National Center for Science and Engineering Statistics

InfoBrief

Higher Education R&D Expenditures Increased 11.2%, Exceeded $108 Billion in FY 2023

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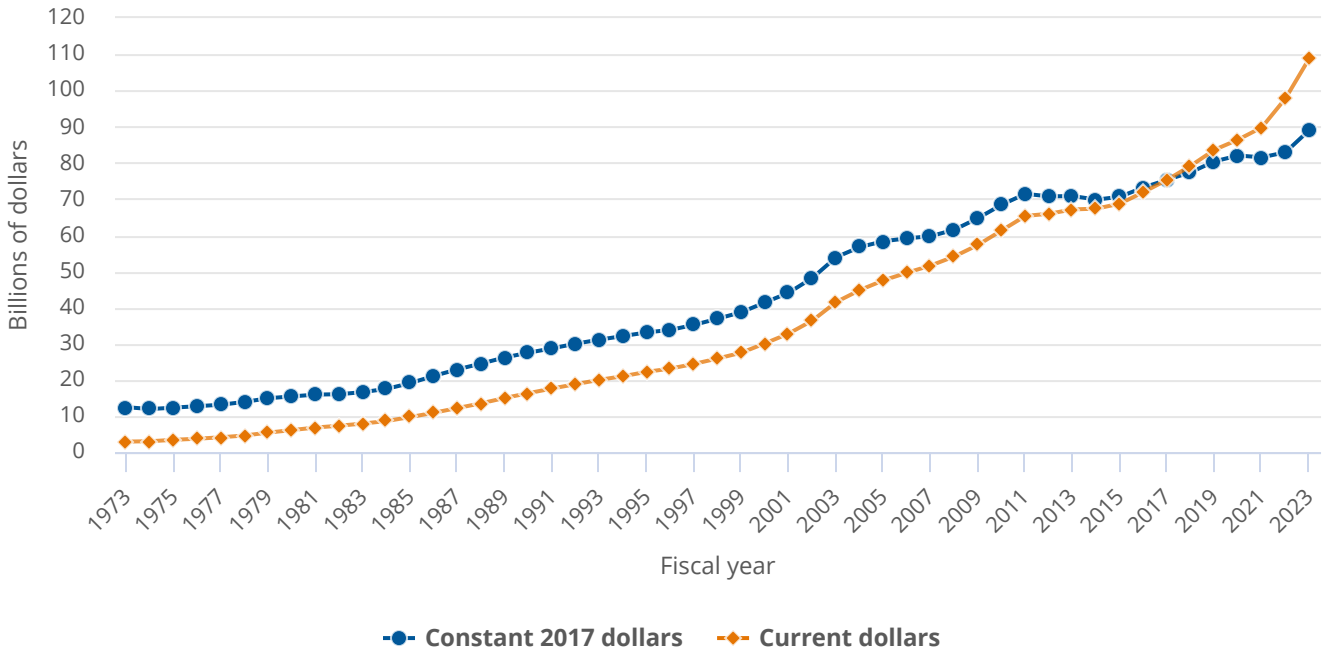
Research and development (R&D) spending by academic institutions increased 11.2% in FY 2023, the largest growth rate in current dollars since FY 2003.[1] Since FY 2013, higher education R&D has grown at an average compound annual rate of 5.0% in current dollars and 2.3% in constant dollars (**figure 1**).[2] Total academic R&D reached $108.8 billion in FY 2023, an increase of $11.0 billion from FY 2022 (**table 1**). R&D expenditures funded by federal sources accounted for $5.6 billion of the total increase. Universities' internally funded R&D expenditures (institution funds) were $3.2 billion greater than in FY 2022, while R&D funded by state and local governments also increased in FY 2023 by $529 million. R&D expenditures funded by nonprofit organizations increased by $706 million and those funded by businesses increased by $523 million. R&D funded by all other sources increased by $459 million in FY 2023.

