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R&D in the Federal Budget: Frequently Asked Questions

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FREQUENTLY ASKED QUESTIONS ABOUT R&D IN THE BUDGET

Research and development (R&D) is one of the most important, yet least understood, parts of the federal budget. The federal government invests about $80 billion in R&D annually. This represents about 30 percent of the nation's total annual expenditure on R&D.

This book is intended to help make sense out of the wealth of numbers, percentage increases and decreases, and often-conflicting interpretations that surround R&D budget issues. It seeks to put the Administration's budget for the coming fiscal year in perspective by sorting out the facts behind the rhetoric and discussing the current budget in the context of past trends and future projections.

This chapter provides answers to eleven frequently asked questions about federal funding for R&D:

1. How does R&D relate to the U.S. economy?
2. How much does the U.S. invest in R&D each year overall?
3. Why does the federal government fund R&D when the private sector is already investing so much in it?
4. Where is federally-funded R&D carried out?
5. What is the share of the federal budget devoted to R&D?
6. Does the government have an "R&D budget"?
7. How does federal R&D relate to other government objectives and priorities?
8. How are R&D priorities set in the President's budget?
9. How does Congress set its R&D priorities?

10. Where does R&D fit among President Clinton's priorities for FY 2001?
11. How does U.S. investment in R&D compare to other countries?

1. How does R&D relate to the U.S. economy?

Science and technology are increasingly recognized as key drivers of economic growth, as well as improved health and quality of life in the United States and throughout the world. Economists estimate that up to half of U.S. economic growth over the past five decades is due to advances in technology. Recent advances in genetics and biotechnology, as well as computers and information technology, have raised public awareness of the vital economic role of research-based technology. High-tech industry is sought after by economic development organizations in virtually every state and locality. Policymakers regard universities as catalysts for high-tech economic development both through entrepreneurial activity that spins off from their research and through the concentrations of highly trained human resources they attract and generate. The federal government plays a central role in sustaining research in the nation's universities.

2. How much does the U.S. invest in R&D each year overall?

R&D is a substantial and growing enterprise in the United States. All in all, the U.S. invested an estimated $247 billion in R&D in 1999 (see Table I-11). This represents 2.79 percent of the nation's GDP. The largest share of this money (about 69 percent) came from industrial firms. Most of the balance (27 percent) came from the federal government. Colleges and universities, private foundations, other nonprofit institutions, and state and local governments provided the remainder. Industry's share of national R&D funding has been growing steadily for several decades (see Chapter 5 for more information on industry support of R&D). From the end of World War II to 1980, the federal government supported the largest share of the nation's R&D.

3. Why does the federal government fund R&D when the private sector is already investing so much in it?

Despite its relatively modest share of total U.S. R&D funding, the federal government's role is critical to the nation's science and technology enterprise. Federal agencies support close to 60 percent of the nation's *basic* research and a similar share of the R&D performed in U.S. colleges and universities (see Table I-8). Basic research is the primary source of the new knowledge that ultimately drives the innovation process. Federally funded research at colleges and universities also plays a key role in educating the next generation of scientists and engineers. (See Chapter 4 for details of basic research and university R&D in the FY 2001 budget.) In addition, federal applied research and development programs provide direct support for key government missions, such as improving the nation's health and medical care, controlling and cleaning up environmental pollution, exploring outer space, and maintaining the nation's defense.

4. Where is federally-funded R&D carried out?

Although the government maintains several hundred laboratories around the country, only about 24 percent of federally supported R&D is actually carried out in these labs. The largest share of federally funded R&D is performed by industrial firms under contracts. A significant amount is conducted under federal grants in colleges and universities as well as other nonprofit institutions, including FFRDCs (federally funded R&D centers) operated by contractors, such as the Department of Energy's (DOE) Argonne National Laboratory in Illinois, which is operated by the University of Chicago.

