National Center for Science and Engineering Statistics

InfoBrief

U.S. R&D Increased by $72 Billion in 2021 to $789 Billion; Estimate for 2022 Indicates Further Increase to $886 Billion

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New data from the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation indicate that research and experimental development (R&D)[1] performed in the United States totaled $789.1 billion in 2021 (**table 1**). The estimated total for 2022, based on performer-reported expectations, is $885.6 billion. Businesses reported a projected $84.1 billion increase in 2022 R&D performance above 2021. (All amounts and calculations are reported in current dollars unless otherwise noted.) Using previous NCSES data, researchers have documented a shift in corporate R&D away from research (basic and applied research combined),[2] and noted the relevance of this shift to "policy discussions on the apparent decline in inventiveness and the associated slowdown in productivity growth."[3] In 2021, businesses funded $130 billion in research, which represented 22% of total business funding for R&D but 49%[4] of total U.S. funding for research. Businesses performed $609 billion of R&D or 77% of total 2021 U.S. R&D.

The U.S. R&D system consists of the activities of a diverse group of R&D performers and sources of funding. Included here are private businesses, the federal government, nonfederal governments, higher education institutions, and other nonprofit organizations. The organizations that perform R&D often receive significant levels of outside funding, and organizations that fund R&D may also themselves be performers. The data for this InfoBrief derive mainly from NCSES surveys of the annual R&D expenditures of these performers and funders.

Table 1

U.S. R&D expenditures, by performing sector and source of funding: 2010–22

(Millions of current and constant 2017 dollars)

Performing sector and source of funds	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Current $millions													
All performing sectors	406,599	426,214	433,698	454,232	475,938	494,470	521,686	553,612	604,028	665,557	716,870	789,072	885,563
Business	278,977	294,092	302,251	322,528	340,728	355,821	379,529	405,792	445,563	498,175	543,220	608,625	692,748
Federal government	50,798	53,524	52,144	51,086	52,687	52,847	51,187	52,553	58,356	62,802	65,093	66,786	73,338
Federal intramural[c]	31,970	34,950	34,017	33,406	34,783	34,199	31,762	32,231	36,793	39,870	41,227	41,464	46,960
FFRDCs	18,828	18,574	18,128	17,680	17,903	18,649	19,424	20,322	21,563	22,932	23,866	25,322	26,378
Nonfederal government	691	694	665	620	583	595	620	632	643	675	683	685	697
Higher education	58,083	60,087	60,876	61,511	62,318	64,604	67,777	71,115	74,890	78,157	80,823	85,787	91,451
Nonprofit organizations	18,050	17,817	17,762	18,487	19,622	20,604	22,573	23,521	24,576	25,749	27,053	27,190	27,329
All funding sources	406,599	426,214	433,698	454,232	475,938	494,470	521,686	553,612	604,028	665,557	716,870	789,072	885,563
Business	248,126	266,426	275,728	297,188	318,410	333,242	360,290	386,538	426,488	482,227	520,364	591,009	672,868
Federal government	126,617	127,014	123,837	120,131	118,367	119,532	118,174	122,470	131,098	135,779	148,169	147,531	159,833
Nonfederal government	4,303	4,386	4,158	4,244	4,214	4,277	4,995	5,076	5,252	5,474	5,676	5,733	5,902
Higher education	12,262	13,103	14,282	15,341	16,176	17,260	18,729	19,880	20,989	21,885	22,560	23,783	25,514
Nonprofit organizations	15,292	15,284	15,694	17,327	18,771	20,160	19,497	19,648	20,201	20,193	20,102	21,017	21,447
Constant 2017 $millions													
All performing sectors	453,632	465,903	465,418	479,297	493,603	508,109	531,028	553,612	590,500	639,911	680,262	715,953	750,649
Business	311,247	321,478	324,357	340,325	353,375	365,635	386,326	405,792	435,584	478,978	515,480	552,227	587,209
Federal government	56,674	58,508	55,958	53,905	54,642	54,305	52,103	52,553	57,049	60,382	61,769	60,597	62,165
Federal intramural[c]	35,668	38,205	36,504	35,250	36,074	35,142	32,331	32,231	35,969	38,334	39,121	37,621	39,806
FFRDCs	21,006	20,303	19,453	18,656	18,568	19,163	19,772	20,322	21,080	22,048	22,647	22,976	22,359
Nonfederal government	771	758	713	654	605	611	631	632	629	649	648	622	590
Higher education	64,802	65,682	65,328	64,905	64,631	66,386	68,991	71,115	73,212	75,145	76,695	77,838	77,519
Nonprofit organizations	20,138	19,476	19,061	19,507	20,350	21,172	22,977	23,521	24,026	24,757	25,671	24,670	23,165
All funding sources	453,632	465,903	465,418	479,297	493,603	508,109	531,028	553,612	590,500	639,911	680,262	715,953	750,649
Business	276,828	291,237	295,894	313,587	330,228	342,434	366,743	386,538	416,936	463,645	493,791	536,244	570,358
Federal government	141,263	138,842	132,894	126,760	122,760	122,829	120,290	122,470	128,162	130,547	140,602	133,860	135,482
Nonfederal government	4,800	4,795	4,462	4,478	4,370	4,394	5,084	5,076	5,135	5,263	5,386	5,202	5,003
Higher education	13,680	14,323	15,326	16,188	16,776	17,736	19,065	19,880	20,519	21,041	21,408	21,579	21,627

Table 1

U.S. R&D expenditures, by performing sector and source of funding: 2010–22

(Millions of current and constant 2017 dollars)

Performing sector and source of funds	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Nonprofit organizations	17,061	16,707	16,841	18,284	19,468	20,716	19,846	19,648	19,748	19,415	19,076	19,069	18,179

FFRDC = federally funded research and development center.

[a] Some data for 2021 are preliminary and may later be revised.

[b] The data for 2022 include estimates and are likely to later be revised.

[c] Federal intramural includes expenditures of federal intramural R&D as well as costs associated with administering extramural R&D.

Note(s):
Data are based on annual reports by performers, except for the nonprofit sector. Expenditure levels for higher education, federal government, and nonfederal government performers are calendar year approximations based on fiscal year data.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

The "Data Sources, Limitations, and Availability" section at the end of this InfoBrief summarizes the main data sources and methodology and provides further details on the data. Data cited in this report that do not appear in one of this InfoBrief's tables or figures come from the companion data tables.

Preliminary 2022 Estimates and Current Trends in U.S. R&D Totals and National R&D Intensity

U.S. Total R&D

Year-over-year increases in U.S. total R&D expenditures averaged $19.1 billion (4.1% compound average growth rate [CAGR][5]) over the 2011–16 period. Beginning with the $50.4 billion increase in 2017–18, subsequent annual increases have been notable including $61.5 billion (2018–19), $51.3 billion (2019–20), and $72.2 billion (2020–21) averaging an 8.6% rate for 2016–21. For 2022, business R&D and total R&D performance are estimated to increase by $84.1 billion and $96.5 billion, respectively.