The data discussed in this report are from the Higher Education Research and Development (HERD) Survey, sponsored by the National Center for Science and Engineering Statistics (NCSES) within the U.S. National Science Foundation. For more information on the survey, see "Data Sources, Limitations, and Availability."

Figure 1

Higher education R&D expenditures: FYs 1973–2023



Note(s):
Gross domestic product deflators come from the Bureau of Economic Analysis and are available in Table 1.1.9 "Implicit Price Deflators for Gross Domestic Product" (accessed 9 September 2024).

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

Table 1

Higher education R&D expenditures, by source of funds: FYs 2013–23

(Millions of current dollars)

Fiscal year	All R&D expenditures	Source of funds					
		Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources
2013	67,109	39,510	3,706	14,938	3,515	3,903	1,537
2014	67,313	38,032	3,916	15,743	3,734	3,978	1,911
2015	68,664	37,911	3,864	16,608	4,009	4,236	2,037
2016	71,880	38,857	4,053	17,911	4,220	4,635	2,204
2017	75,293	40,319	4,187	18,886	4,440	5,160	2,302
2018	79,176	41,934	4,326	20,220	4,726	5,459	2,511
2019	83,646	44,539	4,520	21,114	5,066	5,705	2,702
2020	86,444	46,182	4,604	22,023	5,190	5,758	2,688
2021	89,840	49,193	4,752	22,479	5,123	5,606	2,688
2022	97,835	54,056	4,918	24,537	5,707	5,979	2,638
2023	108,841	59,679	5,447	27,702	6,230	6,685	3,097

Note(s):
Because of rounding, detail may not add to total. Includes all institutions surveyed in the fiscal years shown.

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

R&D Expenditures, by Source of Funding

Federally funded R&D at universities totaled almost $60 billion in FY 2023, which accounted for 55% of total expenditures (table 2). The Department of Health and Human Services (HHS), which includes the National Institutes of Health, supported the largest federal share of R&D. It funded $33.1 billion of FY 2023 higher education R&D expenditures, an increase of $2.8 billion over the previous year. HHS's funding amounted to 56% of total federally supported R&D and 30% of total R&D at higher education institutions. The Department of Defense (DOD) ($9.0 billion) and the National Science Foundation ($6.7 billion) accounted for most of the remaining federally funded R&D expenditures, while three other agencies supported between $1.7 billion and $2.7 billion of university R&D in FY 2023: the Department of Energy (DOE) ($2.7 billion), the National Aeronautics and Space Administration (NASA) ($2.3 billion), and the Department of Agriculture (USDA) ($1.7 billion). All other federal agencies combined supported $4.1 billion of higher education R&D in FY 2023.

Table 2

Federally financed higher education R&D expenditures, by federal agency: FYs 2013–23

(Millions of current dollars)

Source of funds	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	% change 2022–23
All R&D expenditures	66,978	67,161	68,520	71,737	75,149	79,026	83,490	86,306	89,701	97,670	108,681	11.3
All federal R&D expenditures	39,446	37,961	37,847	38,788	40,248	41,860	44,460	46,107	49,118	53,975	59,604	10.4
DOD	5,023	4,927	5,090	5,313	5,634	5,892	6,652	7,078	7,363	7,980	9,048	13.4
DOE	1,876	1,805	1,710	1,772	1,821	1,819	1,940	2,038	2,217	2,488	2,671	7.4
HHS	21,211	20,298	19,994	20,663	21,627	22,837	24,407	25,365	27,522	30,273	33,098	9.3
NASA	1,332	1,329	1,418	1,491	1,406	1,516	1,644	1,758	1,768	2,044	2,296	12.3
NSF	5,393	5,127	5,120	5,114	5,206	5,271	5,333	5,414	5,406	6,037	6,700	11.0
USDA	1,092	1,062	1,119	1,209	1,223	1,186	1,224	1,250	1,304	1,513	1,700	12.4
Other	3,519	3,414	3,397	3,226	3,330	3,339	3,260	3,204	3,537	3,641	4,092	12.4

DOD = Department of Defense; DOE = Department of Energy; HHS = Department of Health and Human Services; NASA = National Aeronautics and Space Administration; NSF = National Science Foundation; USDA = Department of Agriculture.