Altogether, including the research that firms support with their own funds and that which is conducted under government contracts, industry is responsible for performing three-fourths (75 percent) of the nation's total R&D (see Table I-14). U.S. academic institutions perform about 11 percent, while federal laboratories, nonprofit institutions (research institutes, hospitals, etc.), and FFRDCs perform the remainder. Table I-12 shows the relationship between performing sectors and sources of R&D funds in the U.S. (The data in these tables were collected by different means and represent expenditures during calendar years; therefore, they do not correlate with the federal budget data reported elsewhere in this book, which are generally shown in budget authority for fiscal, rather than calendar, years.)

5. What is the share of the federal budget devoted to R&D?

Federal R&D expenditures represent 4.5 percent of the overall proposed $1.8 trillion federal budget for FY 2001 and 13.1 percent of the discretionary portion of that budget. (See Tables I-2 and I-3.) On the whole, trends in R&D funding have closely followed trends in federal discretionary spending. Growth in overall discretionary spending over the past four decades has allowed federal investment to grow in many areas, including R&D. Efforts to balance the federal budget by cutting discretionary spending during the mid-1990s resulted in reductions in most of these areas, including R&D. Recent increases have erased these losses in several agencies and produced significant gains for a few.

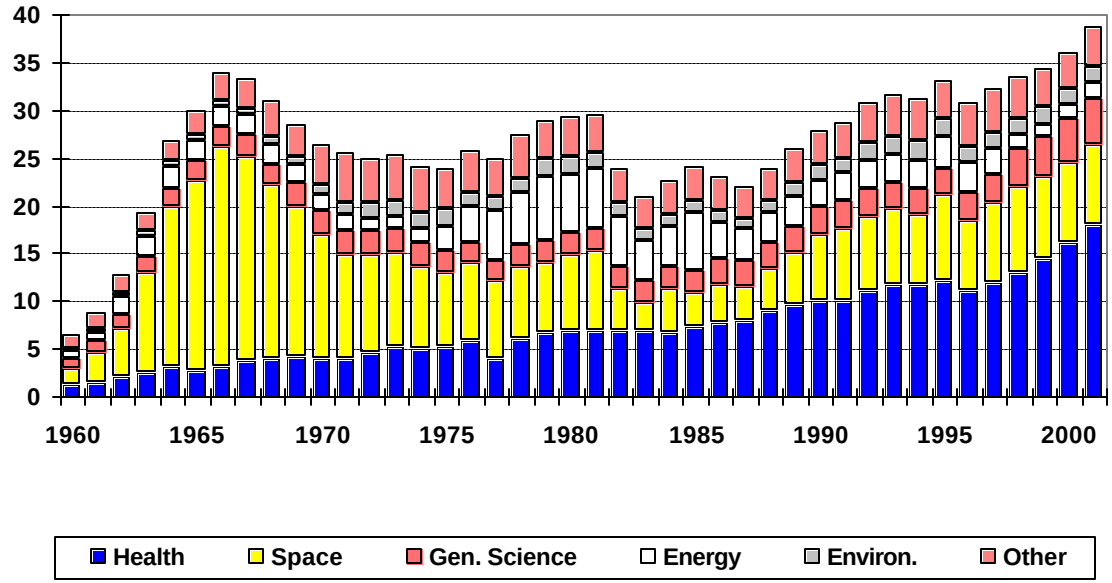
6. Does the government have an "R&D budget"?

Although the President's budget presentation each year generally contains a section devoted to R&D and a number of tables summarizing proposed federal R&D expenditures, it is important to recognize that there is no overall "R&D budget" and no special treatment for R&D within the budget. The "21st Century Research Fund" contained in the President's FY 1999, 2000, and 2001 budgets is *not* an exception to this (see Table I-17 and Chapter 7). Although it has the appearance of an "umbrella" for several domestic R&D programs, it is in fact a device for highlighting these and other science and technology-related programs, underlining the President's interest in them, and allowing the Office of Management and Budget (OMB) and the White House Office of Science and Technology Policy (OSTP) to follow them through the budget development process in a systematic way. It does not provide any formal means of aggregating R&D expenditures or trading off among them.

