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The Federal Role in Technology Development

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Abstract. The federal government has traditionally played a role in fostering technological progress. This has involved both direct federal research and development (R&D) funding and indirect measures that create incentives for increased private sector investments in innovation. However, this mix of initiatives was challenged since the 104th Congress. While support for all on-going efforts continues, some programs have been funded at reduced levels. However, since FY2001, appropriations appear to have reversed this trend.

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Summary

The federal government has traditionally played a role in fostering technological progress. This has involved both direct federal research and development (R&D) funding and indirect measures that create incentives for increased private sector investments in innovation. However, this mix of initiatives has been challenged since the 104th Congress. While support for all on-going efforts continues, some programs have been funded at reduced levels. However, since FY2001, appropriations appear to have reversed this trend. As programs are implemented and mature, concerns are being raised as to the appropriate balance between the importance of bringing new and improved products and processes to the marketplace and protecting the public investment in R&D.

Technology Development: The Federal Role[1]

The federal government funds research and development (R&D) to meet the mission requirements of the departments and agencies (e.g., defense, public health, environmental quality). It also finances work in areas where there is an identified need for research, primarily basic research, not being performed in the private sector. Federal support reflects a consensus that while basic research is the foundation for many innovations, the rate of return to society as a whole generated by investments in such work is significantly larger than the benefits that can be captured by the performing institution. This often leads to underinvestment in research by the business community.

Over the last 20 years, congressional initiatives have expanded the government's role in R&D to include the promotion of technological innovation to meet other national needs, particularly the economic growth that flows from the commercialization and use of new products and production processes. Technological advance can drive the economy because it contributes to the creation of new goods and services, new industries, new jobs,

[1] For a detailed discussion see CRS Issue Brief IB91132, *Industrial Competitiveness and Technological Advancement: Debate Over Government Policy*, by Wendy H. Schacht.

and new capital. It allows for an expanded range of services and extends the geographic distribution of those services. The application of technology also may contribute to the resolution of those national problems that are amenable to such solutions. Experts widely believe that technological progress is responsible for up to one-half the growth of the U.S. economy and is one principal driving force in long-term economic expansion and increases in the nation's standard of living.

Dual Approaches

Congress often has been the source of federal inducements to technological progress. The legislative approach generally reflects the basic tenet that while commercialization of technology is the responsibility of the private sector, there are benefits that may be derived from additional mechanisms to stimulate industrial innovation. As a result of bipartisan efforts, various laws have removed barriers to technology development in the business community and provided incentives for increased private sector R&D. Many legislative initiatives involve promotion of cooperative relationships among government, industry, and academia.

The laws affecting the R&D environment have included both direct and indirect measures to facilitate technological innovation. In general, direct measures are those that concern budget outlays and the provision of services by government agencies. Indirect measures include financial incentives and legal changes (e.g., liability or regulatory reform; new antitrust arrangements). Supporters of an indirect approach argue the market is superior to government in determining those technologies worthy of investment. Mechanisms that enhance opportunities for the market to make such choices are preferred. It is assumed that reliance on the discretion of federal agencies to promote one technology in preference over others will inevitably be subjected to political pressures from entrenched interests. Conversely, proponents of direct government assistance maintain that indirect methods can be wasteful and ineffective, and may compromise other goals of public policy in the hope of stimulating innovative performance. Advocates of federal spending argue it is important to put the country's scarce resources to work on those technologies with the greatest promise as determined by industry and supported by the community's willingness to match government funding.

In the past, while Republicans tended to prefer reliance on free market investment, competition, and indirect federal support, participants in the debates generally did not make definite (or exclusionary) choices between the two approaches, nor consistently favor one over the other. For example, some proponents of a stronger direct role for the government in innovation are also supporters of enhanced tax preferences for R&D spending, an indirect mechanism. Opponents of direct federal support for specific projects (e.g., SEMATECH, flat panel displays) nevertheless may back similar activities focused on more general areas such as manufacturing or information technology.

However, many of these activities were called into question during the 104th Congress as reflected in the House Republican Contract with America, associated budget proposals, and various authorization and appropriations legislation. Similar issues have been raised in subsequent Congresses but appear subject to less conflict. While most of the programs survived termination challenges, such efforts implied a significant change from the past. Under former President Bush, government's stated role was ". . . to support the development of generic or enabling technologies at the pre-competitive stage

of R&D" and included direct federal cost-shared funding for several industrial programs. Increased private sector investment was encouraged as was public-private collaboration through the National Technology Initiative. Also proposed were reductions in the capital gains tax rate, making permanent the research and experimentation tax credit, increasing international intellectual property protection, limiting product liability, and eliminating unwarranted regulation.