Table 2

Annual change in U.S. R&D expenditures and gross domestic product, by performing sectors, 1990–2022

(Percent)

Expenditures and gross domestic product	Longer term trends			Most recent years											
	1991–2001	2001–11	2011–21	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21[a]	2021–22[b]
Current $															
Total R&D, all performers	5.6	4.3	6.4	4.8	1.8	4.7	4.8	3.9	5.5	6.1	9.1	10.2	7.7	10.1	12.2
Business	5.8	3.8	7.5	5.4	2.8	6.7	5.6	4.4	6.7	6.9	9.8	11.8	9.0	12.0	13.8
Federal government	3.5	5.0	2.2	5.4	-2.6	-2.0	3.1	0.3	-3.1	2.7	11.0	7.6	3.6	2.6	9.8
Federal intramural	3.9	4.6	1.7	9.3	-2.7	-1.8	4.1	-1.7	-7.1	1.5	14.2	8.4	3.4	0.6	13.3
FFRDCs	2.6	5.9	3.1	-1.4	-2.4	-2.5	1.3	4.2	4.2	4.6	6.1	6.3	4.1	6.1	4.2
Nonfederal government[c]	NA	NA	-0.1	0.4	-4.2	-6.8	-5.9	2.0	4.3	1.9	1.7	4.9	1.2	0.3	1.7

Table 2

Annual change in U.S. R&D expenditures and gross domestic product, by performing sectors, 1990–2022

(Percent)

Expenditures and gross domestic product	Longer term trends			Most recent years											
	1991–2001	2001–11	2011–21	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21[a]	2021–22[b]
Higher education	6.0	6.3	3.6	3.4	1.3	1.0	1.3	3.7	4.9	4.9	5.3	4.4	3.4	6.1	6.6
Nonprofit organizations	8.9	5.0	4.3	-1.3	-0.3	4.1	6.1	5.0	9.6	4.2	4.5	4.8	5.1	0.5	0.5
Gross domestic product	5.6	4.0	4.2	3.7	4.2	3.9	4.3	3.9	2.8	4.3	5.3	4.2	-0.9	10.7	9.1
Constant 2017 $															
Total R&D, all performers	3.6	2.2	4.4	2.7	-0.1	3.0	3.0	2.9	4.5	4.3	6.7	8.4	6.3	5.2	4.8
Business	3.8	1.7	5.6	3.3	0.9	4.9	3.8	3.5	5.7	5.0	7.3	10.0	7.6	7.1	6.3
Federal government	1.5	2.9	0.4	3.2	-4.4	-3.7	1.4	-0.6	-4.1	0.9	8.6	5.8	2.3	-1.9	2.6
Federal intramural	1.9	2.4	-0.2	7.1	-4.5	-3.4	2.3	-2.6	-8.0	-0.3	11.6	6.6	2.1	-3.8	5.8
FFRDCs	0.6	3.8	1.2	-3.3	-4.2	-4.1	-0.5	3.2	3.2	2.8	3.7	4.6	2.7	1.4	-2.7
Nonfederal government[c]	NA	NA	-2.0	-1.6	-5.9	-8.3	-7.5	1.0	3.3	0.1	-0.6	3.2	-0.1	-4.1	-5.0
Higher education	4.0	4.1	1.7	1.4	-0.5	-0.6	-0.4	2.7	3.9	3.1	2.9	2.6	2.1	1.5	-0.4
Nonprofit organizations	6.9	2.8	2.4	-3.3	-2.1	2.3	4.3	4.0	8.5	2.4	2.1	3.0	3.7	-3.9	-6.1
Gross domestic product	3.5	1.8	2.3	1.6	2.3	2.1	2.5	2.9	1.8	2.5	3.0	2.5	-2.2	5.8	1.9

NA = not available.

FFRDCs = federally funded research and development centers

[a] Some data for 2021 are preliminary and may later be revised.
[b] The R&D data for 2022 include estimates and are likely to later be revised.
[c] Survey data on state internal R&D performance were not available prior to 2006; data for 2008 were not collected.

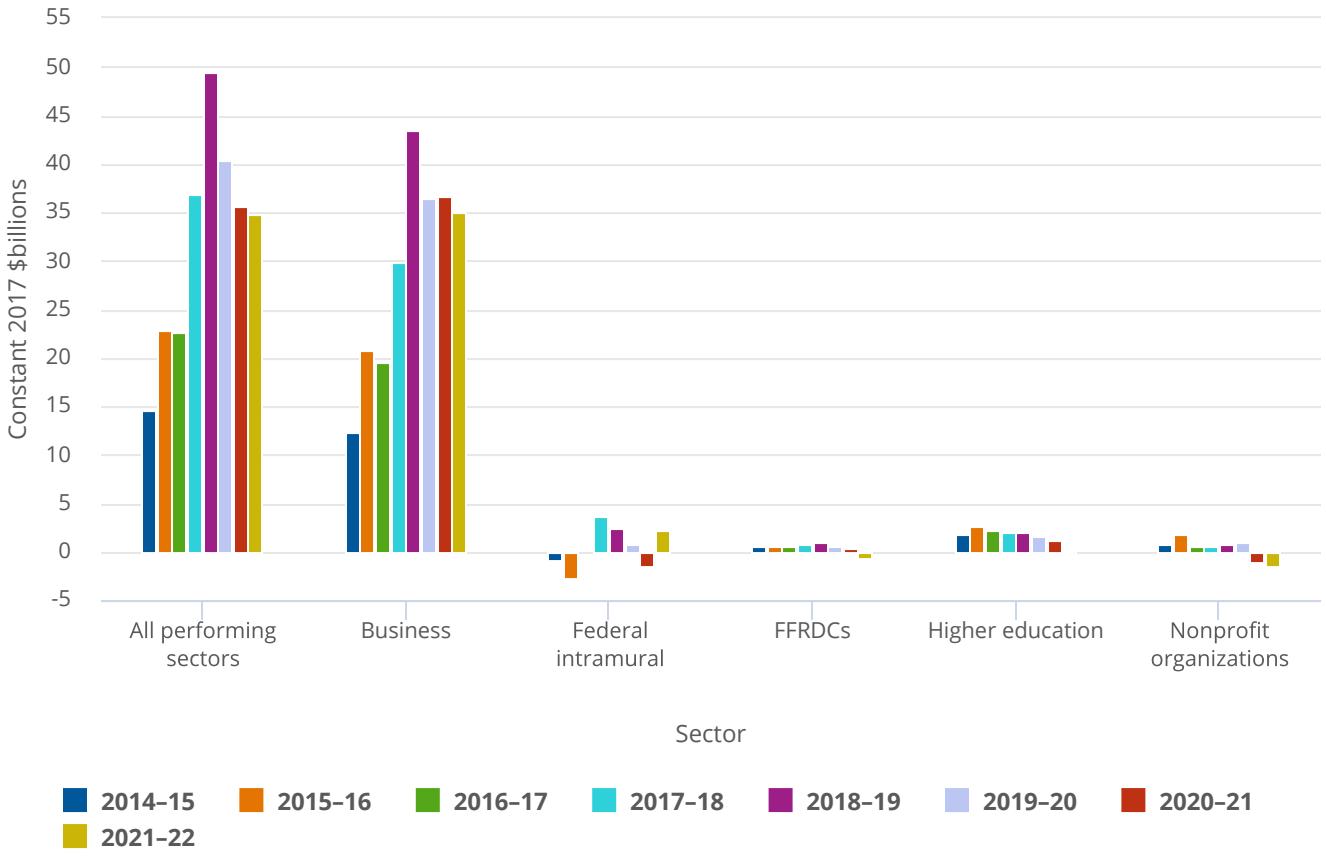
Note(s):
The longer term trend rates are calculated as compound annual growth rates.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Adjusting for inflation,[6] growth in U.S. total R&D averaged 4.4% annually over the 2011–21 period. By comparison, average annual growth of U.S. total R&D in the prior decade (2001–11) was lower at 2.2%. The estimate for 2022 shows inflation-adjusted R&D growing at 4.8% from the 2021 level. Comparisons in constant dollars demonstrate the effect of the recent inflationary episode[7] on real R&D performance. In constant dollar terms, business R&D performance is estimated to increase by $35.0 billion over the 2021 level. Federal intramural R&D decreased in 2021 from the prior year total, but the estimated increase in 2022 (based on FY 2022 obligations and FY 2023 projections for federal intramural R&D), offsets the 2021 decline. For federally funded research and development centers (FFRDCs), nonfederal governments, and universities, the constant value of R&D performance is estimated to decline in 2022 (table 2, figure 1). For nonprofit organizations, the change in 2022 R&D is not statistically significant.

Figure 1

Year-over-year changes in U.S. R&D expenditures, by performing sector: 2014–22



FFRDC = federally funded research and development center.