Note(s):
Because of rounding, detail may not add to total. Institutions reporting less than $1 million in total R&D expenditures completed a shorter version of the survey questionnaire and those totals are not reflected here. R&D expenditures from institutions reporting less than $1 million in R&D in FY 2023 were $160 million. Total federally funded R&D for these institutions in FY 2023 was $75 million.

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

Universities' own funding ($27.7 billion) accounted for 25% of total R&D in FY 2023, which is similar to the percentages reported since 2016 (table 1). Nonprofit organizations ($6.7 billion) and businesses ($6.2 billion) each supported around 6% of total R&D. State and local governments funded 5.0% or $5.4 billion, while all other sources funded 2.8% ($3.1 billion) of higher education R&D.

R&D expenditures increased by at least 9.2% for each of the funding sources from FY 2022 to FY 2023. Expenditures funded by the federal government and state and local governments increased similarly, with federal up 10.4% ($5.6 billion) and state and local up 10.8% ($529 million). Universities' own funds supported 12.9% ($3.2 billion) more in R&D costs in FY 2023, while nonprofit-funded R&D increased by 11.8% ($706 million). R&D funded by businesses was up 9.2% in FY 2023 ($523 million). R&D funded by all other sources, which include funds from foreign governments, foreign or U.S. universities, and gifts designated by the donors for research, increased by 17.4% ($459 million) in FY 2023 after remaining flat or declining each year from FY 2020 to FY 2022.

R&D Expenditures, by Field

In FY 2023, R&D expenditures in science fields increased by 10.7% ($8.2 billion), reaching $84.3 billion, and engineering fields increased by 11.5% ($1.8 billion), reaching $17.5 billion (table 3). R&D expenditures in non-science and engineering (non-S&E) fields ($6.9 billion total) increased by 17.8% ($1.0 billion). R&D expenditures in two life sciences subfields, health sciences ($35.7 billion total, $3.9 billion increase) and biological and biomedical sciences ($19.5 billion total, $1.4 billion increase), showed the largest dollar increases, accounting for 48% of the total university R&D growth in FY 2023. Combined, these two fields also accounted for 51% of total higher education R&D.

Table 3

Higher education R&D expenditures, by FY 2022 total, source of funds, and R&D field: FY 2023

(Millions of current dollars)

Field	Total FY 2022 R&D expenditures	Total FY 2023 R&D expenditures	% change in current dollars, FYs 2022-23	Source of funds, FY 2023					
				Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources
All R&D fields	97,670	108,681	11.3	59,604	5,438	27,655	6,221	6,671	3,092
Science	76,144	84,308	10.7	46,948	3,999	20,711	4,729	5,524	2,397
Computer and information sciences	3,202	3,617	13.0	2,418	93	746	184	103	73
Geosciences, atmospheric sciences, and ocean sciences	3,653	4,033	10.4	2,694	257	744	92	161	86
Atmospheric science and meteorology	669	724	8.2	583	19	89	8	14	10
Geological and earth sciences	1,348	1,488	10.4	921	75	337	51	61	43
Ocean sciences and marine sciences	1,211	1,365	12.7	891	131	237	21	62	23
Geosciences, atmospheric sciences, and ocean sciences nec	425	455	7.2	298	32	81	11	23	10
Life sciences	56,476	62,204	10.1	33,896	3,161	14,982	4,119	4,174	1,872
Agricultural sciences	3,936	4,286	8.9	1,459	1,055	1,313	163	153	142
Biological and biomedical sciences	18,130	19,526	7.7	11,754	606	4,541	909	1,239	477
Health sciences	31,875	35,725	12.1	19,391	1,245	8,328	2,968	2,645	1,148
Natural resources and conservation	1,017	1,080	6.2	513	166	303	19	48	30
Life sciences nec	1,518	1,588	4.6	780	89	497	59	88	74
Mathematics and statistics	879	1,061	20.6	661	31	293	14	53	8
Physical sciences	6,167	6,945	12.6	4,622	130	1,520	216	302	155
Astronomy and astrophysics	814	967	18.8	660	7	174	3	71	52
Chemistry	2,127	2,301	8.2	1,413	56	595	89	107	40
Materials science	286	319	11.4	206	3	70	18	6	17
Physics	2,669	2,967	11.1	2,123	44	598	63	101	38

