



InfoBrief

Businesses Invested \$32.5 Billion in Assets to Support Their R&D Activities in the United States in 2020

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In 2020, businesses invested \$32.5 billion in assets such as buildings, equipment, and software to support their U.S. research and development activities, according to the Business Enterprise Research and Development Survey (BERD) developed and cosponsored by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF) and by the Census Bureau, which collected and tabulated the data. Manufacturing companies accounted for \$19.7 billion (61%) and nonmanufacturing companies for \$12.8 billion (39%) of these capital expenditures for R&D. These capital expenditures are separate from the \$537.6 billion in 2020 U.S. business R&D performance from the same BERD survey (Wolfe 2022).¹

Capital expenditures are payments for the acquisition or improvement of long-lived assets used by a business in its operations.² Businesses that performed or funded R&D had \$686.4 billion in total capital expenditures in the United States in 2020 (table 1). Of this total, \$288.8 billion was spent by manufacturing companies (42%) and \$397.6 billion (58%) was spent by nonmanufacturers.³

Table 1

U.S. capital expenditures by business R&D performers, total and for domestic R&D, by selected industry and company size: 2020

(Millions of U.S. dollars and percent)

Industry and company size	NAICS code	Capital expenditures	Capital expenditures for domestic R&D						Share of R&D capital expenditures to capital expenditures (%)
			R&D capital expenditures (all types)	Land acquisition	Buildings and land improvement	Equipment	Capitalized software	All other	
All industries	na	686,393	32,494	147	4,060	15,731	8,436	4,120	4.7
Manufacturing industries	31–33	288,842	19,727	123	3,073	11,666	2,576	2,289	6.8
Food	311	18,659	449	17	112	224	62	34	2.4
Chemicals	325	57,186	5,311	19	1,661	2,336	452	844	9.3
Pharmaceuticals and medicines	3254	22,872	4,619	16	1,545	1,841	425	792	20.2

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Plastics and rubber products	326	10,040	310	*	65	154	5	85	3.1							
Nonmetallic mineral products	327	4,747	166	i	0	25	i	125	i	1	i	16	i	3.5		
Primary metals	331	9,752	96		0	17		66		*		13		1.0		
Fabricated metal products	332	5,454	278		30	20		157		17		55		5.1		
Machinery	333	16,259	1,298		2	157		727		290		122		8.0		
Semiconductor machinery	333242	1,902	400		1	36		313		28		21		21.0		
Computer and electronic products	334	39,845	7,578		4	i	532		5,349		1,207		485	19.0		
Communications equipment	3342	4,053	742		0		6	i	429		259	i	48	18.3		
Semiconductor and other electronic components	3344	21,535	i	3,850		0		88		2,983		561		218	17.9	
Navigational, measuring, electromedical, and control instruments	3345	6,783		1,046	i	4	i	99	i	673	i	97	i	173	i	15.4
Electrical equipment, appliances, and components	335	3,817		638		0		34		479		21		104	16.7	
Transportation equipment	336	63,159		1,924		42		275		1,208		234		164	3.0	
Motor vehicles, bodies, trailers, and parts	3361-63	52,378		1,418		28		203		865		214		108	2.7	
Aerospace products and parts	3364	8,223		403		1		59		301		13		29	4.9	
Miscellaneous	339	20,418		1,201		7		D		589		D		D	5.9	
Medical equipment and supplies	3391	15,501		1,020		5		74		518		183		240	6.6	
Nonmanufacturing industries	21-23, 42-81	397,551		12,767		24		987		4,065		5,859		1,831	3.2	
Mining, quarrying, oil and gas extraction, and support activities	21	15,851		110		0		4		80		9		17	i	0.7
Utilities	22	102,740		362		0		*	i	12		9		341		0.4
Wholesale trade	42	5,072		181		4		53		56	i	32		36		3.6
Information	51	153,819		5,301		1		361		2,554		2,010		374		3.4
Publishing	511	22,655		1,091		*		186		547		232		125		4.8
Software publishers	5112	22,445		1,085		*		186		547		231		121		4.8
Telecommunications	517	61,468		205	i	0		*		53		148	i	3		0.3
Data processing, hosting, and related services	518	26,346		2,130		*		146		620		1,265		100		8.1
Finance and insurance	52	28,420		1,969		*	i	*		119		1,639	i	211		6.9

