

LARGEST SINGLE-YEAR DECLINE IN U.S. INDUSTRIAL R&D EXPENDITURES REPORTED FOR 2002

by Raymond M. Wolfe

According to estimates produced from the National Science Foundation's (NSF) annual Survey of Industrial Research and Development, companies spent \$190.8 billion on research and development (R&D) they performed in the United States during 2002, compared with \$198.5 billion spent in 2001 (table 1).¹ This \$7.7 billion (3.9 percent) decline is the largest single-year absolute and percentage reduction in the current-dollar cost of industrial R&D performance since the survey's inception in 1953. In inflation-adjusted dollars, the decline was \$8.9 billion, the largest single-year reduction since the survey began and the second largest percentage reduction (4.9 percent); the largest occurred between 1969 and 1970 (6.3 percent). Sampling, however, may have an effect on year-to-year changes in the estimates (see "Limitations of the Data," below).

Contributions both from the company's own and other non-Federal sources (hereafter, company funding) and from Federal sources for R&D were lower in 2002 than in 2001. Company funding amounted to \$174.4 billion, compared with \$181.6 billion during 2001, and Federal funding was \$16.4 billion, compared with \$16.9 billion during 2001. This change in current-dollar expenditures represents declines in constant-dollar expenditures in both categories. This is noteworthy particularly for company-funded R&D. Since 1953, current-dollar company-funded R&D has declined only once (in 2001),

¹Company is defined as a business organization of one or more establishments under common ownership or control.

and constant-dollar estimates have declined only six times (in 1970, 1971, 1975, 1987, 1993, and 2001).

R&D Funds by Sector

In 2002 manufacturing industries performed \$98.2 billion (56 percent) of total company-funded and \$10.7 billion (66 percent) of total federally funded industrial R&D in the United States. Companies classified in the nonmanufacturing industries sector performed \$76.2 billion (44 percent) of company-funded and \$5.7 billion (34 percent) of federally funded industrial R&D. Amounts of company and federally funded R&D reported by top R&D performing industries are given in table 2.

Sales and Employment of R&D-Performing Industries

Domestic net sales of companies that performed R&D in the United States were \$4.9 trillion in 2002 (see table 1 for definition of terms). Manufacturers' sales were \$3.0 trillion in 2002, and companies in nonmanufacturing industries reported sales of about \$1.9 trillion. Sales estimates were about the same for 2001. For 2002, the R&D-to-sales ratio was 3.6 percent for manufacturers and 4.4 percent for companies in nonmanufacturing industries, yielding a 3.9 percent ratio for all industrial R&D performers. This compares to the overall ratio of 4.1 for 2001, the highest achieved since 1953, the first year for which statistics were prepared.



TABLE 1. Funds expended for industrial R&D performance by performing sector, source of funds, size of company, and sales and employment of R&D-performing U.S. companies: 2001 and 2002

Selected characteristics	2001	2002	2001	2002
	Millions of current dollars		Millions of constant (1996) dollars	
Total industrial R&D performance	198,505	190,809	181,416	172,491
Performing sector				
Manufacturing industries	120,705	108,985	110,313	98,522
Nonmanufacturing industries	77,799	81,824	71,101	73,969
Source of funds and performing sector				
Company's own and other non-Federal funds	181,606	174,408	165,971	157,664
Manufacturing industries	109,221	98,240	99,818	88,809
Nonmanufacturing industries	72,384	76,168	66,152	68,856
Federal Government	16,899	16,401	15,444	14,826
Manufacturing industries	11,484	10,745	10,495	9,713
Nonmanufacturing industries	5,415	5,656	4,949	5,113
Size of company (number of employees)				
5–24	4,828	4,261	4,412	3,852
25–49	3,750	3,845	3,427	3,476
50–99	8,202	6,164	7,496	5,572
100–249	12,916	13,227	11,804	11,957
250–499	8,702	8,055	7,953	7,282
500–999	10,564	9,925	9,655	8,972
1,000–4,999	26,748	28,625	24,445	25,877
5,000–9,999	17,487	17,987	15,982	16,260
10,000–24,999	27,065	26,458	24,735	23,918
25,000 or more	78,244	72,261	71,508	65,324
Domestic net sales ¹	4,835,140	4,903,345	4,418,881	4,432,603
Manufacturing industries	3,012,938	3,028,003	2,753,553	2,737,302
Nonmanufacturing industries	1,822,202	1,875,341	1,665,328	1,695,300
	Thousands of employees			
Domestic employment ²	16,749	15,415	na	na
Manufacturing industries	9,913	9,089	na	na
Nonmanufacturing industries	6,836	6,326	na	na
Full-time equivalent (FTE) R&D scientists and engineers ³	1,060	1,066	na	na
Manufacturing industries	616	586	na	na
Nonmanufacturing industries	444	480	na	na