Expenditures for R&D programs are regular budget items. They are contained, along with other types of expenditures, within the budgets of more than 20 federal agencies and departments. For some of those agencies, such as the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the National Institutes of Health (NIH), R&D is a dominant activity. For others, such as the Department of Housing and Urban Development, it is a small part of a much larger set of programs. Some R&D programs are "line items"

Figure 1. Trends in Nondefense R&D by Function, FY 1960-2001

Outlays for the Conduct of R&D, Billions of Constant FY 2000 Dollars



Source: AAAS, based on OMB Historical Tables. Constant dollar conversions based on OMB's Gross Domestic Product deflators. Some Energy programs shifted to General Science beginning in FY 1998.

in the budget and are relatively easy to identify as R&D. Others are included within larger line items and are more difficult to ferret out.

7. How does federal R&D relate to other government objectives and priorities?

Most of the federal government's R&D is mission oriented; that is, it is intended to serve the goals and objectives of the agency that provides the funds (*e.g*., agricultural research in the Department of Agriculture). The only exception to this is NSF, whose mission is to support basic and applied research, research facilities, and education across a wide range of science and engineering disciplines.

The relative priority of different areas of R&D has varied over the years, reflecting changing national priorities and the role of R&D within them. Spending on defense R&D has exceeded all other R&D spending (grouped together as "nondefense R&D") for most of the past four decades, although the relative size of the two sectors has varied considerably over the years. Figure 1 shows how priorities in nondefense R&D have shifted over the same period. Civilian R&D expenditures reached a high point in the mid-1960s, declining for several years thereafter. After several years of significant growth in the late 1980s and the late 1990s, they are just now returning to the levels of the 1960s in real (*i.e*., inflation-adjusted) terms.

Priorities, however, are different now than they were in the 1960s. Space exploration was the dominant function in the 1960s, driven mainly by the Apollo Program. Energy R&D gained priority following the oil shortages of the 1970s and then retreated as national attention turned elsewhere. Health R&D, meanwhile, has shown practically uninterrupted growth over these years and now represents the largest single share of the civilian R&D portfolio. (See Chapter 4 and Table I-4 for details of national priorities in the FY 2001 budget.)

8. How are R&D priorities set in the President's budget?

Priorities for R&D programs generally depend on the priorities of the agencies in which they are located. At one level, this makes good sense, since these R&D programs are not ends in themselves but means to the

ends (missions) that their sponsoring agencies serve. At another level, however, it means that it is difficult for policymakers to assess the overall health of the research enterprise, to coordinate programs among different agencies, and to address issues of balance among various scientific and engineering fields and disciplines.

The Office of Management and Budget, which has overall responsibility for preparation of the President's budget, is able to provide some coordination, although it is hampered by the fact that the agencies that support R&D are treated individually by its different sections in the budget review process. Some coordination also takes place under the National Science and Technology Council (NSTC), an interagency body comprised of cabinet officers and the President. NSTC has organized a number of interagency initiatives in areas of R&D, including global change research, high performance computing and communications, information technology, and motor vehicle research. Budgets for these initiatives are shown in Table I-10. In addition, in the past three years, the "21st Century Research Fund" has provided OMB and OSTP with a tracking mechanism to monitor the status of selected R&D and other science and technology-oriented programs across the major nondefense agencies during the budget formulation and appropriations phases of the budget process (see Table I-17).

9. How does Congress set its R&D priorities?

Even the modest level of coordination in R&D in the executive branch is not matched by Congress. Congressional treatment of R&D, like most other aspects of congressional budget and policymaking, is characterized by fragmentation and diffusion of power. R&D programs are considered at two main levels in Congress, that of authorizations and that of appropriations. Authorizing committees (such as the House Science Committee and the Senate Committee on Health, Education, Labor, and Pensions) develop special expertise and review the substance of programs. However, the legislation they prepare does not directly result in spending but only provides guidance and sets appropriations ceilings.

