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Potential Problems That Should Be Considered in Evaluating the Experimental Technology Incentives Program. PSAD-77-132; B-114821. July 25, 1977. 2 pp. + appendix (9 pp.).

Report to Secretary, Department of Commerce; by Henry Eschwege, Director, Community and Economic Development Div.

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Congressional Relevance: House Committee on Interstate and Foreign Commerce; Senate Committee on Commerce, Science, and Transportation.

Under the Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards, studies and experiments are conducted to develop policy recommendations on how the Government can affect the rate at which the private sector innovates. Problems encountered in program performance could hinder the program's ability to meet its objectives. Findings/Conclusions: In managing projects, the ETIP staff has encountered difficulties that have hampered program activities and could continue to do so in the future. The size of the present staff and its reliance on agencies to assist in conducting cooperative experiments have made it difficult to plan and conduct the desired number of experiments. Also, the effectiveness of the method being used to evaluate experiments has yet to be determined. More effective interaction is needed between ETIP personnel and Federal policymaking and policy research organizations that have similar or related objectives. More coordination and cooperation could help ETIP staff achieve the objectives of the program by improving the performance of necessary background research, enabling the staff to conduct experiments on technology policy issues and enhancing the usefulness of experiment results to policymakers. Recommendations: The Department of Commerce's current evaluation of the program should determine the extent to which these problems have an impact on its performance. If it is found that the program's objectives are not being achieved, then action should be taken to overcome them and/or modify the objectives. (Author/DJM)

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**UNITED STATES
GENERAL ACCOUNTING OFFICE**

**Potential Problems That Should
Be Considered In Evaluating
The Experimental Technology
Incentives Program**

**Department of Commerce
National Bureau of Standards**

Under the Experimental Technology Incentives Program studies and experiments are conducted to develop policy recommendations on how the Government can affect the rate at which the private sector innovates.

GAO has identified problems in Program performance which could hinder the Program's ability to meet its objectives.

The Department's current evaluation of the Program should determine the extent to which these problems have an impact on its performance. If it is found that the Program's objectives are not being achieved, then action should be taken to overcome them and/or modify the objectives.



UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

B-114821

The Honorable
The Secretary of Commerce

Dear Madam Secretary:

We have been conducting a survey of the Experimental Technology Incentives Program of the National Bureau of Standards. In view of the evaluation of the Program recently started by your Department, we are discontinuing our survey. However, the information gained and observations made during our survey show potential problem areas that could hinder the ability of the Program to meet its objectives of (1) conducting coordinated studies and experiments with Government agencies to test and evaluate how Government policies affect the rate at which the private sector innovates, and (2) publishing definitive reports that evaluate the results of the experiments and recommend appropriate policy.

We discussed these potential problems with the Assistant Secretary for Science and Technology and other agency officials concerned with the Program. We are bringing them to your attention for consideration in your Department's evaluation and forthcoming budget decisions for the Program.

Science and technology experts believe that the Program is directed toward an important need and participating agency officials said that their association with the Program had been beneficial. However, Program personnel have encountered management difficulties that have hampered Program activities and could continue to do so in the future.

The size of the present staff and its reliance on other agencies to assist in conducting cooperative experiments have made it difficult for Program management to plan and conduct the number of experiments considered necessary to obtain information to make policy recommendations. The effectiveness of the method being used for evaluating experiments has yet to be determined. There also seems to be a need for more effective interaction between Program personnel and Federal policy-making and policy research organizations having similar or related objectives. Also, the Program should remain in the National Bureau of Standards unless the advantages provided by its location can be matched or surpassed elsewhere. These matters are discussed more fully in the appendix.

We recommend that your Department's current evaluation of the Program determine the extent to which these problems impact on its potential for developing policy recommendations on what the Government can do to accelerate private sector innovation. If it is found that the objectives of the Program are not being achieved because of these problems, then action should be taken to overcome them and/or modify the objectives.

We shall be pleased to discuss the contents of this report in further detail should you so desire. Please contact Mr. Jack S. Heinbaugh, Assistant Director, Procurement and Systems Acquisition Division on 275-3195.

As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report, and the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Chairmen of the four committees identified above; the Director, Office of Management and Budget; and the Chairmen of the Senate Commerce, Science and Transportation Committee, the House Interstate and Foreign Commerce Committee, and the House Science and Technology Committee.

Sincerely yours,

A handwritten signature in cursive script that reads "Henry Eschwege". The signature is written in dark ink and is positioned above the typed name and title.