na = not applicable.

¹ Dollar values for goods sold or services rendered by R&D-performing companies to customers outside the company, including the Federal Government, less such items as returns, allowances, freight charges, and excise taxes. Excludes domestic intracompany transfers and sales by foreign subsidiaries but includes transfers to foreign subsidiaries and export sales to foreign companies.

² Number of people employed in the United States by R&D-performing companies in all activities during the pay period that includes March 12, the date most employers use when paying first-quarter employment taxes to the Internal Revenue Service.

³ Number of people domestically employed by R&D-performing companies engaged in scientific or engineering work at a level requiring knowledge, gained formally or by experience, of engineering or the physical, biological, mathematical, statistical, or computer sciences equivalent to at least that acquired through completion of a four-year college program with a major in one of those fields. Survey statistics show full-time-equivalent (FTE) employment of persons employed by the company during the January following the survey year who were assigned full time to R&D, plus a prorated number of employees who worked part time on R&D.

NOTES: Detail may not add to totals because of rounding. 1996 gross domestic product (GDP) implicit price deflators were used to convert current to constant dollars. Beginning with 2001, statistics exclude data for Federally Funded Research and Development Centers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development.

TABLE 2. Largest R&D performing industries, by source of funds and sector: 2001–2002
(Billions of dollars)

Source of funds and performing sector	2001	2002
Company and other non-government		
Manufacturing industries		
Motor vehicles, trailers, and parts	16.1	15.2
Pharmaceuticals and medicines	10.1	14.2
Semiconductor and other electronic components	14.2	11.9
Navigational, measuring, electromedical, and control instruments	7.6	8.5
Communications equipment	15.2	6.4
Nonmanufacturing industries ¹		
Software publishing	13.0	12.9
Scientific R&D services	10.9	10.7
Computer systems design and related services	8.7	10.4
Federal Government		
Manufacturing industries ²		
Navigational, measuring, electromedical, and control instruments	5.4	5.2
Aerospace products and parts	3.8	4.3
Communications equipment	0.3	0.2
Nonmanufacturing industries		
Scientific R&D services	3.4	2.3
Computer systems design and related services	0.5	1.6
Architectural, engineering, and related services	1.0	1.3

¹Companies in the wholesale and retail trade industry classification are not included because much of R&D reported in the trade category is probably an artifact of how industry codes are assigned during statistical processing (see "Limitations of the Data").

²Federally funded R&D estimates for some industries cannot be disclosed because Title 13 of the United States Code and a pledge of confidentiality to survey respondents prohibit publication or release of data or statistics that may reveal information about individual companies. When a small number of respondents account for a large percentage of the industry estimate, some statistics must be suppressed.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Industrial Research and Development.

Domestic employment by companies that performed R&D in the United States during 2002 was 15.4 million, compared with 16.7 million for 2001. The number of people who were employed by R&D-performing manufacturing companies was 9.1 million in 2002, and R&D-performing companies in nonmanufacturing industries reported employment of 6.3 million. Of those, the number of full-time equivalent (FTE) scientists and engineers who performed industrial R&D in manufacturing industries was about 0.6 million and in nonmanufacturing industries was about 0.5 million.

