken several major efforts to collect and organize information related to state policies and programs for research, technology development, and commercialization (7, 8, 9, 58, 59, 61, 62, 135, 136).

The associations representing local governments have not been as active, in part because they have not received the federal support that NGA did. The data bases of these associations' clearinghouses do contain some information on some programs (83). These programs do not necessarily represent the range of local activity or a systematic sample of the programs. Moreover, these program initiatives are not separately identified in the data bases as part of a separate subcategory of R&TD-based economic and business development within the category of economic development.

Local governments have paralleled state governments over the past two decades in strengthening their management capacity to address issues with scientific and technological components. Unlike state governments, which emphasized their policy management processes, local governments addressed improved service delivery and more productive administrative management (26, 31, 32, 54, 99, 100, 137).

Engineers brought their technological expertise and information sources to adapt technologies for new governmental purposes. Many of these technologies had been developed in federal laboratories or supported with federal funds in academia or industry. The federal government provided support to strengthen the capacity of some local governments to experiment with approaches to link local government needs to technological responses. In addition, federal support to many intermediary organizations, including the nationwide public interest associations representing local governments, helped develop networks among the local governments for information sharing in this area.

Local governments, like state governments, also began to increase their understanding of the changes that were taking place in economic and industrial development. Some of the local policies and programs being developed reinforce those in the states; others complement them (50, 51, 74, 93, 117).

Local governments continued to address retaining and expanding existing industries and attracting new ones. For these industries, the approaches included property and inventory tax policies, loans and grants for new plants and revitalization of old ones, zoning changes, transportation and utility infrastructure investments, and workforce training and retraining.

Increasingly, however, local governments, like state governments, have been finding ways to nurture smaller industries, especially those in the emerging and fast-growth "high technology" sectors. For firms in these sectors, the approaches go beyond those of traditional industries. Some parallel approaches by states but, for the most part, they are unique to local governments. For example, local governments are strengthening their information and service assistance programs through resource directories and referral systems. Orientation workshops are being convened to assist local entrepreneurs in R&TD-related areas, such as proposal preparation, government procurement, and patenting and licensing. Local business incubators and science parks are being developed, often in conjunction with a local university, which may be private or state supported.

In the 1980s, two trends seem to be emerging among local governments regarding R&TD-based economic and business development. First, local governments have been increasing their understanding of the changing forces at work on the industrial sector of the economy and seem to be altering their approaches to address the problems created by these changes or to capitalize on their inherent opportunities. Second, local governments appear to be initiating greater cooperation with each other, with state governments, and with the private sector.

### Statement of the Problem

The importance of technology-based small firms is clear from their relative innovativeness and productivity for technology development and commercialization. Numerous federal, state, and local programs and initiatives exist that support in whole or in part the provision of technical and managerial information and services.

However, there appears to be no body of literature or analytical studies in the public domain that document where in fact such technology-based firms go for such information and services, how they go about doing so, and what satisfaction they have with each source. This issue is

critical to state and local governments in supporting initiatives to provide technical and managerial information and services. It is important also to the federal government as it exercises its leadership role and as it creates new R&TD-based program initiatives or significant changes in existing ones to stimulate economic growth and enhance international competition.

The purpose of this paper is to increase understanding of the sources of technical and managerial information and services used by technology-based small firms. The paper uses limited primary sources and secondary documentation. Both providers and users of such information and services were surveyed. However, because of the limitations in data collection, this effort should be seen as an attempt to refine the hypotheses regarding this subject, rather than providing definitive results. Issues are identified and implications are provided for potential future federal research and program initiatives.

## Research and Analysis Context

### Framework

Primary and secondary sources were used for this report. Secondary sources included the published literature, as well as strategy development and program reports from state governments, provider institutions, and their intermediary organizations. Primary sources consisted of two groups: users of technical and managerial information and services, and the provider institutions and organizations.

### Constraints

The research methodology for this report was constrained by the resources and time available and by the fact that there is a restriction on the number of individuals who may be surveyed by mail, phone, or in person using federal funds without approval by the Office of Management and Budget of the protocol process and survey instrument. These constraints necessarily affect the ability to provide definitive findings and conclusions. Some insights and lessons learned can be gathered, however.

## Published Data from Secondary Sources

### Published Literature

The review of readily available published studies indicates that the sources of technology and managerial information and services from the perspective of technology-based small firms have not been explored systematically. Research journals and practitioner magazines were examined under the headings of clearinghouses, innovation process, technology development, technology transfer, and technology commercialization.

No studies from the users' perspective were found in regularly issued journals. One extensive study of a state's manufacturing firms, which included information on research and technology needs, was published in the newsletter of the provider institution (96). Some reports may be found in journals covering the provider community, devoted to one or more institutions (e.g., 3, 4).

### State Government Strategy Development and Program Reports

Two other sources canvassed were state government offices involved in developing technology-based economic and business strategies or operating programs, and institutions such as universities and federal laboratories that provide the information and services.

Representatives of nine states were surveyed by telephone to determine the extent to which studies or reports might be available that document user surveys related to technology and managerial information and service programs. A short survey protocol was developed (see Appendix B). An attempt was made to contact at least four individuals who were on the NGA Working Group on State Initiatives in Applied Research and at least four who were not. Similarly, an attempt was made to contact at least four individuals who were employees of coordinating state organizations (e.g., boards, commissions, foundations, central agencies for economic development) and at least four who were part of an agency with one or multiple programs but that had no coordinating role.

As anticipated, the responses were conditioned by whether the state had program(s) in place or was beginning anew, and by whether the effort was intended to create a structure with many programs or to develop one or several programs within an existing organization. Thus, in several states, there were different responses for different time periods in the 1980s.

More than two-thirds of the respondents noted that six approaches had been used at one time or another in deciding whether to create a new program or change an existing one. For the respondent states, no programs have yet been eliminated.

The six approaches include:

- Convening or using an existing task force, board of directors, or advisory committee representing all institutions and sectors, as well as intended users, and undertaking strategic-level analyses generally using state staff resources;
- Undertaking detailed analyses by state staff, possibly including interviews of the user community, as well as other affected communities;
- Reviewing anecdotal evidence collected by policy board members and policy and program staffs for unmet needs or opportunities;
- Following up on the gubernatorial or legislative sense that "something needs to be done";
- Working with an "idea champion" to translate an idea into appropriate legislation and regulations;
- Analyzing other state programs for their applicability and for their potential to address needs or capitalize on opportunities.

However, as one of the respondents noted, it is a "movable feast." When a state is considering development and implementation on an overall strategy for R&TD-based economic and business development with a new organizational entity (e.g., a foundation) and with a number of programs, a task force or advisory body may be created. Since its composition tends to be representative of the sec-

tors and institutions affected (e.g., academic, industrial, financial, labor, governmental), the "user community" is involved and its viewpoint heard. Moreover, the staff assigned to support the effort tends to undertake various kinds of strategic analytical studies. Summary reports are published, but, according to the respondents, none would contain detailed information on where technology-based small firms go for information and services.

For other situations, such as creating a new, single program where none existed or adding a program, there tends to be less comprehensive and less detailed analyses: anecdotal evidence is reviewed, programs of other states are analyzed, or gubernatorial or legislative sense of need is addressed. Anecdotal evidence is used extensively in determining need for incremental changes in program design or operations. Only one state respondent noted that the experience of other states had not been perceived as very relevant.

Once a decision is made to create or change a program, the program leadership is more likely to be analytical, to seek advice from the institutions and sectors affected, and to conduct user interviews. However, there do not appear to be any reports generated by the states that contain detailed information on the sources of information and services for technology-based small firms.

### Program Development and Management Reports

Similarly, representatives of provider community institutions were queried about the availability of detailed user surveys as part of the interview process. At least two representatives from each of ten types of provider institutions were surveyed to determine whether reports exist that document studies related to technical and managerial information and service programs. These provider communities include state government agencies, local government agencies, trade associations, scientific/engineering societies, academic-based technical assistance centers, academic-based business assistance centers, research centers; manufacturing technology centers, NASA centers, and federal laboratories.

Of all the respondents, only one had undertaken a rigorous and detailed survey of the potential user community. In most other situations, data on users often is completed for annual reports and/or for budget justification. More importantly, the operations of information and service provider organizations ensure ongoing feedback from users. By definition, however, this data on users and on their feedback is not representative. Actions by provider organizations in the aggregate do not represent the totality of potential responses to user needs for technical and managerial information and services. Put another way, the needs of the user firms cannot be inferred from their use of different provider institutions, even if an appropriate sample of provider institutions could be determined and surveyed. Moreover, the number and type of individuals as providers cannot be estimated, much less located, whether they operate alone or are housed in a provider institution. Thus, any study of institutional providers without individual providers would be inaccurate.

### Limitations of Published Data

The published data from secondary sources has significant limitations: representativeness, timeliness, unevenness, and potential for misunderstanding. The number of respondents from the states and from provider institutions was too small to be representative of their respective populations. Reports containing desired data were available only from provider institutions. With one exception, the reports reflect experience with small firms, not the overall needs of such firms for technical and managerial information and assistance. Where data sets are available in published form (e.g., annual reports) or unpublished form, there is an unevenness across sources in the categories used for types of information and services and for types of users served. Finally, there is a lack of clarity in some instances as to whether users are end-users or intermediary providers and, thus, the potential for misunderstanding exists.

## Nature of Data Collected from Primary Sources

### Framework

Before beginning interviews with representatives from the user and provider communities, it was necessary to consider the range of potentially significant variables in the three areas: nature of information and services, nature of firms assisted, and nature of providers.

### Nature of Information and Services

The information and services fall into two broad categories, technical and managerial, each of which has subcategories. Technology information and services covers products, processes, and materials, as well as scientific advances and technological breakthroughs. Managerial information and services included business organization and startup; business operations; finance; inventory control; production; distribution; marketing; exporting; patents and other intellectual property rights; licensing opportunities, processes, and matchmaking; R&TD procurement opportunities and processes; and training and retraining.

### Nature of Firms Assisted

Firms assisted have at least six variables with potential significance for the provision of information and services. These include:

- Age—startup, fast growing, mature;
- Size, within the 500 employee limit—very small, mid-range, larger;
- Geographic location—region of U.S., proximity to major research and service institution (university, federal laboratory), metropolitan/nonmetropolitan;
- Type—R&TD intensive vs. R&TD plus production;
- Funding sources—all federal, mostly federal, less than half federal;
- Leadership—scientist, engineer, or technologist vs. business manager;

### Nature of Provider

Providers have at least ten variables with potential significance to the provision of information and services to technology-based small firms. These include:

- Organization vs. individual who happens to be within an organization;

- Location—universities and other academic institutions, federal laboratories, professional associations and scientific and engineering societies, other similar firms, state and local governments (directly through their agencies or indirectly through institutions they created);
- Age—startup vs. mature;
- Size of provider unit and backup in total institution;
- Range of assistance provided (see categories under characteristics of information and services provided);
- Funding sources—all federal, mostly federal, less than half federal;
- Cost to users—free, low fee, full recovery fee;
- Extent of information and services provided by individual or organization itself and/or backup institution—electronic data base (on-line or with personal assistance); inquiry/referral (to individual or organization); inquiry/response (to network members through electronic mail feature); network contacts; publications and reports; one-on-one assistance (centrally provided and/or by field agent); subscriber-provided publications and reports (specific response or regularly issued), and/or research and technical analysis backup;
- Mode of information and services provided, e.g., publications, electronic data, phone assistance (with or without 800/900 number); at provider office and/or on user site; and
- Proportion of users that are end-user technology-based small business firms vs. intermediaries that are providers of information or services to them.

**Limitations of Primary Sources**

The collection of data from primary sources also has significant limitations. There are too many variables, and the number of firms that can be interviewed without approval is insufficient and, necessarily, nonrepresentative. At best, as with the secondary published data, the collection of data from such firms serves to support the refinement of hypotheses regarding this topic.

**Survey Methodology: Technology-Based Small Firms**

Since the survey was to be limited to nine respondents, telephone interviews were undertaken. A protocol was developed with a limited number of questions (see Appendix C). The time for the survey had been estimated at 20 minutes. However, discussions triggered by the questions raised the average time to over 30 minutes.

One question was very extensive, involving what amounted to an almost 400-cell matrix. The respondents were asked to identify the types of organizations they had used in the past five years for each of 18 categories of technical and managerial information and services. Twenty-one types of organizations were provided, including "within own firm" and "have not sought this information or service."

The second question related to how the respondents found out about the organizations or individuals from which they finally got the desired information or service. The third question involved ranking by degree of helpfulness ten approaches for accessing information and services.

The final two questions were more open ended. One was directed at the issue of contacting individuals versus organizations; the other was aimed at lessons learned in accessing technical and managerial information and services.

It was determined that a random selection of technology-based small firms would not be useful. Therefore, the firms were selected from award lists of the federal Small Business Innovation Research (SBIR) Program. All were multiple winners and have received Phase II awards; thus, there is documentation that these firms are relatively sophisticated in technology development. Selection criteria included distribution of awards among the major SBIR funding agencies (i.e., DoD, DOE, HHS, NASA, and NSF) and geographic distribution in order to ensure some broad representation.

The firms surveyed had certain characteristics that may not be shared by the universe of technology-based small firms in the nation. Production is not the major activity of most of the firms. None of the respondents volunteered that they are looking for technologies to commercialize from universities, federal laboratories, or other research organizations. Rather they tend to develop their own technologies. Most of the firms came into existence or became operational with full-time employees in the past ten years. The firms varied in size, but those with fewer than 50 full-time equivalent employees dominated. The survey results are on page 98.

**Survey Methodology: Provider Institutions**

A determination was made to identify a set of provider institution categories and to interview by telephone representatives of at least two institutions in each category. Ten categories were selected (see Appendix E). A protocol was developed for these interviews with a limited number of questions (see Appendix D).

The telephone interviews were originally estimated to take about 15 minutes. However, respondents raised the average elapsed time to about 20 minutes. The first question identified 12 groups of institutions and individuals to which the respondents' organizations may be providing information and services. Based on surveys (such as annual reports) or personal impressions, respondents were asked to determine what percentage of users come from each group.

The second question listed 18 categories of technical and managerial information and services and requested that the respondents designate whether their organizations provide them. These are the same 18 categories as in the survey of firms (see also Appendix C).

The third question involved whether the organization used any of ten approaches to provide information and services. While the approaches were the same as in the user survey, in that survey, they were ranked by degree of helpfulness to the firms.

The fourth question related to the operation of the provider organization and the extent to which it was reactive or proactive. The final question paralleled that of the user survey. It was open ended and was directed at lessons learned in providing technical and managerial information and services.

Organizations were selected to maximize diversity across and within the ten provider groups. Lists of providers were collected from intermediary organizations, federal agencies, and the author's files.

The selected providers had certain characteristics that may or may not be similar to those of all provider institutions, a group about which not a great deal is known.

Some of the institutions surveyed provide technical information and services; others offer managerial assistance; still do others both. Some provide such assistance in all technical areas or in all managerial areas, while others work in only part of an area. Of particular interest is the fact that many organizations have evolved to include more categories of either technical or managerial assistance, and some have combined both kinds of assistance. An effort was made to exclude organizations that provide information and services only to members.

### Hypotheses of the Study

Recognizing the limitations of the data, this working paper is limited to issues of greatest potential importance to, and impact on, future federal research and program initiatives in this area.

There were two basic underlying principles for the study: First, general approaches may be more important than the specifics of the user, the provider, and the assistance provided. Second, these general approaches build on the consensus lessons learned in the technology development, transfer, and use process and in the innovation process (e.g., 20, 40, 46).

From these two underlying principles, several hypotheses evolved that lend themselves to verification:

- Users tend to query friends, associates, and acquaintances as trusted "pointers" for referrals.
- Individual referrers and providers tend to be more important than the institutions that "house" them.
- Definition of the real user need tends to be important to the success of a provider's response (even if only a referral), a factor that increases in significance when the user does not understand the true nature of the problem or does not define it specifically.
- As a corollary, a tailored response (or at least the perception thereof) tends to be important to a user's need (i.e., "pull" mode not "push" mode).
- First contact with a potential provider individual or institution tends to be most significant in determining the ultimate success of assistance and the perception of a user's experience (i.e., the "gatekeeper" issue).
- An appropriate referral tends to be very important in determining the efficacy of a provider from a user's perspective.
- Providers that can offer or access a full array of technical and managerial information and services tend to be helpful to the user, even if the initial request was narrow and within only one area (a technology problem may in fact be managerial, and vice-versa).

Other hypotheses evolved that were not as likely to lend themselves to verification, given the primary and secondary data sources. Information from a larger sample may provide the necessary support for verification or nonverification. These hypotheses include:

- Ease in locating and accessing the appropriate information or service tends to be more important than its cost.
- Feasibility of implementation tends to be important in determining user's perception of provider's assistance.
- Provider's response does not ensure utilization of the information or service, even if appropriate, since other factors might intervene.
- Provider institutions tend to be more successful when they do not merely replicate or adopt approaches of other successful similar providers but adapt such approaches to the unique circumstances of their state or regions and to the firms they serve.

## Survey Results

The interview results for the technology-based small firms and the provider institutions are reported in four parallel categories: providers accessed or users served; information and services provided; approaches to accessing or providing assistance; and lessons learned. The user survey yielded information in two additional categories: finding provider organizations or individuals; and accessing individuals versus organizations as sources. These survey results, as noted previously, should not be regarded as definitive conclusions. Rather, they should be read as outcomes or tendencies more likely to occur.

## Technology-Based Small Firms

### Providers of Information and Services

The 21 types of organizations listed as sources of technical and managerial information and services divide into clusters. Four are part of the business community: manufacturers and sales representatives, suppliers, customers, and competitors. For this group of respondents, with their R&TD rather than production orientation, these organizations tend not to be approached, although customers sometimes provide unsolicited suggestions. The five research-oriented sources (e.g., universities, federal laboratories, and nonprofit research institutes) are among the most utilized, as would be expected for this group of firms.

The respondents did not tend to distinguish between federal agencies and federal laboratories and NASA centers. Thus, federal agencies seemed originally to be well utilized. Further probing showed up this misunderstanding, and, at least for this group of respondents, federal agencies had to overcome two barriers: They are perceived as too dependent on data bases rather than tailored, personal services; and too oriented toward commercialization of federally produced or supported technology and, thus, less interested in the needs of an individual firm. Both these perceptions may be the result of the type of firms surveyed.

State and local governments, especially the former, tend to be perceived as important sources of financial as-

sistance but not of technical or managerial assistance. All governments appear to suffer to some degree from the fact that peers are not providing information and services to peers. Peer relationships have two components here: first, there is the engineer-to-engineer or marketeer-to-marketeer peer relationship; second, there is the businessperson to businessperson peer relationship. Governmental staffers readily can overcome the first barrier; many cannot overcome the second because they do not have private sector experience, or not enough of it.

The next group of four providers consists of intermediary organizations (e.g., trade associations, business associations, engineering or scientific societies, and professional societies). Because of the nature of the respondent firms, these sources are among the most used. There is significant potential for peer-to-peer relationships. In addition, these research and technology development oriented firms use the journals, bulletins, newsletters, and other publications of the organizations to keep abreast of developments.

The final group of four types of provider organizations involves consultants, financial advisors, accountants, lawyers, and other similar professionals. Since all of these firms receive federal funds and many have venture capital investors, financial, auditing, and managerial advice tends to be sought or provided on an unsolicited basis.

### Information and Services Provided

The respondents indicated a greater need for assistance in seven managerial categories: finance; marketing; exporting; patents and other intellectual property rights; licensing opportunities, processes, and matchmaking; and R&TD procurement opportunities and processes. The last category was added after the first two interviews.

Since these firms are somewhat established, assistance in organization and startup and in operations are not needed. Issues related to inventory control, production, and distribution are relatively unimportant because these firms are entirely or predominantly R&TD oriented. To the extent that products are manufactured, they tend to be in small runs that do not lend themselves to extensive automation. On the other hand, the research the firms are doing may relate to advanced manufacturing process technologies.

While, on the whole, these firms are not very large, they do depend on skilled, technical staff at all levels. The issue of training and retraining appears to be more a function of localized labor markets. Thus, with the geographic distribution of the firms, response to this question was uneven and not instructive.

### Finding Provider Organizations or Individuals

Respondents were given five choices as to how they find out about the provider organizations or individuals. Four choices were highly rated, with strong similarities in the ranking order among the respondents. In descending these were:

- Prior experience with them;
- Friends or business and professional colleagues, who pointed you in the right direction;
- Being referred by another provider organization or individual originally contacted; and
- Printed matter received.

Since only one of the respondent firms directly accesses external data bases, this category was not rated. More significantly, as noted in response to another question, these firms tend to prefer inquiry/response or inquiry/referral systems with personal services rather than the relatively "depersonalized" online data bases. This was unanticipated, due to the data base sophistication of the firms' staffs.

Under the "other" category was mentioned financial advisors, accountants and auditors, and lawyers who referred the firms to appropriate information or services.