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				Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources
Physical sciences nec	271	391	44.3	220	19	84	43	17	8
Psychology	1,446	1,638	13.2	979	60	463	13	102	22
Social sciences	3,164	3,615	14.3	1,203	209	1,444	48	561	150
Anthropology	133	152	14.4	47	3	86	2	9	5
Economics	665	724	8.8	206	51	282	14	134	36
Political science and government	488	557	14.1	112	18	256	5	123	43
Sociology, demography, and population studies	616	728	18.1	317	39	247	8	103	14
Social sciences nec	1,261	1,455	15.4	521	98	573	20	192	52
Sciences nec	1,157	1,195	3.3	475	60	518	42	69	30
Engineering	15,663	17,468	11.5	10,931	961	3,330	1,317	469	460
Aerospace, aeronautical, and astronautical engineering	1,647	1,914	16.2	1,426	49	169	234	13	22
Bioengineering and biomedical engineering	1,727	1,885	9.1	1,198	73	406	66	109	33
Chemical engineering	1,108	1,247	12.5	713	50	290	111	51	32
Civil engineering	1,686	1,901	12.7	929	322	464	89	53	43
Electrical, electronic, and communications engineering	3,463	3,839	10.8	2,794	95	566	213	91	78
Industrial and manufacturing engineering	615	707	14.9	482	42	123	38	11	10
Mechanical engineering	2,062	2,325	12.7	1,552	75	419	188	43	48
Metallurgical and materials engineering	887	1,039	17.2	693	32	189	75	26	24
Engineering nec	2,466	2,612	5.9	1,143	223	703	301	73	168
Non-S&E	5,862	6,905	17.8	1,725	477	3,614	175	678	236
Business management and business administration	1,081	1,218	12.7	110	46	895	45	61	61
Communication and communications technologies	214	254	18.7	58	17	126	7	37	9
Education	1,741	2,042	17.3	891	199	630	48	237	38
Humanities	713	847	18.7	65	21	595	15	112	39
Law	359	431	20.1	35	27	251	13	83	21

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(Millions of current dollars)

Field	Total FY 2022 R&D expenditures	Total FY 2023 R&D expenditures	% change in current dollars, FYs 2022-23	Source of funds, FY 2023					
				Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources
Social work	363	417	14.8	206	61	107	4	35	4
Visual and performing arts	228	284	24.3	21	14	220	2	16	12
Non-S&E nec	1,164	1,413	21.4	340	92	790	43	96	52

nec = not elsewhere classified; S&E = science and engineering.

Note(s):
This table includes only institutions reporting $1 million or more in total R&D expenditures in 2022. Institutions reporting less than $1 million in total R&D expenditures in 2022 completed a shorter version of the survey form in FY 2023, and that form did not collect R&D expenditures by source and detailed field. Total expenditures from institutions reporting less than $1 million in R&D in FY 2023 was $160 million.