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			R&D capital expenditures (all types)	Land acquisition	Buildings and land improvement	Equipment	Capitalized software	All other	
Professional, scientific, and technical services	54	12,142	2,838	19	522	1,064	865	370	23.4
Computer systems design and related services	5415	4,543	1,148	0	63	573	363	149	25.3
Scientific research and development services	5417	3,532	1,063	18	446	415	100	84	30.1
All companies (number of domestic employees)	–	686,393	32,494	147	4,060	15,731	8,436	4,120	4.7
Small companies									
10–19 ^a	–	1,784	452	2	50	152	108	141	25.3
20–49	–	8,869	1,025	1	121	525	199	178	11.6
Medium companies									
50–99	–	5,891	1,152	11	212	484	218	228	19.6
100–249	–	19,307	1,593	33	350	726	320	164	8.3
Large companies									
250–499	–	21,765	1,295	2	188	506	442	157	5.9
500–999	–	18,493	1,559	15	128	739	485	192	8.4
1,000–4,999	–	81,956	6,406	24	1,185	2,564	1,538	1,095	7.8
5,000–9,999	–	79,859	2,803	18	267	1,261	915	342	3.5
10,000–24,999	–	125,016	6,249	17	606	2,990	1,921	715	5.0
25,000 or more	–	323,454	9,960	23	953	5,785	2,290	908	3.1

* = amount < \$500,000; D = data withheld to avoid disclosing operations of individual companies; i = more than 50% of the estimate is a combination of imputation and reweighting to account for nonresponse; na = not applicable.

NAICS = 2017 North American Industry Classification System.

^a The Business Enterprise Research and Development Survey does not include companies with fewer than 10 domestic employees.

Note(s):

Detail may not add to total because of rounding. Industry classification is 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. Statistics are representative of companies located in the United States that performed or funded \$50,000 or more of R&D and are not comparable with estimates published for years prior to 2018. The "undistributed" column shown in prior years is no longer necessary because of processing improvements implemented beginning in 2015.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2020.

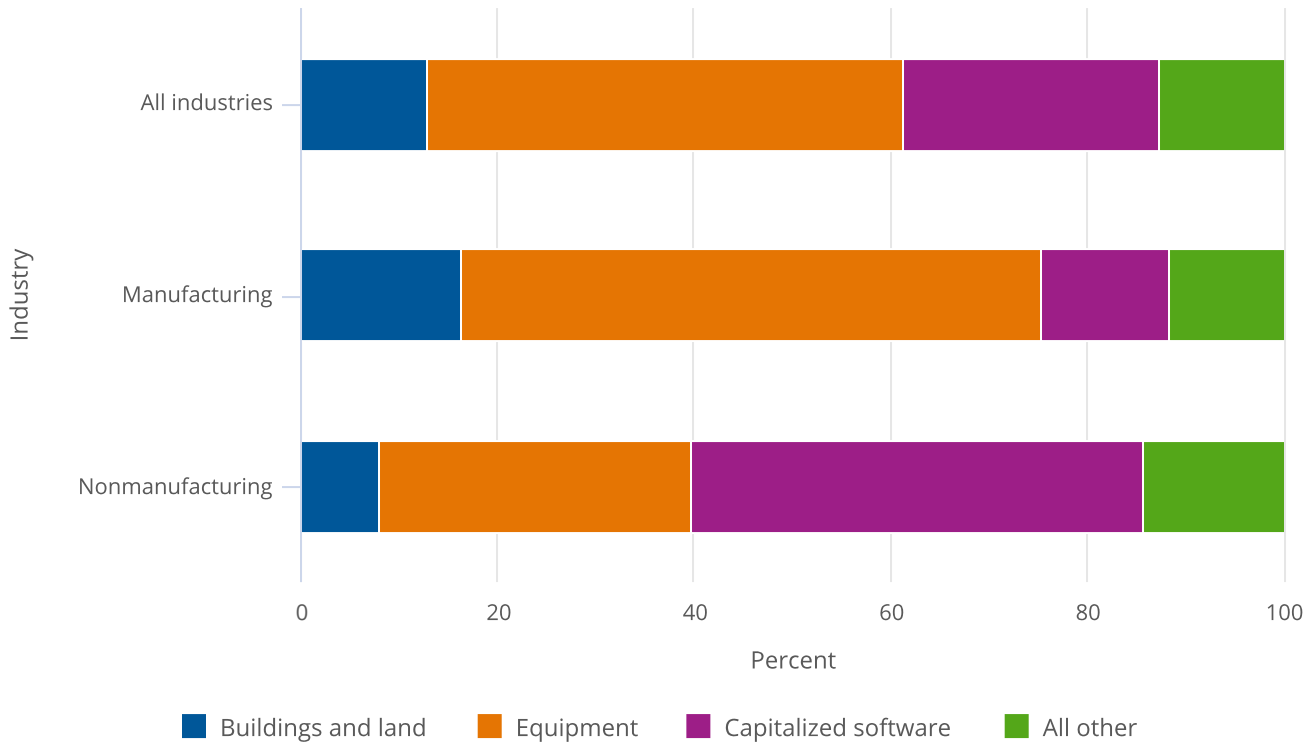
R&D Capital Expenditures by Type of Asset

