

TABLE 61

Worldwide R&D paid for by the company and performed by the company and others, by business activity: 2008–22

(Millions of U.S. dollars)

Business activity ^a	Business code ^b	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All business activities	21100–81000	328,040	311,170	316,262	336,629	352,951	376,974	399,656	412,590	440,429	471,440	523,512	570,184	613,845	716,646	799,154
Oil and gas extraction	21100	1,215	1,223	1,268	1,379	D	1,487	1,308	1,486	1,089	986	0 - 23,467	902	790	681	524
Mining	21200	NA	D	75	128	92	114	56	71	63	170	114	0 - 25,025	114	102 i	158 i
Support activities for mining, including oil and gas	21300	NA	993	1,638	1,386	1,814	1,749	1,995	1,831	1,380	1,577	951 i	1,650 i	928	660	882 i
Utilities	22100	NA	1,607	903	639	686	615	549	726	515	501	0 - 23,467	415	424	740	D
Construction	23000	NA	198	918	269	393 i	307	297	700	276	501	691	880	1,069	746	752
Food manufacturing	31100	2,983	4,039	4,478	4,970	4,635	7,028	6,842	5,892	6,073	5,827	5,806	5,905	6,334	6,397	7,646
Beverage manufacturing	31210	605	564	926	668	641	772	753	728	787 i	851	762	723	817	942	894
Tobacco manufacturing	31220	D	792	800	717	662	668	672	681	731	853	722	807	821	999	990
Textile, apparel, and leather products manufacturing	31990	NA	673	658	712	759	787	780	847	1,333	1,093	1,155	965	918	661	688
Wood products manufacturing	32100	264	304	239	208	D	244	336 i	251	0 - 7,094	263	297	0 - 25,025	271	506	340
Paper manufacturing	32200	1,130	1,144	1,231	1,156	1,362	1,588	1,614	D	1,555	1,743	1,592	1,784	1,531	1,840	1,637
Printing and related support activities	32300	297	241	244	265	356 i	391	390	321	340	286	359	468	395	360	398
Petroleum refineries	32401	NA	NA	708	591	807	558	617	526	625	567	640	0 - 25,025	0 - 26,968	537	558
Asphalt paving, roofing, and saturated materials manufacturing	32402	NA	NA	35	39	45	123	78	75	93	137	134	134	225	174	D
Other petroleum and coal products manufacturing, including motor oil, hydraulic fluid, and charcoal	32403	NA	NA	403	415	382	488	460 i	416	339	383	258	0 - 25,025	238	220	319
Basic chemicals manufacturing	32510	3,806	2,978	3,133	3,614	4,271	4,136	4,036	3,505	3,579	3,576	3,540	3,267	3,776	4,033	4,019
Resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing	32520	1,152	1,459	1,444	1,228	1,437	1,383	1,771	1,703	1,401	1,200	1,743	1,803	1,800	1,757	1,833
Pesticide, fertilizer, and other agricultural chemicals manufacturing	32530	2,100	1,990	1,722	2,333	2,307	2,364 i	2,508 i	D	2,338 i	2,479 i	3,196 i	2,919	1,696	1,829	1,874
Pharmaceutical, medicinal, botanical, and biological products (except diagnostic substances) manufacturing ^c	32541	70,016	68,588	71,603	67,688	69,473	68,318	68,846	63,606	69,518	71,762	77,733	80,548	81,181	95,179	88,109
In vitro diagnostic substances manufacturing ^c	32542	1,988	1,159	1,207	1,544	1,371 i	1,066	1,159	972	1,286	1,567	1,381	1,582	1,913	2,033	2,198