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

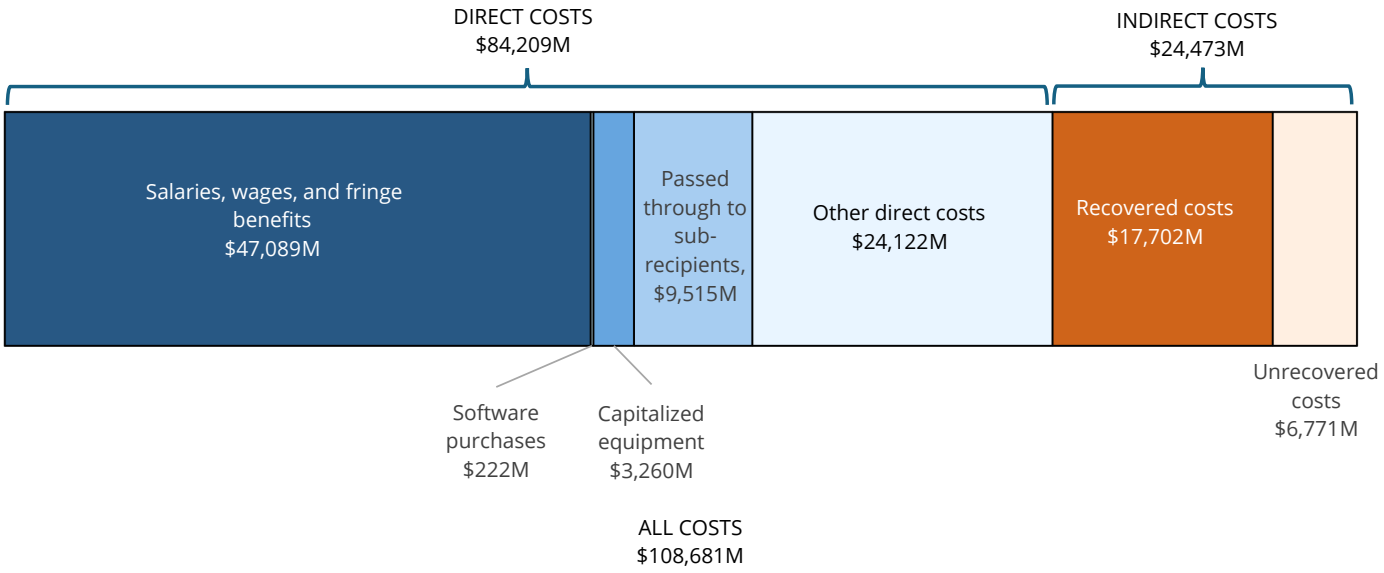
While the federal government funded 55% of all FY 2023 R&D expenditures, federally funded expenditures in several fields accounted for more than 70% of their respective national totals: atmospheric science and meteorology (81%); aerospace, aeronautical, and astronautical engineering (75%); electrical, electronic, and communications engineering (73%); and physics (72%). State and local governments funded about 15% or more of R&D expenditures in four fields: agricultural sciences (25%), civil engineering (17%), natural resources and conservation (15%), and social work (15%). The fields with the highest shares of institutionally funded R&D were anthropology (57%) and the non-S&E fields as a whole (52%). Within the non-S&E fields, only two were supported by less than 50% of institutional funds: education (31%) and social work (26%). Nonprofit organizations and businesses provided similar levels of R&D support in FY 2023 at 6.1% and 5.7%, respectively. However, nonprofits funded at least 19% of R&D in two fields: political science and government (22%) and law (19%), while businesses funded 11.0% or more of R&D in three fields: aerospace, aeronautical, and astronautical engineering (12.2%); engineering, not elsewhere classified (11.5%); and physical sciences, not elsewhere classified (11.0%).[3]

R&D Expenditures, by Type of Cost

Of the more than $108 billion in total FY 2023 R&D expenditures, higher education institutions identified $84.2 billion in direct costs and $24.5 billion in indirect costs (figure 2). Salaries, wages, and fringe benefits paid to R&D personnel ($47.1 billion) accounted for the largest portion of direct costs. Institutions also passed R&D funding totaling $9.5 billion to other universities ($5.2 billion) or other organizations excluding contractors or other vendors ($4.3 billion) as part of their FY 2023 direct costs.[4] Software purchases and movable equipment exceeding institutional capitalization thresholds accounted for another $3.5 billion, combined. Other direct costs, including (but not limited to) travel, tuition, waivers, computer usage fees, supplies, and services (such as consulting) amounted to over $24.1 billion. Among indirect costs, $17.7 billion of facilities and administrative costs were reimbursed from external R&D sponsors. Another $6.8 billion was identified as unrecovered indirect costs.[5,6]