Henry Eschwege
Director

ISSUES FOR CONSIDERATION IN EVALUATING THE
EXPERIMENTAL TECHNOLOGY INCENTIVES PROGRAM

ORIGIN OF PROGRAM

In the summer of 1971, the Nixon Administration attempted to bolster the lagging economy. Adverse conditions included a high inflation rate, a worsening foreign trade balance, and a high level of unemployment, including a large number of scientists and engineers. With the growing realization by economists that research and development has a positive impact on economic growth and productivity, Administration officials began to look for ways to apply scientific and technological resources to civilian sector problems.

In July 1971, the President launched the New Technological Opportunities Program to generate proposals for new Federal initiatives in science and technology. This effort initially consisted of three elements: Office of Science and Technology personnel reviewed proposals for new technology projects from Federal agencies; a member of the Council of Economic Advisers headed a study of potential economic incentives to spur the funding and utilization of R&D in industry; and a group headed by the Treasury Department dealt with the transfer of technology among nations. Opinions were solicited from industry executives and specially convened advisory panels. This entire effort was coordinated through staff of the Domestic Council and ultimately reviewed by White House staff.

The New Technological Opportunities Program generated many proposals, but by December 1971, the White House staff recommended that no major funding be provided. It was felt that there was no sound basis for funding major new projects because not enough was known about how the Government could bring about change in technological innovation in the marketplace. As a consequence, officials at the National Bureau of Standards and the National Science Foundation were told to design experimental programs to test various means of providing this information. The new programs were included in the Fiscal Year 1973 budget request.

On March 16, 1972, the President sent a science and technology message to Congress which included goals for three new programs. The Experimental Research and Development Incentives Program at the National Science Foundation and the Experimental Technology Incentives Program (ETIP) at the National Bureau of Standards were conceived to "...determine effective ways of stimulating non-Federal investment in research and development and (improve) the application of research and development results." The experiments of

the programs were to be "...designed to test a variety of partnership arrangements among the various levels of government, private firms and universities."

Also, a study program known as the Research and Development Assessment Program was established at the National Science Foundation to "...support assessments and studies focused specifically on barriers to technological innovation and on the consequences of adopting alternative Federal policies which would reduce or eliminate these barriers."

Our work focused on the Experimental Technology Incentives Program's management and activities. Our survey was performed at the Department of Commerce headquarters, the National Bureau of Standards, the National Science Foundation, the Office of Management and Budget, and several other Government agencies and groups involved with the Program. We also obtain views on the Program from acknowledged experts in science and technology policy. Our observations follow.

THE ETIP PROCESS

The strategy of the Program is first to identify Government functions that may influence whether and in what ways private industry makes use of new technology and then to develop experiments in cooperation with other Government agencies and private sector organizations, testing whether new policies or procedures can lead to more effective use of technology in private industry.

Experiments and studies in three areas of Government policy are being conducted:

- procurement, including the testing of potential incentives to technology innovation such as life cycle costing, value incentive clauses, and performance specifications;
- regulation, including changes such as alternatives to mandatory standards and reducing the time to establish new standards; and
- economic assistance, including problems relating to venture capital, small business policies, and commodities supplies and shortages.

Early projects proposed for the Program included policy subjects such as patents, taxes, and anti-trust administration. Cooperation with industry to develop specific technologies was also considered. However, these proposals were not accepted.

In February 1974, the Secretary of Commerce approved the present ETIP Plan and released funds previously appropriated. As of March 1, 1977, there were 17 full-time staff positions and 78 projects had begun, consisting of 26 experiments, 22 studies, 12 evaluation projects and 18 other projects. As of September 30, 1976, \$14.7 million had been obligated and for Fiscal Year 1977 \$3.1 million has been apportioned.

The methodology of the Program for gaining information that might lead to policy recommendations is:

- researching broad technology-economic related issues to identify areas for potential study and experimentation;
- working with an agency to define specific subjects likely to result in some policy changes;
- designing an experiment or a background study which can lead directly to experimentation, or designing a general study if experimentation is inappropriate;
- conducting the experiment or study in cooperation with the agency based upon a project plan;
- evaluating the project to assess its impact on the agency and the economy; and
- following up on the information gained from individual projects and recommending appropriate policy.

We have identified potential weaknesses in the activities of the Program as discussed in the following sections.

PLANNING, CONDUCTING AND EVALUATING THE PROGRAM'S STUDIES AND EXPERIMENTS

Planning Experiments

The ETIP staff has found that background literature does not exist in many areas of Program interest and background studies must be performed before experiments can be designed to test how the Government can increase technological innovation in private industry. A satisfactory method of studying and analyzing program areas and designing experiments has not yet been developed.

The Program management has concluded that the ETIP staff must perform problem area identification rather than relying on contractors. In dealing with contractors, difficulties encountered included delays caused by the contracting process, the costs of the contracts, and the length of time required for the contractors

to learn about agency operations. In addition, having contractors perform studies does not allow the ETIP staff to gain the direct knowledge through research that would be valuable in managing the experiments identified as a result of the studies.