The Clinton Administration expanded upon this approach in the context of a national strategy for commercial technological advancement as part of a defined national economic policy. There have been efforts to increase direct federal funding for "industry led" technology programs (with matching private sector commitments); to augment cooperation among all levels of government, industry, and academia; to move from defense R&D toward civilian R&D support; and to shift emphasis from basic research to include development of commercial products and processes. The Administration's strategy for civilian technology investment was based upon support of both direct and indirect federal assistance.

Current Initiatives

An overview of the current mix of indirect and direct measures designed to facilitate technological advancement is offered below.

Indirect Measures. Among the most visible indirect mechanism is the **Research and Experimentation Tax Credit** originally mandated by the 1981 Economic Recovery Tax Act (P.L. 97-34). Extended several times, the most recently through June 30, 2004, the law allows a 20% credit for increases in a firm's qualified research costs above the average expenditures for the previous 3 tax years. Qualified costs include in-house expenditures such as wages for researchers, materials, and payments for use of equipment; 65% of corporate grants towards basic research at universities and other relevant institutions; and 65% of payments for contract research. The credit is applicable to 75% of a company's tax liability. Small, start-up firms also are eligible.

Various legislative initiatives have been enacted to facilitate cooperative ventures among government, business, and academia in recognition of the fact that investments in research and development are often costly, long term, and risky. It is argued that collaborative R&D ameliorates these factors and permits work to be performed that crosses traditional boundaries of expertise and experience. To encourage increased private sector R&D activity, the **National Cooperative Research Act** (P.L. 98-462) clarifies the antitrust laws as they relate to joint research efforts and eliminates treble damage awards for those ventures actually found in violation if prior disclosure to the government has been made. These changes came in response to industry's reluctance to enter into cooperative efforts because of the threat of antitrust prosecution. Through FY2002, over 765 joint research ventures have filed with the Department of Justice since passage of this legislation. In addition, the success of this law precipitated the enactment of the **National Cooperative Production Amendments Act of 1993** (P.L. 103-42) which extends the provisions of the National Cooperative Research Act to joint manufacturing ventures with certain reservations concerning location and ownership of the participating enterprises.

Another indirect approach to augment commercialization involves the transfer of technology from federal laboratories and contractors to the industrial community mandated by the **Stevenson-Wydler Technology Innovation Act** (P.L. 96-480), as amended.[2] This law created institutional mechanisms by which government agencies and their laboratories can move technology to the private sector as well as integrate industrial expertise into the federal R&D enterprise. Additional incentives are contained in the **Federal Technology Transfer Act** (P.L. 99-502) and the **Defense Authorization Act of 1990** (P.L. 101-189) which enable government laboratories to enter into cooperative R&D agreements (CRADAs) with universities and industry. In pursuing joint efforts, the laboratory may accept funds, personnel, services, and property from the collaborating party and may provide personnel, services, and property (but **not** funds) to the other organization. The work performed must be consistent with the laboratory's mission. Preference for cooperative ventures is given to small businesses, companies that will manufacture in the United States, or foreign firms from countries that permit American companies to enter into similar arrangements. To date, over 5,000 CRADAs have been signed (including NASA Space Act Agreements).

P.L. 96-517, **Amendments to the Patent and Trademark Act** (commonly referred to as the **"Bayh-Dole Act"**), utilizes the ownership of inventions arising out of government-sponsored R&D to encourage development of new technologies. The law provides for title to inventions made with federal R&D funding to be vested in the contractor if it is a small business, university, or not-for-profit institution. Patent ownership is seen as a way to promote the additional private sector investment necessary for commercialization. Certain rights are reserved for the government.[3]

Direct Measures. Government programs directly funding technology development experienced the most scrutiny since the 104th Congress. Several times the House has acted to delete appropriations for the Advanced Technology Program. While many of these activities require cost sharing of at least 50% with non-federal partners and usually are responsive to industry-led priorities, there are indications that some Members view them as inappropriate federal government involvement in market choices.

The **Advanced Technology Program** (ATP), provides seed funding, matched by private-sector investment to companies or consortia of universities, businesses, and government laboratories for development of generic technologies that have broad application across industries.[4] Managed by the National Institute of Standards and Technology (NIST), a laboratory of the Department of Commerce, this program was established by the Omnibus Trade and Competitiveness Act of 1988 (P.L.100-418). Awards, based on technical and business merit, are made for work which is high-risk and past the basic research stage but not yet ready for commercialization. Initial funding for

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[2] For further detail see CRS Report RL30320, *Patent Ownership and Federal Research and Development: A Discussion on the Bayh-Dole Act and the Stevenson-Wydler Act*, by Wendy H. Schacht.

[3] For additional discussion see CRS Report 98-862, *R&D Partnerships and Intellectual Property: Implications for U.S. Policy*, by Wendy H. Schacht.