Figure 2

Higher education R&D expenditures, by type of cost: FY 2023



Note(s):
Totals only include institutions reporting $1 million or more in total R&D expenditures in FY 2022. Institutions reporting less than $1 million in total R&D expenditures in FY 2022 completed a shorter version of the survey form in FY 2023 that did not include this question. R&D expenditures from institutions reporting less than $1 million in R&D in FY 2023 were $160 million. Because of rounding, detail may not add to total.

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

Top University Research Performers

The top 30 institutions in terms of R&D expenditures accounted for 42% of the total spent on R&D within the higher education sector in FY 2023, which is consistent with the preceding years (table 4). Thirty-three institutions reported at least $1 billion in R&D expenditures in FY 2023, compared with 29 institutions in FY 2022 and 24 in FY 2021.[7] Sixteen of the top 30 institutions were public, accounting for $24.4 billion in total R&D expenditures; 14 were private, accounting for $21.6 billion.[8] Almost all of the institutions (28 of the 30) had medical schools.[9] Emory University moved onto the list of 30 universities with the highest R&D totals in FY 2023, replacing the Massachusetts Institute of Technology at number 30. No institutions changed more than 3 positions.

Table 4

Thirty institutions reporting the largest FY 2023 R&D expenditures: FYs 2021–23

(Millions of current dollars)

Institution	Rank	2021	2022	2023	% change 2022–23
All institutions	-	89,701	97,670	108,681	11.3
Leading 30 institutions	-	38,030	41,235	45,963	11.5
Johns Hopkins U.[a]	1	3,181	3,420	3,802	11.2
U. California, San Francisco	2	1,710	1,806	2,047	13.3

Table 4

Thirty institutions reporting the largest FY 2023 R&D expenditures: FYs 2021–23

(Millions of current dollars)

Institution	Rank	2021	2022	2023	% change 2022–23
U. Pennsylvania	3	1,632	1,791	1,954	9.1
U. Michigan, Ann Arbor	4	1,640	1,771	1,926	8.8
U. Washington, Seattle	5	1,489	1,560	1,734	11.2
U. Wisconsin-Madison	6	1,380	1,524	1,732	13.6
U. California, Los Angeles	7	1,455	1,536	1,722	12.1
U. California, San Diego	8	1,425	1,533	1,705	11.2
U. North Carolina, Chapel Hill	9	1,206	1,361	1,550	13.9
Stanford U.	10	1,274	1,385	1,538	11.0
Duke U.	11	1,238	1,391	1,508	8.4
New York U.	12	1,064	1,276	1,457	14.2
Cornell U.	13	1,184	1,300	1,452	11.7
Ohio State U.	14	1,236	1,363	1,449	6.3
Harvard U.	15	1,254	1,308	1,435	9.7
Georgia Institute of Technology	16	1,114	1,231	1,405	14.1
U. Pittsburgh, Pittsburgh	17	1,135	1,252	1,398	11.7
U. Maryland[b]	18	1,142	1,229	1,385	12.7
Columbia U. in the City of New York	19	1,099	1,231	1,342	9.0
Yale U.	20	1,165	1,191	1,327	11.4
U. Minnesota, Twin Cities	21	1,073	1,202	1,320	9.8
Texas A&M U., College Station and Health Science Center	22	1,148	1,153	1,278	10.8
U. Texas M. D. Anderson Cancer Center	23	1,125	1,183	1,255	6.1
Vanderbilt U. and Vanderbilt U. Medical Center	24	1,019	1,086	1,253	15.4
U. Florida	25	960	1,086	1,250	15.1
Pennsylvania State U., University Park and Hershey Medical Center	26	971	1,020	1,207	18.3
Washington U., Saint Louis	27	989	1,047	1,169	11.7
U. Southern California	28	956	1,040	1,155	11.1
Northwestern U.	29	913	1,001	1,114	11.3
Emory U.	30	853	958	1,094	14.2

[a] Johns Hopkins University includes the Applied Physics Laboratory, with $2,333 million in total R&D expenditures in FY 2023.