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Biotechnology-based pharmaceutical and biological products (except diagnostic substances)	32543	NA	NA	NA	NA	NA	10,356	14,947	23,172	24,458	30,555	36,012	41,733	43,753	54,314	69,445
Soap, cleaning compound, and toilet preparations manufacturing	32591	2,787	2,883	3,147	3,472	3,266	3,406	3,493	3,353	3,361	3,257	3,380	3,196	3,053	3,215	3,461
Paint, adhesive, and other chemical manufacturing	32592	2,152	2,320	2,238	2,011	2,087	1,979	2,131	D	2,121	2,094	1,666	1,747	1,775	1,765	1,780
Plastics and rubber products manufacturing	32600	2,536	2,842	3,128	3,689	3,739	3,586	3,592	3,251	3,926	3,904	3,643	3,491	3,501	3,803	4,108
Clay and glass products manufacturing	32710	966 i	312	1,056 i	920 i	1,154 i	1,077	1,130	1,145	1,198	1,345	1,521	1,511	1,647	1,598	1,582
Cement, concrete, lime, gypsum, and other nonmetallic mineral products manufacturing	32790	738	555	522	590	621	618 i	800	601	652	443	446	543	432	434	455
Primary metal manufacturing	33100	NA	840	933	783	882	792	853	719	0 - 7,094	714	808	849	987	1,107	1,270
Fabricated metal products manufacturing	33200	2,935	2,438	1,971	2,471	2,517	2,460	2,560	2,521	2,562	2,695	2,798	3,110	3,980	4,662	3,916
Agricultural machinery and equipment manufacturing	33311	1,404	1,507	1,523	1,430	1,893	2,055	1,990	1,916	1,977	1,867	2,440	2,458	2,208	2,302	2,848
Construction machinery manufacturing	33312	581	653	682	875	816	1,693	1,729	1,556	1,462	1,588	1,880 i	1,871	1,525	1,895	1,910
Mining, oil, and gas field machinery and equipment manufacturing	33319	NA	1,629	1,765	2,204	2,589	1,942 i	1,462	2,115	1,528	1,586	1,739	1,300	1,308	1,475	1,552
Semiconductor machinery manufacturing	33321	2,553	1,978	2,279	2,574	1,266 i	3,500	3,363	3,459	3,688	3,996	4,465	4,687	5,082	6,409	7,051
Industrial machinery manufacturing (except semiconductor machinery)	33322	1,191	853	806	1,128	1,031	1,006	1,237	1,181	893	1,222	0 - 23,467	1,406	1,131	1,394	1,516
Photographic and photocopying equipment manufacturing	33331	NA	852	270	757	25 i	108	25	114	59	52	67	0 - 25,025	171	77	D
Commercial, service industry, temperature control, and air-flow control machinery manufacturing	33332	NA	977	1,268	1,143	1,621	1,661	2,251	1,947	0 - 7,094	2,245	2,263	2,169	1,951	2,400	2,980
Digital cameras manufacturing	33333	NA	NA	NA	NA	NA	NA	33	587 i	519	571	274	458	364 i	303	238
Engine, turbine, and power transmission equipment manufacturing	33360	2,386	1,589	3,481	3,623	4,068	3,870	3,346	2,626	2,641	3,164	2,756	0 - 25,025	2,942	2,761	3,143
Metalworking and other general purpose machinery manufacturing	33390	2,039	1,618	1,998	2,359	1,916	2,052	2,585	2,728	2,591	2,547	2,996	2,860	3,222	3,163	3,393
Computers and peripheral equipment manufacturing and magnetic and optical media ^d	33412	NA	13,094	12,672	13,319	14,716	15,113	13,437	16,547	23,130	27,553	27,801	25,331	31,371	35,180	37,324
Telephone apparatus manufacturing, including routers, modems, and gateways	33421	6,739	7,758	9,010	9,530	9,335	9,622	10,526	12,366	10,715	10,403	11,487	11,254	10,135	10,475	10,509
Radio, television, and wireless communication equipment manufacturing	33422	5,958	5,181	5,719	4,383	4,773	5,967	5,848 i	3,542	2,839	2,482	0 - 23,467	2,475	2,329	3,916	4,422