[4] For more information see CRS Report 95-36, *The Advanced Technology Program*, by Wendy H. Schacht.

ATP in FY1991 was $36 million; by FY1995, this had expanded significantly to $341 million (after rescissions). Support began to decline in FY1996. Attempts were made by the House to terminate the program although funding has continued. FY2002 ATP appropriations totaled $184.5 million.

Also created by the 1988 Trade Act was a program of regional manufacturing technology transfer centers, now known as the **Manufacturing Extension Partnership** (MEP).[5] Knowledge and technologies developed under the auspices of the National Institute of Standards and Technology are used to assist small and medium-sized companies. To date all states have manufacturing technology centers or smaller outreach centers. Beginning with $11.9 million in FY1991, the Partnership expanded in FY1994 to include the Centers Program, the Manufacturing Outreach effort, and the State Extension Program. A new program, LINKS, was added in FY1995 to tie together federal, state, and local agencies, the private sector, and the manufacturing outreach institutions through communications and computer data systems. Recently, funding has remained stable as additional financial responsibilities are taken over by the non-federal partner. FY2002 funding for the program is $106.5 million.

The **Small Business Innovation Research Program**, mandated by P.L. 97-219, as amended, is an activity to assist small, high technology companies perform research, development, and commercialization in areas of interest to the government.[6] Each federal agency with an R&D budget over $100 million is required to set aside a percentage of that funding (2.5% through the end of FY2008) for grants to small firms. Financing is, in part, dependent on companies obtaining private sector support for the commercialization of the resulting products or processes. A pilot effort, the **Small Business Technology Transfer Program**, also was created to encourage small firms to work with universities or federal laboratories to facilitate the commercialization of research performed in these institutions. This activity is funded by a set-aside (originally 0.15% and increased to 0.3%). Initially expected to sunset in FY1996, the program has been extended through FY2009.

Issues For Consideration: A New Approach?

In the past, government support for technology development has been reflected in the balance between legislatively mandated incentives for private sector investment and direct government financing of R&D. The activities of the 104th Congress displayed a preference for the first approach while subsequent Congresses further explored technology policy within the context of budget decisions. Although on-going programs were funded, some support was at reduced levels. What happens next might be dependent on how the debate is framed. Will federal funding of specific technology ventures continue to be seen by the majority as "picking winners and losers" or will spending for efforts such as the Advanced Technology Program be seen as fostering productive collaboration among firms? Is the government making decisions which should best be left to the marketplace or is there an overriding national need for federal investment in these industry-led programs?

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[5] See: CRS Report 97-104, *The Manufacturing Extension Partnership*, by Wendy H. Schacht.

[6] Additional detail in CRS Report 96-402, *The Small Business Innovation Research Program*, by Wendy H. Schacht.

There appears to be agreement with the basic premise that the government does have a role in fostering technological advancement in the private sector; the debate is over how this is best achieved within existing and future budget constraints. In place of direct federal appropriations, some have suggested the creation of tax incentives which, proponents argue, would provide the capital resources necessary for industry to invest in additional R&D. Thus, efforts such as a permanent and expanded research and experimentation tax credit are considered a viable substitute for government cost-shared programs. Changes in the capital gains tax to encourage long term investments, particularly in high technology companies, also have been proposed to increase the amount of funding available for industrial use.

Regulatory reform may be used to facilitate technology development by diminishing the costs associated with bringing a new product or process to the marketplace. Disincentives to new technology development embodied in the threat of large punitive damage awards might be addressed by liability reform. In addition, other ideas might be considered to encourage collaborative work among industry, university, and government. These include changes to the antitrust laws pertaining to cooperative development and/or commercialization activities, increasing state government participation in relevant federal decisionmaking, and strengthening intellectual property protection.

Legislative activity has emphasized creation of an environment conducive to such cooperative ventures. To date, Congress has determined that efforts that provide title to inventions made under federal funding to contractors and/or collaborating parties should be used to support innovation and technology development. In return for patent ownership, Congress has accepted as satisfactory the anticipated payback to the country through goods and services to improve our health, welfare, and standard of living. These benefits have been considered more important than the initial cost of the technology to the government or any potential unfair advantage of one company over another in a cooperative venture. However, as such efforts become more widespread and as new issues emerge, additional decisions may need to be made on how to maintain a balance between the importance of bringing new products and processes to the marketplace and protecting the public investment in R&D.

Research and development funding constitutes the largest single portion of total federal discretionary spending and is therefore subject to cuts as legislators move toward a balanced budget. As a result, priorities concerning the allocation of financing may need to be established. The 107th Congress may find it productive to explore new methods to encourage increased activities by other parties in the innovation process, particularly if the goal is to continue the technological advancement which has been so instrumental to this nation's economic growth and high living standard.