



InfoBrief

U.S. R&D Increased by \$51 Billion, to \$606 Billion, in 2018; Estimate for 2019 Indicates a Further Rise to \$656 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 \$606.1 billion in 2018 ([table 1](#)). The estimated total for 2019, based on performer-reported expectations, is \$656.0 billion. These numbers compare with U.S. R&D totals of \$494.5 billion in 2015 and \$406.6 billion in 2010. (All amounts and calculations are reported in current dollars, unless otherwise noted.)

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 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 mainly derive from NCSES surveys of the annual R&D expenditures of these performers and funders (see "[Data Sources and Availability](#)" for additional information).

Table 1

U.S. R&D expenditures, by performing sector and source of funds: 2010–19

(Current and constant 2012 millions of dollars)

Performing sector and source of funds	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019 ^a
	Current \$millions									
All performing sectors	406,600	426,213	433,719	454,271	475,969	494,482	521,703	555,245	606,085	656,038
Business	278,977	294,092	302,251	322,528	340,728	355,821	379,528	405,791	445,637	485,826
Federal government	50,798	53,524	52,144	51,086	52,687	52,847	51,187	52,553	58,356	63,051
Federal intramural ^b	31,970	34,950	34,017	33,406	34,783	34,199	31,762	32,231	36,793	40,086
FFRDCs	18,828	18,574	18,128	17,680	17,903	18,649	19,424	20,322	21,563	22,965
Nonfederal government	691	694	665	620	583	595	621	636	656	678
Higher education	58,084	60,088	60,895	61,548	62,352	64,621	67,774	71,108	74,897	78,717
Nonprofit organizations ^c	18,050	17,815	17,764	18,489	19,620	20,599	22,594	25,157	26,538	27,767
All funding sources	406,600	426,213	433,719	454,271	475,969	494,482	521,703	555,245	606,085	656,038
Business	248,124	266,429	275,728	297,188	318,411	333,241	360,002	386,098	425,999	463,745
Federal government	126,617	127,015	123,837	120,132	118,368	119,525	116,870	121,610	129,610	138,880

Table 1**U.S. R&D expenditures, by performing sector and source of funds: 2010–19**

(Current and constant 2012 millions of dollars)

Performing sector and source of funds	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019 ^a
Nonfederal government	4,303	4,387	4,158	4,243	4,214	4,271	4,508	4,597	4,762	4,960
Higher education	12,263	13,103	14,299	15,378	16,209	17,293	18,432	19,585	20,704	21,791
Nonprofit organizations ^c	15,294	15,280	15,697	17,331	18,768	20,153	21,892	23,355	25,010	26,662
Constant 2012 \$millions										
All performing sectors	423,054	434,387	433,719	446,436	459,260	472,627	493,465	515,500	549,507	584,369
Business	290,267	299,733	302,251	316,965	328,767	340,094	358,986	376,745	404,037	432,751
Federal government	52,854	54,551	52,144	50,205	50,837	50,512	48,416	48,791	52,909	56,163
Federal intramural ^b	33,264	35,621	34,017	32,830	33,562	32,687	30,043	29,924	33,359	35,707
FFRDCs	19,590	18,930	18,128	17,375	17,275	17,824	18,373	18,867	19,550	20,456
Nonfederal government	719	707	665	609	563	568	587	590	595	604
Higher education	60,434	61,240	60,895	60,486	60,163	61,764	64,105	66,018	67,905	70,117
Nonprofit organizations ^c	18,780	18,157	17,764	18,170	18,931	19,689	21,371	23,356	24,061	24,733
All funding sources	423,054	434,387	433,719	446,436	459,260	472,627	493,465	515,500	549,507	584,369
Business	258,165	271,539	275,728	292,062	307,233	318,513	340,516	358,460	386,233	413,082
Federal government	131,740	129,451	123,837	118,060	114,212	114,242	110,544	112,905	117,511	123,708
Nonfederal government	4,477	4,471	4,158	4,170	4,066	4,082	4,264	4,268	4,317	4,418
Higher education	12,759	13,354	14,299	15,112	15,640	16,528	17,434	18,183	18,771	19,411
Nonprofit organizations ^c	15,913	15,573	15,697	17,032	18,109	19,262	20,707	21,683	22,675	23,750

FFRDC = federally funded research and development center.

^a The data for 2019 are estimates and will later be revised.^b Federal intramural includes expenditures of federal intramural R&D as well as costs associated with administering extramural R&D procurements.^c R&D performed by nonprofit organizations are estimated and may later be revised.**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).