The respondents were asked how many referrals it tended to take to get to the organization or individual with the desired answer. In general, those surveyed expected to find the information or arrange for the service with no more than three referrals. In exceptional circumstances, that number could be significantly larger.

### Approaches for Accessing Assistance

One set of questions had to do with how the respondents access information and services. They were asked to rate ten broad approaches as very helpful, somewhat helpful, or not helpful.

The one-on-one visit approaches (at the firm's site, off-site, such as at the provider's office, or another location) had the highest rankings, as anticipated. Clearly, this applies more to services than information. The other two approaches with a significant number of very helpful rankings were: telephone or written inquiry/response or inquiry/referral systems; and magazines, journals, bulletins, handbooks, or other reports or printed matter.

Conferences and workshops, and classes and seminars are considered somewhat helpful. Videotapes, films, television, or other video materials fall between somewhat helpful and not helpful, possibly due to the limited offerings for the types of firms. Online data bases generally are rated not helpful, as discussed above. For the categories of exchange of researchers and of joint research projects, there was no experience to rate.

### Individuals versus Organizations as Sources

Respondents were asked whether they tend to contact individuals they know or have heard about or organizations they think should have the answer. Finding and contacting appropriate individuals clearly is the driving force. The respondents did not consider important the specific organization or type of organization where the individual was located.

### Lessons Learned

The responses to this open-ended question regarding lessons learned in accessing technical and managerial information and services are similar to those for technology transfer and commercialization. Among the lessons stated or implied by two or more respondents include the following:

- Individual sources tend to be preferred to institutional sources (person-to-person contact).
- Technology questions appear to be easier to respond to than managerial ones (which may have much to do with the fact that most respondents are scientists or engineers and that they should be able to describe their technical problems more precisely than their managerial ones).

- Personally provided information or services tend to be preferred over data bases, printed matter, and video materials (person-to-person contact).
- Receipt of the information or service as an individual tends to be preferred over a group setting (person-to-person contact).
- On-site receipt of technical services tends to be preferred (i.e., tailored response), but there are many exceptions (e.g., advanced factory floor experiment at another firm, unique facilities or equipment at a university or federal laboratory).
- Some individuals and institutions are better able to tailor responses to the needs of the firm, but the firm has the responsibility to be specific about the problem or issue.
- Many organizations are not large enough and/or do not have sufficient backup support to respond appropriately; the real issue is whether they can provide a referral to a more appropriate provider.
- One-stop, multi-service centers which provide technical and managerial information and services, backup research, facilities, and equipment, a network of contacts are inherently preferable to the respondents because of the time they may save.

## Provider Institutions

### Users of Information and Services

The 12 types of organizations listed as users of technical and managerial information and services cover a broad range of groups. There is a considerable overlap between these 12 types of users and the 21 types of providers in the user survey. Nine types of user organizations are essentially equivalent to 15 of the 21 types of providers.

The range of groups includes: small firms and large corporations; universities, federal laboratories, and nonprofit research institutes; federal, state, and local agencies; intermediary associations representing various sectors; consultants, financial advisors, auditors, lawyers, and other similar professionals; and foreign organizations and individuals.

By their nature, most of the provider organizations surveyed assist users in the private sector. Other user groups were represented, however, particularly the three categories of research institutions, an indication of one research organization helping another. For some providers, foreign organizations and individuals represent another type of user group.

With most of the providers, the users tend to be small firms more than large corporations. There is a much greater number of small businesses, and they also tend to seek outside assistance more often than large corporations. Large corporations appear to be more interested in technology transfer for commercialization and in joint research efforts. The respondent technical information and service providers were aware that virtually all small-business users were from technology-based firms. The same cannot be said for managerial information and assistance providers, since the data available did not necessarily indicate the technology intensiveness of the firms.

### Information and Services Provided

Organizations with the capacity to offer technical information and services tend to provide support in all four substantive categories: product development, manufacturing process technologies, materials, and scientific advances and/or technological breakthroughs. The level of support and the range of areas vary. For example, manufacturing technology centers obviously are strong in manufacturing process technologies, but may be relatively weak in product development.

There appears to be a greater diversity among providers regarding the categories of managerial information and services. Small business development centers are strongest in organization and startup, and in business operations. Originally oriented to the service sector, they are tending to expand their capacity to support the operations of manufacturing enterprises (e.g., inventory control, production, distribution, and marketing). More specialized areas, such as exports, intellectual property rights, licensing opportunities, processes, and matchmaking, and RT&D procurement opportunities and processes, are more likely to be the strengths of university-based centers. State and local government agencies also are active in R&TD procurement opportunities and processes, particularly for the federal SBIR program, and in training and retraining activities.

### Approaches for Providing Assistance

Provider institutions were requested to identify, from among the same ten choices as in the user survey, the approaches they used to provide information and services, and to rank the choices in terms of frequency of use.

Telephone responses to outside inquiries, one-on-one visits at the provider's office, and provision of printed matter were mentioned most frequently by virtually all the respondents. Convening conferences and workshops and conducting classes and seminars were activities appropriate to governmental agencies and intermediary organizations. Organizations that provide technical services often make site visits to firms for one-on-one assistance. Some of these organizations have the equivalent of engineering extension "circuit riders." Exchanges of researchers and joint research projects are fostered by federal laboratories and centers and by industry-university cooperative research centers and their equivalents. Approaches such as video materials and online data bases do not appear with great frequency, but they are considered to be productive uses of resources by institutions providing them.

With the exception of intermediary organizations (i.e., trade associations and scientific and technical societies), the respondents are not membership organizations. The remaining provider organizations tend to seek firms that could use their information or services. In most instances, however, a general marketing approach is used, such as mailing brochures or maintaining an exhibit booth at meetings. In other situations, such as the engineering extension "circuit riders," a targeted outreach approach is used.

### Lessons Learned

As in the case of the user survey, the "lessons learned" responses of the providers of technical and managerial information and services are similar to those in technology trans-

fer and commercialization. Among the lessons stated or implied by three or more individuals surveyed include:

- Providers understand users' preference for person-to-person contact, with individually provided assistance to an individual user at the user's site tailored to the user's specific needs, although they usually are constrained by mission objectives or by personnel or fiscal resources from adhering to those preferences.
- Ability to respond and provide appropriate information and services, whether technical or managerial, is dependent initially on the users' capability to describe problems fairly precisely and narrowly.
- Many organizations are not large enough and/or do not have sufficient backup support to respond, but they can be successful if they provide a more appropriate referral.
- A one-stop, multi-service center, which provides technical and managerial information and services, backup research and facilities and equipment, and a network of contacts, is inherently preferable because of its integrated approach, its potential for a timely response, and its productive use of resources.

## Implications for Federal Research and Program Initiatives

### Framework

This section reviews some preliminary, tentative implications from the analysis of the user and provider surveys. These implications are directed primarily to federal government research and program activities. In this instance, however, federal initiatives cannot be undertaken in a vacuum. They would be dependent on the information and service providers, their intermediaries, and funders, including state and local governments.

Moreover, these implications are based on assumptions regarding federal government roles in undertaking certain kinds of activities and stimulating activities by other organizations. For sources of information and services to technology-based small businesses, these other organizations would include provider institutions and their intermediary organizations, as well as state and local governments and their public interest associations.

### Assumptions

#### Federal Roles

As noted above, federal initiatives in this area would be dependent on the providers of technical and managerial information and services, their intermediaries, and funders, including federal, state, and local governments, all of which have policy and program initiatives.

Broad appropriate roles of the federal government need to be examined within this context. We suggest that these broad roles come under the generic headings of stimulating and facilitating activities by others and performing some activities directly. Where possible, the role of stimulating and facilitating activities by others is preferred by most clientele of federal initiatives.

These assumptions suggest four operational roles for the federal government, given the context and institutional environments within which they will operate. These four roles include:

- Strengthen the institutional capacity of these public interest associations and intermediary organizations, whose constituent members provide the information and services to firms and/or whose members support provider institutions in that activity.
- Systematize and accelerate the development and diffusion of knowledge and experience in providing such information and services and/or in supporting the institutions that undertake that assistance.
- Identify and fill gaps in this knowledge and experience, including information about users.
- Facilitate networking among providers of such information and services, among their intermediaries, and among supporters of that assistance.

#### Target Audience for Federal Initiatives

A simplistic model of the system of supplying information and services to such firms would be: users - providers - funders. As in the case of most models of human and institutional behavior, reality is more complicated.

Users, the technology-based small firms, may belong to intermediary organizations that provide information and services, e.g., trade associations, scientific or engineering societies, or professional associations. As a membership service, most of these intermediaries provide only referrals, a task done more indirectly through newsletters and journals than directly through inquiry/response systems.

Providers of technical and managerial information and services include a range of institutions, including federal, state, and local governments. Most of these providers have their own intermediary organizations, which can serve two important functions: the exchange of information on their experiences (i.e., what works under what conditions and why and the maintenance of a network of contacts. For example, university-based providers have the National Association of Management and Technical Assistance Centers; small business development centers, the SBDC Connection; federal laboratories, the Federal Laboratory Consortium and its Clearinghouse; and state and local governments and their public interest associations.

These intermediaries tend to be membership organizations, and the information and service functions are provided within the dues structure or through a separate subscriber fee. In some cases, the intermediary is a federal entity (e.g., the FLC Clearinghouse) or is supported in whole or in part by federal monies (e.g., the SBDC Connection).

In considering the role of the federal government in stimulating innovative activities by others, one must distinguish between the beneficiaries and the providers. Ultimately, the federal interest is in all businesses and beneficiaries, both large corporations and small firms that potentially could benefit from new technology-based products, better manufacturing process technologies, new materials, and scientific advances and technological breakthroughs.

*Providers of assistance could be considered* beneficiaries, but only in the sense of receiving federal support to serve the ultimate users. In the context of the assumptions made here, these providers of assistance and their organizational network and supporters are the target audience for federal activities. This audience includes state and local governments because they are direct providers of assistance and fund program initiatives.

**Subject Focus of Federal Initiatives**

The same *federal programmatic and legislative context* also affects the suggested subject focus for any initiative. Program initiatives by state and local government, information and networking programs by provider intermediaries, and program contact names should be the focus.

At the federal level, additional attention need not be directed at resource directories of scientists, engineers, and management experts, and data bases of research in progress, scientific advances, technological breakthroughs, and technologies available for licensing. The resources tend to be developed by the providers and their intermediaries, and many of them exist through the federal government (e.g., NTIS, FLC). This is not to imply that strengthening these federally supported data bases is not an ongoing task.

In addition, there is a need to better understand the processes by which technology-based small firms access technical and managerial information and services from provider organizations. Little information is available from the firms' perspective on what kind of information is sought from which kinds of provider institutions and how it is provided. Additionally, there is a need to know how satisfied the users are with each type of provider, information or service, and mechanism used. Support of this research effort is most appropriate at the federal level because of the distributed benefits of the results.

**Funding Levels**

Implementation of new federal program initiatives in this area are not expected to be very expensive, especially since they are intended to build on existing capacity. It is assumed, therefore, that the major expenditures in the long term would be grants and contracts rather than federal agency salaries and related staff expenses. This does not imply that some federal initiatives cannot or should not be within these agencies.

**Potential Initiatives**

Based on these assumptions and the user and provider surveys, there appear to be important niches for the federal government to expand into in order to make a cost-effective contribution to the growth of the country's industrial health and competitiveness and its place in the global economy. These niches flow from the composite of the stimulating and facilitating activities under the four roles noted above.

**Strengthen Institutional Capacity**

State and local governments provide technical and managerial information and services and fund other provider institutions (e.g., public university-based engineering extension programs). The associations representing these governments operate clearinghouses on these state and local program initiatives.

The findings from a report on clearinghouses (see page 49) are instructive for potential federal initiatives. That report states:

> The economic development-related clearinghouses that do exist are underfunded, do not have complete information (either not all programs are included or not all desired information has been collected on each program), and may not have the information automated (much less accessible on-line).
>
> *In addition,* the information collected by one organization may overlap that collected by another. Finally, there is no commonality of categories of information collected by each organization both among state or local programs and, thus, analysis of program initiatives across levels of government is extremely difficult.

A somewhat similar situation exists with the providers and their intermediary organizations. To the extent that there are any "clearinghouses" of information about providers, they are embryonic (e.g., SBDC Connection) and/or contain limited information (e.g., NAMTAC). Moreover, for most groups of providers, the intermediaries provide referrals using their staffers' anecdotal experience, if they provide any assistance at all.

Thus, little is known about each group of provider institutions and about what they provide to technology-based small business users, the characteristics of the firms they serve, how they provide information and services, and the feedback they receive. On this basis, the findings regarding the public interest association clearinghouses apply to the intermediary organizations, except that the public interest associations are further along in their efforts.

The implications for potential federal government initiatives would include the following.

- Strengthen the capacity of intermediary organizations to improve their assistance programs by providing extramural funds to support enhanced data collection, organizations, and automation by public interest associations and intermediaries representing providers, including selected information on state and local programs and provider assistance programs, more detailed case examples, and assessment studies.
- Use the leadership and convening powers of a lead federal agency to work with these associations and intermediary organizations to reduce overlap in collecting data (but sharing information about the structure of the data sets) and to increase where appropriate commonality of information on each of the two groups of data (state and local initiatives and provider assistance programs), to provide a mechanism to link information across data bases.

**Systematize and Accelerate the Development and Diffusion of Knowledge and Experience**

At the present time, there is no agency with responsibility for research on the technology development and commercialization process, within which is research on the issue of sources of information and services by technolo-

gy-based small firms. At one time, such research might have been supported by the National Science Foundation. There is limited research activity by individual agencies, but it is necessarily focused on their own operational missions (e.g., EDA, SBA). Thus, over the next few years, the opportunity exists to collect information on SBDCs through federal support of the SBDC Connection, but not about NAMTACs member institutions.

No agency has the oversight role on behalf of the federal interest in this issue. The newly created Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation in the Department of Commerce has a mandate to address state and local government programs and activities. A parallel mandate for nongovernmental provider institutions and their intermediaries does not yet exist.

The implications for potential future government initiatives would include the following.

- Support through extramural awards research on sources of technical and managerial information and services by technology-based small firms
- Support through extramural awards expansion of existing data collection and analysis efforts related to the processes by which provider institutions undertake their assistance to the users and through which state and local governments support this provision of assistance.
- Identify, document, and disseminate through a lead agency information on federal programs and activities that complement state and local government initiatives and provider institutions' activities in this area (e.g., NTIS, FLC).

**Identify and Fill Gaps in Knowledge and Experience**

As noted immediately above, there are major and minor gaps in information about state and local programs and the activities of provider institutions in this area. Another major gap exists in the assessment of the efficacy of these programs and activities. (See, for example, 30, 37.)

Some assessments do exist, usually as self-assessments performed by academic researchers. These assessments, with few exceptions, are limited to how well the provider institutions are serving the firms. Moreover, there is virtually no agreement on appropriate assessment methodologies. This information would be useful to state and local governments as providers and funders as well as to providing institutions. The intermediary organizations, including the public interest associations, could use this information to assist their members.

The implications for potential federal government initiatives would include the following:

- Support through extramural awards research on assessment methodologies appropriate for providers of information and assistance to technology-based small firms and disseminate the results to providers through their intermediary organizations.
- Initiate through extramural awards research on other priority gap-filling needs identified by an advisory mechanism (temporary or permanent) of users, providers, and funders (including the federal government).

**Facilitate Networking**

The success of new federal research and program initiatives in this area will depend in great part on cooperation among federal agencies and between them and public interest associations representing state and local governments and intermediary organizations representing the assistance providers.

Interagency coordination would involve agencies that provide information and services and fund organizations to do so (e.g., NASA and its Technology Utilization Program), as well as those that only provide information (e.g., NTIS). Funders of outside research (e.g., NSF) also would be involved. This coordination would help ensure a comprehensive federal response that would complement the programs and activities of state and local governments and of provider institutions.

The federal government can minimize its investments and increase its probability of success if it coordinates its efforts with the ongoing programs and activities of the state and local government associations. The same level of coordination with the intermediary organizations is desirable for the same reasons, although these organizations tend to be less further along in their ability to provide information to members. Through such cooperation, the federal government would increase the probability that its efforts complement and reinforce those of organizations and institutions to which technology-based small firms turn for assistance.

The implications for potential future federal initiatives would include the following.

- Convene, through a lead agency, representatives of these public interest associations and intermediary organizations as well as federal agencies to exchange information on programs, activities, and contact names in this area.
- Foster the creation of a network of these representatives to stimulate ongoing communication and to facilitate referrals among them.

## SUMMING UP

The potential for future federal research and program initiatives in this area appears to be limited in no small part by a lack of understanding of how important the issue is. Federal, state, and local governments and private funders, as well as the provider institutions, have not undertaken comprehensive research on the users' perspective of technical and managerial information and assistance programs. The few reports that do exist could provide the beginnings of a comprehensive baseline effort to serve all providers and funders.

In addition to this research effort, more attention needs to be directed at understanding how provider institutions operate. Finally, there needs to be strengthened capacity of intermediary organizations representing the state and local governments and the providers to undertake dissemination and networking.

In all of these efforts, there is a federal interest in contributing to the nation's economic health and international competitiveness through the strategic investment of staff time and outside awards. In the long term, the federal gov-

ernment benefits because large corporations and small firms, especially those that are technology based, are the ultimate beneficiaries.

## Implications for the Clearinghouse

### Introduction

This section reviews some preliminary implications from the analysis of the provider and user surveys for the design and operations of the Department of Commerce Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. As noted in the previous section, these implications are necessarily tentative because of the data limitations.

These implications flow directly from those for federal research and program initiatives. This section translates those suggestions, where appropriate, to the Clearinghouse. The implications were based on certain assumptions regarding the roles of the federal government in undertaking certain kinds of activities and in stimulating activities by other organizations. The other organizations would include institutions that provide technical and managerial information and services to technology-based small firms and their intermediary organizations, as well as state and local governments, which provide and fund such assistance, and their public interest associations.

The discussions at the seven focus group sessions, the five "thinker sessions" and the two review sessions of the papers, provided additional context to this section on implications for the Clearinghouse. Of particular importance is the consensus that was emerging on the issue of initial audience and subject focus.

## Assumptions

### Clearinghouse Roles

The previous section suggested that most clientele of federal initiatives prefer that the government stimulate and facilitate actions by others rather than undertake direct federal activities.

These assumptions suggested four operational roles for the federal government and, by inference, for the Clearinghouse. These four operational roles include: strengthen institutional capacity; systematize and accelerate the development and diffusion of knowledge and experience; identify and fill gaps; and facilitate networking.

### Target Audience for the Clearinghouse

In the previous section, the target audiences for federal initiatives in this area were shown to be intermediary organizations representing providers of technical and managerial information and services, state and local governments and their public interest associations.

A consensus evolved that the Clearinghouse should serve federal agencies and state and local governments and their associations. This consensus was based both on a reading of the appropriate section from the *Omnibus Trade and Competitiveness Act of 1988* and its legislative history and on the resources available to the Clearinghouse in the short term.

On this basis, it is suggested that this consensus position be adopted for the initial operations of the Clearinghouse. A focused effort on the intermediary organizations would be delayed until either the initial phase is complete or additional resources are made available to the Clearinghouse.

### Subject Focus of the Clearinghouse

The subject focus detailed in the previous section remains unchanged in principle. However, information and networking programs by intermediaries representing provider institutions other than those supported by state and local initiatives would necessarily be deferred to a later phase. Thus, the focus would be on program initiatives by state and local governments, information and networking programs by the public interest associations, and program contact names in governmental organizations and in public interest associations.

The section on suggested federal initiatives also outlined the need to better understand the processes by which technology-based firms access technical and managerial information and services from provider organizations. Since state and local governments provide and fund such assistance of the provider institutions, this need is still appropriate in the initial phase of the Clearinghouse's operations.

### Funding Levels for the Clearinghouse

The statement made in the report on clearinghouses (page 49) regarding funds is appropriate here also. It reads as follows:

> In the absence of information to the contrary, the authors of this paper have assumed that the existing budget level of the Clearinghouse ($250K/year) is not fixed, and might be increased if a strong programmatic case should be made. It further has been assumed that the percentage mix of intramural expenditures for staff salaries and related staff expenses and of extramural grants and contracts also is not fixed. Again, this might be changed if a strong case should be made.

## Potential Initiatives for the Clearinghouse

The framework for a special niche for the Clearinghouse, suggested in the section on potential federal research and program initiatives, is based in large part on the recognition that other federal agencies and the state and local government associations have a number of activities in the technology-based economic and business development arena. Thus, stimulating and facilitating additional activities by these associations and agencies would be a cost-effective approach to achieve the goals for the Clearinghouse stated in the legislation.