Note(s):
Some data for 2021 are preliminary and may later be revised. The data for 2022 include estimates and are likely to later be revised. Annual changes in nonfederal government R&D expenditures are included in the "All performing sectors" category but not shown separately because they are less than $0.1 billion.

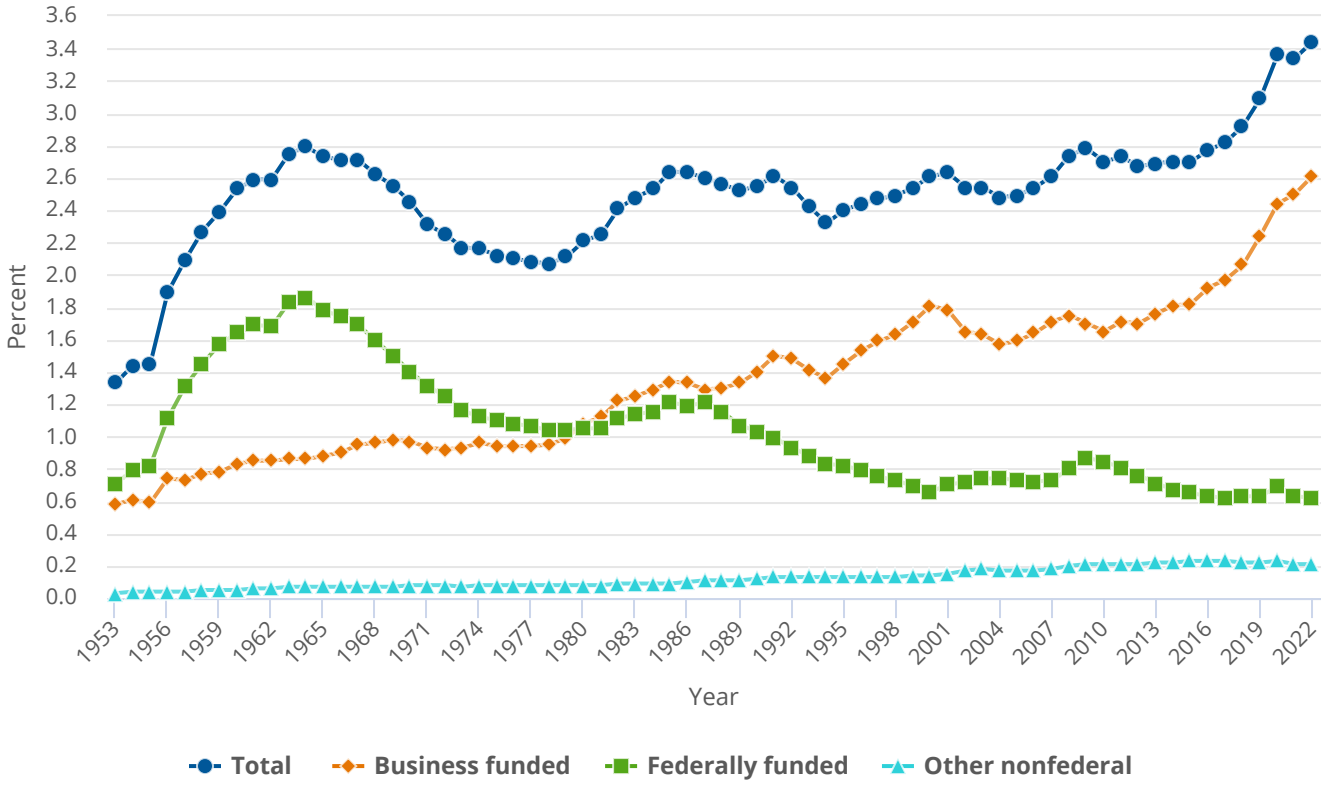
Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

R&D-to-GDP Ratio

The ratio of total national R&D expenditures to gross domestic product (GDP) (i.e., R&D intensity) is widely used by national statistical offices and other policy analysts as an overall gauge of the relative priority of a nation's R&D effort among multiple investment and consumption options. In this edition of the *National Patterns* series, the ratio of U.S. R&D to GDP was 3.34% in 2021 and is estimated to be 3.44% in 2022 (figure 2). Prior to 2019 when R&D intensity reached 3.09%, the highest U.S. ratios recorded were 2.79% in 1964, 2.78% in 2009, 2.77% again in 2016, 2.82% in 2017, and 2.92% in 2018.[8] Reaching an R&D intensity level above 3.0% is widely regarded in the R&D policy community as a notable national achievement. The U.S. 2021 R&D to GDP ratio exceeded the Organisation for Economic Co-operation and Development average (2.72%). The U.S. ratio also exceeded that of other key R&D-performing nations, such as China (2.43%), France (2.22%), and the United Kingdom (2.91% [provisional]). Israel (5.56%) and South Korea (4.93%) had higher ratios than the United States, whereas Germany (3.13%) and Japan (3.30%) had similar ratios to the United States.[9]

Figure 2

Ratio of U.S. R&D to GDP, by source of funds for R&D: 1953–2022



GDP = gross domestic product

Note(s):
Some data for 2021 are preliminary and may later be revised. The data for 2022 include estimates and are likely to later be revised. The federally funded data represent the federal government as a funder of R&D by all performers; similarly the business funded data cover the business sector as a funder of R&D by all performers. The "other" category includes the R&D funded by all other sources—mainly, by higher education, nonfederal government, and nonprofit organizations. The gross domestic product data used reflect the U.S. Bureau of Economic Analysis statistics of late October 2023.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

The extent to which the rising ratio of U.S. R&D to GDP is attributable to increased business funding of R&D is clear. Over the past decade (2011–21), business funding grew at an 8.3% rate while federal funding grew at a 1.5% rate and GDP grew at a 4.2% rate. Notably, the higher education sector's funding of R&D grew at 6.1% over the same period.

Federally funded R&D as a percentage of GDP peaked in the 1960s at 1.86% in 1964 and generally has declined since. Since 2014, federal funding for R&D has remained at or below 0.70% of GDP. By contrast, business R&D funding in 2010 was 1.65% of GDP and increased to 2.50% by 2021.

Performers of R&D

Business

The business sector is by far the largest performer of U.S. R&D. In 2021, domestically performed business R&D accounted for $608.6 billion, or 77% of the $789.1 billion national R&D total (table 1 and table 3). The business sector's predominance in national R&D performance has long been the case, with its annual share ranging between 69% and 77% since 2000.

Table 3

Sales, R&D, R&D intensity, and employment for companies that performed or funded business R&D in the United States, by selected industry and company size: 2021

(Millions of dollars, percent R&D intensity, thousands of employees)

Industry, NAICS code, and company size	Domestic net sales ($millions)[a]	All R&D ($millions)[b]	R&D sales intensity (%)[c]	Domestic employment (headcounts in thousands)[d]		
				Total	R&D[e]	R&D employment intensity (%)[e]
All industries, 21–33, 42–81	13,112,161	608,624	4.6	23,716	2,171	9.2
Manufacturing industries,[f] 31–33	6,553,082	326,807	5.0	10,344	1,020	9.9
Nonmanufacturing industries, 21–23, 42–81	6,559,080	281,817	4.3	13,372	1,151	8.6
Information, 51	1,705,718	148,612	8.7	2,196	455	20.7
Software publishers, 5112	304,517	39,585	13.0	461	129	28.0
Professional, scientific, and technical Services, 54	493,145	70,974	14.4	1,570	370	23.6
Computer systems design and related services, 5415	204,181	22,025	10.8	558	114	20.4
Scientific research and development services, 5417	85,251	36,397	42.7	290	140	48.3
Microbusinesses						
1–9	14,405	6,125	42.5	62	39	62.8
Small companies						
10–19	35,815	5,477	15.3	85	36	42.4
20–49	104,550	15,061	14.4	298	99	33.2
Medium companies						
50–99	146,296	14,540	9.9	418	92	22.0
100–249	381,256	24,023	6.3	886	157	17.7
Large companies						
250–499	371,747	23,932	6.4	741	110	14.8
500–999	499,161	27,432	5.5	926	110	11.9
1,000–4,999	2,000,807	94,615	4.7	3,148	340	10.8
5,000–9,999	1,536,766	62,817	4.1	1,933	211	10.9
10,000–24,999	2,240,551	104,607	4.7	3,260	309	9.5
25,000 or more	5,780,807	229,995	4.0	11,959	668	5.6

NAICS = North American Industry Classification System.