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Other communication equipment manufacturing (except radio, television, and wireless communication equipment)	33429	2,482	1,352	715	1,092	2,111	1,826	1,782	1,844	i 1,660	1,977	0 - 23,467	2,192	2,497	837	811
Audio and video equipment manufacturing	33430	773	977	1,352	1,019	1,081	1,108	1,282	1,587	1,535	1,252	1,461	1,686	1,667	1,945	2,118
Semiconductor and other electronic components manufacturing	33440	29,911	26,118	29,457	32,354	38,109	40,001	41,125	39,810	40,585	41,053	44,130	46,545	55,227	62,242	72,075
Electromedical, electrotherapeutic, and irradiation apparatus manufacturing	33451	3,822	2,544	3,046	3,230	3,494	3,816	4,330	3,875	4,053	3,865	4,815	4,646	4,470	4,907	5,440
Search, detection, navigation, guidance, aeronautical, and nautical system and instruments manufacturing	33452	1,845	2,229	2,417	2,161	2,337	2,564	2,424	2,033	2,614	2,378	3,136	3,198	2,921	1,898	3,235
Measuring and control instruments manufacturing (not listed elsewhere)	33459	3,458	4,425	4,579	4,566	4,871	5,308	5,424	5,637	5,662	5,505	5,469	5,430	5,733	6,091	6,357
Electrical equipment, appliances, and components manufacturing	33500	4,687	4,229	4,500	4,768	4,773	5,272	5,501	5,313	5,905	6,177	5,456	6,455	6,511	6,522	7,834
Motor vehicles manufacturing	33610	18,296	13,165	14,524	17,011	18,362	17,743	18,984	18,357	20,573	22,481	23,693	21,666	20,639	28,583	31,676
Motor vehicle body and trailer manufacturing	33620	70	96	190	73	98	i 107	i 104	160	118	47	99	0 - 25,025	117	189	218
Motor vehicle parts manufacturing	33630	5,401	4,158	4,310	4,681	4,736	5,600	7,146	7,285	6,801	7,621	8,852	9,459	9,089	9,414	9,299
Aircraft manufacturing	33641	4,053	7,390	4,430	4,512	4,716	i 4,373	4,221	4,859	5,639	4,671	6,467	5,404	4,993	5,342	5,475
Aircraft engine and engine parts manufacturing	33642	2,433	1,765	1,978	2,136	D	1,787	2,068	i D	0 - 7,094	1,455	1,759	1,474	1,310	3,223	2,751
Other aircraft parts and auxiliary equipment manufacturing	33643	1,222	1,135	1,825	1,752	3,121	3,270	2,980	3,482	3,047	3,239	2,054	1,347	1,412	1,302	2,082
Guided missiles, space vehicles, and related parts manufacturing	33644	1,402	1,176	1,132	1,050	659	487	877	1,034	954	1,055	1,210	1,140	1,906	950	2,755
Railroad rolling stock manufacturing	33651	195	83	177	165	237	224	363	310	224	251	213	0 - 25,025	299	246	330
Ship and boat building	33660	151	i 616	i 608	154	143	i 192	489	251	618	157	144	0 - 25,025	154	161	281
Motorcycle, bicycle, and parts manufacturing	33691	199	194	186	234	197	231	283	320	335	355	429	437	489	547	506
Military armored vehicle, tank, and tank components manufacturing	33692	107	228	182	118	135	90	159	202	130	367	i 23,467	i 381	275	437	i 429
All other transportation equipment manufacturing	33699	176	135	232	367	437	425	361	430	478	505	521	496	546	538	432
Furniture and related products manufacturing	33700	511	495	402	344	431	433	455	509	411	479	467	517	522	521	475
Medical equipment and supplies manufacturing	33910	11,587	11,457	13,226	13,701	14,259	15,264	14,317	15,145	15,939	17,055	16,832	18,877	19,383	22,097	24,067