The Program staff has found that the potential cooperating agency must help in defining the reasons for and scope of experiments. The staff needs to make sure that the objectives of both ETIP and the other agencies are met through the cooperative arrangement and must overcome administrative barriers encountered due to the limited experience most agencies have had in working in a cooperative arrangement. A methodology for combining the resources of ETIP, potential cooperating agencies, and contractors is still being developed.

Designing experiments has been unexpectedly difficult because of the inherent complexities of making policy analyses and working with other agencies. Also conducting and monitoring on going projects has limited the staff time available for planning new projects. The Program's management does not believe the existing staff level is sufficient to perform background research needed to identify problems and design experiments.

The experience gained in developing on-going Program areas should be considered in order to formulate time and staff requirements for identifying problem areas and designing experiments. This information should improve future planning by permitting a better balance between program objectives and program resources.

Conducting ETIP Experiments

The Program plan approved in 1974 stated that many experiments would be necessary to develop general conclusions upon which policy recommendations would be based. In the procurement area, the strategy is to test known incentives in as many environments as possible. Several subjects have been identified for experiments in the regulatory area. However, the Program staff has encountered difficulties that have slowed the rate at which experiments can be initiated.

The strategy of the Program requires that the staff be heavily engaged in all phases of the experimentation process. The staff initially underestimated the time required to effectively plan, conduct, and monitor experiments. The activities of the Program are far more complex than originally envisioned, partly because the agencies cooperating with ETIP have different mission objectives.

We believe that the Department's current evaluation of the Program should determine:

- whether the present rate of experimentation is adequate to develop information useful for making policy recommendations within an acceptable period of time; and
- the extent to which increases in ETIP staffing could increase the rate of experimentation.

Evaluating Experiments

The importance of evaluating experiments to provide a sound basis for policy recommendations was noted in ETIP plans. However, the designs for some experiments started in Fiscal Years 1974 and 1975 did not adequately consider evaluation needs and there were uncertainties in initial experimental results. In January 1976, ETIP personnel stressed the need to incorporate evaluation designs in project planning. Thus, recent ETIP experiments may permit more useful evaluations than earlier ones. However, most ETIP experiments begun since that time have not been completed. Therefore, it is not yet possible to determine the extent to which improved project designs will result in useful evaluations.

Evaluation difficulties are major problems in obtaining useful information from experiments on how Government action can increase technological innovation in private industry. Experience to date indicates that the following factors may limit the information that can be obtained through evaluation or increase the time and cost of evaluation activities:

- the difficulties in convincing cooperating agencies of the importance of rigorous evaluation plans;
- the complex problem areas addressed by ETIP experiments. For instance, it is difficult to relate the effect of specific regulation changes on technology innovation;
- the need to complete many experiments before drawing general conclusions about a problem area;
- the cost of collecting information necessary to reach conclusions from experiments and studies. For example, about \$3 million has been obligated for ETIP procurement experiments and studies and \$1.8 million for evaluation of their results. The ETIP staff estimates that evaluation requires at least one half the staff required for conducting and monitoring projects;

--the length of time needed for policies to have an effect on technological innovation by industry. The National Bureau of Standards estimates that it could take years for new procurement experiments to produce technological innovation in industry.

ETIP plans call for contractors to assess the impacts of experiments and studies in procurement, regulatory, and economic assistance policy areas. In 1976, ETIP management contracted with Stanford Research Institute and Research Triangle Institute to evaluate the procurement experiments and studies. The contractors are to submit their evaluation plans to ETIP in September 1977 and evaluation reports in 1978. A contractor evaluation of the regulatory area is scheduled to begin in Fiscal Year 1977. The economic assistance evaluation is scheduled to begin in 1978.

It will not be possible to judge the effectiveness of the present strategy of using contractors to assess the impact of experiments and studies until reports are prepared on the procurement area in 1978. Thus, ETIP management does not now have a proven method of gaining useful information from its experiments for making recommendations on technology policy.

INTERACTION WITH OTHER POLICY-MAKING AND POLICY RESEARCH GROUPS

Agencies

The strategy of the Program is to conduct experiments with other Government agencies. The staff believes that, by cooperating in ETIP experiments, Federal agencies can become familiar with the use of new procedures and prepare for expanded use of procedures being tested.

Officials of cooperating agencies whom we contacted told us that the experiments have benefited their agencies. For example, a Federal Supply Service official told us that the Program has improved the Service's ability to develop new procurement procedures. The role of the Program in Federal Supply Service efforts to apply life-cycle costing was discussed in a previous General Accounting Office Report.^{1/} Officials of other agencies told us that association with ETIP helped them become more aware of their activities' effect on industry and that the expertise obtained from the Program staff helped them develop better projects.