[a] Dollar values are for goods sold or services rendered by R&D-performing or R&D-funding companies located in the United States to customers outside of the company, including the U.S. federal government, foreign customers, and the company's foreign subsidiaries. Included are revenues from a company's foreign operations and subsidiaries and from discontinued operations. If a respondent company is owned by a foreign parent company, sales to the parent company and to affiliates not owned by the respondent company are included. Excluded are intracompany transfers, returns, allowances, freight charges, and excise, sales, and other revenue-based taxes.

[b] All R&D is the cost of R&D paid for and performed by the respondent company and paid for by others outside of the company and performed by the respondent company.

[c] R&D intensity is the cost of domestic R&D paid for by the respondent company and others outside of the company and performed by the company divided by domestic net sales of companies that performed or funded R&D.

[d] Data recorded on 12 March represent employment figures for the year. Total employment at companies that performed or funded R&D.

[e] Headcounts of researchers, R&D managers, technicians, clerical staff, and others assigned to R&D groups.

[f] Only selected (NAICS 42, 51, 5413, 5415, 5417) nonmanufacturing sectors are sampled for the 1–9 employee population in the Annual Business Survey. Based on prior survey results, businesses with 1–9 employees in other nonmanufacturing subsectors are not believed to perform substantial amounts of R&D.

Note(s):
Detail may not add to total because of rounding. Industry classification was based on the dominant business code for domestic R&D performance, where available. For companies that did not report business codes, the classification used for sampling was assigned.

Source(s):
National Center for Science and Engineering Statistics and Census Bureau, Annual Business Survey, Business Enterprise Research and Development Survey, 2021.

R&D performed in the United States by businesses occurs widely in manufacturing and nonmanufacturing. In 2021, manufacturing companies of all sizes (1 employee to more than 25,000 employees) performed 53.7% of all business R&D (table 3). By contrast, microbusinesses (1–9 employees) in manufacturing industries account for just 12.2% of R&D performed by companies with fewer than 10 employees. The R&D sales intensity (42.5%) and R&D employment intensity (62.8%) are both greater for microbusinesses than for other businesses. Information (NAICS 51),[10] including software publishing (5112), Computer systems design and related services (NAICS 5415), and scientific research and development services (NAICS 5417) account for 73.5% of nonmanufacturing industry R&D.[11]

Table 4

U.S. R&D expenditures, by performing sector, source of funds, and type of R&D: 2021

(Millions of dollars and percent distribution)

Performing sector and type of R&D	Source of funds ($millions)						Percent distribution by performer
	Total	Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
R&D	789,072	591,009	147,531	5,733	23,783	21,017	100.0
Business	608,625	582,664	24,587	392	**	981	77.1
Federal government	66,786	239	66,336	42	**	168	8.5
Federal intramural	41,464	0	41,464	0	0	0	5.3
FFRDCs	25,322	239	24,873	42	**	168	3.2
Nonfederal government	685	16	305	349	3	12	0.1
Higher education	85,787	5,080	44,683	4,621	23,506	7,897	10.9
Nonprofit organizations	27,190	3,010	11,620	328	274	11,958	3.4
Percent distribution by funding source	100.0	74.9	18.7	0.7	3.0	2.7	-
Basic research	118,626	42,642	47,407	2,987	14,970	10,621	100.0
Business	40,845	38,305	2,404	39	**	97	34.4
Federal government	11,688	42	11,610	7	**	29	9.9
Federal intramural	6,604	0	6,604	0	0	0	5.6
FFRDCs	5,084	42	5,006	7	**	29	4.3
Nonfederal government	120	3	53	61	0	2	0.1
Higher education	54,047	2,885	28,693	2,726	14,841	4,902	45.6
Nonprofit organizations	11,926	1,408	4,646	153	128	5,591	10.1
Percent distribution by funding source	100.0	35.9	40.0	2.5	12.6	9.0	-
Applied research	144,037	87,335	42,226	1,922	6,324	6,229	100.0
Business	88,707	84,782	3,491	142	**	292	61.6
Federal government	21,304	118	21,083	21	**	83	14.8
Federal intramural	11,132	0	11,132	0	0	0	7.7
FFRDCs	10,173	118	9,951	21	**	83	7.1
Nonfederal government	521	12	232	266	2	9	0.4
Higher education	23,528	1,476	12,341	1,391	6,236	2,085	16.3
Nonprofit organizations	9,977	947	5,080	103	86	3,761	6.9
Percent distribution by funding source	100.0	60.6	29.3	1.3	4.4	4.3	-
Experimental development	526,408	461,034	57,896	823	2,489	4,165	100.0
Business	479,072	459,578	18,690	211	**	592	91.0
Federal government	33,792	79	33,643	14	**	56	6.4
Federal intramural	23,728	0	23,728	0	0	0	4.5
FFRDCs	10,065	79	9,915	14	**	56	1.9
Nonfederal government	44	1	20	23	*	1	0.0
Higher education	8,213	719	3,650	505	2,429	911	1.6
Nonprofit organizations	5,287	656	1,894	71	60	2,606	1.0

Table 4

U.S. R&D expenditures, by performing sector, source of funds, and type of R&D: 2021

(Millions of dollars and percent distribution)

Performing sector and type of R&D	Source of funds ($millions)						Percent distribution by performer
	Total	Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
Percent distribution by funding source	100.0	87.6	11.0	0.2	0.5	0.8	-

* = amount < $0.5 million; ** = small to negligible amount, included as part of the funding provided by nonprofit organizations.

FFRDC = federally funded research and development center.

Note(s):
Some data for 2021 are preliminary and may later be revised.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Higher Education

R&D performed in the United States by the higher education sector totaled $85.8 billion in 2021, or 11% of U.S. total R&D (table 1 and table 4).[12] In the period 2000–21, the higher education share of U.S. total R&D ranged between 11% and 14%. Adjusted for inflation, growth in this sector's R&D performance averaged 1.7% annually during 2011–21, well behind U.S. total R&D growth (4.4%). For the preceding decade, growth in higher education R&D performance was a robust 4.1%. The annual percent change in 2010–20 varied; there was low growth or contraction in 2010–14 with a return to modest increases in 2015–20. The estimate for 2022 indicates a slight contraction (-0.4%) when measured in constant dollars as inflation outpaced an increase in the level of higher education R&D performance (table 2).

Federal Agencies and Federally Funded Research and Development Centers

The federal government performed $66.8 billion of the U.S. R&D total in 2021 (table 1 and table 3). This amount included $41.5 billion (5% of the U.S. total) performed by the intramural R&D facilities of federal agencies and $25.3 billion (3%) performed by the 43 federally funded research and development centers (FFRDCs).[13] The federal share of U.S. R&D performance ranged between 11% and 13% in 2001–11. Subsequently, the federal share is estimated to decline to 8% in 2022. Measured in constant dollars, federal R&D performance is estimated to increase in 2022 after a modest decline in 2021 (table 2).

State Government

State agency intramural R&D performance in 2021 totaled $685 million—a small share (about 0.1%) of the U.S. total (table 1 and table 4). This includes all 50 states and the District of Columbia.