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Miscellaneous manufacturing not listed elsewhere (games, office supplies, slot machines, etc.)	33990	2,976	2,793	2,341	2,698	D	2,976	2,816	D	3,121	3,130	3,415	3,052	3,744	3,720	3,786
Merchant wholesalers, durable goods	42300	449	923 i	714	711	1,277 i	589	516	1,551	637	448	771 i	702	835	1,332 i	1,226
Merchant wholesalers, nondurable goods	42400	257	365 i	348	605	699 i	327	209	484	219	273	322	0 - 25,025	529	734 i	781
Wholesale electronic markets and agents and brokers (business to business)	42500	14	43 i	19 i	70	173 i	18	D	35	24	0 - 12,866 i	89 i	0 - 25,025 i	61	52	170 r
Retail trade (except electronic shopping and electronic auctions)	44000	NA	50	164	74	100 i	120	65	D	120	119	263	0 - 25,025	0 - 26,968	580 i	432
Electronic shopping and electronic auctions	45411	NA	NA	753	D	1,749	1,284	D	D	8,200 i	0 - 12,866	0 - 23,467 i	0 - 25,025 i	0 - 26,968 i	15,678 i	15,976 i
Transportation	48000	NA	319	211	111	199	377	412	229 i	123	722	2,080	9,072	0 - 26,968	5,995	6,883
Couriers, messengers, and express delivery services	49200	D	14	6	D	D	90	348	D	394	425	451	290	949	1,172	D
Warehousing and storage	49300	26	17	19	16	17	4	3	D	0	82	79	162 i	35	24	D
Newspaper, periodical, book, and directory publishers (except Internet)	51110	180	748	853	408 i	257 i	339 i	103	117	87	99	175	88	74	105	D
Software publishers (except Internet) ^e	51120	31,369	26,362	28,457	29,992	31,209	35,047	41,052	36,040	34,699	31,400	32,842	31,525	30,456	37,548	43,881
Motion picture and sound recording (except Internet)	51200	104	135	93	67	67	38	83 i	12	20	42 i	155	0 - 25,025	86	36	102 r
Broadcasting (except Internet)	51500	NA	89	100	115	165 i	179	206	306	347	460	424	500	0 - 26,968 i	D	452
Wired telecommunications carriers	51710	673	D	1,499 i	1,685	1,631 i	1,012 i	1,166	1,269 i	1,180	1,027	476	428	504	598	622
Wireless telecommunications carriers (except satellite)	51720	532 i	186	724 i	815 i	860 i	1,732 i	2,500	1,192 i	1,458 i	1,969	2,439	2,641	2,414	2,974	3,065
Satellite telecommunications	51740	153	108	229	114	163	176	134	705 i	746	625	476	486	0 - 26,968	529	640
Other telecommunications (not listed elsewhere)	51790	501	351	338	462	399	377	330	536	362	381	745	0 - 25,025	501	378	340
Data processing, hosting, and related services ^e	51800	NA	2,889	3,051	5,293	4,406	4,381	5,402	6,895	7,040	6,975	7,699	9,985	12,675	15,108	13,572
Cloud computing applications and Internet-based software services	51801	NA	NA	NA	NA	NA	4,344	6,730	6,801	11,913	19,581	24,607	33,733	47,436	53,479	64,350
Other information services, including Internet publishing, broadcasting, and Web search portals ^e	51910	NA	5,519	7,270	9,456	12,998	15,433	17,443	25,330	27,524	32,484	43,287	53,057	60,972	73,561	96,932