For discretionary programs, including R&D, the power to write the legislation that provides actual spending authority resides in the Appropriations Committees of the House and Senate. These committees

are each divided into 13 subcommittees, each of which is responsible for a bill that controls one portion of the budget. Table I-9 shows the distribution of R&D funds among these appropriations subcommittees.

The division of the budget into 13 appropriations bills limits the extent to which it is possible to coordinate or trade off increases and decreases in agency R&D budgets in the congressional process. For example, three R&D agencies—NSF, NASA, and the Environmental Protection Agency (EPA)—come under the jurisdiction of the Subcommittee on Veterans' Affairs, Housing and Urban Development, and Independent Agencies. NIH appropriations are decided by the Labor, Health and Human Services, and Education subcommittee. This means, for example, that money used for the large increase in NIH's budget in FY 2000 did not come from the same pot of money that funds NSF and NASA and did not result in lower appropriations for those agencies.

10. Where does R&D fit among President Clinton's priorities for FY 2001?

The President's FY 2001 budget would provide $85.4 billion for the federal investment in R&D, about $2.1 billion (2.5 percent) more than the current FY 2000 estimate (see Table I-1). With 2.0 percent inflation projected over the next year, the total federal R&D portfolio would gain roughly 0.5 percent in purchasing power. The overall 2.5 percent increase is the net result of a 1.4 percent cut in defense R&D and an increase of 6.6 percent in nondefense R&D programs.

Every major R&D funding agency would receive an increase except the Department of Defense (DOD). (Please see Chapters 8 through 14 and the Agency Tables II-1 through II-18 for more information on R&D in the largest R&D funding agencies.)

The FY 2001 budget packages many of the proposed increases in new or existing multi-agency initiatives organized around a common theme, and most of them would receive large increases (see Table I-10 for funding levels of the major initiatives; the initiatives are discussed in various chapters within the book). The new National Nanotechnology Initiative proposes $495 million in FY 2001, double the current funding level for existing programs, for fundamental research at the nanoscale level. The

budget also includes an information technology (IT) R&D initiative which assembles several existing IT R&D programs into a $2.3 billion package, up from $1.7 billion in FY 2000 (please see Chapter 24). There is also a new initiative in biobased products and bioenergy, and funding boosts for existing initiatives in climate change technology (see Chapter 17), global change research (see Chapter 17), and the Partnership for a New Generation of Vehicles.

The budget also places a high priority on a balanced allocation of resources among science and engineering disciplines. Although a series of large increases for the National Institutes of Health (NIH) has resulted in an emphasis on biomedical and life sciences research in recent years, the FY 2001 budget proposes a more balanced federal research portfolio through large increases for R&D in non-life sciences disciplines. (Please see Chapter 2 for more information on historical trends in funding among disciplines; please see Chapters 15 through 26 for detailed analyses of the President's budget by discipline.)

11. How does the U.S. investment in R&D compare to other countries?

In absolute terms, the $247 billion spent on R&D from all sources in the U.S. in 1999 is larger than the total R&D expenditures of Japan, Germany, the United Kingdom, and France combined. When one looks at the national R&D expenditures of various countries in relation to the size of their economies, however, the picture is somewhat different. R&D represents 2.79 percent of gross domestic product (GDP) in the United States. This places the U.S. somewhat below Japan but above most other major industrialized countries—including the United Kingdom, France, and Germany (whose R&D/GDP ratio has been falling steadily since reunification).

A significant share of the U.S. R&D investment is on the military side, where it has relatively little impact on the civilian economy and U.S. industrial competitiveness. This is very different from the situation in Germany and Japan, which devote only a small portion of their R&D resources to defense. For nondefense R&D only, the U.S. R&D/GDP ratio of 2.25 percent is about the same as Germany's and above the other

major European industrialized nations, but well below the nearly 3 percent ratio for Japan.