Nonprofit Organizations

R&D performed in the United States by nonprofit organizations (excluding higher education institutions and federal and nonfederal government) was $27.2 billion in 2021 (table 1 and table 4).[14] This was 3% of U.S. total R&D, a share that has changed little since the early 2000s.

R&D by Type of R&D

In 2021, basic research activities in all sectors accounted for $118.6 billion, or 15% of U.S. total R&D expenditures (table 5). Applied research was $144.0 billion, or 18% of the total. Most of the total of U.S. R&D expenditures was experimental development at $526.4 billion, or 67%.

Table 5

U.S. R&D expenditures, by type of R&D: Selected years, 1970–2022

(Billions of current and constant 2017 dollars and percent)

Type of R&D	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Current $billions																	
All R&D	26.3	63.2	152.0	267.9	406.6	426.2	433.7	454.2	475.9	494.5	521.7	553.6	604.0	665.6	716.9	789.1	885.6
Basic research	3.6	8.7	23.0	42.0	76.5	73.7	74.0	79.3	82.9	84.4	87.5	90.2	97.9	105.0	111.8	118.6	129.4
Applied research	5.8	13.7	34.9	56.5	78.9	81.7	86.6	88.0	91.6	97.1	109.5	113.3	118.3	130.2	132.5	144.0	159.9
Experimental development	16.9	40.7	94.1	169.4	251.2	270.8	273.1	287.0	301.4	313.0	324.7	350.1	387.8	430.3	472.5	526.4	596.2
Constant 2017 $billions																	
All R&D	130.1	160.6	256.3	368.5	453.6	465.9	465.4	479.3	493.6	508.1	531.0	553.6	590.5	639.9	680.3	716.0	750.6
Basic research	17.8	22.2	38.8	57.8	85.3	80.6	79.4	83.6	86.0	86.8	89.1	90.2	95.7	101.0	106.1	107.6	109.7
Applied research	28.5	34.9	58.8	77.7	88.0	89.3	93.0	92.8	95.0	99.7	111.4	113.3	115.7	125.2	125.8	130.7	135.6
Experimental development	83.8	103.5	158.6	233.0	280.3	296.0	293.1	302.8	312.6	321.6	330.5	350.1	379.1	413.7	448.4	477.6	505.4
Percent distribution																	
R&D performance																	
All R&D	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basic research	13.7	13.8	15.2	15.7	18.8	17.3	17.1	17.4	17.4	17.1	16.8	16.3	16.2	15.8	15.6	15.0	14.6
Applied research	21.9	21.7	23.0	21.1	19.4	19.2	20.0	19.4	19.2	19.6	21.0	20.5	19.6	19.6	18.5	18.3	18.1
Experimental development	64.4	64.5	61.9	63.2	61.8	63.5	63.0	63.2	63.3	63.3	62.2	63.2	64.2	64.7	65.9	66.7	67.3
R&D performance by performer																	
Basic research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	15.7	13.8	20.1	16.7	21.4	17.7	18.0	24.6	26.5	25.8	28.6	28.4	29.8	31.0	32.5	34.4	35.8
Federal intramural	15.6	13.9	10.1	9.0	6.7	6.8	7.4	6.7	6.9	7.0	7.0	6.9	7.0	7.0	6.5	5.6	6.1
FFRDCs	8.5	14.8	13.2	9.6	8.7	8.8	7.7	5.3	5.0	4.9	4.8	4.6	4.4	4.4	4.3	4.3	4.1
Nonfederal government	NA	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Higher education	51.6	49.3	48.3	53.0	50.7	53.9	54.0	50.7	48.7	49.2	49.0	49.7	48.3	47.0	45.5	45.6	44.7
Nonprofit organizations	8.5	8.2	8.3	11.7	12.4	12.7	12.8	12.6	12.8	13.0	10.4	10.2	10.4	10.5	11.1	10.1	9.3
Applied research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	57.9	59.5	69.9	69.3	56.9	57.7	58.6	58.0	58.3	58.2	57.4	56.5	56.3	58.5	59.1	61.6	62.7
Federal intramural	23.2	18.5	10.5	10.8	10.2	9.8	9.9	9.4	9.6	9.6	9.0	8.9	9.4	8.7	8.7	7.7	8.3
FFRDCs	5.8	5.5	3.3	3.1	6.6	6.4	6.6	7.8	7.6	7.6	7.0	7.1	7.3	7.1	7.2	7.1	6.7
Nonfederal government	NA	NA	NA	NA	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3
Higher education	7.8	11.8	12.6	11.3	18.2	18.6	17.8	17.8	17.5	17.5	16.9	17.3	17.4	16.5	16.8	16.3	15.6
Nonprofit organizations	5.2	4.6	3.7	5.5	7.4	6.8	6.4	6.4	6.5	6.6	9.3	9.8	9.3	8.8	7.7	6.9	6.3
Experimental development	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	80.9	83.1	83.3	90.8	86.7	86.4	87.2	87.8	88.0	88.7	89.8	90.3	90.2	90.5	90.7	91.0	91.6

Table 5

U.S. R&D expenditures, by type of R&D: Selected years, 1970–2022

(Billions of current and constant 2017 dollars and percent)

Type of R&D	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Federal intramural	13.3	10.0	10.3	5.5	7.5	8.1	7.3	6.9	6.7	6.1	4.9	4.5	4.9	4.9	4.7	4.5	4.3
FFRDCs	4.7	4.9	3.9	2.1	2.8	2.5	2.5	2.3	2.2	2.3	2.3	2.3	2.2	2.1	2.0	1.9	1.7
Nonfederal government	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Higher education	0.7	1.3	1.5	0.7	2.0	1.9	2.0	2.0	2.0	2.0	2.0	1.9	1.8	1.7	1.6	1.6	1.5
Nonprofit organizations	0.4	0.7	1.0	0.9	1.1	1.1	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.8	0.9	1.0	0.9

NA = not available.

FFRDC = federally funded research and development center.

[a] Some data for 2021 are preliminary and may later be revised.
[a] The data for 2022 include estimates and are likely to later be revised.

Note(s):
Data throughout the span of time reported here are consistently based on Organisation for Economic Co-operation and Development *Frascati Manual* definitions for basic research, applied research, and experimental development. Prior to 2010, however, some changes had been introduced in the questionnaires of the sectoral expenditure surveys to improve the accuracy of respondents' classification of their R&D by type. Accordingly, small percentage changes in the historical data may not be meaningful.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