^{1/}Letter Report to the Administrator of General Services, General Services Administration, PSAD-76-160, July 23, 1976.

However, we are concerned about reliance of the Program on agencies to conduct cooperative experiments on those issues that have been identified as necessary to provide a knowledge base in a policy area. For example, Program officials believe that multi-year contracting may encourage technology innovation in private industry and information on this aspect of the procurement process is necessary. However, they have not been able to reach an agreement with another Federal agency to test multi-year contracting. Consideration should be given to the extent to which the inability to reach agreements with other Federal agencies has hindered the effectiveness of the Program.

Policy Groups

Since ETIP began, policy-mechanisms have been legislatively established that might assist Program officials in reaching agreements with agencies to conduct experiments:

- The Office of Science and Technology Policy, established in 1975, is responsible for recommending Federal policies designed to advance the application of scientific and technological capabilities to national needs;
- The National Center for Productivity and Quality of Working Life, established in 1975, is responsible for developing a national policy for productivity growth in consultation with the appropriate organizations in Government; and
- The Office of Federal Procurement Policy, established in 1974, is responsible for providing overall direction of procurement policy.

The participation of these groups in identifying issues appropriate for experiments should be considered as a way to increase the ability of ETIP personnel to conduct experiments on technology policy questions. Their involvement in the planning of ETIP experiments could also enhance the usefulness of ETIP results in policy-making by these groups.

ETIP staff members have coordinated informally with these policy-making groups. For example, the Program staff has kept the Office of Federal Procurement Policy aware of its procurement experiments. As a result of a request by the ETIP Director, the Office of Federal Procurement Policy issued a letter in January 1977 encouraging greater use of the Life-Cycle Costing technique in procurement. However, as noted in a previous GAO report 1/, greater

1/Manufacturing Technology--A Changing Challenge to Improved Productivity, LCD-75-436, June 3, 1976.

coordination among groups concerned with productivity and technology could yield more effective results. Therefore, the Department of Commerce's evaluation of ETIP should consider the benefits of better interaction with appropriate policy-making groups.

Improved coordination with Federal organizations conducting research in areas related to ETIP experiments may also be beneficial. Personnel in the Division of Policy Research and Analysis in the National Science Foundation identify issues relating research and development and technology innovation to national purposes, and analyze policy options and their potential effect. The Division staff has studied the effect of Government regulations on technological innovation and sponsored research on factors affecting industrial productivity.

In the past, informal interaction has taken place between personnel at ETIP and the Division of Policy Research and Analysis on the planning and management of specific projects. However, as previously noted, the ETIP staff has concluded that it is necessary in many cases for them to perform background research before initiating experiments to find out how the Government can increase technological innovation in the private sector. Better interaction may enable ETIP personnel to make more use of research performed by others in planning its experiments.

ORGANIZATIONAL LOCATION OF ETIP

The Congress has questioned whether ETIP should continue to be a part of the National Bureau of Standards.

In considering the institutional setting of the Program, we noted that the Department of Commerce's mission includes stimulating and supporting industrial research and development. The National Bureau of Standards has a tradition of cooperative interaction with mission-oriented Government agencies and private industry. Also, the Bureau's management understands the long time frames required for experimentation and is sensitive to the uncertainty of the research process.

The location of ETIP at the Bureau appears suitable because of the following characteristics of the Program:

- Program experiments must continue for 3 to 6 years before results can be observed,
- Access to other agencies is necessary for experimenting, and,
- All experiments contain the risk of failure.

Unless these advantages can be matched or surpassed elsewhere, we believe that the location of ETIP is less important to success than the commitment of management reflected through adequate staffing and funding support.

CONCLUSIONS

In managing projects, the ETIP staff has encountered difficulties that have hampered Program activities and could continue to do so in the future. The size of the present staff and its reliance on agencies to assist in conducting cooperative experiments have made it difficult to plan and conduct the desired number of experiments. Also, the effectiveness of the method being used for evaluating experiments has yet to be determined.

We believe that more effective interaction is needed between personnel at ETIP and Federal policy-making and policy research organizations that have similar or related objectives. Greater coordination and cooperation could help ETIP staff achieve the objectives of the Program by improving the performance of necessary background research, abetting the ability of the staff to conduct experiments on technology policy issues, and enhancing the usefulness of experiment results to policy-makers.

RECOMMENDATION

We recommend that the Department of Commerce's current evaluation of ETIP determine the extent to which these problems impact on the potential of the Program to develop policy recommendations on what the Government can do to accelerate private sector innovation. If it is found that the objectives of the Program are not being achieved because of these problems, then the Secretary of Commerce should act to overcome them and/or modify the objectives as necessary.