Current Trends in U.S. Total R&D and R&D Intensity

U.S. Total R&D

The 2010–17 period saw sizable year-over-year increases in U.S. R&D expenditures, averaging \$21 billion annually—a stark contrast with essentially no change between 2008 and 2010, a period marked by the impacts of the Great Recession.² The increase in 2018 was \$51 billion over the 2017 level. The estimated level for 2019 similarly is \$50 billion more than in 2018. These sustained annual increases in U.S. total R&D are due mainly to consistently higher levels of business R&D performance, which accounted for about 80% of the increase each year (table 1).

Adjusted for inflation, growth in U.S. total R&D averaged 3.3% annually over the 2010–18 period, moderately higher than the 2.3% average growth of U.S. gross domestic product (GDP).³ By comparison, average annual growth of U.S. total R&D in the prior decade (2000–10), was lower at 2.1%, although it still outpaced the 1.7% rate of GDP expansion.⁴ The estimate for 2019 shows R&D growing at 6.3%, compared to GDP at 4.0%.⁵

R&D-to-GDP Ratio

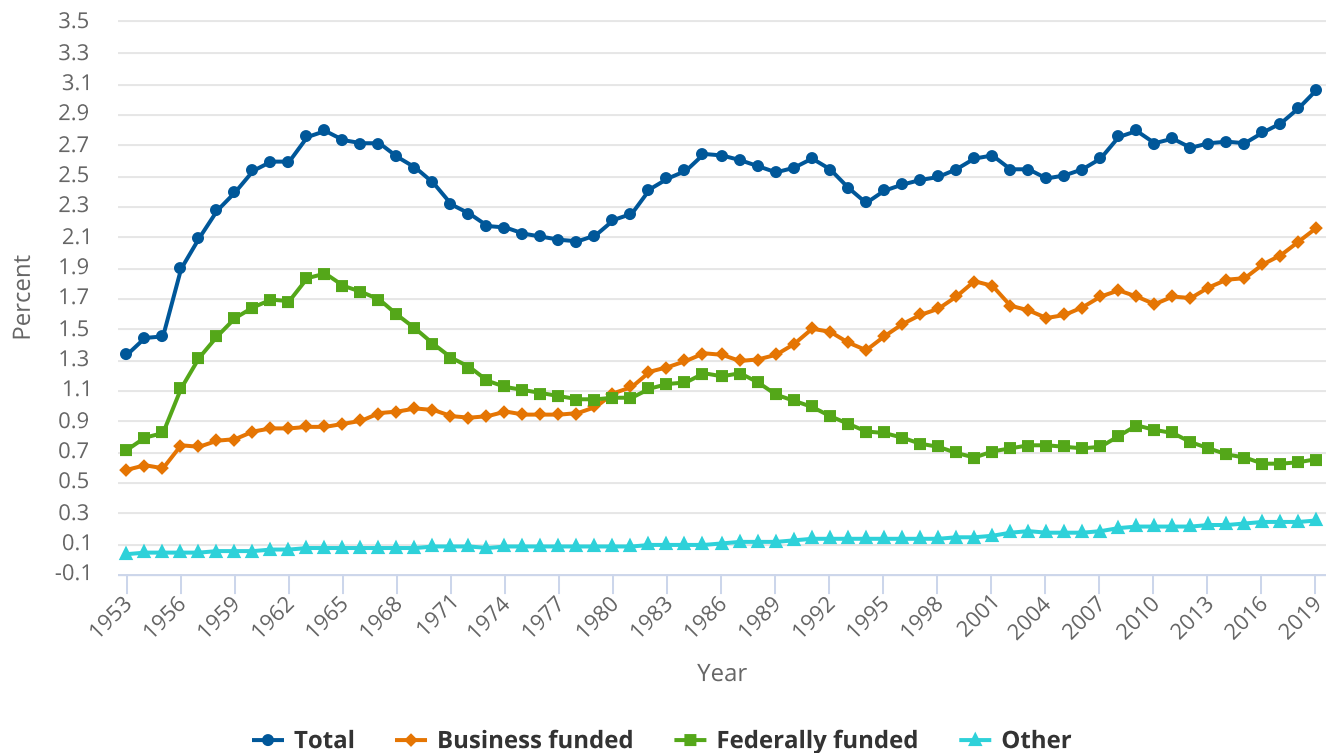
The ratio of total national R&D expenditures to GDP is widely used by national statistical offices and other policy analysts as an overall gauge of the intensity of a nation's R&D effort. In this new edition of the *National Patterns* data, the ratio of U.S. R&D to GDP was 2.94% in 2018 and estimated to be 3.06% in 2019.