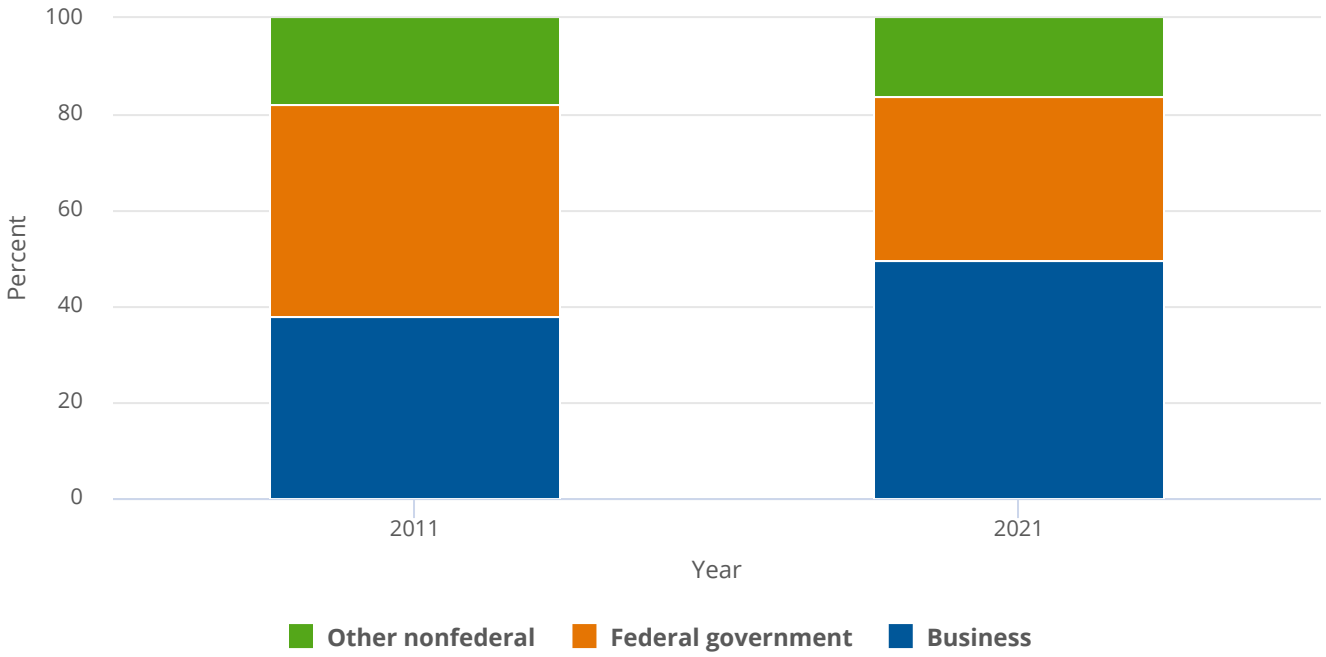
The higher education sector accounted for just under half (46%) of basic research performance in 2021 (table 5). The business sector was the second-largest basic research performer (34%). Business was the majority performer (62%) of the $144.0 billion of applied research in 2021; higher education was second at 16%. Federal intramural performers plus FFRDCs accounted for 15% of the applied research total. Business continued to dominate development performance, accounting for 91% of the U.S. total $526.4 billion of that category in 2021.

Federal funding accounted for 40% of the $118.6 billion of basic research in 2021 (table 4).[15] But federal funds were less prominent for applied research (29% of $144.0 billion) and experimental development (11% of $526.4 billion). The business sector provided the greatest share of funding for applied research (61%) and the predominant share for experimental development (88%). Notably, it also accounted for a sizable share (36%) of funding for basic research.

Over the 2011–21 period, the split of U.S. total R&D expenditures among the three types of R&D did not largely change. The share of applied research ranged between 18% and 21% throughout the period (table 5). Similarly, the share of basic research remained in the 15%–17% range. Experimental development's share ranged between 62% and 67%. Adjusting for inflation, about $27 billion more in basic research was performed in 2021 than in 2011, $41 billion more in applied research, and $182 billion more in experimental development.

Figure 3

U.S. research expenditures, by source of funds: 2011 and 2021



Note(s):
Figures for 2021 are preliminary and may later be revised. Other nonfederal includes nonfederal government, higher education, nonprofit organizations.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Social scientists have noted important differences in the nature, role, and impact of research (basic and applied combined) and experimental development.[16] Additionally, the shifting in the relative roles of performers and funders by sector—particularly among business, government, and higher education—is of great interest (table 6, figure 3). In 2021, business expenditures on R&D performed by domestic businesses, higher education institutions, governments, and nonprofit organizations totaled $591.0 billion, divided between $461.0 billion (78%) on experimental development and $130.0 billion (22%) on research (table 7). These business expenditures on research funded 49% of total U.S. research in 2021, up from 38% in 2011 (figure 3). Over the same period, the federally funded share of U.S. total research declined from 44% in 2011 to 34% in 2021. Comparably, the federally funded share of basic research fell from 53% in 2011 to 40% in 2021.

R&D performance also demonstrates the enhanced role of business in the domestic research system. In 2011, businesses performed 18% of U.S. basic research and 39% of total research, but the sector's share of basic and total research rose to 34% and 49%, respectively, by 2021. The share of U.S. basic research performed by higher education institutions—historically, the nation's largest basic research performer—declined from 54% in 2011 to 46% in 2021. In absolute terms, higher education basic research performance increased from $40 billion to $54 billion during this period. The increased relative role of the business sector as a funder and performer of basic and applied research is remarkable.

Table 6

U.S. R&D expenditures by type of R&D and source of funds: Selected years, 1970–2022

(Billions of current and constant 2017 dollars and percent)

Type of R&D and source of funds	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Current $billions																						
Research	9.3	13.0	22.5	40.1	57.9	70.5	98.5	129.7	145.2	155.4	155.4	160.6	167.2	174.5	181.5	197.0	203.5	216.2	235.2	244.3	262.7	289.4
Business	3.0	4.2	8.0	16.1	23.6	31.1	45.4	50.7	56.2	58.6	58.7	63.0	67.2	70.9	74.5	85.4	87.7	93.7	107.4	113.0	130.0	146.8
Federal government	5.6	7.5	12.4	20.3	27.8	30.5	39.7	58.9	63.1	69.7	68.7	68.3	68.6	70.3	71.7	75.0	77.6	82.6	86.7	89.5	89.6	97.4
Other nonfederal	0.8	1.2	2.1	3.7	6.5	8.9	13.4	20.0	26.0	27.1	28.0	29.3	31.5	33.3	35.3	36.6	38.2	39.9	41.1	41.8	43.1	45.2
Nonfederal government	0.2	0.3	0.5	0.8	1.3	1.6	2.1	2.8	3.8	3.8	3.7	3.7	3.7	3.7	3.8	4.3	4.4	4.6	4.7	4.9	4.9	5.1
Higher education	0.3	0.4	0.9	1.6	3.0	3.8	5.9	8.9	11.1	11.1	11.8	12.8	13.7	14.5	15.4	16.7	17.7	18.7	19.6	20.2	21.3	22.9
Nonprofit organizations	0.3	0.5	0.8	1.3	2.3	3.4	5.4	8.3	11.0	12.2	12.4	12.8	14.0	15.1	16.1	15.6	16.1	16.6	16.7	16.6	16.9	17.2
Constant 2017 $billions																						
Research	46.3	46.6	57.1	79.0	97.7	105.4	135.5	159.0	165.0	173.3	169.9	172.4	176.5	181.0	186.5	200.5	203.5	211.4	226.2	231.8	238.3	245.3
Business	14.7	15.2	20.3	31.7	39.9	46.5	62.5	62.2	63.8	65.4	64.2	67.6	70.9	73.6	76.5	86.9	87.7	91.6	103.3	107.3	117.9	124.5
Federal government	27.7	27.1	31.5	40.0	46.8	45.6	54.7	72.3	71.7	77.7	75.1	73.3	72.4	72.9	73.7	76.3	77.6	80.7	83.4	84.9	81.3	82.5
Other nonfederal	3.9	4.3	5.3	7.3	11.0	13.3	18.4	24.5	29.5	30.2	30.6	31.5	33.2	34.5	36.3	37.3	38.2	39.0	39.5	39.6	39.1	38.3
Nonfederal government	1.1	1.2	1.2	1.5	2.2	2.4	2.8	3.5	4.3	4.2	4.1	3.9	3.9	3.9	3.9	4.4	4.4	4.5	4.6	4.7	4.5	4.3
Higher education	1.2	1.5	2.2	3.2	5.0	5.7	8.1	10.9	12.7	12.4	12.9	13.8	14.5	15.0	15.8	17.0	17.7	18.3	18.9	19.2	19.3	19.4
Nonprofit organizations	1.5	1.7	1.9	2.6	3.8	5.1	7.4	10.2	12.5	13.7	13.6	13.8	14.8	15.7	16.6	15.9	16.1	16.2	16.1	15.8	15.3	14.6
Percent distribution																						
Research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	31.7	32.6	35.5	40.1	40.8	44.1	46.1	39.1	38.7	37.7	37.8	39.2	40.2	40.6	41.0	43.3	43.1	43.4	45.7	46.3	49.5	50.7
Federal government	59.9	58.2	55.2	50.7	47.9	43.3	40.3	45.5	43.4	44.9	44.2	42.5	41.0	40.3	39.5	38.1	38.1	38.2	36.9	36.6	34.1	33.6
Other nonfederal	8.4	9.3	9.3	9.2	11.3	12.6	13.6	15.4	17.9	17.4	18.0	18.3	18.8	19.1	19.5	18.6	18.8	18.4	17.5	17.1	16.4	15.6
Nonfederal government	2.5	2.5	2.1	1.9	2.2	2.3	2.1	2.2	2.6	2.4	2.4	2.3	2.2	2.1	2.1	2.2	2.2	2.1	2.0	2.0	1.9	1.8
Higher education	2.7	3.1	3.8	4.0	5.1	5.4	6.0	6.8	7.7	7.1	7.6	8.0	8.2	8.3	8.5	8.5	8.7	8.7	8.3	8.3	8.1	7.9
Nonprofit organizations	3.2	3.6	3.4	3.3	3.9	4.9	5.5	6.4	7.6	7.9	8.0	8.0	8.4	8.7	8.9	7.9	7.9	7.7	7.1	6.8	6.4	6.0
Current $billions																						
Experimental development	16.9	22.7	40.7	74.5	94.1	113.1	169.4	195.6	259.6	251.2	270.8	273.1	287.0	301.4	313.0	324.7	350.1	387.8	430.3	472.5	526.4	596.2
Business	7.5	11.6	22.9	41.9	59.6	79.7	140.5	157.1	201.8	189.5	207.7	212.7	230.0	247.5	258.8	274.9	298.8	332.8	374.8	407.3	461.0	526.0