[b] University of Maryland includes expenditures from University of Maryland, Baltimore and University of Maryland, College Park campuses. In FY 2019, the two campuses began reporting as one research unit to reflect their new strategic partnership. This relationship was codified through the University of Maryland Strategic Partnership Act passed by the Maryland General Assembly in 2016. Prior to 2019, both campuses reported to the Higher Education Research and Development Survey as separate institutions.

Note(s):
Because of rounding, detail may not add to total. Rankings are based on unrounded totals. This table reflects the leading 30 institutions for FY 2023; the institutions listed may not be in the top 30 of prior fiscal years.

Source(s):
National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

Data Sources, Limitations, and Availability

The higher education R&D expenditures data were collected from a census of 914 universities and colleges that grant a bachelor's degree or higher and expended at least $150,000 in R&D in FY 2022. To reduce respondent burden, the HERD Survey requests abbreviated data (short form) from institutions reporting less than $1 million in R&D expenditures during the previous fiscal year. Except for the totals reported in table 1 and figure 1, all other totals shown in this report exclude expenditures from the 250 institutions that completed the short-form version of the survey. The institutions completing the short-form survey accounted for $160 million (0.15%) of total higher education R&D expenditures in FY 2023.

The fiscal year referred to throughout this report is the academic fiscal year. For most academic institutions, FY 2023 represents 1 July 2022 through 30 June 2023.

The amounts reported include all funds expended for activities specifically organized to produce research outcomes and either sponsored by an outside organization or separately accounted-for using institution funds. R&D expenditures at university-administered federally funded research and development centers (FFRDCs) are collected in a separate NCSES survey, the FFRDC Research and Development Survey.

The full set of data tables and technical information from this survey are available at https://ncses.nsf.gov/surveys/higher-education-research-development/2023.

NCSES has reviewed this product for unauthorized disclosure of confidential information and approved its release (NCSES-DRN24-058).

Notes

1 For more details on yearly R&D expenditures from FYs 1953–2023, see table 1 in the survey's FY 2023 detailed data tables.

2 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, Table 1.1.9 Implicit Price Deflators for Gross Domestic Product, accessed on 9 September 2024. Note that GDP deflators are calculated on an economy-wide scale and do not explicitly focus on R&D.

3 Engineering fields, not elsewhere classified could include agricultural engineering, engineering design, engineering mechanics, engineering physics, engineering science, forest engineering, nanotechnology, naval architecture and marine engineering, nuclear engineering, ocean engineering, petroleum engineering, and other engineering fields that cannot be classified using the fields provided on the HERD questionnaire. Physical science fields, not elsewhere classified includes other physical science fields that cannot be classified using the fields provided on the HERD questionnaire.

4 For more details on R&D expenditures passed through to subrecipients, see tables 4, 74–77, and 86 in the survey's FY 2023 detailed data tables.

5 For more information on the definitions and collection of these fields, see the HERD questionnaire and technical notes at https://ncses.nsf.gov/surveys/higher-education-research-development/2023#methodology.

6 Unrecovered indirect cost means the difference between the amount charged to a federal award and the amount that could have been charged to a federal award under a nonfederal entity's approved negotiated indirect cost rate.

7 For more details on institutions ranked by total R&D expenditures, see tables 5, 7, and 21–23 in the survey's FY 2023 detailed data tables.

8 For more details on institutional control of colleges and universities, see tables 68, 70, and 71 in the survey's FY 2023 detailed data tables.

9 For more details on R&D expenditures at institutions with medical schools, see table 72 in the survey's FY 2023 detailed data tables.

Suggested Citation

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