BERD estimates capital expenditures for R&D in five types of assets: land acquisition, buildings and land improvements, equipment, capitalized software, and all other (which includes intangible assets such as patents). Of the \$32.5 billion of R&D capital expenditures, equipment accounted for almost half (\$15.7 billion), followed by capitalized software (\$8.4 billion). Buildings and land improvements and "all other" each accounted for \$4.1 billion of capital expenditures for R&D. About \$0.1 billion was devoted to land acquisition in support of R&D.⁴

Figure 1 shows that the types of assets supporting U.S. business R&D differ for manufacturing vs. nonmanufacturing sectors. Manufacturing industries as a whole invested primarily in equipment (59%), with the next largest category being buildings and land (16%). The largest category for nonmanufacturing industries was capitalized software (46%), followed by equipment (32%). **Figure 2** shows these categories by selected industries. Notably, semiconductor and other electronic component manufacturing (North American Industry Classification System [NAICS] code 3344) and aerospace product and parts manufacturing (NAICS 3364) each had a share of over 70% for equipment expenditures (**table 1**).

Figure 1

Share of U.S. business capital expenditures in support of R&D, by type of capital expenditures: 2020

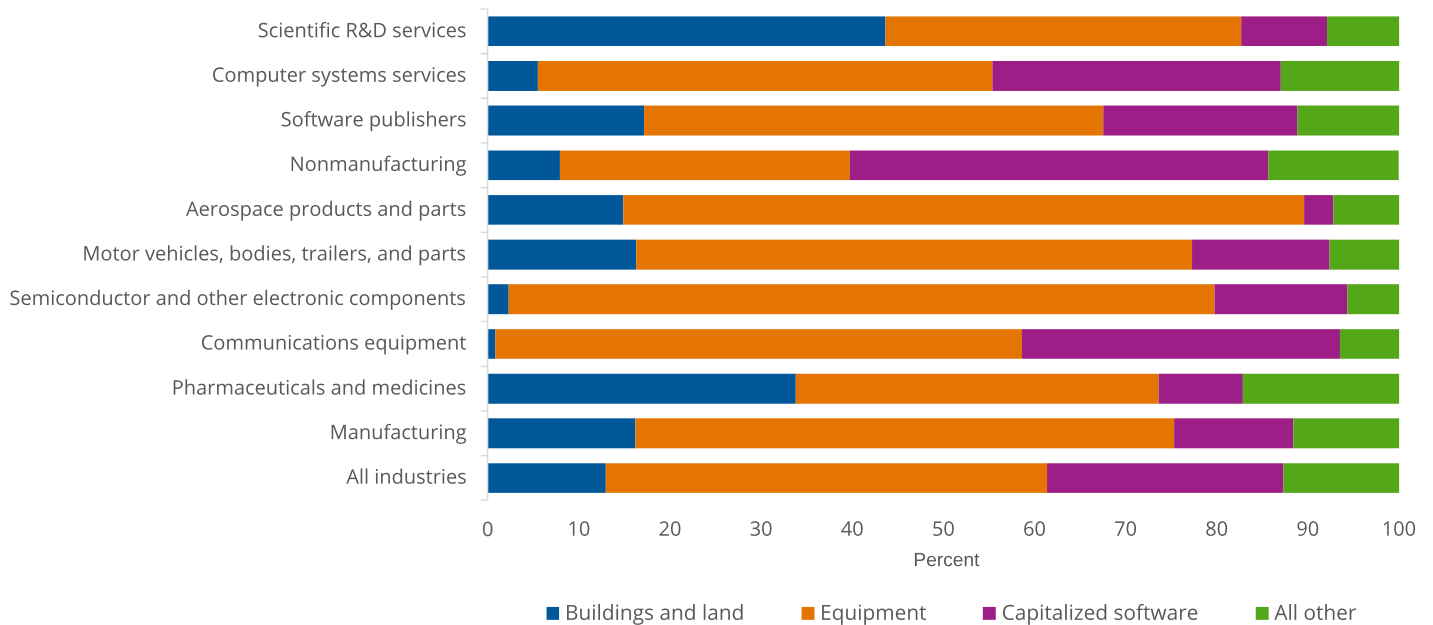


Note(s):

Statistics are representative of companies located in the United States that performed or funded \$50,000 or more of R&D and are not comparable with estimates published for years prior to 2018.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2020.

Figure 2**Share of U.S. business capital expenditures for domestic R&D, by selected industry: 2020****Note(s):**

Detail may not add to total because of rounding. Industry classification is 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. Statistics are representative of companies located in the United States that performed or funded \$50,000 or more of R&D and are not comparable with estimates published for years prior to 2018.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2020.