This emphasis on the activities of other federal agencies and public interest associations is not an end in itself, merely a means to accomplish the Clearinghouse's operational roles and supplement its limited resources. In addition, stimulating and facilitating activities of others would permit the Clearinghouse to move more quickly beyond the initial target audience to address the needs and opportunities of nongovernmental provider organizations and

*their* intermediary organizations, all in the service of the large corporations and small firms.

The suggested niche for the Clearinghouse is organized under the same four operational roles of the federal government noted above.

**Strengthen Institutional Capacity**

Because of the need to limit the initial activities of the Clearinghouse, the suggestions for potential federal government initiatives must be modified. Thus, the specific implications for the initial phase of the Clearinghouse would include the following:

- Strengthen the capacity of public interest associations to improve their assistance programs to members and federal agencies by providing extramural funds to support enhanced data collection, organization, and automation, including selected information on all state and local programs that provide information and services to technology-based small firms or that fund other institutions to do so, more detailed case examples on these programs and activities, and assessment studies where publicly available.
- Use the leadership and convening powers of the Clearinghouse to work with these associations to reduce overlap in collecting data (but sharing information about the structure of the data sets) and to increase where appropriate commonality in selected categories of information on each state and local initiative to provide a mechanism to link information across data bases.

**Systematize and Accelerate the Development and Diffusion of Knowledge and Experience**

The initiatives suggested for the federal government under this operational role need to be adapted to the Clearinghouse limitations. On this basis, the implications for the initial phase of the Clearinghouse would include the following.

- Determine the availability of funds from other federal agencies or, if unavailable, use the Clearinghouse's funds to support through extramural awards research on sources of technical and managerial information and services by technology-based small firms.
- Support through extramural awards expansion of existing data collection and analysis efforts related to the processes by which state and local government agency providers undertake their assistance to user firms and through which state and local governments support provision of assistance through nongovernmental provider institutions.
- Identify, document, and disseminate information on federal programs and activities that complement state and local government activities in this area (e.g., NTIS, FLC).

**Identify and Fill Gaps in this Knowledge and Experience**

The major and minor gaps outlined in the section on federal initiatives include references to providers of information and assistance, to be deferred to a later phase of the Clearinghouse's operation. Thus, the specific implications for the initial phase of the Clearinghouse would include the following.

- Support through extramural awards research on assessment methodologies appropriate for providers of information and assistance to technology-based small firms in order for state and local governments to improve the efficacy of their own assistance programs and of their programs of support to provider institutional and disseminate the results of such research to these governments through their public interest associations.
- Initiate through extramural awards research on other priority gap-filling needs identified by an advisory mechanism (temporary or permanent) of representatives from the user, provider, and federal, state, and local government communities.

**Facilitate Networking**

Interagency and intergovernmental cooperation and coordination will contribute much to the success of the Clearinghouse and, at the same time, have the potential to minimize the Clearinghouse's own investments. The section on federal initiatives included coordination with intermediary organizations, an activity appropriate for deferral to a later phase. On this basis, the specific implications for the Clearinghouse would include the following.

- Convene representatives of appropriate federal agencies and of the state and local interest associations to exchange information on programs, activities, and contact names.
- Foster the creation of a network of these representatives to stimulate ongoing communication and to facilitate referrals.

## Clearinghouse Design and Operations

The programs and activities suggested for the Clearinghouse in this section are relatively small in their demand for staff and extramural resources compared to programs and activities driven by substantive issues other than sources of information and services by technology-based small firms.

Clearly, the necessity to implement the Clearinghouse in phases implies the need for flexibility in planning and implementing various potential program directions. Although driven by a broad mandate but limited funds, phased implementation within an overall strategic plan permits amending this plan as circumstances change and operational experience indicates a need for modifications. Temporary task forces or a permanent advisory committee composed of representatives of the user, provider, and governmental communities would ensure continued appropriateness of existing programs and priorities for potential new directions.

Although this author would suggest that a focus on intermediaries should be part of the immediate next phase (in perhaps three to five years depending on resources made available to the Clearinghouse), it is recognized that many other priorities may emerge before that time.

## Summing Up

The potential for the Clearinghouse is limited in part by the resources made available to it and by a lack of understanding of the importance of some of the issues the Clearinghouse ultimately must address. One of these issues is the sources of technical and managerial information and services used by technology-based small firms and their experiences with these sources and with their mechanisms for providing such assistance. A comprehensive research effort in this field, a documentation of case examples, and a compendium of assessment efforts would assist federal, state, and local governments both as assistance providers and as funders of provider institutions. The Clearinghouse has an exceptional opportunity for a cost-effective strategic investment of staff and extramural resources to make a major contribution in this area that will contribute to the nation's economic health and international competitiveness.

# State R&TD-Based Business and Economic Development Strategies

## Categories of State Investment of Funds and People

### Leadership/Convening

Development, articulation, and implementation of an integrated approach (e.g., Pennsylvania, New York).

Creation of state advisory body with representatives from the government, academic, federal laboratory, industry (especially small business that is generally underrepresented), finance, and workforce communities (e.g., Colorado).

Creation of a research and technology development (R&TD) subcabinet or interagency council (e.g., Colorado, Florida, Kansas)

Designation of an appropriate unit within the Executive Office of the Governor for continued oversight responsibility in the implementation of the state's integrated approach (e.g., Hawaii).

Conduct of an R&TD audit to determine what policies and programs are in place that affect R&TD for economic and business development (e.g., tax policies, procurement regulations); to this author's knowledge, no state has performed such an audit.

### Technical and Business Information and Services

Creation of a one-stop multiservice center that includes such information and services on an integrated basis among its roles and responsibilities (e.g., Utah, Ohio).

Orientation conferences or workshops in areas related to R&TD, such as proposal preparation, government procurement, patenting and licensing (e.g., Michigan).

Entrepreneurship training and assistance (e.g., Pennsylvania).

### Financial Assistance

Investment in innovative products or in technology-based small business firms where permitted by state constitution; seed and startup capital to bridge gap between idea/prototype stage and traditional venture capital funding sources (e.g., Colorado, Utah).

Public pension fund participation in private venture capital pools and other capital formation programs to increase availability of venture capital in state (e.g., Michigan)

Tax policies that foster R&TD, including policies that promote technology-based small business firms or capital formation for them (e.g., Montana).

State funding programs that leverage or match federal funds, as in SBIR bridge financing (e.g., New York, New Jersey) or SBIR proposal preparation support (e.g., Oklahoma).

### R&D Infrastructure

Industry-university cooperative research centers, university-based advanced technology centers, and/or centers of excellence, particularly with a specific technology transfer and commercialization component (e.g., Arizona, Washington).

Research programs that support individual research projects in universities and/or in private firms that are intended to promote innovation and technology development (e.g., Arkansas).

University policies that promote R&TD and cooperative research with technology-based firms and other collaborative or consulting relationships between individual researchers and such firms:

- Tenure and promotion criteria;
- Patent and other intellectual property rights policies;
- Access to facilities, equipment, specialized research libraries.
- University research foundations (e.g., Washington, Wisconsin).

Incubator operations (e.g., Georgia, Ohio, Pennsylvania) and science parks (e.g., Arizona, North Carolina), fostered or supported in whole or in part by state and local government, often through universities.

*Appendix B*

## Protocol for Telephone Survey of State R&TD Leadership

_____ (your state) has an array of programs for R&D-based economic and business development. This is particularly true for assisting technology-based small firms.

When _____(your state) made or is making decisions regarding changing the mix of programs in its overall strategy, obviously it considers the programs in place.

If a new program is to be created or an existing one changed or eliminated, how does your state go about deciding to do so and what to do?

Convenes a task force or uses an existing umbrella organization representing all potentially affected institutions and sectors as well as intended users_____

Undertakes detailed analyses, possibly including surveys or interviews of potential users and of other affected communities____

Reviews anecdotal evidence collected by policy board members and policy and program staffs____

Follows up on gubernatorial or legislative sense that "something needs to be done"____

Works with an "idea champion" to translate an idea into appropriate program legislation and regulations_____

Analyzes programs in other states for their applicability and potential to address needs or capitalize on opportunities____

Does the same approach(es) apply for level of dollars for a program? Yes____ No____

If no, in what way is it different? For example, is there more analysis or less analysis? Is it more detailed or less detailed?

Once a decision is made to create a new program or make major changes in an existing one, does the same approach apply to the program leadership as it determines the operating details, e.g., procedures, criteria for providing assistance? Yes_____No_____

If no, in what way is it different?

*Appendix C*

# Protocol for Telephone Survey of Users

As you know, federal and state governments as well as the private and nonprofit sectors spend a significant amount of money to provide technical and managerial information and services to firms like yours. Yet, there are almost no studies on where technology-based small firms go for this information and service.

We know a lot about the types of providers of information and services, who they serve, and how they go about doing so. But without information from users like yourself, we will be spending money poorly and allocating service people to the wrong tasks.

The 1988 *Trade and Competitiveness Act* mandated that the federal government conduct certain studies. As part of one of these efforts, I have been asked to explore where technology-based small firms like yours go to find technical and managerial information and services, as well as what their experience has been with the organizations and individuals in doing so.

I would like to spend about 20 minutes on the phone with you to cover a number of questions. Can you take the time now or shall we reschedule the call to a more convenient time today or tomorrow/Monday?

First, I would like to ask you a few general questions about the firm.

- Does your firm conduct only research and technology development or are you also into production? R&TD___ Prod___
- How long has the firm been in business? Years___ Since___
- About how many full-time equivalent employees do you now have? FTE___
- Are you an SBIR winner? Y___ N___
- How many Phase Is have you won? #___
- How many Phase IIs? #___
- In what year did you win your first SBIR award? Year___
- What is the firm's core technology area or areas?

  _____

  _____

  _____

Now on to the details of the questionnaire.

**1. The first question is a long one and, unfortunately, I am going to read you a list of 21 types of providers of technical and business information and services. You may want to get out a piece of paper and list them.**

1. Within my own firm
2. Manufacturers representatives or sales presentations (specify large corporations or small firms)
3. Suppliers (specify large corporations or small firms)
4. Customers (specify large corporations or small firms)
5. Competitors (specify large corporations or small firms)
6. University/college-based engineering or business extension services (including SBDCs)
7. University/college-based research institutes or centers
8. University or college departments other than above
9. Federal laboratories
10. Nonprofit research institutes (e.g., Battelle, SRI)
11. Federal agencies
12. State or local agencies
13. Trade associations, e.g., manufacturing association, tool and die association
14. Business associations, e.g., chamber of commerce
15. Engineering or scientific societies, e.g., ASPE, ASME, ACS
16. Professional societies
17. Technical or managerial consultants
18. Venture capitalists, bankers, or other financial advisors
19. Accountants, lawyers, or other similar professionals
20. Other individuals not associated with any organization listed above, e.g., friends, retirees
21. Not applicable: have not sought this information or service

Now I will read off different types of technical and managerial information and services you may have used. If you used more than one organization for one technical or managerial information or service, please also identify the one used most frequently.

Also, please differentiate between your contacting an institution or organization as opposed to an individual you know or heard about who happened to be "housed" in that organization.

For each of the following 18 categories of technical and managerial information and services I will be reading off, please think about (or look over) the list of organizations you have heard (or written down) and tell me the organization or organizations you have used in the past five years.

A. Technical information and services
   1. Product development (new or existing) # from provider list___
   2. Manufacturing process technologies #___
   3. Materials #___
   4. Scientific advances and/or technological breakthroughs #___
   5. Other technical information or services (please specify) #___

B. Managerial information and services

6. Business organization and startup #___
7. Business operations #___
8. Finance #___
9. Inventory control #___
10. Production #___
11. Distribution #___
12. Marketing #___
13. Exporting #___
14. Patents and other intellectual property rights #___
15. Licensing opportunities, processes, and matchmaking #___
16. R&TD procurement opportunities and processes #___
17. Training and retraining #___
18. Other managerial information and services (specify) #___

**2. The next question relates to how you tend to find out about the organizations or individuals from which you finally got the information or services you wanted. I will give you six possible answers and ask you to rank them.**

Again, how did you find out about the organizations or individuals which helped you:

1. From prior experience with them #___
2. From friends or business and professional colleagues, who pointed you in the right direction #___
3. From printed materials sent to you #___
4. From electronic data bases you access #___
5. From being sent by another provider organization or individual you originally contacted #___
6. From another source (specify) #___

If you were sent by another organization or individual, how many references does it tend to take to get to the organization or individual with the answer you want? #___

**3. The next set of questions has to do with your experience with the ways you tend to access information and services. What we will be discussing is the most helpful to you of the means of accessing technical and managerial information and services.**

I will read off 10 broad approaches for accessing such information and services and ask you to determine whether that approach is:

Very helpful to you (V)

Somewhat helpful (S)

Not helpful, or (N)

You have no opinion (X)

The 10 broad approaches are:

1. Conferences and workshops
2. Classes and seminars
3. Magazines, journals, bulletins, handbooks, or other reports or publications
4. Videotapes, films, television, or other video materials
5. Data bases directly accessed by you (inquiry/response)
6. Telephone or written inquiry/response or referral systems
7. One-on-one counseling at your firm's site
8. One-on-one counseling off site, i.e., at the provider's office or another location
9. Exchange of researchers between your firm and a university or federal laboratory
10. Joint research project at a university, federal laboratory, or in another firm

Of the _____ you rated "very helpful" (READ OFF LIST), please rank order them if you can.

Would there be any difference in your answers between accessing information versus accessing services?

**4 The last two questions are short and open-ended. In general, do you tend to try to contact an individual you know or heard about or an organization which you consider should have the answer? Why?**

**5. Finally, what major lesson or lessons have you learned regarding accessing technical and managerial information and services?**

*Appendix D*

## Protocol for Telephone Survey of Providers

As you know, federal and state governments as well as the private and nonprofit sectors spend a significant amount of money to provide technical and managerial information and services to technology-based small business firms. Yet, there are almost no studies on where such firms go for this information and services.

Information regarding providers of information and services like yourselves does exist, including types of providers, who they serve, and how they go about doing it. However, this information tends to be gathered by the provider organizations but not aggregated or analyzed.

The *1988 Trade and Competitiveness Act* mandates that the federal government undertake several studies, including one for which I am developing a working paper on providers of technical and managerial information and services.

OPTION 1:

Your name has been suggested to me by _____

OPTION 2:

Your name has been selected because your organization is representative of one category of providers of technical or managerial information and services.

I would like to spend about 15 minutes on the phone with you to cover several questions. Can we take the time now or shall be reschedule the call to a more convenient time today or tomorrow/Monday?

First, I would like to ask you a few questions about your organization.

What kind of information and services does your organization provide?

_____

_____

How long has the organization been providing this information and services? Years___ Since___

Has the mix of information and services changed since your organization's beginning? Y___N___ If so, in what way?

_____

_____

About how many full-time equivalent employees do you now have? FTE_____

Are your information and services open only to members? Y___N___

Now on to the details of the questionnaire.

**1. The first question has to do with broad categories of organizations and individuals to which you provide information and services. Based on your own surveys (e.g., for your own annual reports) or your impressions if such data is not available, what percentage of users come from the following 12 groups?**

1. Small business firms? %_____ Any breakdown between technology-based small firms and others?
2. Large corporations? %_____
3. Universities and colleges? %_____
4. Federal laboratories? %_____
5. Nonprofit research institutes? %_____
6. Federal agencies? %_____
7. State or local agencies? %_____
8. Trade or business associations? %_____
9. Engineering, scientific, or professional societies? %_____
10. Technical or managerial consultants; venture capitalists, bankers, or other financial advisors; accountants, lawyers, or other similar professionals? %_____
11. Foreign organizations and individuals? %_____
12. Other individuals not associated with any organization listed above? %_____

**2. The next set of questions relates to the types of information and services your organization provides. For each of the following 18 categories of technical and managerial information and services I will be reading off, please state whether your organization provides them.**

A. Technical information and services

1. Product development (new or existing) Y___N___
2. Manufacturing process technologies Y___N___
3. Materials Y___N___
4. Scientific advances and/or technological breakthroughs Y__N__
5. Other technical information and services (please specify) Y___N___

B. Managerial information and services

6. Business organization and startup Y___N___
7. Business operations Y___N___
8. Finance Y___N___
9. Inventory control Y___N___
10. Production Y___N___
11. Distribution Y___N___

12. Marketing
    Y___N___
13. Exporting
    Y___N___
14. Patents and other intellectual property rights
    Y___N___
15. Licensing opportunities, processes, and matchmaking
    Y___N___
16. R&TD procurement opportunities and processes
    Y___N___
17. Training and retraining
    Y___N___
18. Other managerial information and services (please specify)
    Y___N___

Of the ____ categories you noted (READ OFF LIST), please rank order the top three most often requested by technology-based small firms?

**3. Next, I would like to inquire about the approaches you use to provide information and services. I will read off 10 broad approaches and ask you to identify which ones you use.**

1. Conference and workshops
2. Classes and seminars
3. Magazines, journals, bulletins, handbooks, or other printed materials
4. Videotapes, films, television, or other video materials
5. Data bases directly accessed by some outside individual or organization
6. Telephone response to an outside inquiry, including referrals
7. One-on-one counseling off site, i.e., at a firm's site or another location
8. One-on-one counseling at your office
9. Exchange of researchers between your organization and a firm
10. Joint research project at your organization, a university, a federal lab, or in a private firm.

Which of these 10 broad approaches do you believe are most helpful to technology-based small business firms?

Of the _____ approaches you use (READ OFF LIST), please rank order them if you can in terms of frequency of use.

(FOR ORGANIZATION PROVIDING BOTH INFORMATION AND SERVICES) Would there be any difference in your answer between accessing information and accessing services?

**4. Does your organization respond exclusively to inquiries or do you also proactively seek individuals and organizations which can use the information and services you provide? Reactive ___Proactive __**

(FOR MEMBERSHIP ORGANIZATION) What type of marketing approaches do you use to elicit more requests for information or services from your members?

_____

_____

_____

From nonmembers?

_____

_____

**5. Finally, what major lesson or lessons have you learned regarding the provision of information and services to technology-based small firms?**

*Appendix E*

## Categories of Provider Institutions Surveyed

State government agencies
Local government agencies
Trade associations
Scientific/engineering societies
Academic-based technical assistance centers
Academic-based business assistance centers
Academic-based research and technology development centers
Manufacturing technology centers
NASA centers
Federal laboratories

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# Guides

TO PROMOTE AMERICAN BUSINESS
PRODUCTIVITY, TECHNOLOGY, AND INNOVATION

# A GUIDE TO DIRECTORIES

## Providing Information on Federal, State, and Local Initiatives

**Clearinghouse for State and Local Initiatives**
**on Productivity, Technology, and Innovation**
**Technology Administration**
**U.S. Department of Commerce**
**Washington, DC 20230**

## To Promote American Business

The *Omnibus Trade and Competitiveness Act of 1988* established the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation within the U.S. Department of Commerce. The primary mission of the Clearinghouse is to enhance nationwide awareness and use of the many federal, state, and local initiatives that seek to bolster the competitiveness of American businesses in world markets.

The Department of Commerce entered into an agreement with the U.S. Advisory Commission on Intergovernmental Relations to develop a feasible and effective operating plan for the Clearinghouse. The plan recognizes that a great deal of activity is under way to assist in promoting and adopting federal, state, and local initiatives to enhance the productivity, technology, and innovation of American businesses. Therefore, the Clearinghouse has been designed to reinforce these efforts rather than to replace or duplicate them.

This booklet is one in a series of three *Guides* being distributed by the Clearinghouse to acquaint users with the variety of resources available—including national clearinghouses that provide information and assistance on productivity improvement, technology transfer, and business innovation—and to encourage widespread contacts among organizations and experts in these fields.

Comments and suggestions for improving the guidebooks—or about other Clearinghouse activities—are welcome. In addition to these guidebooks and other information services, the Clearinghouse intends to provide policy analysis to help federal, state, and local policymakers identify and implement the most effective initiatives to stimulate business productivity, technological advance, and innovation.

Inquiries should be directed as follows:

By phone: (202) 377-0826 or 377-2922

By mail: Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation
Technology Administration
U.S. Department of Commerce
Washington, DC 20230

## How to Use This Guide

This guide summarizes 19 directories of programs and initiatives undertaken by federal, state, and local governments to stimulate business competitiveness. The directories vary considerably in the type of information and amount of detail provided. The guide includes directories that (1) focus exclusively on programs and resources that promote technology-based development; (2) emphasize a single type of business assistance, such as financial aid; (3) list development resources available at universities; and (4) provide state-by-state listings of small business assistance programs.

The directories are grouped into two broad categories—technology, research, and development; and general business and economic development. A summary of each directory describes the type and extent of information provided; directory format; and cost and contact information.

**Key Directory Features.** A table following this section provides quick reference to the type of information in each directory. Specifically, the table identifies directories of state programs involving:

*Technology Assistance*—information and specialized services that focus on problems managers face in developing and implementing new technologies, such as patent and legal information, invention evaluation, and product testing.

*Technology Research Centers*—facilities that focus on a particular area of research, generally linked with a university and/or a major state industry.