The U.S. ratio generally has been rising since the mid-1990s, though with some periods of decline (figure 1). The highest U.S. ratios recorded are 2.79% in 1964, 2.79% in 2009, 2.84% in 2017, 2.94% in 2018, and estimated to reach 3.06% in 2019.⁶

Most of the rise in R&D-to-GDP ratio over the past several decades owes to the increase of nonfederal spending on R&D, particularly by the business sector. This arises largely from the growing role of business R&D in the national R&D system, which in turn reflects the increase of R&D-reliant goods and services in the national and global economies. By contrast, the share of federally funded R&D expenditures declined from the mid-1980s to the late 1990s, notably from cuts in defense-related R&D. This was followed by a gradual uptick through 2009, driven by increased federal spending on biomedical and national security R&D and the one-time incremental funding for R&D provided by the American Recovery and Reinvestment Act of 2009 (ARRA).⁷ The federally funded share, however, has mostly declined since 2010 (figure 1).

Figure 1

Ratio of U.S. R&D to gross domestic product, by source of funding for R&D: 1953–2019



Note(s):

Data for 2019 are estimates; some of these data may 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 represent businesses as funders of R&D by all performers. Other includes funding for U.S. R&D by nonfederal government, higher education, and nonprofit organizations.

Source(s):

GDP data from Bureau of Economic Analysis, National Economic Accounts, Gross Domestic Product, https://apps.bea.gov/iTable/index_nipa.cfm, accessed 3 August 2020; R&D data from National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

R&D by Type of Work

In 2018, basic research activities accounted for \$101.1 billion, or 17% of total U.S. R&D expenditures (table 2). Applied research was \$116.3 billion, or 19% of the total. Most of the total of U.S. R&D expenditures was experimental development at \$388.6 billion, or 64%.

Higher education accounted for somewhat under half (46%) of the \$101.1 billion of basic research in 2018 (table 2). The business sector was the second largest basic research performer (29%). Business was the majority performer (57%) of the \$116.3 billion of applied research in 2018. Higher education was second at 18%; federal intramural performers plus FFRDCs amounted to 17% of the applied research total. Business continued to dominate experimental development, accounting for 90% of the \$388.6 billion of that category in 2018.

Federal funding accounted for 41% of the \$101.1 billion of basic research in 2018. But federal funds were less prominent for applied research (34% of \$116.3 billion) and experimental development (12% of \$388.6 billion). The business sector provided the greatest share of funding for applied research (54%) and the predominant share for experimental development (86%). It also accounted for a sizable share (30%) of funding for basic research.

Table 2

U.S. R&D expenditures, by performing sector, source of funds, and type of work: 2018

(Millions of dollars and percent distribution)

Performing sector and type of work	Total	Source of funds (\$millions)					Percent distribution by performer
		Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
R&D	606,085	425,999	129,610	4,762	20,704	25,010	100.0
Business	445,637	419,268	25,199	120	*	1,049	73.5
Federal government	58,356	194	57,956	45	*	162	9.6
Federal intramural	36,793	0	36,793	0	0	0	6.1
FFRDCs	21,563	194	21,163	45	*	162	3.6
Nonfederal government	656	*	269	387	*	*	0.1
Higher education	74,897	4,580	37,736	4,210	20,704	7,669	12.4
Nonprofit organizations	26,538	1,957	8,451	*	*	16,130	4.4
Percent distribution by funding source	100.0	70.3	21.4	0.8	3.4	4.1	-
Basic research	101,123	30,261	41,562	2,526	12,961	13,813	100.0
Business	29,208	26,549	2,536	12	*	112	28.9
Federal government	11,096	39	11,015	9	*	33	11.0
Federal intramural	6,827	0	6,827	0	0	0	6.8
FFRDCs	4,269	39	4,188	9	*	33	4.2
Nonfederal government	120	*	49	70	*	*	0.1
Higher education	46,983	2,587	24,288	2,435	12,961	4,713	46.5
Nonprofit organizations	13,717	1,087	3,675	*	*	8,956	13.6
Percent distribution by funding source	100.0	29.9	41.1	2.5	12.8	13.7	-
Applied research	116,319	62,989	39,756	1,636	5,544	6,394	100.0
Business	66,609	61,036	5,359	23	*	191	57.3
Federal government	19,704	90	19,518	21	*	75	16.9
Federal intramural	11,111	0	11,111	0	0	0	9.6
FFRDCs	8,593	90	8,407	21	*	75	7.4
Nonfederal government	514	*	211	303	*	*	0.4
Higher education	20,899	1,368	10,658	1,289	5,544	2,041	18.0
Nonprofit organizations	8,593	496	4,009	*	*	4,088	7.4
Percent distribution by funding source	100.0	54.2	34.2	1.4	4.8	5.5	-
Experimental development	388,642	332,748	48,292	600	2,199	4,804	100.0

Table 2**U.S. R&D expenditures, by performing sector, source of funds, and type of work: 2018**

(Millions of dollars and percent distribution)