Outsourcing, Technology, and Collaborative R&D

In NSF's continuing effort to maintain and improve the relevance of the statistics resulting from the Survey of Industrial Research and Development, several new items were added to the survey for 2001 and were retained for 2002. These included an item that asked

for the sector identification of the performer of extramural or outsourced R&D and an item that asked how much R&D companies performed in the following technological areas: biotechnology, materials synthesis and processing, and software development, including the percentage of R&D attributable to nanotechnology in each area.

Preliminary statistics for 2002 indicate that 319 companies reported expenditures of \$4.9 billion for the performance of R&D by other for-profit companies, 134 reported \$0.3 billion for the performance of R&D by universities and colleges, and 47 reported \$0.1 billion for the performance of R&D by nonprofit organizations other than universities and colleges. Preliminary statistics resulting from the 2002 technology area item indicate that 2,694 companies reported aggregate expenditures of \$13.5 billion for performance of biotechnology R&D, 5,367 companies spent \$14.6 billion for materials synthesis and processing R&D, and 10,238 companies spent \$24.0 billion for software development R&D. Of the companies that reported expenditures for these technology areas, the following numbers of companies reported that 50 percent or more of the R&D was attributable to nanotechnology: 400 biotechnology R&D performers, 1,029 materials synthesis and processing R&D performers, and 989 software development R&D performers.

For 2002 a new item added to the survey asked for both the amount of R&D performed in collaboration with another organization and the sector identification of that organization. Preliminary statistics for 2002 indicate that 180 companies performed R&D in collaboration with other organizations: 152 reported aggregate expenditures of \$3.9 billion for the performance of R&D in collaboration with other for-profit companies; 53 reported \$57.0 million for the performance of R&D in collaboration with universities and colleges, 13 reported \$22.0 million for the performance of R&D in collaboration with nonprofit organizations other than universities and colleges; and 13 reported \$21.0 million for the performance of R&D in collaboration with Federal laboratories. Final, detailed statistics for these new items will be available later this year in *Research and Development in Industry: 2002* at <http://www.nsf.gov/sbe/srs/indus/start.htm>. It will contain the full set of tables available from the 2002 survey and will also provide historical trends.

Data Notes

Estimates in this report were derived from the annual Survey of Industrial Research and Development. The survey is a nationally representative sample of all for-profit U.S. based companies, publicly or privately held, with five or more employees (for detailed information, see <http://www.nsf.gov/sbe/srs/sird/start.htm>). The primary focus of the survey is U.S. industry as a performer of, rather than a source of funds for, research and development. The sample design for the survey was redesigned in 2002 to better estimate year-to-year changes and to strengthen current-year state and detailed industry estimates; however, R&D is performed by about 2 percent of U.S. companies, and the estimates are subject to sampling error.

Limitations of the Data

The estimates reported here are subject to both sampling and non-sampling errors. The sample has been designed to provide reliable estimates of the overall total of R&D performed and to control the sampling error at both the industry and state level. Nonsampling errors may result from several conditions. (1) Assignment of a company's industrial classification: A company is assigned

to one industry according to payroll activity, which may not be the same as the company's R&D activity. For example, if the majority of a company's payroll shifts from one activity to another from year to year, all of its R&D activity similarly shifts to the new activity from year to year. The U.S. Bureau of the Census, which collects and tabulates the survey, and NSF are conducting further research in this area. (2) Definitions of terms: Companies may define R&D activities differently or may interpret the definitions differently. (3) Data availability: Substantial variation in company accounting procedures exists, which affects the availability of the data requested.

For more information, contact

Raymond M. Wolfe
 Research and Development Statistics Program
 Division of Science Resources Statistics
 National Science Foundation
 4201 Wilson Boulevard, Suite 965
 Arlington, VA 22230
 703-292-7789
rwolfe@nsf.gov

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