*Research Parks*—cluster of businesses often located near a university to help link university and private firms' research activities.

*Seed Capital Financing*—early stage financing for promising new and developing technological and innovative firms.

*Other Financing Assistance*—loans, royalty agreements, tax credits, and other financing mechanisms to promote the development of new and innovative businesses.

*Incubators*—facilities that nurture entrepreneurship by providing managerial, technical, and secretarial support to start-up firms.

*Worker Training*—programs that provide customized training.

*Business Assistance*—programs of general assistance, such as management counseling, accounting, and legal advice.

*Export Assistance*—programs that promote international trade capabilities of in-state firms, such as export financing, international market research, and trade advice.

*Case Studies*—analysis of selected state programs.

The table also indicates directories that provide information on federal resources and local initiatives, and highlight business promotion activities by other countries.

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| **State Programs** | | | | | | | | | | | | | | | | | | | |
| *Technology Assistance* | | * | | * | * | * | | * | * | | * | * | | | | | | | * |
| Technology Research Centers | * | * | | * | * | * | | * | * | | * | * | | | * | | | | |
| Research Parks | | * | | | * | * | | * | * | | * | * | | | | | | | |
| Seed Capital Financing | | * | | * | * | * | * | * | * | | * | * | * | | | | | | * |
| Other Financing Programs | | * | | * | * | | | * | * | | * | * | * | | | * | * | * | * |
| Incubator Facilities | | | | * | * | * | | * | * | | * | | | | * | | | | |
| Worker Training | | * | | * | * | | | * | * | | * | * | | | | | | * | * |
| Business Assistance | | * | | * | | * | | * | * | | * | * | | | * | | * | * | * |
| Export Assistance | | * | | * | | | | | | | | | | | * | * | * | * | * |
| Case Studies | | | | * | | | | | | | * | | * | | | | | | |
| **Description of Federal Resources** | | * | * | * | * | * | | | | * | | * | * | * | | | * | | * |
| **Local Initiatives** | | | | | | | | | | * | * | * | | | | | | | |
| **Description of Foreign Government Activities** | | | | | | | | | | | * | | | | | | | | |

### Directories

1. *Centers of Excellence: A Catalogue* (National Aeronautics and Space Administration and LFW Management Associates, Inc., 1988)
2. *Directory of Federal and State Business Assistance: A Guide for New and Growing Companies* (Center for Utilization of Federal Technology, National Technical Information Service, U.S. Department of Commerce, 1988)
3. *Directory of Federal Laboratories and Technology Resources 1986-1987: A Guide to Services, Facilities and Expertise* (Center for Utilization of Federal Technology, National Technical Information Service, U.S. Department of Commerce, 1986)
4. *Directory of Incentives for Business Investment and Development* (National Association of State Development Agencies, 1986)
5. *Industrial Research and Development and Technology Resource Directory* (Machinery and Allied Products Institute, 1988)
6. *Promoting Technological Excellence: The Role of State and Federal Extension Activities* (National Institute of Standards and Technology and the National Governors' Association, 1989)
7. *State-Funded Seed Capital Programs Available For New Technology-Based Ventures* (LFW Management Associates,Inc., and the National Aeronautics and Space Administration, 1989)
8. *State Technology Development Programs: A Summary and State-by-State Listing* (National Association of State Development Agencies, 1988)
9. *State Technology Programs in the U.S.* (Office of Science and Technology, Department of Trade and Economic Development, State of Minnesota, 1988)
10. *Tapping Federal Laboratories and Universities to Improve Local Economies: The Role of the Mayor and City Government* (U.S. Conference of Mayors and the U.S. Economic Development Administration, 1988)
11. *Technology-Based Regional Economic Development: An Overview* (Rensselaer Polytechnic Institute, 1988)
12. *Technology, Innovation, and Regional Economic Development* (U.S. Office of Technology Assessment, 1984)
13. *Capital Formation in the States* (U.S. Small Business Administration, 1988)
14. *Catalog of Federal Domestic Assistance* (Office of Management and Budget and the U.S. General Services Administration, annual)
15. *Directory of Economic Development Programs at State Colleges and Universities* (American Association of State Colleges and Universities, 1988)
16. *The Guide to State and Federal Resources for Economic Development* (Northeast-Midwest Institute, 1988)
17. *The Small Business Resource Guide* (AT&T and the U.S. Small Business Administration, 1988)
18. *The States and Small Business* (U.S. Small Business Administration, 1989)
19. *Working Together: A Guide to Federal and State Resources for Rural Economic Development* (U.S. Small Business Administration and Southwestern Bell, 1988)

## Technology, Research, and Development

### CENTERS OF EXCELLENCE: A CATALOGUE

108 pages, 1988

**Sponsoring Organization**
National Aeronautics and Space Administration (NASA) and LFW Management, Inc.

**Type of Information**
Summary information on state/university/industry research and development centers.

**Extent of Coverage**
Information on R&D centers for each state includes name of the statewide coordinator. Information for jointly funded R&D centers includes director's name and contact information, research focus, year established, budget information, and private industry participation.

**Directory Format**
R&D centers arranged by state.
No index.

**Cost**
Free

**Contact**
Technology Utilization Division
NASA Headquarters—Code CU
600 Independence Avenue, SW
Washington, DC 20546
(202) 453-8377

### DIRECTORY OF FEDERAL AND STATE BUSINESS ASSISTANCE: A GUIDE FOR NEW AND GROWING COMPANIES 1988-1989

170 pages, 1988

**Sponsoring Organization**
Center for Utilization of Federal Technology,
National Technical Information Service,
U.S. Department of Commerce

**Type of Information**
Descriptions of direct federal and state programs and services that address day-to-day and long-term business needs.

**Extent of Coverage**
The directory is divided into three sections: federal, state, and private.

Descriptions of 182 federal and 500 state programs and services include the type of assistance offered; eligibility requirements, and contact information. Emphasis is on state initiatives that support technology-oriented firms. The private assistance section focuses on manufacturing technology centers.

Programs included offer assistance in at least one of following areas: finance, information, networking, marketing, management, technical.

**Directory Format**
Federal section arranged alphabetically by department and agency.

State assistance programs arranged alphabetically by state.

Three private assistance organizations and a list of manufacturing technology centers included.

Index.

**Cost**
$29 plus $3.00 handling

**Contact**
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
(703) 487-4650
Order Number: PB88-101977

### DIRECTORY OF FEDERAL LABORATORY AND TECHNOLOGY RESOURCES 1986-1987: A GUIDE TO SERVICES, FACILITIES, AND EXPERTISE

300 pages, 1986

**Sponsoring Organization**
Center for the Utilization of Federal Technology,
National Technical Information Service,
U.S. Department of Commerce

**Type of Information**
Inventory of resources at federal laboratories, engineering centers, and agencies available to assist academic and business sectors.

Descriptions of facilities and programs with scientific and engineering expertise and equipment.

**Extent of Coverage**
Summarizes 900 federal resources under 32 subject categories. Resources are identified as expertise, facility, information service, or other service. Descriptions include contact information.

**Directory Format**
Arranged by subject. Resources listed by title of program or facility.

Indexed by subject, resource, state, and agency.

**Cost**
$29

**Contact**
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650
Order Number: PB86-100013

### DIRECTORY OF INCENTIVES FOR BUSINESS INVESTMENT AND DEVELOPMENT IN THE UNITED STATES: A STATE-BY-STATE GUIDE

687 pages, 1986

**Sponsoring Organization**
National Association of State Development Agencies

**Type of Information**
Compilation of state financial incentives and other assistance to attract investment by out-of-state firms and expansion by in-state businesses.

Descriptions of direct loans and loan guarantees, industrial revenue bonds, venture capital programs, and state grants to support research and development.

**Extent of Coverage**
Classifies initiatives as follows:

*Taxes and Tax Incentives*—tax credits for job creation, investment tax credits, property tax abatement, and tax exemptions for research and development.

*Special Programs*—enterprise zones, publicly chartered development banks, and worker training programs.

*Issue Specific Programs*—small business development and high technology development.

*Non-Financial Assistance*—management training, and research and development.

Descriptions include eligibility criteria, level of activity, application process, and contact information.

**Directory Format**

Arranged by state, with specific programs listed by economic development category.

Indexed by economic development subjects.

**Cost**

$68.25 plus $2.00 handling

**Contacts**

National Association of State Development Agencies
444 North Capitol Street, NW, Suite 611
Washington, DC 20001
(202) 624-5411

University Press of America (Orders)
4720 Boston Way
Lanham, MD 20705
(301) 459-3366

### THE INDUSTRIAL R&D AND TECHNOLOGY RESOURCE DIRECTORY

245 pages, 1988

**Sponsoring Organization**

Machinery and Allied Products Institute

**Type of Information**

Summaries of state industrial research and development programs, including technology transfer offices, seed capital funds, business incubators, research parks, financing assistance, and centers of excellence.

**Extent of Coverage**

The directory is divided into three sections—state technology initiatives, industrial R&D consortia, and federal technology resources.

Descriptions of state technology initiatives include program history, staffing, accomplishments, and contact information for most programs.

Detailed descriptions of 14 industrial R&D consortia that are exempt from antitrust laws under the 1984 *National Cooperative Research Act* contain the type and goal of research; number of consortium members; benefits to business members; and contact information. Another 68 consortia are identified with a statement of research objectives.

The directory also describes consortia that have filed for antitrust exemption, and how to obtain information on federal technology resources to support business research and development.

The section on federal technology transfer resources covers the following information:

Summaries of four directories published by the Center for the Utilization of Federal Technology, which identify facilities, experts, and inventions that are available to the private sector.

A list of key federal contacts for firms interested in using federally developed technology.

Descriptions of industry/government collaborative initiatives sponsored by the Department of Energy, National Institute of Standards and Technology, and National Science Foundation.

A list of 40 industry/university research centers and 14 engineering research centers sponsored by the National Science Foundation.

**Directory Format**

Individual entries listed by subject and referenced to directory section (state, industrial consortia, federal).

State programs displayed in a table (Part A, Section 1), with each program checked under one of five categories: general, business incubators, financing programs, centers of excellence, and research parks. Program descriptions and contact information are in Part B.

Indexed by subject.

**Cost**

$35 (MAPI members); $45 (non-members)

**Contact**

Machine and Allied Products Institute
1200 18th Street, NW
Washington, DC 20036
(202) 331-8430

### PROMOTING TECHNOLOGICAL EXCELLENCE: THE ROLE OF STATE AND FEDERAL EXTENSION ACTIVITIES

75 pages, 1989

**Sponsoring Organization**

National Institute of Standards and Technology and the National Governors' Association

**Type of Information**

Findings of a 1988-89 nationwide survey of state and federal organizations providing business and technology assistance to small and medium-sized businesses.

Overview of state-supported programs and federal technology extension programs, specialized technology extension programs, and conclusions and recommendations regarding an appropriate federal role in encouraging technology extension programs.

**Extent of Coverage**

Drawing on survey responses from 178 state-supported organizations and 53 federal program centers, the directory assesses state incubators, research parks, seed capital, technology assistance, and technology research centers. There is detailed information on nine state technology extension programs.

The directory describes the following federal programs: small business development centers, university centers, industrial applications centers, and trade adjustment assistance centers.

**Directory Format**

Individual programs listed under state or federal sections.

No index.

**Cost**

$15 from NGA; $17 plus $3.00 handling from NTIS

**Contacts**

National Governors' Association
444 North Capitol Street, NW
Washington, DC 20001-1572
(202) 624-5330

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
(703) 487-4650
Order Number: PB90-120742

### STATE-FUNDED SEED CAPITAL PROGRAMS AVAILABLE FOR NEW TECHNOLOGY-BASED VENTURES

108 pages, 1989

**Sponsoring Organization**

National Aeronautics and Space Administration (NASA) and LFW Management Associates, Inc.

**Type of Information**

Compendium of state seed capital programs for technology-based businesses.

**Extent of Coverage**
A brief summary of each program includes funding methods, budget, types of technology targeted, eligibility criteria, application process, and contact information.

**Directory Format**
Arranged by state.
No index.

**Cost**
Free

**Contact**
Technology Utilization Division
NASA Headquarters—Code CU
600 Independence Avenue, SW
Washington, DC 20546
(202) 453-8377

### STATE TECHNOLOGY DEVELOPMENT PROGRAMS: A SUMMARY AND STATE-BY-STATE LISTING

126 pages, 1988

**Sponsoring Organization**
National Association of State Development Agencies

**Type of Information**
Lists of more than 280 programs in 45 states to promote technological innovation, including research grants, equity capital programs, incubator facilities, management assistance, research parks, tax credits, and technical assistance.

**Extent of Coverage**
Summarizes recent and historical efforts by each state to stimulate technology-based economic development, along with data on total and per capita program expenditures, principal technologies targeted, comparison of technology policymaking bodies; and trends in technology efforts.

State technology initiatives are grouped into five broad types—programs to stimulate research, support capital investment, improve management, introduce technology into firms, and train labor—with a general description of assistance and goals. State program listings include the administering organization, year established, annual funding, technologies supported, and assistance provided.

**Directory Format**
Programs classified and described by type (Part 1) and listed by state (Part 2).

**Cost**
$20

**Contact**
National Association of State Development Agencies
444 North Capitol Street, NW, Suite 444
Washington, DC 20001
(202) 624-5411

### STATE TECHNOLOGY PROGRAMS IN THE UNITED STATES

121 pages, 1988

**Sponsoring Organization**
Governor's Office of Science and Technology,
Minnesota Department of Trade
and Economic Development

**Type of Information**
General overview of state initiatives to promote technology and stimulate innovation.

Summaries of 43 state programs.

**Extent of Coverage**
The directory defines 11 types of programs and initiatives: technology offices, technology research centers, research grants, research parks, incubators, technology transfer, technical/managerial assistance, seed and venture capital, technical training, information and networking, and royalty type investment.

Tables and charts show the following: listing of program types by state, distribution of program types for 1986 and 1988, distribution of state program expenditures for 1988, total 1988 state expenditures and source of funding, 1986 and 1988 state program funding levels, and 1988 state per capita expenditures.

Descriptions of individual programs and initiatives include the type of assistance, total state funding, funding source, and budgets.

**Directory Format**
Table on program types, by state.
Detailed state section organized by program type.
Appendix contains contact information.
Glossary of technical terms.

**Cost**
Free

**Contact**
Governor's Office of Science and Technology
Minnesota Department of Trade
and Economic Development
150 East Kellogg Boulevard
St. Paul, MN 55101
(612) 297-4368

### TAPPING FEDERAL LABORATORIES AND UNIVERSITIES TO IMPROVE LOCAL ECONOMIES: THE ROLE OF THE MAYOR AND CITY GOVERNMENT

86 pages, 1988

**Sponsoring Organization**
U.S. Conference of Mayors and the U.S. Economic Development Administration

**Type of Information**
Analysis of the role of municipal government in promoting technology transfer from federal laboratories and universities to cities.

Case studies of nine cities that have technology transfer programs.

**Extent of Coverage**
The directory examines the benefits of technology transfer and the importance of local government involvement, with an historical overview of federal policies encouraging cooperation between federal laboratories and the private sector.

Separate chapters discuss the three stages of technology transfer—research and development, product development, and commercialization—and the local role in each stage.

Ways that municipal governments can access state programs or encourage their states to establish such programs are highlighted.

The case study localities are: City-County of Los Alamos, New Mexico; City of Golden/Jefferson County, Colorado; Oak Ridge, Tennessee; Fort Wayne, Indiana; New Haven, Connecticut; Pittsburgh, Pennsylvania; Birmingham, Alabama; Philadelphia, Pennsylvania; and Tucson, Arizona.

The case studies include: brief socioeconomic profiles, economic development and technology transfer strategies, sources of technologies and technical assistance, intermediaries and facilitators, and examples of success or progress.

**Directory Format**
Table of exhibits for individual programs.

Includes (1) contact information for regional university centers of the Federal Laboratory Consortium and the Economic Development Administration, and (2) list

of directories and technical publications available from the Center for the Utilization of Federal Technology.

**Cost**
$18

**Contact**
United States Conference of Mayors
1620 Eye Street, NW
Washington, DC 20006
(202) 293-7330

### TECHNOLOGY-BASED REGIONAL ECONOMIC DEVELOPMENT: AN OVERVIEW

300 pages, 1988

**Sponsoring Organization**
Center for Science and Technology Policy,
Rensselaer Polytechnic Institute

**Type of Information**
Impact of technological change and innovation on regional economic development.

State initiatives to promote technology-based economic development.

Analysis of case studies of state programs.

Selected international programs.

**Extent of Coverage**
Thirty-three case studies of regional and state economic development initiatives are divided into four categories: direct support of research and development, technology transfer and information transfer; training and retraining; financial assistance programs; and consulting networks.

Separate chapters review the role of technology parks and incubator centers; foreign technology initiatives; Michigan's technology-based regional economic development programs, with recommendations for the Flint area; and state trends.

**Directory Format**
Appendix lists more than 550 technology-based initiatives and programs, arranged by state and title under one of the four program categories.

No index.

**Cost**
$25

**Contact**
Center for Science and Technology Policy,
School of Management
Rensselaer Polytechnic Institute
Troy, New York 12180
(518) 276-6836

### TECHNOLOGY, INNOVATION, AND REGIONAL ECONOMIC DEVELOPMENT

167 pages, 1984

**Sponsoring Organization**
Office of Technology Assessment, U.S. Congress

**Type of Information**
Analysis of the potential benefits of high technology industries to regional and local economies.

Review of state and local government initiatives, and the roles of universities, the private sector, and the federal government in promoting technology development. (A companion publication—*Encouraging High-Technology Development*—identifies the state and local programs surveyed for this study.)

**Extent of Coverage**
The directory reviews definitions of high-technology industry, with tables showing the number of jobs generated and the regional distribution of industries; factors that influence the location of high-technology industries; and the importance of start-up firms and the role of venture capital.

Findings of a 1983 survey of state and local initiatives are presented, with examples from among 153 state programs that benefit high-technology firms. Federal policies and programs reviewed include research and development, technology transfer, regional economic developments, and planning and demonstration projects.

**Directory Format**
Organized by state, universities, local government, and the private sector.

Appendices focus on (1) economic theories addressing the potential benefit of high-technology development; (2) the economic impact of formation and growth of high-technology firms; and (3) factors influencing location of high-technology firms.

No index.

**Cost**
Out of print but may be found in some libraries.

**Contact**
Office of Technology Assessment
600 Pennsylvania Avenue, SE
Washington, DC 20510
(202) 224-8996

## General Business and Economic Development

### CAPITAL FORMATION IN THE STATES

62 pages, 1988

**Sponsoring Organization**
U.S. Small Business Administration

**Type of Information**
Analysis of small business financing needs and corresponding state initiatives in terms of three stages of business development.

Descriptions of a limited number of representative state programs.

**Extent of Coverage**
Separate chapters analyze finance mechanisms for each stage of business development:

*Start-Up:* research and development grants, seed capital loans, and royalty agreements, with a list of 33 assistance programs in 19 states.

*Growth-Stage:* state program funding through direct loans, loan guarantees, equity purchases, equity guarantees, state-sponsored development corporations with private investors, tax credits for investment in venture capital companies, and export financing.

*Mature-Stage:* programs that enhance mature firms' access to capital markets by issuing debt and equity securities; state modification of state securities regulation—blue sky laws—to simplify the securities offering process for small firms; and the level of small business and venture capital investment permitted for public employee pension funds, by state (table).

**Directory Format**
Appendix, organized by program category, contains detailed descriptions of selected state programs, including program title, total funding, year of establishment, and contact information for programs and key state officials.

No index.

**Cost**
Free

**Contact**
U.S. Small Business Administration
Office of Advocacy
1441 L Street, NW
Washington, DC 20416
(202) 653-6533

### CATALOG OF FEDERAL DOMESTIC ASSISTANCE

1,300 pages, annual, with semiannual update

**Sponsoring Organization**
U.S. Office of Management and Budget
and U.S. General Services Administration

**Type of Information**
Compendium of 1,139 federal assistance programs, including business and commerce, education, employment training, and community development.

**Extent of Coverage**
Program descriptions include administering agency, objectives and goals, type of assistance, restrictions, eligibility requirements, application and award procedures, total program funding, examples of funded projects, proposal evaluation criteria, and contact information.

The catalog includes a section on writing a federal grant proposal.

**Directory Format**
Arranged by federal department. Programs listed by number within 51 agencies.

Appendices include executive review requirements, authorization, budget codes, regional and local office addresses, and information sources.

Indexed by agency program, function, subject, and applicant eligibility.

Federal Assistance Programs Retrieval Service—an on-line version of the Catalog—is operated by GSA, (202) 453-4126.