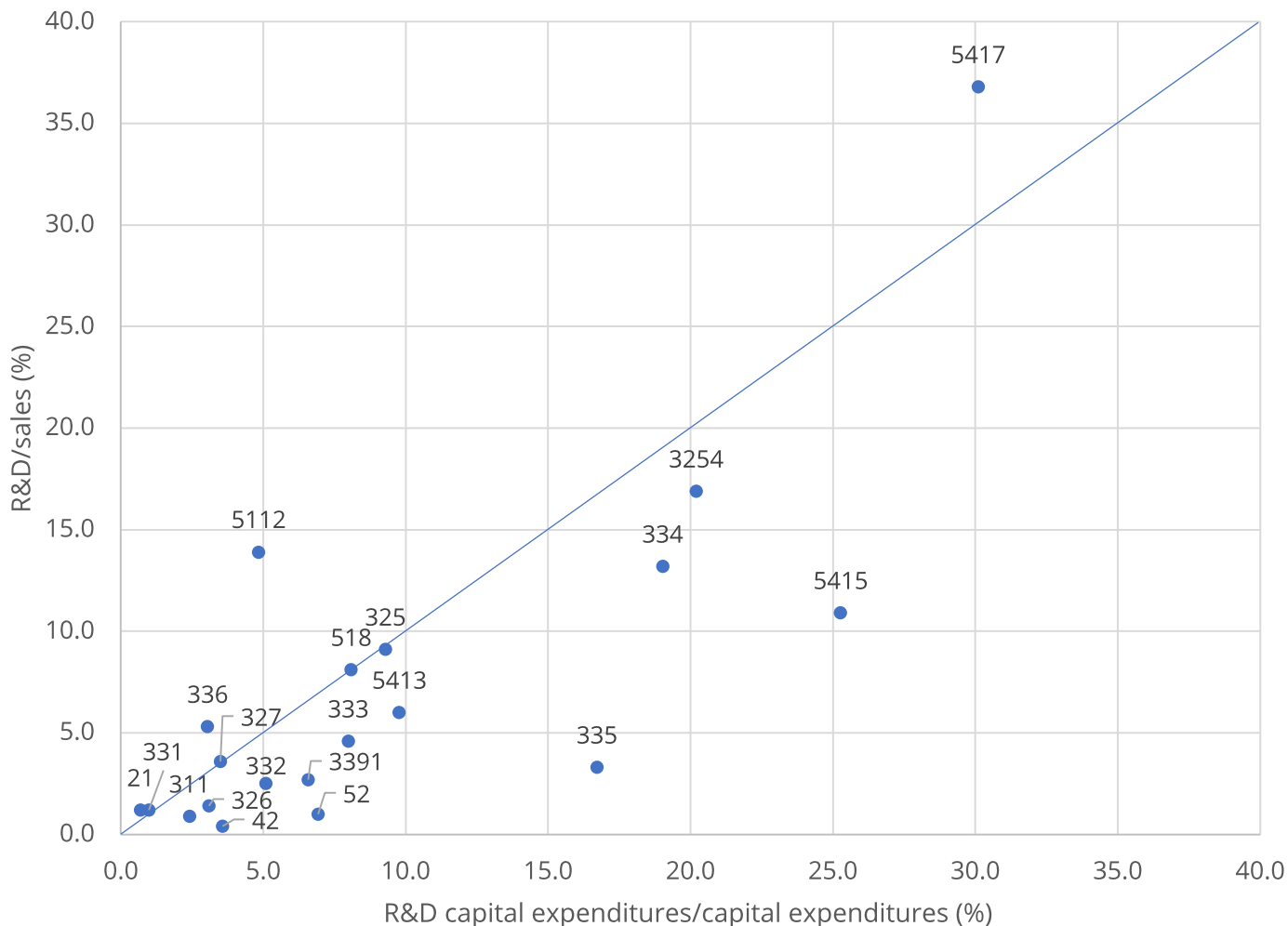
Intensity Measures by Industry

As shown in the last column of [table 1](#), in 2020, U.S. R&D capital expenditures accounted for 5% of the \$686.4 billion in total U.S. capital expenditures by businesses that performed or funded R&D. The balance of capital expenditures supports other supply chain activities such as manufacturing, the provision of services, and other business operations. Interestingly, the overall share of domestic R&D to domestic sales of R&D performers is also about 5% (Wolfe 2022). Furthermore, industries with relatively large shares of R&D capital expenditures also have relatively higher R&D-to-sales intensities ([figure 3](#)).

For some industries, such as chemical manufacturing (NAICS 325) and pharmaceutical and medicine manufacturing (NAICS 3254), the R&D capital expenditure intensity is of a similar magnitude to the R&D-to-sales intensity, as can be seen in [figure 3](#), where the values are close to the diagonal reference line.⁵ However, for the software publishers industry (NAICS 5112), the R&D intensity measured as R&D-to-sales ratio is about three times its R&D capital expenditure intensity. The R&D-to-sales share is also higher relative to R&D capital expenditure intensity for another R&D-intensive service industry, scientific research and development services (NAICS 5417), though by a smaller factor. These two intensities, alongside labor costs-based intensities examined in Moris and Shackelford (2022), provide a fuller picture of the relative importance of labor and capital inputs in different industries' R&D. This understanding can in turn help researchers and policymakers evaluate and explain the impact of changing economic conditions and policy measures on business R&D and innovation.

Figure 3

U.S. R&D capital expenditures as share of capital expenditures and R&D-to-sales share, by selected industry: 2020



NAICS = 2017 North American Industry Classification System.