Performing sector and type of work	Total	Source of funds (\$millions)					Percent distribution by performer
		Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
Business	349,820	331,682	17,304	85	*	748	90.0
Federal government	27,556	65	27,422	15	*	54	7.1
Federal intramural	18,856	0	18,856	0	0	0	4.9
FFRDCs	8,700	65	8,567	15	*	54	2.2
Nonfederal government	23	*	9	13	*	*	0.0
Higher education	7,016	626	2,790	486	2,199	916	1.8
Nonprofit organizations	4,228	374	767	*	*	3,086	1.1
Percent distribution by funding source	100.0	85.6	12.4	0.2	0.6	1.2	-

* = small to negligible amount, included as part of the funding provided by other sectors.

FFRDC = federally funded research and development center.

Note(s):

R&D performed by nonprofit organizations are estimated and may later be revised.

Source(s):

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

Data Sources 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 on the organizations that perform and fund the vast majority of U.S. R&D. In some cases, the primary data from these surveys are adjusted to enable consistent integration of the statistics across these separately conducted surveys. 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 calculated.

The R&D surveys involved include NCSES's annual surveys of business R&D (the Business Research and Development Survey, for 2017–18; the preceding Business R&D and Innovation Survey, for 2008–16; and the Survey of Industrial R&D, for 2007 and earlier years). In addition, for the first time in *National Patterns*, the business R&D data include the R&D expenditures reported by micro companies (generally, companies with fewer than 10 employees) through NCSES surveys fielded for 2016 and onward (the 2016 Business R&D and Innovation Survey—Microbusiness, which collected statistics on the R&D activities of businesses with 1–5 employees, and for 2017–18, the Annual Business Survey, which collected statistics on the R&D activities of businesses with 1–9 employees).⁸ Other NCSES surveys involved are the Higher Education Research and Development Survey (for FYs 2010–19), and the preceding Survey of R&D Expenditures at Universities and Colleges, (for FY 2009 and earlier years); the Survey of Federal Funds for Research and Development (FYs 2019–20 and earlier years), the FFRDC Research and Development Survey (FY 2019 and earlier years), and the Survey of State Government Research and Development (for FYs 2006–19). Amounts for the R&D performed by nonprofit organizations with funding from the nonprofit sector and from business sources are estimated, based on parameters from the 1996–97 Survey of R&D Funding and Performance by Nonprofit Organizations.

A full set of detailed statistical tables associated with the National Patterns data will be available in the report *National Patterns of R&D Resources: 2018–19 Data Update*, at <https://www.nsf.gov/statistics/natlpatterns/>. This supplementary report provides further details on the nature of the data and the *National Patterns* methodologies. For further information and questions, contact the author.

Notes

- 1** *Research and experimental development* 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*: 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*: Original investigation undertaken in order to acquire new knowledge; directed primarily toward a specific, practical aim or objective. *Experimental development*: 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 (Organisation for Economic Co-Operation and Development, *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. 7th ed. Paris.)
- 2** For further details on the 2008–10 trends, please see an earlier report in the *National Patterns* series: Boroush M; National Center for Science and Engineering Statistics (NCSES). 2013. *U.S. R&D Resumes Growth in 2011 and 2012, Ahead of the Pace of the Gross Domestic Product*. NSF 14-307. Arlington, VA: National Science Foundation. Available at: <https://www.nsf.gov/statistics/infbrief/nsf14307/>.
- 3** In this report, dollars adjusted for inflation (i.e., constant dollars) are based on the GDP implicit price deflator (currently in 2012 dollars) as published by the Department of Commerce, Bureau of Economic Analysis (BEA) (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.
- 4** Data on U.S. R&D and GDP prior to 2010 appear in the companion report, *National Patterns of R&D Resources: 2018–19 Data Update*.
- 5** The 2010–18 R&D total data in [table 1](#) suggest the trend in year-over-year increases may be shifting toward a higher average annual increase starting in 2017, or perhaps 2016. But the next edition of the *National Patterns* series—which will provide final 2019 data and an estimate for 2020—likely will be needed to confirm this shift.
- 6** Due to sample variability in the data for the business R&D component, the calculated R&D-to-GDP ratios for 1965, 2009, and 2017 are not significantly different from one another at a 90% confidence level.
- 7** For a further discussion, see: National Science Board, National Science Foundation. 2020. “Recent Trends in U.S. R&D Performance,” in *Research and Development: U.S. Trends and International Comparisons. Science and Engineering Indicators 2020*. NSB-2020-3. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsb20203/recent-trends-in-u-s-r-d-performance>.
- 8** Estimates from the NCSES business 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, please see the technical notes in the accompanying Data Update at <https://www.nsf.gov/statistics/natlpatterns/>.

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