**Cost**
$38

**Contact**
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(202) 783-3238
Stock Number: 922-009-00000-7

### DIRECTORY OF ECONOMIC DEVELOPMENT PROGRAMS AT STATE COLLEGES AND UNIVERSITIES

182 pages, 1988

**Sponsoring Organization**
American Association of State Colleges and Universities

**Type of Information**
Directory of 382 economic development programs at 170 public higher education institutions.

**Extent of Coverage**
The range of programs includes centers for small business development, research and development, and technology commercialization.

Program descriptions include: goals; type of assistance/services offered; beneficiaries; program structure—staffing, advisory board, funding, and evaluation criteria; products or publications; future plans; information for colleges interested in establishing a program; and contact information.

**Directory Format**
Indexed by program objective and state.

**Cost**
$22.50 plus $2.00 handling

**Contacts**
American Association of State Colleges and Universities
One Dupont Circle
Washington, DC 20036
(202) 293-7070

University Publishing Associates (Orders)
4720 Boston Way
Lanham, MD 20706
(301) 459-3366

### THE GUIDE TO STATE AND FEDERAL RESOURCES FOR ECONOMIC DEVELOPMENT

394 pages, 1988

**Sponsoring Organization**
Northeast-Midwest Institute

**Type of Information**
List of state and major federal economic development resources.

Case studies of 60 state programs and descriptions of about 400 other state programs.

**Extent of Coverage**
The directory is divided into two parts—state and federal.

State economic development efforts include business development, cooperative research, finance, technology centers, targeted development programs, trade, infrastructure, training, and tax incentives. Separate chapters on each category contain an overview, case studies of selected state programs, and brief summaries of additional programs. Tables show programs for financial and technical assistance, tax incentives, assistance targeted to distressed areas, and small businesses.

The federal section focuses on economic assistance programs (grants, loans, loan guarantees, and technical assistance) administered by the Departments of Housing and Urban Development, Labor, Commerce, and Agriculture, and the Small Business Administration. Each program description includes eligibility criteria, current and projected funding, distribution of funds by state (table), discussion of common problems, program contacts, and local agency office locations.

**Directory Format**
Chapters arranged by types of assistance, with programs arranged by agency and program type.

Reference tables identify state development areas.
No index.

**Cost**
$37.50 plus $2.00 handling

**Contact**
Northeast-Midwest Institute
218 D Street, SE
Washington, DC 20003
(202) 544-5200

### THE SMALL BUSINESS RESOURCE GUIDE

133 pages, 1988

**Sponsoring Organization**
AT&T & U.S. Small Business Administration

**Type of Information**
Directory of federal, state, and private agencies and organizations that provide assistance and information for small business.

**Extent of Coverage**

The directory is divided into three sections—federal, state, and private.

The federal section identifies agencies, offices, and programs, with a brief description of each type of assistance and contact information.

The state section lists agencies offering programs or assistance under the following categories: business development, financial assistance, procurement assistance, publications, special programs, and international trade. Contact information is included for the state economic development agency. There are no descriptions of individual programs.

A separate section lists private business associations and trade groups, with short descriptions of services. There are listings of television shows focusing on business issues and publications for small business managers.

**Directory Format**

Appendices list regional offices of federal departments and agencies, as well as contact information; federal agencies that maintain a Small Business Innovation Research (SBIR) program; foreign embassies and foreign chambers of commerce in the United States; and American Chamber of Commerce offices abroad, with contacts.

Glossary of small business terms.

No index.

**Cost**

Free

**Contact**

U.S. Small Business Administration
The Answer Desk
1441 L Street, NW
Washington, DC 20416
(202) 653-7562

### THE STATES AND SMALL BUSINESS: A DIRECTORY OF PROGRAMS AND ACTIVITIES

411 pages, 1989

**Sponsoring Organization**

U.S. Small Business Administration

**Type of Information**

Directory of state assistance programs, offices, and legislation to aid small business.

**Extent of Coverage**

State assistance programs covered include management, finance, procurement, joint ventures, and regulatory requirements.

For each state, small business assistance is divided into five categories: small business offices, programs, and activities; governor's advisory council or task force; legislative committees and subcommittees; legislation; state small business conferences.

Summaries of 1987 and 1988 state legislation are featured. Each entry describes program goals, type of assistance, and contact information.

**Directory Format**

Arranged by state. Programs classified by assistance categories.

Appendices identify state Small Business Development Centers and the 10 regional SBA offices, with contact information; and business regulatory flexibility acts in 24 states.

Glossary of business development terms.

No index.

**Cost**

$12

**Contact**

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(202) 783-3238
Stock Number: 045-000-00257-8

### WORKING TOGETHER: A GUIDE TO FEDERAL AND STATE RESOURCES FOR RURAL ECONOMIC DEVELOPMENT

207 pages, 1988

**Sponsoring Organization**

U.S. Small Business Administration
and Southwestern Bell Telephone

**Type of Information**

Summaries of federal and state programs for rural economic development.

**Extent of Coverage**

The directory is divided into two sections—federal and state.

Assistance programs highlighted are financial assistance, business development, procurement assistance, and minority small business assistance, with contact names and phone numbers.

The federal programs provide assistance in at least one of the following areas: small business, agriculture and rural communities, economic development, communities affected by defense programs, vocational and adult education, energy related development, health and human services, community development grants, development of American Indian lands and people, job training, and transportation. Summaries include contact information for programs and federal offices in each state.

The state section lists 700 programs, divided under six assistance categories: capital/finance, information/technical assistance, infrastructure, marketing, technology, and workforce.

Program descriptions include contact information for programs and key state officials. There is an overview of types of rural assistance across states (chart).

**Directory Format**

Federal programs arranged by agency.

State programs arranged by state. Programs classified by assistance categories.

No index.

**Cost**

Free

**Contact**

U.S. Small Business Administration
1441 L Street, NW
Washington, DC 20146
(202) 653-6365

TO PROMOTE AMERICAN BUSINESS
PRODUCTIVITY, TECHNOLOGY, AND INNOVATION

# A GUIDE TO NATIONAL CLEARINGHOUSES

**on Federal, State, and Local Information and Assistance**

**Clearinghouse for State and Local Initiatives**
**on Productivity, Technology, and Innovation**
**Technology Administration**
**U.S. Department of Commerce**
**Washington, DC 20230**

## To Promote American Business

The *Omnibus Trade and Competitiveness Act of 1988* established the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation within the U.S. Department of Commerce. The primary mission of the Clearinghouse is to enhance nationwide awareness and use of the many federal, state, and local initiatives that seek to bolster the competitiveness of American businesses in world markets. These initiatives include technology transfer, workforce preparation, international trade, innovative management and financing, and other essential services to the business community.

The Department of Commerce entered into an agreement with the U.S. Advisory Commission on Intergovernmental Relations to develop a feasible and effective operating plan for this Clearinghouse. The plan recognized that a great deal of activity is under way to assist in promoting and adopting federal, state, and local initiatives designed to enhance the productivity, technology, and innovation of American businesses. Therefore, the Clearinghouse was designed to reinforce these efforts rather than to replace or duplicate them.

This booklet is one in a series of three guides distributed by the Clearinghouse to acquaint users with the variety of resources available. It is a national directory of clearinghouses that provide information and assistance on federal, state, and local initiatives in these fields. The other guides feature published directories of federal, state, and local initiatives on productivity, technology, and innovation, and a roster of contacts for use by organizations and experts in these fields to help them improve their services.

Comments about the guidebooks—or other Clearinghouse activities—and suggestions for improvement are welcome. In addition to these guidebooks and other information services, the Clearinghouse intends to provide policy analysis services designed to help federal, state, and local policymakers identify and implement the most effective initiatives to stimulate business productivity, technological advance, and innovation.

Inquiries should be directed as follows:

By phone: (202) 377-0826 or 377-2922

By mail: Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation
Technology Administration
U.S. Department of Commerce
Washington, DC 20230

## How to Use this Guide

This guide describes 21 national clearinghouses that provide information on community and economic development programs, state and local government management, or technology and technology transfer. Users of these clearinghouses include state and local governments seeking innovative economic development strategies, private sector firms requiring technical assistance, business assistance providers looking for additional information for their clients, community organizations seeking to network with other organizations, and academic researchers looking for scientific technological breakthroughs.

This guide delineates the kind of information, assistance, and products offered by each clearinghouse. Emphasis is on the nature and scope of information available, how to obtain access to this information, and related fees and charges. The major features of these clearinghouses are tabulated for easy reference.

The clearinghouses presented in this guide have been grouped into three functional categories according to the type of information provided: community and economic development, state and local government operations, and technology information.

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## Services Offered by the Clearinghouses

| | On-Line to Users | | Not On-Line to Users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | On-Line and Staff Assistance | On-Line No Assistance | Auto-mated for Staff Searches | Not Auto-mated/ Manual Search by Staff | Contact Referral Service | Electronic Bulletin Board | Distributes Own Publications | Distributes Other Publica-tions | Member Technical Assis-tance | Non-Member Technical Assis-tance | Access to Expert Con-tacts |
| **Community and Economic Development** | | | | | | | | | | | |
| Community Information Exchange | EN | EN | | | EN | EN | EN | | EN | | EN |
| CUED | | | | DSR | DSR | | DSR | | DSR | | DSR |
| FAPRS | DB | | | | | | DB | | | | |
| Handsnet | | EN | | | EN | EN | | | EN | | EN |
| NAB | | | DSR | | | | DSR | | | | DSR |
| NAMTAC | | | | B | B | | | | B | | B |
| Rural Information Center | CS | CS | | | CS | CS | CS | CS | CS | | |
| SBDC Connection | | | B | | B | | B | | B | | B |
| Thriving Hometowns | | | DSR | | DSR | | DSR | | DSR | DSR | DSR |
| **State and Local Government Operations** | | | | | | | | | | | |
| CIVITEX | | | DSR | | DSR | | DSR | | | | DSR |
| ISIS | DB | DB | | | | | DB | DB | DB | | |
| Legisnet | DB | DB | | | | | DB | DB | DB | | DB |
| Local Exchange | EN | | | | EN | EN | EN | | EN | | EN |
| Login | EN | | | | | EN | | | | | |
| MIS | | | DSR | | DSR | | DSR | DSR | | | DSR |
| **Technology Information** | | | | | | | | | | | |
| File FATD | | DB | | | | | DB | DB | | | DB |
| FEDRIP | | DB | | | | | | | | | DB |
| FLC | | | B | | B | B | | | B | | B |
| NASA TU | | | CS | | CS | | | | CS | | |
| TAIS | DB | | | | DB | | DB | | | DB | DB |

**Legend:**
EN—Electronic Network
DB—On-Line Data Base
DSR—Document Search and Retrieval
B—Broker Services
CS—Combined Services

## Methods of Access to Clearinghouses

The clearinghouses can be grouped into five categories that reflect major differences in the methods of user access to data bases:

- Electronic Networks;
- On-Line Data Bases;
- Document Search and Retrieval Services;
- Broker Services; and
- Combined Services.

**Electronic Networks.** Electronic network clearinghouses provide users with both on-line access to computerized data bases and interactive electronic networking services. These data bases generally encompass multiple subsets, bibliographic citations, abstracts, and contact information, and are keyword driven.

The unique feature of electronic network clearinghouses is that they offer users an additional avenue of information—on-line communication with other users. Through electronic mail and electronic bulletin board services, users may exchange messages and documents directly with other users, as well as post information on upcoming conferences, legislation, and programs. After review, much of this user-generated information is incorporated into the clearinghouse data base.

**On-Line Data Bases.** These clearinghouses, like the electronic networks described above, offer users direct computer access to clearinghouse data bases and often provide access to other on-line data bases. They do not have electronic networking features.

**Document Search and Retrieval Services.** The clearinghouses in this category generally maintain computerized data bases accessible only by clearinghouse staff. Users must call or write the clearinghouse and describe the type of information sought. The clearinghouse will mail or FAX the information to the user.

**Broker Services.** Broker clearinghouses locate individuals who can provide the necessary information or assistance to users. Some of the clearinghouses in this category are on-line to users, while others must be accessed by clearinghouse staff. In general, these clearinghouses do not produce publications or provide other services.

**Combined Services.** These clearinghouses combine several of the attributes of the other categories, but no single approach is predominant. Some of the specific activities combined include computerized data bases, information retrieval, broker services, and electronic networking capabilities.

The Clearinghouses are listed by method of access.

**Electronic Networks**

Community Information Exchange

HandsNet

Local Exchange—National League of Cities et al.

LOGIN—William C. Norris Institute

**On-Line Data Bases**

Federal Laboratory Technology Data Base (File FATD)—Center for the Utilization of Federal Technology (CUFT) within the National Technical Information Service (NTIS)

Federal Assistance Programs Retrieval System (on-line version of *Catalog of Federal Domestic Assistance*)—U.S. General Services Administration

Federal Research in Progress (FEDRIP) Data Base—National Technical Information Service (NTIS)

Integrated State Information System (ISIS)—Council of State Governments (CSG)

National Legislative Network (LEGISNET)—National Conference of State Legislatures (NCSL)

Technology Applications Information System (TAIS)—Strategic Defense Initiative Organization, Department of Defense

**Document Search and Retrieval Services**

CIVITEX—National Civic League

Management Information System (MIS)—International City Management Association (ICMA)

National Alliance of Business Clearinghouse (NAB)

National Council for Urban Economic Development Clearinghouse (CUED)

Thriving Hometowns Network—National Association of Towns and Townships (NATaT)

**Broker Services**

Federal Laboratory Consortium Clearinghouse (FLC)

National Association of Management and Technical Assistance Centers (NAMTAC)

SBDC Connection

Teltech

**Combined Services**

Rural Information Center—U.S. Department of Agriculture Extension Service and the National Agricultural Library

Technology Utilization Program (TU)—National Aeronautics and Space Administration (NASA)

## NATIONAL COUNCIL FOR URBAN ECONOMIC DEVELOPMENT CLEARINGHOUSE (CUED)

**Sponsoring Organization**
National Council for Urban Economic Development

**Information and Services**
Economic development programs and strategies nationwide, including enterprise zones and education/economic development linkages.

Technical Advisory Service for cities and communities, to provide advice and recommendations on development strategies.

**Nature and Scope of the Data Base**
Includes books, periodicals, government reports, formal papers, CUED publications, and clippings and articles. Not computerized.

**Data Sources**
Reports from CUED members, including state and local elected officials, community organization leaders, entrepreneurs, and academicians.

Staff research and technical assistance projects.

Subscriptions and publications exchange.

**Access to Clearinghouse**
Access is through phone inquiries or mail. CUED publications are key in disseminating information to users.

**Clearinghouse Publications**
None.

CUED publications filed with the Clearinghouse include:

*Developments*, newsletter (22 times a year);

*Commentary*, journal about successful economic development projects (quarterly);

*Economic Development Abroad*, newsletter (bimonthly); and

*Information Service Reports*, analyses of practical technical topics, such as innovation in state and local development, entrepreneurial development, and working capital for small business.

CUED also publishes annual reviews on economic development and the federal budget; a legislative update series; and "how-to" guides and manuals on a range of subjects, such as establishing small business incubators.

**Users**
Open primarily to CUED staff and members. Nonmembers may use the Clearinghouse depending on staff availability and the nature of the request.

**Fees**
Membership fees, $265 to $575 annually, including publications.

Charges for staff time and copying for information requests requiring extensive research.

Nonmembers charged for each request.

**Contact**
Ms. Nancy McCrea
National Council for Urban Economic Development
1730 K Street, NW, Suite 915
Washington, DC 20006
(202) 223-4735

## COMMUNITY INFORMATION EXCHANGE

**Sponsoring Organization**
Community Information Exchange

**Information and Services**
How to plan, finance, and develop community revitalization projects.

Case studies, leads on funding sources, referrals to technical experts, sample documents, and technical bulletins.

On-line network and customized research service.

**Nature and Scope of the Data Base**
Contains about 270 case studies of community development projects, 225 listings of funding sources, 225 listings of technical assistance providers, and an annotated bibliography of about 400 publications covering community revitalization issues. Computerized.

**Data Sources**
Newsletters of other organizations.

Books, reports, and conferences.

User contributions through networking and the electronic bulletin board.

**Access to Clearinghouse**
Access is through a modem and computer terminal. Users' manual provided. On telephone inquiries, staff searches the data bases.

**Clearinghouse Publications**
*Alert*, community development newsletter (bimonthly).

*Knowledge Bits*, one-page resource checklist (monthly).

The Exchange also produces technical bulletins and periodic special information packets on selected revitalization topics.

**Users**
Subscribers include community-based organizations, national and regional organizations, state and local economic development offices, foundations, and church groups, generally working for revitalization of low-income areas.

**Fees**
Annual subscription, $50.

Computer fees, $25. Access, $40 per hour for community groups and $70 per hour for all others. Computer networking facilities, $10 per hour for community groups, $20 for others.

Staff assistance, the same as the hourly computer fees ($40/$70). Customized research, $85 per hour for community groups and $125 per hour for others.

**Contact**
Ms. Dorothie Haygood
Community Information Exchange
1029 Vermont Avenue, NW, Suite 710
Washington, DC 20005
(202) 628-2981

## FEDERAL ASSISTANCE PROGRAMS RETRIEVAL SYSTEM (FAPRS)

**Sponsoring Organization**
U.S. General Services Administration (GSA)

**Information and Services**
On-line access to the *Catalog of Federal Domestic Assistance*. Includes federal domestic assistance programs, including federal grants, loans, loan guarantees, and technical assistance.

Technical assistance available.

**Nature and Scope of the Data Base**
Contains more than 1,000 assistance programs administered by 51 federal agencies, with summaries of

agency functions, descriptions of assistance programs, eligibility criteria, and contact information.

Organized in question-answer and key word format. FAPRS provides a list of program numbers and titles, the full text of selected programs; or specific sections of the text.

**Data Sources**

*Catalog of Federal Domestic Assistance*

**Access to Clearinghouse**

Access is through a modem and computer terminal.

**Clearinghouse Publications**

*Catalog of Federal Domestic Assistance* and a semiannual newsletter.

**Users**

Users include state and local governments, small businesses, researchers, and libraries.

**Fees**

Cost-recovery basis. No initiation or monthly fees.

Telephone fees:

800 telephone service—$6.18/hour or
Telenet service—$1.36-$2.60/hour

Data Processing fees (prime time rates):

Connect Time—$3.00/hour
CPU Time—$.96/second

GSA estimates that the average total cost for a prime time on-line session is:

$4-$6 for one search
$7-$9 for two searches
$10-$13 for three searches

Keyword searches are more expensive.

**Contact**

Mr. A. Jerald Varner
Federal Domestic Assistance Catalog Staff (WKU)
General Services Administration
300 7th Street, SW
Ground Floor, Reporters Building
Washington, DC 20407
(202) 453-4126 (until June 1, 1990)
(202) 708-5126 (effective June 1, 1990)

## [ANDSNET

**Sponsoring Organization**

HandsNet

**Information and Services**

On-line library covering human service issues, including hunger, housing and homelessness, health care, legal services, community and economic development, and available resources and funding.

Electronic mail services.

Network from subscribing support centers. On-line technical assistance; toll-free number for assistance.

**Nature and Scope of the Data Base**

On-line library, updated daily, of full-text articles, organized by subject and key words. Includes legislative alerts, calendar events, news and analysis of public policy, summaries from major daily papers and wire services, updates on laws and regulations, data bases of poverty statistics, Federal Register abstracts, and descriptions of model programs.

**Data Sources**

Data from national research centers, state and local government agencies, public policy advocates, service organizations, community action associations, legal service programs, and grassroots coalitions.

Subscriber surveys.

**Users**

Subscribers include housing advocates, homeless shelters, food and nutrition programs, health care providers, public policy activists, legal service providers, and others working on human service issues.

**Clearinghouse Publications**

Newsletter describing the work of the network, available on request.

**Access to Clearinghouse**

Access is through a modem and computer, using CONNECT software.

**Fees**

Subscription fee, $25 per month or $270 per year. Discounts available for group subscriptions. Required $100 purchase of software.

On-line charges:

$10 per hour during business hours,
$5 per hour nights, weekends, and holidays.

Local access numbers in most areas.

**Contact**

HandsNet Subscriptions
819 Pacific Avenue,Suite 2
Santa Cruz, CA 95060
(408) 427-0808
Fax: (408) 427-0115
Connect ID: HN0004

## NATIONAL ALLIANCE OF BUSINESS CLEARINGHOUSE (NAB)

**Sponsoring Organization**

National Alliance of Business Special Research Library

**Information and Services**

Case studies on employment, job training, education reform, and workplace learning to help businesses fill the need for highly qualified, job-ready workers. Includes information on economic development, entrepreneurship, worker dislocation, tax incentives, and on-the-job training opportunities.

Services include: quick answer service (locating facts, studies, and appropriate experts); information searches (compiling information packages from a variety of sources); and literature searches and bibliography preparations.

**Nature and Scope of the Data Base**

Consists of four computerized files:

Abstracts of more than 2,100 policy reports and how-to publications;

Contact information for a network of national, regional, state, and local sources of information and technical assistance;

Profiles of 700 innovative training projects, listing funding sources and amounts, target populations and occupations, types of training, business involvement, and contacts; and

Descriptions of 325 model state and local employment training and education programs.