Table 6

U.S. R&D expenditures by type of R&D and source of funds: Selected years, 1970–2022

(Billions of current and constant 2017 dollars and percent)

Type of R&D and source of funds	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Federal government	9.4	11.0	17.6	32.3	33.9	32.4	27.5	36.5	54.5	56.9	58.3	55.6	51.5	48.1	47.8	43.2	44.9	48.5	49.1	58.7	57.9	62.5
Other nonfederal	0.1	0.1	0.2	0.4	0.6	0.9	1.4	2.1	3.2	4.8	4.8	4.8	5.4	5.9	6.4	6.6	6.4	6.6	6.4	6.6	7.5	7.7
Nonfederal government	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.8	0.8	0.8
Higher education	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.3	2.5	2.6
Nonprofit organizations	0.0	0.1	0.1	0.2	0.3	0.5	0.9	1.4	2.2	3.0	2.9	2.9	3.3	3.6	4.0	3.9	3.6	3.6	3.5	3.5	4.2	4.2
Constant 2017 $billions																						
Experimental development	83.8	81.7	103.5	146.6	158.6	168.9	233.0	239.9	294.9	280.3	296.0	293.1	302.8	312.6	321.6	330.5	350.1	379.1	413.7	448.4	477.6	505.4
Business	37.1	41.7	58.3	82.4	100.4	119.1	193.3	192.6	229.3	211.5	227.1	228.3	242.7	256.7	265.9	279.9	298.8	325.3	360.4	386.5	418.3	445.9
Federal government	46.5	39.5	44.7	63.6	57.1	48.5	37.8	44.7	62.0	63.5	63.7	59.6	54.4	49.9	49.2	44.0	44.9	47.4	47.2	55.7	52.5	53.0
Other nonfederal	0.3	0.4	0.5	0.7	1.1	1.4	1.9	2.6	3.6	5.3	5.2	5.2	5.7	6.1	6.6	6.7	6.4	6.4	6.2	6.2	6.8	6.5
Nonfederal government	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.5	0.6	0.7	0.5	0.6	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Higher education	0.0	0.1	0.2	0.2	0.4	0.4	0.5	0.6	0.7	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.1	2.2	2.2	2.2	2.3	2.2
Nonprofit organizations	0.2	0.2	0.3	0.4	0.5	0.7	1.2	1.8	2.5	3.4	3.1	3.1	3.5	3.8	4.2	4.0	3.6	3.6	3.3	3.3	3.8	3.6
Percent distribution																						
Experimental development	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	44.2	51.1	56.3	56.2	63.3	70.5	83.0	80.3	77.8	75.4	76.7	77.9	80.1	82.1	82.7	84.7	85.3	85.8	87.1	86.2	87.6	88.2
Federal government	55.4	48.4	43.2	43.3	36.0	28.7	16.2	18.6	21.0	22.7	21.5	20.3	18.0	16.0	15.3	13.3	12.8	12.5	11.4	12.4	11.0	10.5
Other nonfederal	0.3	0.5	0.5	0.5	0.7	0.8	0.8	1.1	1.2	1.9	1.8	1.8	1.9	1.9	2.0	2.0	1.8	1.7	1.5	1.4	1.4	1.3
Nonfederal government	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Higher education	0.0	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4
Nonprofit organizations	0.2	0.3	0.3	0.2	0.3	0.4	0.5	0.7	0.8	1.2	1.1	1.1	1.2	1.2	1.3	1.2	1.0	0.9	0.8	0.7	0.8	0.7

[a] Some data for 2021 are preliminary and may later be revised.

[b] The R&D data for 2022 include estimates and are likely to later be revised.

Note(s):
Other nonfederal includes nonfederal government, higher education, and nonprofit organizations.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Table 7

U.S. business R&D expenditures, by type of R&D: 1970–2022

(Billions of current and constant 2017 dollars and percent)

Type of R&D	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[a]	2022[b]
Current $billions																						
R&D	10.4	15.8	30.9	58.0	83.2	110.9	186.0	207.8	258.0	248.1	266.4	275.7	297.2	318.4	333.2	360.3	386.5	426.5	482.2	520.4	591.0	672.9
Research	3.0	4.2	8.0	16.1	23.6	31.1	45.4	50.7	56.2	58.6	58.7	63.0	67.2	70.9	74.5	85.4	87.7	93.7	107.4	113.0	130.0	146.8
Experimental development	7.5	11.6	22.9	41.9	59.6	79.7	140.5	157.1	201.8	189.5	207.7	212.7	230.0	247.5	258.8	274.9	298.8	332.8	374.8	407.3	461.0	526.0
Constant 2017 $billions																						
R&D	51.8	56.9	78.6	114.0	140.3	165.6	255.7	254.8	293.2	276.8	291.2	295.9	313.6	330.2	342.4	366.7	386.5	416.9	463.6	493.8	536.2	570.4
Research	14.7	15.2	20.3	31.7	39.9	46.5	62.5	62.2	63.8	65.4	64.2	67.6	70.9	73.6	76.5	86.9	87.7	91.6	103.3	107.3	117.9	124.5
Experimental development	37.1	41.7	58.3	82.4	100.4	119.1	193.3	192.6	229.3	211.5	227.1	228.3	242.7	256.7	265.9	279.9	298.8	325.3	360.4	386.5	418.3	445.9
Percent distribution																						
R&D	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Research	28.3	26.7	25.8	27.8	28.4	28.1	24.4	24.4	21.8	23.6	22.0	22.9	22.6	22.3	22.4	23.7	22.7	22.0	22.3	21.7	22.0	21.8
Experimental development	71.7	73.3	74.2	72.2	71.6	71.9	75.6	75.6	78.2	76.4	78.0	77.1	77.4	77.7	77.6	76.3	77.3	78.0	77.7	78.3	78.0	78.2

[a] Some data for 2021 are preliminary and may later be revised.

[b] The R&D data for 2022 include estimates and are likely to later be revised.