Note(s):

Codes shown in scatter plot refer to NAICS industry classification codes; see table data source. The diagonal is a reference line where the horizontal values (x-axis) are the same as the vertical values (y-axis). Industry classification is 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. Statistics are representative of companies located in the United States that performed or funded \$50,000 or more of R&D and are not comparable with estimates published for years prior to 2018.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2020.

Survey Information and Data Availability

In this InfoBrief, money amounts are expressed in current U.S. dollars and are not adjusted for inflation. A company is defined as a business organization located in the United States, either U.S. owned or a U.S. affiliate of a foreign parent company, with one or more establishments under common ownership or control.

The sample for BERD was selected to represent all for-profit, nonfarm companies that were publicly or privately held, had 10 or more employees in the United States, and performed or funded R&D either domestically or abroad. Industry classification of businesses in BERD was based on the dominant business activity for domestic R&D performance, where available. Units that did not report business activity codes for R&D are assigned an industry using administrative payroll data.

Beginning in survey year 2018, companies that performed or funded less than \$50,000 of R&D were excluded from tabulation. In prior years, companies that performed or funded any amount of R&D were tabulated. This change has affected the comparability of these estimates to those published in prior years, though at the same time the excluded companies in aggregate represented a very small share of total R&D expenditures in prior years (Wolfe 2022).

The statistics from the survey are based on a sample and are subject to sampling and nonsampling errors. (See “Technical Notes” in the reports with the data tables at <https://www.nsf.gov/statistics/srvybrds/>).

References

Annual Capital Expenditures Survey (ACES). 2020. Available at <https://www.census.gov/programs-surveys/aces/data/tables.html>. See Table 1a under the 2021 release.

Moris F, Shackelford B; National Center for Science and Engineering Statistics (NCSES). 2023. *Labor Costs Account for Over Two-Thirds of U.S. Business R&D Performance in 2020*. NSF 23-322. Alexandria, VA: National Science Foundation. Available at <https://ncses.nsf.gov/pubs/nsf23322>.

Wolfe R; National Center for Science and Engineering Statistics (NCSES). 2022. *Businesses Spent Over a Half Trillion Dollars for R&D Performance in the United States*. NSF 22-343. Alexandria, VA: National Science Foundation. Available at <https://ncses.nsf.gov/pubs/nsf22343>.

Notes

1 Although BERD estimates separately U.S. R&D performance and the capital expenditures discussed here, these two measures should not be summed unless data users subtract depreciation expenses from domestic R&D performance by type of cost, which is available under “Data” at <https://www.nsf.gov/statistics/srvyberd/>. BERD measures R&D performance in terms of current costs or expenses, which include labor costs, materials and supplies, expensed equipment (not capitalized), leased facilities and equipment, and expenses for depreciation and amortization on property, plant, and equipment. R&D performance expenditures are dominated by labor costs, in comparison with current costs associated with facilities or equipment such as rental expenses or expensed equipment. This situation is particularly the case for service industries. For example, in 2020, the R&D of the information sector (NAICS 51) (which includes the software services industry) is rather labor-intensive with over 80% of the sector’s R&D performance accounted for by labor costs, compared with 69% for all industries (Moris and Shackelford 2023).

2 Businesses also can acquire assets by merging with or purchasing other businesses. Assets acquired through mergers and acquisitions are not included in the BERD estimates.

3 As a reference point, the Census Bureau’s Annual Capital Expenditures Survey (ACES), a separate survey covering all U.S.-located businesses (regardless of R&D activity), estimated \$1,706.4 billion in 2020 in total domestic capital expenditures for structures and equipment (ACES 2020). The ACES “equipment” category includes capitalized software. Further, ACES includes organizations that are out of scope for BERD, such as nonprofits and businesses with fewer than 10 employees, whereas BERD includes capital expenditures that are excluded by ACES, such as land and intangible assets like patents.

4 Land acquisition is combined with buildings and land improvements in a category named “buildings and land” in the analysis below.

5 Along the diagonal reference line, the horizontal values (x-axis) are the same as the vertical values (y-axis).

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