**Data Sources**

Special projects conducted by NAB and jointly with three other organizations.

**Access to Clearinghouse**

Access is by phone, mail, and visit. In addition to the data base, the Special Research Library has a traditional collection of materials and books on employment, training, and economic development.

**Clearinghouse Publications**

None.

NAB produces numerous publications on workforce issues.

**Users**

Direct access limited to NAB staff. Arrangements may be made with the Special Research Library to obtain information.

**Fees**

None.

**Contact**

Ms. Helen White, Senior Manager
Clearinghouse Information Services
National Alliance of Business
1201 New York Avenue, NW
Washington, DC 20005
(202) 289-2910

## NATIONAL ASSOCIATION OF MANAGEMENT AND TECHNICAL ASSISTANCE CENTERS (NAMTAC)

**Sponsoring Organization**

National Association of Management and Technical Assistance Centers

**Information and Services**

Support service to NAMTAC members, supplying information and assistance on administrative, programmatic, and policy issues related to operation of university-based management and technical assistance centers.

**Nature and Scope of the Data Base**

Monthly newsletter and other publications; conferences, seminars, and workshops spotlighting such issues as: entrepreneurship and new ventures; commercializing basic university research; developing international markets; dealing with dislocations caused by plant closings; improving manufacturing productivity; and the university's role in statewide economic development.

**Data Sources**

Members, which are university-based agencies, provide information.

**Access to Clearinghouse**

Access is by phone and mail from members and others.

**Clearinghouse Publications**

*NAMTAC Newsletter* (monthly) on legislation and other developments of interest to members.

*Resource Guide* describes programs of all NAMTAC members.

Compilation of the evaluation forms used by members and a list of member publications.

**Users**

Primary users are NAMTAC members. Others may call for referrals.

**Fees**

Organizational membership, $250 per year. Individual membership: $50 per year for those in NAMTAC constituency organizations; $250 for others.

Associate and affiliate memberships are available to agencies that share NAMTAC goals but are not university based.

**Contact**

Mr. Harold Williams
NAMTAC
733 15th Street, NW, Suite 917
Washington, DC 20005
(202) 347-6740

## RURAL INFORMATION CENTER

**Sponsoring Organization**

Rural Information Center, U.S. Department of Agriculture

**Information and Services**

Information and referral services on rural revitalization, including economic development, local government services, health services, quality of life and natural resources, and leadership and community change.

Referrals to outside organizations or experts.

Extension Service offices for additional technical consultation.

National Agricultural Library electronic bulletin board service, (301) 344-8510.

**Nature and Scope of the Data Base**

National Agricultural Library and the Extension Service's nationwide educational network. Computerized.

The Library maintains an extensive collection of books, journals, instructional program manuals, audio-visual materials, and computer software; and AGRICOLA, an index to more than 2.5 million books and articles.

The nationwide extension network provides program expertise and follow-up assistance, as well as outreach contacts.

Computer access available to several other data bases, including DIALOG, LOGIN (Local Government Information Network), NARS (Narrative Accomplishment Reporting System), FAPRS (Federal Assistance Programs Retrieval System), and IRCN (International Resource Center Network).

**Data Sources**

National Agricultural Library.
Center staff research.
Extension Service programs and contacts.

**Access to Clearinghouse**

Access is through the Extension Service's nationwide network of county and state offices, or by mail, E-mail, electronic bulletin board, and phone.

**Clearinghouse Publications**

*Rural Information Center Publication Series*
*Quick Bibliographies*

**Users**

Users include state and local governments, academic institutions, and community organizations working on rural revitalization. Open to anyone interested in rural development.

**Fees**

No fee for RIC publications and data base searches by staff. Cost-recovery fees for extensive searches.

**Contact**

Ms. Patricia John
Rural Information Center
National Agricultural Library, Room 304
Beltsville, MD 20705
(301) 344-2547

## SBDC CONNECTION: THE INFORMATION LINK FOR SMALL BUSINESS

**Sponsoring Organization**

U.S. Small Business Administration (SBA), in cooperation with the Association of Small Business Development Centers (SBDCs); managed by a University of Georgia SBDC.

**Information and Services**

Nationwide data base for use by SBDCs on SBDC programs, experiences, and activities in providing business assistance, for use by SBDCs.

No technical assistance.

**Nature and Scope of the Data Base**

Began service in April 1989. Information collected from each SBDC encompasses business counseling, training, management, finance, marketing, engineering, and technical assistance programs.

SBDCs generally are located in colleges, universities, and vocational schools, but also may be found in some local chambers of commerce and economic development corporations.

**Data Sources**

SBDC offices and the SBA.

**Access to Clearinghouse**

Access is through an 800 phone number, mail, and FAX. On-line access expected in the future.

**Clearinghouse Publications**

Newsletter, bibliographies, and other materials. Disseminates SBDC materials and SBA program information. Documents may be borrowed.

**Users**

Restricted to the 54 SBDCs in 47 states, Puerto Rico, and the Virgin Islands. In each, a lead SBDC extends the services offered through a network of subcenters, for a total of more than 600 service locations. Service to other cooperating agencies and institutions is available with some restrictions.

**Fees**

Cost-recovery fee for copying six pages or more.
Postage fees charged.
Computer search time fee for detailed inquiries, billed through an SBDC account.

**Contact**

Ms. Deborah Sommer
SBDC Connection
University of Georgia
1180 East Broad Street
Athens, GA 30602
(404) 542-5760

## THE THRIVING HOMETOWNS NETWORK

**Sponsoring Organization**

National Association of Towns and Townships (NATaT)

**Information and Services**

Data base of small town economic development case studies on how small communities can learn and adopt new approaches to problems, such as job creation.

Case studies describe economic problems faced by the community; community demographics; economic development strategy; project activities; organizations, governments, and others who spearheaded or assisted the project; total cost; project financing; obstacles encountered and how they were overcome; project benefits and results. Includes contacts.

No technical assistance.

**Nature and Scope of the Data Base**

Network expected to be in operation by May 1990, with about 100 small town economic development case studies. Additional case studies will be added on a continuing basis.

**Data Sources**

Case studies from NATaT files. Network expects to solicit new small town examples on a continuing basis. (Approximately 11,000 small local governments are members of NATaT.)

**Access to Clearinghouse**

Initial access is by phone or letter for an inquiry form. Network staff searches the data base and mails the appropriate case studies.

**Clearinghouse Publications**

Guidebooks, videos, and workshops on strategies for solving small town problems, from NATaT's Center for Small Communities.

**Users**

Expected users include local elected officials, rural development specialists, community organizations, state agency staff, and local colleges.

**Fees**

NATaT expects to charge a nominal fee based on the number of searches requested.

**Contact**

Ms. Nancy Stark
Thriving Hometowns Network
National Association of Towns and Townships
1522 K Street, NW, Suite 730
Washington, DC 20005
(202) 737-5200

## CIVIC INFORMATION AND TECHNIQUES EXCHANGE (CIVITEX)

**Sponsoring Organization**
National Civic League

**Information and Services**
Information and referral service focused on methods of community problem solving.
No technical assistance.

**Nature and Scope of the Data Base**
Three computerized data bases:
Profile Data Base—brief descriptions of more than 700 recent and active community projects; project profiles describe the type of problem, how the problem was solved, the type of financing. Includes contacts. Types of problems involve economic development, health, housing, education, and the environment.
CIVIDEX Data Base—referral information on approximately 200 organizations; and
Civic Studies Data Base—one-page summaries of approximately 800 problem-solving projects of the 1980s.

**Data Sources**
National Civic League All-America Cities program.
Local Initiatives Support Corporation.
John Hay Whitney Foundation.
Local groups and individuals involved in community initiatives.
Data bases verified and updated periodically.

**Access to Clearinghouse**
Access is through a toll-free number. Staff searches the data bases and mails the appropriate profiles.

**Clearinghouse Publications**
None.
The National Civic League publishes:
*National Civic Review*, focusing on innovative methods of solving community problems (bimonthly).
*Civic Action*, newsletter (bimonthly).
National Civic League publications list available.

**Users**
Users include local governments, community groups, churches, businesses, and nonprofit organizations. Open to any individual or organization.

**Fees**
Charge per search, depending on number of profiles.
National Civic League membership includes five searches: individuals, $50; corporations, $100; local governments, $100-$300, according to population; nonprofit organizations, $75.

**Contacts**
Ms. Joanne Greek
Ms. Betsy Horsley
CIVITEX
National Civic League
1601 Grant Street, Suite 250
Denver, C0 80203
(800) 223-6004

## INTEGRATED STATE INFORMATION SYSTEM (ISIS)

**Sponsoring Organization**
States Information Center, Council of State Governments (CSG).

**Information and Services**
Documents, abstracts, and bibliographies on topics of interest to state legislative, executive, and judicial branches of government.
Response to specific inquiries and document loans.

**Nature and Scope of the Data Base**
Two computerized data bases:
BiblioFile—bibliographic data base containing more than 9,000 titles. Includes records for state and federal documents listed in the *State Government Research Checklist* since March 1981 and other documents published by CSG and other organizations; and
StataBase—long-text data base containing more than 2,500 abstracts and full-text records of CSG products. Includes abstracts of CSG issue briefs, newsletter articles, model legislation, and innovative state programs.

**Data Sources**
State agencies.
CSG research and program staff.
Federal agencies and public interest associations.

**Access to Clearinghouse**
Access for CSG members is through a modem and computer terminal or telephone requests. On-line searches by key words.

**Clearinghouse Publications**
*Backgrounders* (periodic), brief summaries of reports in the ISIS data base on subjects of current interest to the states.

**Users**
Available only to state government officials and staff, and to private sector members of the CSG Associates Program. Primary users are legislative branches.

**Fees**
Part of CSG membership fee; telephone line charges are separate.

**Contact**
Mr. William Voit
Integrated State Information System
States Information Center
Council of State Governments
Iron Works Pike
P.O. Box 11910
Lexington, KY 40578
(606) 231-1827

## NATIONAL LEGISLATIVE NETWORK (LEGISNET)

**Sponsoring Organization**
National Conference of State Legislatures

**Information and Services**
On-line data base of state legislative report abstracts, program evaluations, briefs on state legislative issues, case law, and federal and association reports.

**Nature and Scope of the Data Base**
Three on-line data bases:
Legislative Information System (LIS)—more than 12,000 reports, monographs, papers, briefs, and articles;
Uniform and Model Acts—will contain all the acts promulgated by the National Conference of Commissioners on Uniform State Laws, as well as model acts prepared by other organizations; and
LEGISNET Index—on-line version of the LEGISNET thesaurus.
No technical assistance.

**Data Sources**

State legislatures and executive offices, and other state government associations.

Private associations, research organizations, and the federal government.

**Access to Clearinghouse**

Access is through a modem and computer or request for NCSL staff to search the data base. LEGISNET training sessions are available.

Abstracts, issue briefs, and articles are available for full text printing by the user. Other documents must be ordered through LEGISNET.

**Clearinghouse Publications**

None.

NCSL publishes a number of publications on innovative economic development strategies.

**Users**

Available to state legislators and their staffs. Others subscribe to NCSL's Foundation for State Legislatures.

**Fees**

No charge for state legislatures. Foundation for State Legislatures subscriptions, $1,500.

**Contacts**

Mr. Bob Frohling
Ms. Jo Martinez
LEGISNET
National Conference of State Legislatures
1050 17th Street, Suite 2100
Denver, CO 80265
(303) 623-7800

## LOCAL EXCHANGE

**Sponsoring Organization**

National League of Cities (NLC), International City Management Association (ICMA), Public Technology, Inc. (PTI), Government Finance Officers' Association (GFOA), and Association of Metropolitan Sewerage Agencies (AMSA), developed in partnership with GTE Education Service.

**Information and Services**

On-line information network for local government policy development and problem solving. Includes information on such topics as management, finance, budgeting, and improving municipal services.

Electronic bulletin boards cover administration, community and economic development, public safety and public works, university communities, small communities, legislative and regulatory updates, and general topics.

Opportunity to conduct on-line workshops on specific topics, and to generate questionnaires, conference registration forms, and other types of forms. Subscribers provide information to other organizations in an easily usable form.

**Nature and Scope of the Data Base**

Eight computerized data bases include:

NLC's Urban Affairs Abstracts—monthly service, articles from 400 municipally oriented periodicals;

Local Government Solutions—more than 2,000 case studies collected by NLC, PTI, and ICMA that document innovative solutions to local problems;

NLC's Economic Development Dispatches—100 files of information on case studies, publications, and news about upcoming conferences;

PTI's and ICMA's Microlink—a data base with information about microcomputer applications, product announcements, and networking issues;

NLC's Legislative News—information on current legislative and regulatory news;

GFOA's GF-Net—more than 600 abstracts of interest to municipal finance officers (covering economic, Federal Reserve, money market, municipal market, and municipal ratings). GF-Net is updated several times a day from the Dow Jones Capital Markets Wire;

ICMA's Jobs—an up-to-date listing of job opportunities in local governments;

User Directory—a listing of all Local Exchange users, including addresses and telephone numbers.

**Data Sources**

NLC, ICMA, PTA, and GFOA.

**Access to Clearinghouse**

Access is through a modem and computer terminal. Search by key words.

Subscribers receive a training diskette. An 800 customer service phone number also is available.

**Clearinghouse Publications**

None.

Sponsoring organizations produce a number of publications of interest to state and local governments.

**Users**

Primary users are local government officials and their staffs.

**Fees**

Subscription service. Fees based on population: over 100,000, of $700 for seven sign-on IDs; 25,000 to 100,000, $500 for five IDs; and under 25,000, $300 for three IDs.

State municipal leagues, $400 for three IDs; additional IDs, $45.

Hourly connect charges and transmission charges.

**Contact**

Ms. Kathryn Shane McCarty
Director of Information Services
Local Exchange
National League of Cities
1301 Pennsylvania Avenue, NW
Washington, DC 20004
(202) 626-3180

## LOCAL GOVERNMENT INFORMATION NETWORK (LOGIN)

**Sponsoring Organization**

William C. Norris Institute (Control Data Corporation)

**Information and Services**

On-line information service offering articles, case studies, program descriptions, and other information on issues ranging from solid waste disposal and economic development to city arts and cultural programs.

Electronic mail feature with a question and answer format.

**Nature and Scope of the Data Base**

Computerized data base contains some 40,000-50,000 articles, program descriptions, and other information. Search by key words. Includes a subject line, a 3-4 line summary, the text, and contact person.

Types of information include:

Case studies of innovative local government programs, projects, policies, and practices;

Announcements of new federal loans and grants and federal program changes;

Updates and news briefs about pending federal legislation;

Innovations in local government finance;

Approaches for serving the elderly, the homeless, and victims of domestic violence;

Urban technologies from other countries;

Examples of private-sector initiatives and public-private cooperation;

Syndicated articles on state and local government issues;

Case studies of economic and community development; and

Approaches and educational resources for improving productivity in government.

On-line access to the Greenwood Press *Index to Current Urban Documents*, which lists more than 3,500 citations.

**Data Sources**

Variety of organizations that serve local governments, such as U.S. Conference of Mayors, National League of Cities, League of California Cities, Academy for State and Local Government, Harvard University John F. Kennedy School of Government, U.S. Department of Housing and Urban Development, and U.S. Department of Energy.

**Access to Clearinghouse**

Access is through a modem and a computer terminal via one of more than 400 access ports across the country. Users assigned an ID. Search by key words.

Subscribers receive a user manual and reference guide. Toll-free assistance hot-line is available.

**Clearinghouse Publications**

None.

Documents cited in the Greenwood Press Index may be ordered through LOGIN.

**Users**

Open only to local government officials, state municipal leagues, state and federal agencies, and nonprofit organizations serving local governments.

**Fees**

Annual subscription/membership package ranging from almost $3,000 to almost $6,000. Special membership packages available for smaller jurisdictions.

**Contact**

LOGIN Information Services
245 E. 6th Street, Suite 809
St. Paul, MN 55101-9006
(800) 328-1921

## MANAGEMENT INFORMATION SERVICE (MIS)

**Sponsoring Organization**

International City Management Association (ICMA)

**Information and Services**

Information on issues ranging from economic and business development to local administration and management.

No technical assistance.

**Nature and Scope of the Data Base**

Contains information on more than 16,000 documents. Approximately 12,000, generally reports and articles, cover background information and case studies on local government programs and initiatives; about 5,000 are manuals, handbooks, ordinances, budgets, videos, and technical specifications. Computerized.

Approximately 2,000 documents are added annually. Outdated documents are eliminated systematically.

**Data Sources**

Reports from local governments.
ICMA research staff reports.
Service providers to local governments.
Print and electronic media.

**Access to Clearinghouse**

Accessible only by MIS staff. Users call or write; bibliographic references are sent by mail or FAX; full-text documents and videos are loaned once the user makes a selection.

**Clearinghouse Publications**

*Data Base Update* (quarterly), report highlighting new materials in the data base and generally containing about 30 articles.

Subscribers to MIS also receive a number of ICMA publications:

*MIS Reports* (monthly), report on critical issues of concern to local governments;

*MIS Bulletin*, newsletter on recent inquiries and new contributions to the MIS data base;

*Info Packs*, semiannual packet of materials on a selected issue (compiled from the MIS data base);

*Public Management* (monthly), magazine; and

*Municipal Yearbook* (annual), providing analysis of the changing roles and functions of local governments and highlights of major national and state legislation that affects local governments.

**Users**

Primary users are local governments. Any official of a subscribing jurisdiction may use MIS on an unlimited basis.

**Fees**

Subscription service. Fees based on population. Non-subscribers, $50 per inquiry.

**Contact**

Ms. Joy Pierson
Inquiry Service Manager
Management Information Service
International City Management Association
777 North Capital Street, NE, Suite 500
Washington, DC 20002
(202) 962-3659 or 962-3632

## FEDERAL LABORATORY TECHNOLOGY DATA BASE (File FATD)

**Sponsoring Organization**

Center for the Utilization of Federal Technology (CUFT), National Technical Information Service (NTIS), U.S. Department of Commerce.

**Information and Services**

Technology transfer resource linking U.S. companies and other users with technology expertise and information at federal laboratories. Offers access to all information CUFT collects for its publications on resources available from federal laboratories. CUFT licenses government-owned inventions on behalf of a number of agencies.

**Nature and Scope of the Data Base**

The information—more than 16,000 records as of 1989—includes the following:

Identification of more than 1,100 federal laboratory resources listed by area of expertise; facilities and equipment available for sharing; technical information centers; and special services for supplying R&D samples and supplies;

New technologies having "better-than-average potential" for domestic application; and

Descriptions of U.S. government-owned inventions that companies may use to develop new products and processes.

Contact and source information is included for many of these entries.

**Data Sources**

CUFT collections for its printed publications. Data base updated every two weeks.

**Access to Clearinghouse**

Access is through a commercial on-line information service, BRS Information Technologies. Menu-driven searching is available via a modem and computer terminal. All records are assigned subject codes, searchable through specific subject subsets.

*Federal Laboratory Technology-Online*, free publication, includes access procedures, searching techniques, and data base descriptions.

**Clearinghouse Publications**

None.

CUFT publishes a number of publications and directories on technology transfer and business assistance programs. Some of these publications include:

*Tech Notes* (monthly), covering current technological advances considered to have potential commercial or other application ($175 per year);

*Federal Laboratory Technology Catalog* (annual), summarizing the prior year's *Tech Notes* ($39);

*Government Inventions for Licensing Abstract Newsletter* (weekly), bulletin covering inventions from all federal agencies that alerts businesses and entrepreneurs to opportunities for licensing and marketing government-owned inventions ($235 per year); and

*Directory of Federal Laboratory and Technology Resources* ($59.95).

**Users**

Users include industry, universities, federal, state, and local governments, as well as individual scientists and engineers.

**Fees**

$60 per hour during office hours; $50 per hour during off-hours.

**Contacts**

Information about the data base and CUFT publications:

National Technical Information Service
U.S. Department of Commerce
5825 Port Royal Road
Springfield, VA 22161
(703) 487-4650
Ask for brochures PR-801 and PR-725.

Information not covered in the brochures:

Mr. Edward Lehmann
Center for the Utilization of Federal Technology
National Technical Information Service
U.S. Department of Commerce
5825 Port Royal Road
Springfield, VA 22161
(703) 487-4805

## FEDERAL RESEARCH IN PROGRESS DATA BASE (FEDRIP)

**Sponsoring Organization**

National Technical Information Service (NTIS), U.S. Department of Commerce

**Information and Services**

On-line data base with summaries of active, federally funded research projects in the physical sciences, engineering, and life sciences.

No technical assistance.