Source(s):
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Data Sources, Limitations, and Availability

The statistics on U.S. R&D presented in this report derive mainly from integrating the data on R&D expenditures and funding collected by NCSES's annual national surveys of the organizations that perform and fund the vast majority of U.S. R&D. These surveys cover each of four sectors of the economy: higher education, government, business enterprise, and nonprofit organizations.[17] In some cases, the primary data from these surveys are adjusted to enable consistent integration of the statistics across these separately conducted surveys. The 2022 business R&D data is based on respondents' projected R&D costs and will be revised when actual R&D costs are collected in the following year. In addition, preliminary or otherwise estimated values may be used where final data from one or more of the surveys are not yet available but can reasonably be estimated. Estimates in this InfoBrief are based on census and sample survey data which are subject to nonsampling error. Sample-survey–based estimates are also subject to sampling error. All comparative statements in this InfoBrief have undergone statistical testing and are significant at the 90% confidence level except statements reliant on modeled estimates.

The R&D surveys include NCSES's annual surveys of business R&D (the Business Enterprise Research and Development Survey for 2019–21, the preceding Business Research and Development Survey for 2017–18, the Business R&D and Innovation Survey for 2008–16, and the Survey of Industrial R&D for 2007 and earlier years). In addition, the business R&D totals include the R&D expenditures reported by "micro" companies (defined as companies with fewer than 10 employees) through NCSES surveys fielded for 2016 and forward (the 2016 Business R&D and Innovation Survey—Microbusiness and the Annual Business Survey (ABS) since 2017).[18] Other NCSES survey data sources are the Higher Education Research and Development Survey (for FYs 2010–20), the preceding Survey of R&D Expenditures at Universities and Colleges (FY 2009 and earlier years), the Survey of Federal Funds for Research and Development (FYs 2020–21 and earlier years), and the FFRDC Research and Development Survey (FY 2020 and earlier years). Amounts for the R&D performed by nonprofit organizations with funding from the nonprofit sector and from business sources are estimated based on data and parameters from the FY 2021 Nonprofit Research Activities (NPRA) module of the ABS, the 2016 NPRA Survey, and the 1996–97 Survey of R&D Funding and Performance by Nonprofit Organizations.

A full set of detailed statistical tables and methodology information for the *National Patterns* data are available at https://ncses.nsf.gov/data-collections/national-patterns/2021-2022. For further information and questions, contact the author.

Notes

1 *Research and experimental development* (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge—including knowledge of humankind, culture, and society—and to devise new applications of available knowledge. *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. *Applied research* is original investigation undertaken in order to acquire new knowledge; directed primarily toward a specific, practical aim or objective. *Experimental development* is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes. See Organisation for Economic Co-Operation and Development (OECD). 2015. *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development.* The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing: Paris. Available at https://doi.org/10.1787/9789264239012-en.

2 For example, see Mowery DC. 2009. Plus ca change: Industrial R&D in the 'Third Industrial Revolution.' *Industrial and Corporate Change* 18 (1): 1–50 and Arora A, Belenzon S, and Patacconi A. 2018. The Decline of Science in Corporate R&D. *Strategic Management Journal* 39 (1): 3–32.

3 Arora A, Belenzon S, and Sheer L. 2021. Knowledge Spillovers and Corporate Investment in Scientific Research. *American Economic Review*, 111 (3): 871–898.

4 Percentages in this report are calculated based on unrounded data.

5 All growth rate calculations are reported using compound annual growth rates unless otherwise noted.

6 In this report, dollars adjusted for inflation (i.e., constant dollars) are based on the gross domestic product (GDP) implicit price deflator (currently in 2017 dollars) as published by the Bureau of Economic Analysis (BEA) at https://www.bea.gov/iTable/index_nipa.cfm. Note that GDP deflators are calculated on an economy-wide scale and do not explicitly focus on R&D.

7 Inflation measured by the Consumer Price Index (CPI) for 2014–20 ranged between 0.1% and 2.4%. Inflation was 4.7% and 8.0% in 2021 and 2022, respectively (https://www.minneapolisfed.org/about-us/monetary-policy/inflation-calculator/consumer-price-index-1913-). While the CPI is a more commonly known inflation measure, as noted above and in accordance with international standards for R&D reporting, dollars in this report are adjusted for inflation using the GDP implicit price deflator.

8 Due to sample variability in the data for the business R&D component, the calculated R&D-to-GDP ratios for 1964, 2009, and 2017 are not significantly different from one another at a 90% confidence level. Additionally, non-U.S. R&D-to-GDP ratios are adjusted for net R&D capital accumulation.

9 See Organisation for Economic Co-Operation and Development, OECD Main Science and Technology Indicators Database, September 2023. Available at https://www.oecd.org/sti/msti.htm.

10 North American Industry Classification System (NAICS).

11 Additional statistics on R&D performed in the United States by the business sector are available at https://ncses.nsf.gov/surveys/annual-business-survey/ and https://ncses.nsf.gov/surveys/business-enterprise-research-development/. See also:
Britt R; National Center for Science and Engineering Statistics (NCSES). 2023. *Business R&D Performance in the United States Tops $600 Billion in 2021*. NSF 23-350. Alexandria, VA: National Science Foundation. Available at http://ncses.nsf.gov/pubs/nsf23350.
Kindlon A; National Center for Science and Engineering Statistics (NCSES). 2023. *Microbusinesses Performed $6.1 Billion of R&D in the United States in 2021*. NSF 24-302. Alexandria, VA: National Science Foundation. Available at https://ncses.nsf.gov/pubs/nsf24302.

12 The data on higher education R&D reported by *National Patterns* differ from the underlying survey data in several respects. First, *National Patterns* translates the Higher Education R&D (HERD) Survey's primary data in academic fiscal years to calendar year equivalents. Second, *National Patterns* reports higher education R&D expenditures that are adjusted to remove the double-counting of pass-through funding included in HERD Survey source data. For further details on this topic, see "Technical Notes" at https://ncses.nsf.gov/data-collections/national-patterns/2021-2022#technical-notes.

13 The number of FFRDCs reflects that NCSES was informed in June 2021 that the Green Bank Observatory separated from the National Radio Astronomy Observatory in October 2016 to become an independent institution; both retained FFRDC status. The Master Government List of FFRDCs was subsequently updated to reflect this change.

14 The most recent data on nonprofit organization R&D come from the FY 2021 Nonprofit Research Activities (NPRA) module of the ABS and the 2016 NPRA Survey. Data for nonprofit organization R&D, 2017–19 are estimated based on the 2016 and 2020 data as revised in the 2021 survey. The availability of NPRA survey data allowed for improved measurement of nonprofit R&D performance over the 2017–22 period, resulting in minor changes to previously published estimates. For 1998–2015, data for nonprofit organization R&D funded by the federal government come from the NCSES annual Survey of Federal Funds for Research and Development; data for that funded by businesses and by the nonprofit sector itself are estimated, based on parameters from the 1996–97 Survey of Research and Development Funding and Performance by Nonprofit Organizations.

15 Estimates of the type of R&D by source of funding are based on survey responses for federal funding by type of R&D and modeled using nonfederal funding sources of total R&D and the total nonfederally funded R&D by type. Because of this estimation procedure, comparisons of R&D type by funding source are not supported by statistical testing. *National Patterns of R&D* uses the general term "estimates" to describe survey estimates, modeled estimates, and projections. Results that combine these techniques are also called estimates because survey estimates are their major component.

16 For example, see Arora A, Belenzon S, and Sheer L. 2021. Knowledge Spillovers and Corporate Investment in Scientific Research. *American Economic Review* 111 (3): 871–898 or Mezzanotti F and Simcoe T; National Bureau of Economic Research. 2023. *Research and/or Development? Financial Frictions and Innovation Investment*. Working Paper No. 31521.

17 For further details on the correspondence between sectors used to measure R&D and those used in the System of National Accounts, please see the *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development* (https://doi.org/10.1787/9789264239012-en).

18 Estimates from the NCSES business and nonprofit organization R&D surveys mentioned are all derived from sample data and thereby contain sampling error. Consequently, estimates of total U.S. R&D also contain sampling error. For more information on this topic and other surveys used in the *National Patterns* tabulations, see the "Technical Notes" at https://ncses.nsf.gov/data-collections/national-patterns/2021-2022#technical-notes.

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