**Nature and Scope of the Data Base**

Compilation of about 116,000 citations of active research projects funded by the federal government. Eleven government agencies share information with FEDRIP. Abstracts describe the basis of the research, its objectives, and, in many instances, intermediate findings. The agency data bases available to FEDRIP are:

AGRIC, Department of Agriculture (17,500 projects);

CRISP, Public Health Service (49,100 projects);

ENRGY, Department of Energy (5,900 projects);

NASA (700 projects);

NBS, National Institute of Standards and Technology (90 projects);

NSF, National Science Foundation (13,500 projects);

TRANS, Transportation Research Board of the National Academy of Sciences (4,000 projects);

USGS, Water Resources Division of the U.S. Geological Survey (300 projects);

VA, Department of Veterans Affairs (14,900 projects);

SBIR, Small Business Innovation Research Program (7,800 projects); and

NIOSH, National Institute for Occupational Safety and Health (300 projects).

**Data Sources**

Federal agencies described above.

**Access to Clearinghouse**

Access is through DIALOG Information Services via an 800 number, modem, and computer terminal. Searched primarily by subject and organization name (including the organization performing the research and the sponsoring or funding federal agency).

Available also from NERAC, Inc., which performs searches based on a user profile.

*Search Guide to the Federal Research in Progress Data Base—FEDRIP, a free booklet, describes the range of information covered and the procedure.* On-line training and group presentations are available.

**Clearinghouse Publications**
None.

**Users**
Users include researchers from business, universities, and government.

**Fees**
DIALOG hourly computer connect fee, $81.
NERAC subscription rate based on anticipated use.

**Contact**
DIALOG Information Services
3460 Hillview Avenue
Palo Alto, CA 94304
(800) 334-2564

NERAC, Inc.
One Technology Drive
Tolland, CT 06084
(203) 872-7000

## THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER CLEARINGHOUSE (FLC)

**Sponsoring Organization**
Federal Laboratory Consortium

**Information and Services**
Operates as a technology broker between federal laboratories and private and public sector users.

Technology information exchanges arranged to assist business product development, as well as to address state and local policy and program needs.

Technical assistance provided. The Clearinghouse will work with industry groups to help create and identify potential laboratory staff for a special technology interest group.

**Nature and Scope of the Data Base**
Capable of providing access points for all technologies being developed in member federal laboratories (excluding selected Department of Defense technologies).

Resource directory data base identifies expertise of individual laboratories and covers over one-third of the laboratories and centers.

"Technical specialists" for each of 35 technology areas respond to specific requests.

**Data Sources**
Clearinghouse data bases. Access to data bases of the National Technical Information Service, National Aeronautics and Space Administration, and others for referral information.

**Access to Clearinghouse**
Access is through a technical request form indicating the problem, desired results, action to date, what the inquirer expects from the laboratory, and the date the information or assistance is needed. Request sent to the appropriate laboratory by phone, mail, electronic mail, or FAX.

**Clearinghouse Publications**
None.

FLC produces publications on the Clearinghouse and its other activities, including a montly newsletter highlighting available laboratory technology.

**Users**
Primary users generally from corporations, state and local governments, and universities. Open to any interested individual or organization.

**Fees**
Free.

**Contact**
Mr. Allan Sjoholm
FLC Clearinghouse
1007 5th Avenue, Suite 810
San Diego, CA 92101
(619) 544-9033

## NASA TECHNOLOGY UTILIZATION PROGRAM (TU)

**Sponsoring Organization**
National Aeronautics and Space Administration (NASA) (at NASA facilities and NASA-supported organizations, such as academic institutions).

**Information and Services**
Information and technical assistance to broaden and accelerate the transfer of aerospace technology to other sectors of the economy.

Access to several NASA assistance programs including:

Industrial Application Centers—ten user assistance centers, affiliated with universities, that provide both public and private information retrieval services and technical help to government and industry clients;

Industrial Application Center Affiliates—state-sponsored business or technical assistance centers in 29 states that provide access to NASA's technology transfer network; and

Applications Team—working on engineering projects to solve public and private sector problems through the application of pertinent aerospace technology.

Support teams, with seed funding, develop prototype hardware to prove applicability of technology to problems.

**Nature and Scope of the Data Base**
Access to about one million documents in the NASA data bank and in more than 400 other computerized data bases. Includes selected contents of some 15,000 scientific and technical journals.

**Data Sources**
NASA R&D contracts.

**Access to Clearinghouse**
Initial access is contact with the Industrial Application Centers by phone, mail, or meetings. Staff searches data base through a system called RECON.

**Clearinghouse Publications**
*NASA Tech Briefs* (monthly) provides information on:

Newly developed products and processes;
Advances in basic and applied research;
Improvements in shop and laboratory techniques;
Sources of technical data and computer programs; and
Other innovations with commercial potential originating at NASA field centers or at the facilities of NASA contractors.

More detailed information on particular innovations is available in a "Technical Support Package."

*Spinoff,* annual volume to heighten awareness of technology transfer and its potential for economic and social benefit.

**Users**
Users include state and local governments, private firms, technical and business assistance providers, and researchers.

**Fees**

Charges for computer searches and project services provided by the Industrial Application Centers.

**Contact**

Mr. Leonard Ault
Technology Utilization Division
NASA Headquarters
600 Independence Avenue, NW
Washington, DC 20546
(202) 453-8377

## TECHNOLOGY APPLICATIONS INFORMATION SYSTEM (TAIS)

**Sponsoring Organization**

Office of Technology Applications, Strategic Defense Initiative Organization (SDIO), U.S. Department of Defense (DOD)

**Information and Services**

On-line computerized referral system containing descriptions of technologies developed for the Strategic Defense Initiative (SDI) program. As permitted by DOD rules, links organizations and individuals seeking to commercialize SDI technology with the inventors.

Office of Technology Applications makes unclassified, nonproprietary SDI technologies available to other federal agencies and to the U.S. private sector. Technology Applications Office staff provides personalized business assistance on request.

**Nature and Scope of the Data Base**

As of March 1990, contains:

1,300+ technology abstracts containing unclassified summaries of SDI funded technologies with spinoff potential;

Descriptions of more than 180 federal and 420 state/local business assistance programs;

Opportunities and requirements for submitting proposals for SDI research funding under the SDI Small Business Innovation Research program and the SDI Innovative Science and Technology program; and

Listings of 15 other on-line federal data bases of technology information (DOD, NTIS, etc.).

**Data Sources**

Researchers and/or government sponsors responsible for SDI contracts. The information received from these sources is standardized to fit the TAIS format.

Other federal agencies and organizations.

**Access to Clearinghouse**

Access through computer modem. Technology abstracts searched by technology hierarchy and key words. Additional information may be requested on abstracts. Technology Applications Office responds by mail and also informs the holder of the technology of the user's interest.

**Clearinghouse Publications**

Annual reports, brochures, press releases, and press kits.

**Users**

Primary users are large corporations, small firms, entrepreneurs, universities, federal agencies, and state and local governments.

TAIS is available to any U.S. citizen or business that has completed a Militarily Critical Technical (MCT) Data Agreement (DD Form 2345) and has been certified as eligible for access by the Defense Logistics Agency (800-352-3572). Federal agency representatives may obtain access certification by addressing a request on official letterhead to the SDIO Technology Applications Office, OSD/SDIO/TNO, Washington, DC 20301-7100.

**Fees**

Free (possible long-distance telephone charge).

**Contact**

Col. Daniel Heitz, Director
Technology Applications Office
Strategic Defense Initiative Organization
OSD/SDIO/TNO
Attn: TAIS
Washington, DC 20301-7100
(202) 693-1563

## TELTECH

**Sponsoring Organization**

Teltech

**Information and Services**

Consulting service for scientists and engineers facing questions in new or unfamiliar technical areas. Includes a network of technical experts, an interactive literature searching capability, and training courses.

Telephone consultation available in more than 2,400 science and technology subjects.

**Nature and Scope of the Data Base**

Access to more than 1,200 external data bases, and printed materials covering technical and general business information. A partial listing includes:

DIALOG—data bases covering science and technology, business, and current affairs;

Dow Jones—including the *Wall Street Journal* and *Barrons;*

Datatimes—domestic and international newspapers;

Newsnet—industry newsletters; and

ORBIT—dealing with patents, petroleum, packaging, and materials.

Network of 7,000 technical experts available for telephone consultation, drawn from universities, federal laboratories, consulting groups, and private industry, as well as from retired scientists and engineers.

**Data Sources**

Data bases described above.

**Access to Clearinghouse**

Access is through CompuServe. Information specialist searches data base; user watches on a computer screen and comments by phone, pinpointing the documents needed. Teltech coordinates delivery of printed materials.

Interactive literature searching service relies on on-line systems. Specialists network uses an on-line system or users may call Teltech's help staff.

**Clearinghouse Publications**

None.

**Users**

Users include corporations, and small and medium-sized manufacturers.

**Fees**

Subscription service. Annual fees, $6,000 to $30,000, cover all data base and search charges as well as expert contact.

**Contact**

Mr. Ron Helgeson
Teltech
9855 West 78th Street
Eden Prairie, MN 55344
(612) 829-9000

TO PROMOTE AMERICAN BUSINESS
PRODUCTIVITY, TECHNOLOGY, AND INNOVATION

# A GUIDE TO
# PROFESSIONAL PROGRAM DEVELOPERS AND ADMINISTRATORS

**Clearinghouse for State and Local Initiatives**
**on Productivity, Technology, and Innovation**
**Technology Administration**
**U.S. Department of Commerce**
**Washington, DC 20230**

## To Promote American Business

The *Omnibus Trade and Competitiveness Act of 1988* established the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation within the U.S. Department of Commerce. The primary mission of the Clearinghouse is to enhance nationwide awareness and use of the many federal, state, and local initiatives that seek to bolster the competitiveness of American businesses in world markets.

The Department of Commerce entered into an agreement with the U.S. Advisory Commission on Intergovernmental Relations to develop a feasible and effective operating plan for the Clearinghouse. The plan recognizes that a great deal of activity is under way to assist in promoting and adopting federal, state, and local initiatives designed to enhance the productivity, technology, and innovation of American businesses. Therefore, the Clearinghouse was designed to reinforce these activities rather than to replace or duplicate them.

This selected *Guide to Professional Program Developers and Administrators* **is not a clearinghouse information list. Do not call these people for Clearinghouse information.** Its purpose is to facilitate contacts among organizations and experts in these fields to help them improve their services. The other booklets in this series of three *Guides* being distributed by the Clearinghouse acquaint users with the variety of resources available—a directory of national clearinghouses that provide information and assistance on productivity improvement, technology transfer, and business innovation, and a directory of federal, state, and local initiatives in these fields.

Comments and suggestions for improving the guidebooks—or about other activities of the Clearinghouse—are welcome. In addition to these guidebooks and other information services, the Clearinghouse intends to provide policy analysis services designed to help federal, state, and local policymakers identify and implement the most effective initiatives to stimulate business productivity, technological advance, and innovation.

Inquiries should be directed as follows:

By phone: (202) 377-0826 or 377-2922

By mail: Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation
Technology Administration
U.S. Department of Commerce
Washington, DC 20230

## How to Use this Guide

This directory consists of four parts: (1) a master list, by organization, with separate sections for the federal government, state and local institutions and organizations, universities, and nongovernmental organizations; (2) a list of names categorized by subject of expertise; (3) a list of names by geographical location; and (4) an alphabetical list of names. *The number before each name directs the user to the corresponding entry in the master list,* which contains addresses and phone numbers for each person and organization.

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# U.S. Government Listings

## ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS

1. Dr. Bruce D. McDowell, Director
Government Policy Research
Advisory Commission
on Intergovernmental Relations
1111 20th Street, NW, Suite 2000
Washington, DC 20575
(202) 653-5540

Clearinghouse Operations, Public Policy and Legislation, Technology Transfer

## AGRICULTURE, U.S. DEPARTMENT OF

### Agricultural Research Service

2. Mr. James Hall, Technology Transfer Coordinator
USDA-ARS-OCI
4th Floor, Building 005
Beltsville, MD 20705
(301) 344-4045

Technology Transfer

### Extension Service

3. Dr. Theodore Maher,
National Program Leader for Local Governments
Extension Service
U.S. Department of Agriculture
Room 3865, South Building
Washington, DC 20250-0900
(202) 447-7185

Economic Development, Technology Transfer, Workforce Preparation

### Rural Information Center

4. Ms. Patricia John
Rural Information Center
Room 304, National Agricultural Library
Beltsville, MD 20705
(301) 344-2547

Clearinghouse Operations, Technology Transfer, Economic Development

## APPALACHIAN REGIONAL COMMISSION

5. Mr. Robert Decker, Director
Economic and Program Analysis
Appalachian Regional Commission
1666 Connecticut Avenue, NW
Washington, DC 20235
(202) 673-7849

Economic Development, Program Evaluation, Technology Transfer

## COMMERCE, U.S. DEPARTMENT OF

### Economic Development Administration

6. Mr. David H. Geddes, Director
Mr. Richard E. Hage,
National Technical Assistance Coordinator
Technical Assistance Research Division
Economic Development Administration
14th Street and Constitution Avenue, NW
Room 7319
Washington, DC 20230
(202) 377-2127

Economic Development, Technology Transfer, Scientific Research

### Technology Administration

**Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation**

7. Dr. Robert Atkinson, Coordinator
Clearinghouse for State and Local Initiatives
on Productivity, Technology, and Innovation
H4418
U.S. Department of Commerce
Washington, DC 20230
(202) 377-0659

Clearinghouse Operations

8. Mr. Richard A. Johnson, Manager
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Clearinghouse for State and Local Initiatives
on Productivity, Technology, and Innovation
H4418
U.S. Department of Commerce
Washington, DC 20230
(202) 377-2922

Clearinghouse Operations

9. Ms. Elizabeth Robertson
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Clearinghouse for State and Local Initiatives
on Productivity, Technology, and Innovation
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U.S. Department of Commerce
Washington, DC 20230
(202) 377-0826

Clearinghouse Operations

### National Institute of Standards and Technology (NIST)

10. Dr. Robert E. Chapman, Acting Director
Office of Technology Commercialization
National Institute of Standards and Technology (NIST)
Building 221, Room A-343
Gaithersburg, MD 20899
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Clearinghouse Operations, Research Assistance, Technology Transfer

11. Dr. David E. Edgerly, Acting Deputy Director
Technology Services
National Institute of Standards and Technology (NIST)
Building 221, Room A-363
Gaithersburg, MD 20899
(301) 975-4500

Clearinghouse Operations, Research Assistance, Technology Transfer

**National Technical Information Service, Center for the Utilization of Federal Technology (NTIS/CUFT)**

12. Dr. Darcia Bracken
National Technical Information Service,
Center for the Utilization of Federal Technology
Room 304, Forbes Building
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4838

Technology Transfer

**Technology Commercialization**

13. Mr. Joseph P. Allen, Deputy Director
Office of Technology Commercialization
H4418
U.S. Department of Commerce
Washington, DC 20230
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Technology Transfer

14. Mr. Theodore J. Lettes, Manager
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Office of Technology Commercialization
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U.S. Department of Commerce
Washington, DC 20230
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Innovative Management and Financing,
Technology Transfer

**Technology Policy**

15. Mr. Tip Parker
Senior Technology Economics Specialist
Office of Technology Policy
H4835
U.S. Department of Commerce
Washington, DC 20230
(202) 377-0825

Technology Transfer

**CONGRESS, U.S.**

**House of Representatives**

**Committee on Science, Space, and Technology**

16. Mr. James Turner, Counsel
Mr. David Goldston, Republican Special Assistant
Subcommittee on Science, Research
and Technology
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, DC 20515
(202) 225-8844 (Turner)
(202) 225-4024 (Goldston)

Public Policy and Legislation

17. Mr. Wesley Warren, Republican Special Assistant
Subcommittee on Natural Resources,
Agriculture Research and Environment
U.S. House of Representatives
388 House Office Building Annex II
Washington, DC 20515
(202) 226-6993

Public Policy and Legislation

**Senate**

**Committee on Commerce, Science, and Transportation**

18. Mr. Patrick J. Windham
Subcommittee on Science, Technology, and Space
U.S. House of Representatives
427 Hart Senate Office Building
Washington, DC 20510
(202) 224-9360

Public Policy and Legislation

**Committee on Small Business**

19. Mr. Charles E. Ludlam, Tax Counsel
SR-428A Russell Senate Office Building
Washington, DC 20510-6350
(202) 224-8495

Public Policy and Legislation

**Library of Congress**

20. Ms. Wendy Schacht, Specialist
Science and Technology
CRS/SPRD, LM 413
U.S. Library of Congress
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Washington, DC 20540
(202) 707-7066

Clearinghouse Operations

**Technology Assessment, U.S. Office of**

21. Ms. Edith Page, Senior Associate
Office of Technology Assessment
600 Pennsylvania Avenue, SW
Washington, DC 20510-8025
(202) 224-8713

Program Evaluation

**DEFENSE, U.S. DEPARTMENT OF**

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Technology Application Information System
Strategic Defense Initiative Organization
OSD/SDIO/T/TA
U.S. Department of Defense
Washington, DC 20301-7100
(202) 693-1563

Technology Transfer

**EDUCATION, U.S. DEPARTMENT OF**

23. Dr. Susan S. Klein, Senior Research Associate
Office of Educational Research and Improvement
U.S. Department of Education
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Washington, DC 20208-5720
(202) 357-6289

Clearinghouse Operations, Program Evaluation,
Workforce Preparation

24. Dr. Winifred Warnat, Director
Vocational Technical Education
U.S. Department of Education
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Washington, DC 20202-7241
(202) 732-2441

Workforce Preparation

**ENERGY, U.S. DEPARTMENT OF**

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Office of Energy Research
U.S. Department of Energy, ER-42
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Washington, DC 20585
(202) 586-3560

Technology Transfer

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

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Office of Mobilization Preparedness
Federal Emergency Management Agency
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Washington, DC 20472
(202) 646-3054

Innovative Management and Financing

**FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER**

27. Dr. Beverly Berger, Washington, DC Representative
Federal Laboratory Consortium
for Technology Transfer
1550 M Street, NW, 11th Floor
Washington, DC 20005
(202) 331-4220

Technology Transfer

28. Mr. Del Delabarre, FLC Administrator
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Sequim, WA 98382
(206) 683-1005

Technology Transfer

29. Mr. Clifford E. Lanham, Manager
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U.S. Army Laboratory Command
Attn: AMSLC-TP-TT
2800 Powder Mill Road
Adelphi, Maryland 20783-1145
(202) 394-4210

Scientific Research, Technology Transfer

30. Dr. Loren C. Schmid, Chairman
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(509) 375-2559

Scientific Research, Technology Transfer

31. Mr. Allan Sjoholm, Manager
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(619) 544-9033

Clearinghouse Operations, Technology Transfer

**GENERAL SERVICES ADMINISTRATION, U.S.**

32. Mr. A. Jerald Varner
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Washington, DC 20407
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Clearinghouse Operations

**LABOR, U.S. DEPARTMENT OF**

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U.S. Department of Labor
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Workforce Preparation

**MANAGEMENT AND BUDGET, U.S. OFFICE OF**

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Productivity Analysis

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, U.S.**

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Technology Transfer

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Technology Transfer

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Technology Transfer

**NATIONAL INSTITUTES OF HEALTH, U.S.**

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Research Assistance

**NATIONAL SCIENCE FOUNDATION**

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Technology Development, Technology Transfer

40. Ms. Joyce Hamaty
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National Science Foundation
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(202) 357-9838

Technology Development, Technology Transfer

**SMALL BUSINESS ADMINISTRATION, U.S.**

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Office of Advocacy
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Innovative Management and Financing,
Clearinghouse Operations

**TENNESSEE VALLEY AUTHORITY**

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(615) 632-6435

Technology Transfer

**TRADE REPRESENTATIVE, OFFICE OF THE U.S.**

43. Mr. J. David Morrissy, Director
Capital Manufactures and Materials Trade Policy
Office of the U.S. Trade Representative
600 17th Street, NW
Washington, DC 20506
(202) 395-4946

International Trade

**TRANSPORTATION, U.S. DEPARTMENT OF**

44. Mr. Norman Paulhus
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U.S. Department of Transportation
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Washington, DC 20590
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Technology Transfer

**VETERANS AFFAIRS, U.S. DEPARTMENT OF**

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U.S. Department of Veterans Affairs
810 Vermont Avenue, NW, Room 938 (110)
Washington, DC 20420
(202) 233-5177

Workforce Preparation

# State and Local Institutions and Organizations

## ARKANSAS

### Arkansas Science and Technology Authority

46. Ms. Alice Smith, Vice President
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Little Rock, AR 72201
(501) 371-3554

Technology Transfer

## INDIANA

### Indiana Corporation for Science and Technology*

47. Dr. Stephen Gage, President
Indiana Corporation for Science and Technology
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Indianapolis, IN 46204-2242
(317) 635-3058

Technology Transfer

*State funded nonprofit corporation

## IOWA

### Iowa Department of Economic Development

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Iowa Department of Economic Development
200 East Grand Avenue
Des Moines, IA 50309
(515) 281-3850

Innovative Management and Financing

## MARYLAND

### Maryland Department of Economic and Employment Development

49. Mr. Campbell C. Johnson, III, Manager
Marketing Resources
Division of Business Development
Maryland Department of Economic and Employment Development
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Baltimore, MD 21202
(301) 333-6980

Innovative Management and Financing

### Montgomery County High Technology Council, Inc.*

50. Mr. Walter H. Plosila, President
Montgomery County High Technology Council, Inc.
51 Monroe Street, Suite 1701
Rockville, MD 20850
(301) 762-6325

Innovative Management and Financing, Clearinghouse Operations, Economic Development

*Nonprofit, nongovernment, deals with county government

## MICHIGAN

### Michigan Modernization Service

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Michigan Modernization Service
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Lansing, MI 48913
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Technology Transfer

### Michigan Strategic Fund

52. Dr. James Kenworthy, Manager
Research and Technology
Michigan Strategic Fund
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Lansing, MI 48933
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Innovative Management and Financing

53. Mr. Steve Rohde, Director
Private Institutions Program
Michigan Strategic Fund
525 West Ottawa Street, 3rd Floor
Lansing, MI 48933
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Innovative Management and Financing

## NEW HAMPSHIRE

### New Hampshire Department of Resources and Economic Development

54. Mr. William E. Pillsbury, Director
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Innovative Management and Financing

## NEW JERSEY

### New Jersey Commission on Science and Technology

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New Jersey Commission on Science and Technology
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Trenton, NJ 08625-0832
(609) 633-2740

Research Assistance

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### New York State Science and Technology Foundation

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Economic Development, Technology Development, Technology Transfer

NORTH DAKOTA

**North Dakota Economic Development Commission**

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North Dakota Economic Development Commission
Loverty Memorial Building
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Innovative Management and Financing

OHIO

**Thomas Edison Program**

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Thomas Edison Program
77 South High Street, 26th Floor
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(614) 466-3086

Innovative Management and Financing,
Technology Transfer

PENNSYLVANIA

**Ben Franklin Partnership**

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Harrisburg, PA 17120
(717) 787-4147

Innovative Management and Financing,
Research Assistance, Technology Development

VIRGINIA

**Center for Innovative Technology**

60. Dr. Gene Calvert, Director
Technology Transfer
Center for Innovative Technology
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Herndon, VA 22070-4005
(703) 689-3037

Innovative Management and Financing,
Technology Development, Technology Transfer

# Universities

## CALIFORNIA

**University of Southern California**

**Western Research Application Center**

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Western Research Application Center
at the University of Southern California (USC)
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Los Angeles, CA 90007
(213) 743-8988

Clearinghouse Operations, Technology Transfer

## FLORIDA

**University of Florida**

**Southern Technology Applications Center**

62. Mr. Ronald J. Thornton, Director
Southern Technology Applications Center
University of Florida
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Box 24
Alachua, FL 32615
(904) 462-3913

Technology Transfer

## ILLINOIS

**University of Illinois at Chicago**

**Center for Urban Economic Development (UICUED)**

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Center for Urban Economic Development
University of Illinois at Chicago
815 West Van Buren Street, Suite 500
Chicago, IL 60607
(312) 996-4329

Economic Development, Innovative Management and Financing

## INDIANA

**Indiana University-Purdue University at Indianapolis (IUPUI)**

**Indianapolis Center for Advanced Research, Inc.**

64. Dr. F. Timothy Janis
Director, Technology Transfer
Indianapolis Center for Advanced Research, Inc.
611 North Capitol Avenue
Indianapolis, IN 46204
(317) 262-5000

Technology Transfer

## MARYLAND

**University of Maryland**

**Dingman Center for Entrepreneurship**

65. Dr. Charles O. Heller
Dingman Center for Entrepreneurship
College of Business and Management
University of Maryland
College Park, MD 20742
(301) 454-8080

Innovative Management and Financing

**Technology Extension Service—Engineering and Research Center**

66. Mr. W. Travis Walton
Engineering and Research Center
University of Maryland
College Park, MD 20742
(301) 454-1941

Innovative Management and Financing, Technology Transfer

## NEW YORK

**State University of New York at Buffalo**

**N.Y. Disability Technology Information Network**

67. Dr. William C. Mann
New York Disability Technology Information Network
Department of Occupational Therapy
State University of New York at Buffalo
515 Stockton Kimball Tower
Buffalo, New York 14214
(716) 831-3141/2

Workforce Preparation

## NORTH CAROLINA

**University of North Carolina at Chapel Hill**

**Small Business and Technology Development Center**

68. Mr. Scott Daugherty, Director
Small Business and Technology Development Center
University of North Carolina
Raleigh, NC 27612
(919) 733-4643

Innovative Management and Financing, Technology Development, Technology Transfer

**University of North Carolina at Greensboro**

69. Dr. John Rees, Chairman
Department of Geography
Room 129 Graham
University of North Carolina
Greensboro, NC 27412
(919) 334-5388

Economic Development, Program Evaluation, Public Policy and Legislation, Technology Transfer

## OHIO

**Central State University**

**Office of Strategic Planning and Institutional Research**

70. Dr. Barbara Fleming, Director
Office of Strategic Planning and Institutional Research

Central State University
Wilberforce, Ohio 45384
(513) 376-6234

Innovative Management and Financing

PENNSYLVANIA

**Pennsylvania State University**

**Pennsylvania Technical Assistance Program (PENNTAP)**

71. Dr. H. LeRoy Marlow, Director
PENNTAP
Pennsylvania State University
101 George Building
University Park, PA 16802
(814) 865-6277

Technology Transfer

SOUTH DAKOTA

**South Dakota State University**

**Engineering and Environmental Resource Center**

72. Mr. LaDell R. Swiden, Acting Director
Engineering and Environmental Resource Center
South Dakota State University
Box 507, Wenona Hall
Brookings, SD 57007-0199
(605) 688-4184

Economic Development, Productivity Analysis, Research Assistance, Technology Development, Technology Transfer

VIRGINIA

**George Mason University**

73. Dr. Brack Brown
Department of Public Affairs
George Mason University
4400 University Drive
Fairfax, VA 22030
(703) 323-2272

Public Policy and Legislation

WASHINGTON, DC

**Howard University**

**Small Business Development Center**

74. Ms. Nancy Flake
Small Business Development Center
Howard University
School of Business and Public Administration Building
6th & Fairmont Streets, NW, Room 128
Washington, DC 20059
(202) 636-5150

Innovative Management and Financing, Clearinghouse Operations

WEST VIRGINIA

**Marshall University**

75. Dr. Robert F. Maddox
Executive Assistant to the President
Office of Research and Economic Development
Marshall University
1050 4th Avenue
Huntington, WV 25755
(304) 696-6797

Innovative Management and Financing, Economic Development, International Trade, Workforce Preparation

**West Virginia University**

76. Dr. Rachel B. Tompkins
Associate Provost for Economic Development and Extension
West Virginia University
P.O. Box 6031
Morgantown, WV 26505-6031
(304) 293-5691

Economic Development, Program Evaluation, Technology Transfer

**Regional Research Institute**

77. Dr. Philip Shapira
Regional Research Institute
West Virginia University
511 North High Street
Morgantown, WV 26506
(304) 293-2896

Economic Development

**ADVANCED DEVELOPMENT DISTRIBUTION, INC.**

73. Mr. Paul R. Brockman
*President and Chief Executive Officer*
*Advanced Development Distribution, Inc.*
P.O. Box 88
Alexandria, VA 22313-0088
(703) 971-3580 or (703) 684-6331

Technology Development, Technology Transfer

**AMERICAN ASSEMBLY OF COLLEGIATE SCHOOLS OF BUSINESS**

79. Ms. Jacqueline Harrington
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American Assembly of Collegiate Schools of Business
605 Old Ballas Road, Suite 220
St. Louis, MO 63141
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Workforce Preparation

**AMERICAN ELECTRONICS ASSOCIATION**

80. Mr. J. Richard Iverson
President and Chief Executive Officer
American Electronics Association
1225 I Street, NW, Suite 1225
Washington, DC 20005
(202) 682-9110

Public Policy and Legislation, Techology Development, Technology Transfer

**AMERICAN PLANNING ASSOCIATION**

81. Ms. Marya Morris
Planning Advisory Service
American Planning Association
1313 E. 60th Street
Chicago, IL 60637
(312) 955-9100

Innovative Management and Financing, Economic Development

**AMERICAN SOCIETY FOR TRAINING AND DEVELOPMENT**

82. Dr. Curtis E. Plott, Executive Director
American Society for Training and Development
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126 Brown, Dr. Nevin
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45 Giannini, Dr. Margaret
79 Harrington, Ms. Jacqueline
23 Klein, Dr. Susan S.
132 Kohl, Dr. Kay J.
75 Maddox, Dr. Robert F.
3 Maher, Dr. Theodore
67 Mann, Dr. William C.
138 Nidiffer, Dr. Kenneth E.
82 Plott, Dr. Curtis E.
24 Warnat, Dr. Winifred
120 White, Ms. Helen

# State Listing

**Arkansas**
46 Smith, Ms. Alice

**Arizona**
84 Boettcher, Mr. Chris

**California**
104 Dormanen, Ms. Susan
105 Hansen, Mr. Derek P.
61 King, Mr. Radford
31 Sjoholm, Mr. Allan
104 Williams, Ms. Chris

**Colorado**
89 Chapman, Mr. Richard
91 Greek, Ms. Joanne
91 Horsley, Ms. Betsy
128 Pilcher, Mr. Daniel E.
128 Puls, Ms. Barbara
139 Rubin, Mr. Stephen A.

**Connecticut**
137 Gorham, Mr. John
117 McGovern, Mr. Kevin
137 Peake, Mr. Tipp

**Florida**
62 Thornton, Mr. Ronald J.

**Illinois**
90 Boyce, Mr. Ken
81 Morris, Ms. Marya
111 Nyrop, Ms. Kirsten
63 Wiewel, Dr. Wim

**Indiana**
47 Gage, Dr. Stephen
64 Janis, Dr. F. Timothy

**Iowa**
48 Plazak, Mr. David

**Kentucky**
96 Voit, Mr. William

**Louisiana**
115 Williams, Mr. J. Trent

**Maryland**
49 Johnson, Mr. Campbell C., III

**Michigan**
51 Cleveland, Mr. John
52 Kenworthy, Dr. James
53 Rohde, Mr. Steve
108 Tornatzky, Dr. Lou

**Minnesota**
114 Coleman, Ms. Joan
144 Helgeson, Mr. Ron
144 Shuster, Mr. Joseph

**Missouri**
79 Harrington, Ms. Jacqueline

**New Hampshire**
54 Pillsbury, Mr. William E.

**New Jersey**
143 Fellman, Dr. Jack
55 Goodman, Mr. David
146 Richardson, Mr. Ralph

**New York**
86 Beckler, Mr. David Z.
56 Deffigos, Mr. John S.
86 Kirsch, Mr. David A.
67 Mann, Dr. William C.
116 McDowell, Ms. Harriette
146 Richardson, Mr. Ralph

**North Carolina**
68 Daugherty, Mr. Scott
69 Rees, Dr. John
140 Rosenfeld, Mr. Stuart A.

**North Dakota**
57 Patrie, Mr. William A.

**Ohio**
148 Bement, Dr. Arden L.
58 Coburn, Mr. Christopher
70 Fleming, Dr. Barbara
133 Glaser, Mr. Helmut I.

**Pennsylvania**
85 Corner, Mr. Harold
59 Koppel, Mr. Jacques
71 Marlow, Dr. H. LeRoy
100 Philpot, Mr. Donald

**South Dakota**
72 Swiden, Mr. LaDell R.

**Tennessee**
42 Wright, Mr. Brown

**Texas**
145 Morris, Mr. Richard

**Washington**
28 Delabarre, Mr. Del
30 Schmid, Dr. Loren C.

**West Virginia**
102 Dyer, Mr. Kevin
75 Maddox, Dr. Robert F.
77 Shapira, Dr. Philip
76 Tompkins, Dr. Rachel B.

**Washington, DC Metropolitan Area**
13 Allen, Mr. Joseph P.
7 Atkinson, Dr. Robert
35 Ault, Mr. Leonard
142 Ball, Col. James A.
27 Berger, Dr. Beverly
99 Bernard, Ms. Kathleen
12 Bracken, Dr. Darcia
78 Brockman, Mr. Paul R.
73 Brown, Dr. Brack
127 Brown, Mr. Hamilton
126 Brown, Dr. Nevin
33 Bryant, Mr. Kelly W., II
60 Calvert, Dr. Gene
87 Carson, Mr. Thomas B.
10 Chapman, Dr. Robert E.
38 Chen, Dr. Philip S., Jr.
129 Clarke, Ms. Marianne
36 Clarks, Mr. Henry
136 Davis, Dr. Ruth
83 Deam, Mr. John B.
5 Decker, Mr. Robert
11 Edgerly, Dr. David E.
110 Farr, Ms. Cheryl
74 Flake, Ms. Nancy
92 Fosler, Mr. Scott
6 Geddes, Mr. David H.
45 Giannini, Dr. Margaret
37 Gilbert, Mr. Ray L.
106 Godown, Mr. Richard
121 Golden, Mr. James D.
150 Goldsmith, Ms. Marta
26 Grichar, Mr. James S.
39 Grucza, Ms. Margaret
6 Hage, Mr. Richard E.
2 Hall, Mr. James
40 Hamaty, Ms. Joyce
41 Hankins, Mr. Mark
93 Haygood, Ms. Dorothie
22 Heitz, Col. Daniel
65 Heller, Dr. Charles O.
98 Hughes, Dr. Kent H.
136 Istvan, Mr. Edwin J.
80 Iverson, Mr. J. Richard
4 John, Ms. Patricia
8 Johnson, Mr. Richard A.
94 Karinch, Ms. Maryann
101 Kelly, Mr. Edward T.
118 Kiernan, Dr. Casey
23 Klein, Dr. Susan S.
132 Kohl, Dr. Kay J.
29 Lanham, Mr. Clifford E.
107 Larson, Mr. Charles
14 Lettes, Mr. Theodore J.
112 Ling, Mr. James
113 Lipman, Ms. Barbara
19 Ludlam, Mr. Charles E.
119 Maddock, Mr. Jerome
3 Maher, Dr. Theodore
125 Malamud, Mr. William
130 McCarty, Ms. Kathryn Shane
1 McDowell, Dr. Bruce D.
147 Mogavero, Mr. Louis
124 Morin, Mr. William G.
43 Morrissy, Mr. J. David
138 Nidiffer, Dr. Kenneth E.
34 O'Brien, Mr. Richard J.
21 Page, Ms. Edith
109 Palmintera, Ms. Diane
15 Parker, Mr. Tip
44 Paulhus, Mr. Norman
131 Peters, Mr. Paul
134 Phelps, Mr. Paul R.
94 Pickitt, Mr. John L.
50 Plosila, Mr. Walter H.
82 Plott, Dr. Curtis E.
95 Poole, Mr. Kenneth
103 Rabinowitz, Mr. Stuart

9 Robertson, Ms. Elizabeth
142 Rood, Ms. Sally
88 Russell, Ms. Christine

20 Schacht, Ms. Wendy
125 Sink, Ms. Claire
97 Souby, Mr. James M.

127 Stark, Ms. Nancy
141 Susskind, Mr. Kenneth R.
135 Toregas, Dr. Costis
16 Turner, Mr. James
32 Varner, Mr. A. Jerald
66 Walton, Mr. W. Travis

24 Warnat, Dr. Winifred
17 Warren, Mr. Wesley
120 White, Ms. Helen
123 Williams, Mr. Harold
18 Windham, Mr. Patrick J.
122 Wohlbruck, Ms. Aliceann
149 Wyckoff, Mr. James M.

## Alphabetical List of Individuals


113 Allen, Mr. Joseph P.
7 Atkinson, Dr. Robert D.
35 Ault, Mr. Leonard

142 Ball, Col. James A.
86 Beckler, Mr. David Z.
148 Bement, Dr. Ardent L.
27 Berger, Dr. Beverly
99 Bernard, Ms. Kathleen
84 Boettcher, Mr. Chris
90 Boyce, Mr. Ken
12 Bracken, Dr. Darcia
78 Brockman, Mr. Paul R.
73 Brown, Dr. Brack
127 Brown, Mr. Hamilton
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60 Calvert, Dr. Gene
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89 Chapman, Mr. Richard
10 Chapman, Dr. Robert E.
38 Chen, Dr. Philip S., Jr.
129 Clarke, Ms. Marianne
36 Clarks, Mr. Henry
51 Cleveland, Mr. John
58 Coburn, Mr. Christopher
114 Coleman, Ms. Joan
85 Corner, Mr. Harold

68 Daugherty, Mr. Scott
136 Davis, Dr. Ruth
83 Deam, Mr. John B.
5 Decker, Mr. Robert
56 Deffigos, Mr. John S.
28 Delabarre, Mr. Del
104 Dormanen, Ms. Susan
102 Dyer, Mr. Kevin

11 Edgerly, Dr. David E.

110 Farr, Ms. Cheryl
143 Fellman, Dr. Jack
74 Flake, Ms. Nancy
70 Fleming, Dr. Barbara
92 Fosler, Mr. Scott

47 Gage, Dr. Stephen
6 Geddes, Mr. David H.
45 Giannini, Dr. Margaret
37 Gilbert, Mr. Ray L.
133 Glaser, Mr. Helmut I.
106 Godown, Mr. Richard
121 Golden, Mr. James D.
150 Goldsmith, Ms. Marta
16 Goldston, Mr. David
55 Goodman, Mr. David
137 Gorham, Mr. John
91 Greek, Ms. Joanne
26 Grichar, Mr. James S.
39 Grucza, Ms. Margaret

6 Hage, Mr. Richard E.
2 Hall, Mr. James
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41 Hankins, Mr. Mark
105 Hansen, Mr. Derek P.
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93 Haygood, Ms. Dorothie
22 Heitz, Col. Daniel
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91 Horsley, Ms. Betsy
98 Hughes, Dr. Kent H.

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80 Iverson, Mr. J. Richard

64 Janis, Dr. F. Timothy
49 John, Ms. Patricia
94 Johnson, Mr. Campbell C., III
101 Johnson, Mr. Richard A.

52 Karinch, Ms. Maryann
101 Kelly, Mr. Edward T.
52 Kenworthy, Dr. James
118 Kiernan, Dr. Casey
61 King, Mr. Radford
86 Kirsch, Mr. David A.
23 Klein, Dr. Susan S.
132 Kohl, Dr. Kay J.
59 Koppel, Mr. Jacques

29 Lanham, Mr. Clifford E.
107 Larson, Mr. Charles
14 Lettes, Mr. Theodore J.
112 Ling, Mr. James
113 Lipman, Ms. Barbara
119 Ludlam, Mr. Charles E.

119 Maddock, Mr. Jerome
75 Maddox, Dr. Robert F.
3 Maher, Dr. Theodore
125 Malamud, Mr. William
67 Mann, Dr. William C.
71 Marlow, Dr. H. LeRoy
130 McCarty, Ms. Kathryn Shane
1 McDowell, Dr. Bruce D.
116 McDowell, Ms. Harriette
117 McGovern, Mr. Kevin
147 Mogavero, Mr. Louis
124 Morin, Mr. William G.
81 Morris, Ms. Marya
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111 Nyrop, Ms. Kirsten

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44 Paulhus, Mr. Norman
137 Peake, Mr. Tipp
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82 Plott, Dr. Curtis E.
95 Poole, Mr. Kenneth
128 Puls, Ms. Barbara

103 Rabinowitz, Mr. Stuart
69 Rees, Dr. John
146 Richardson, Mr. Ralph
9 Robertson, Ms. Elizabeth
53 Rohde, Mr. Steve
142 Rood, Ms. Sally
140 Rosenfeld, Mr. Stuart A.
139 Rubin, Mr. Stephen A.
88 Russell, Ms. Christine

20 Schacht, Ms. Wendy
30 Schmid, Dr. Loren C.
77 Shapira, Dr. Philip
144 Shuster, Mr. Joseph
25 Sink, Ms. Claire
31 Sjoholm, Mr. Allan
46 Smith, Ms. Alice
97 Souby, Mr. James M.
127 Stark, Ms. Nancy
141 Susskind, Mr. Kenneth R.
72 Swiden, Mr. LaDell R.

62 Thornton, Mr. Ronald J.
76 Tompkins, Dr. Rachel B.
135 Toregas, Dr. Costis
101 Tornatzky, Dr. Lou
16 Turner, Mr. James

32 Varner, Mr. A. Jerald
96 Voit, Mr. William

66 Walton, Mr. W. Travis
24 Warnat, Dr. Winifred
17 Warren, Mr. Wesley
120 White, Ms. Helen
63 Wiewel, Dr. Wim
104 Williams, Ms. Chris
123 Williams, Mr. Harold
115 Williams, Mr. J. Trent
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