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Finance: banking and credit intermediation	52200	NA	D	1,235	1,703	2,454	3,238	3,553	3,299	5,171	5,657	4,975	5,718	9,013	13,704	12,137
Securities, commodity contracts, and other financial investments and related activities, including funds and trusts	52310	NA	678	903	1,347	1,110	1,323	1,147	1,597	1,683	1,785	1,445	1,654	2,061	5,133	5,262
Insurance carriers and related activities	52400	NA	798	611	872	1,429	1,772	1,069	1,573	1,444	1,430	0 - 23,467	2,596	2,967	4,008	2,529
Real estate	53100	20	32	3	13	27	105	199	288	440	253	380	0 - 25,025	372	680	793
Rental and leasing services	53200	NA	129	146	51	59	94	80	80	106	i	571	i	699	1,067	2,925
Lessors of nonfinancial intangible assets, including patent licensing	53300	80	259	268	369	437	100	97	104	45	97	24	i	71	75	95
Legal, accounting, tax preparation, bookkeeping, and payroll services	54111	NA	D	505	705	i	535	696	1,128	1,587	1,052	1,130	1,426	2,040	2,611	2,960
Architectural, engineering, and related services	54130	1,742	1,115	1,390	1,380	1,232	1,495	1,649	2,449	1,975	1,795	2,575	0 - 25,025	2,592	3,007	3,864
Specialized design services	54140	75	76	65	283	157	i	81	42	13	26	133	0 - 23,467	0 - 25,025	0 - 26,968	97
Computer systems design and related services ^e	54150	11,476	12,292	11,528	13,673	13,909	i	12,577	13,288	14,090	14,864	13,998	18,287	22,535	17,395	19,970
Management, scientific, and technical consulting services	54160	1,110	2,246	1,380	1,618	2,066	i	1,428	1,681	1,531	1,668	1,591	2,443	1,689	1,995	3,033
Research and development services in the social sciences and humanities	54172	NA	96	8	19	64	36	47	15	0 - 7,094	i	348	27	28	0 - 26,968	38
Research and development services in biotechnology ^{c,f}	54173	NA	6,850	2,601	6,238	6,294	1,723	1,344	2,387	1,176	930	1,147	1,244	1,633	2,319	3,392
Research and development services in the physical, engineering, and life sciences (except biotechnology)	54174	NA	3,208	1,447	2,751	3,166	2,143	3,040	3,197	2,767	2,226	2,324	2,750	5,706	5,042	5,828
Research and development services in nanotechnology	54175	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	122	i	173
Advertising and related services	54180	37	1,950	422	97	375	i	390	424	452	373	412	1,160	i	1,262	i
Professional, scientific, and technical services (not listed elsewhere)	54190	439	1,036	543	1,242	1,199	1,627	810	944	622	695	912	1,266	1,574	1,417	2,055
Management of companies and enterprises	55100	11	40	23	43	18	76	43	D	20	71	0 - 23,467	0 - 25,025	51	39	D
Administrative and support services	56100	NA	419	640	348	609	589	459	375	588	1,558	2,668	3,575	3,806	3,369	4,404
Waste management and remediation services	56200	NA	15	684	20	D	23	D	D	8	0 - 12,866	0 - 23,467	0 - 25,025	0 - 26,968	513	r

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Offices of physicians	62110	40	37	371	36	42 i	43	39	28	70	102 i	113	196	195	143	D
Medical and diagnostic laboratories	62150	903	246	409	287	364	347	410	424	0 - 7,094 i	855	1,739 i	2,104	1,630 i	2,478	3,554
Other ambulatory health care services (ambulance, dental, home health care)	62199	NA	47	145 i	15	45 i	52	37	39	23	70	48	150	83	304	331
Hospitals and nursing care facilities	62200	NA	62 i	68	2	2 i	2	2	4	6	18	0 - 23,467	0 - 15,636	0 - 26,968	7	9
Social assistance services	62400	NA	D	15	13	36	47	17	2	2	6	13	0 - 25,025	0 - 26,968	D	7
Arts, entertainment, and recreation	71000	NA	161	137	85	70	29	103 i	50	45	42	45	479	0 - 26,968	90	D
Accommodation and food services	72000	NA	50	119	84	149 i	163	D	106	76	62	126	0 - 25,025	0 - 26,968	456	D
Other services (not listed elsewhere)	81000	NA	89	465	345	484	405	550	669	0 - 7,094	0 - 12,866	0 - 23,467	507	581	D	8,738 i
Undistributed ^g	–	10,660	14,175	5,373 i	D	491	359 i	69	0	0	0	0	0	0	0	0

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; r = relative standard error is more than 50%; NA = not available.

^a Data are tabulated independent of the industry classification of the company. Companies were asked to report their sales and R&D activity in one or more business activity codes.

^b Business codes and descriptions are based on 2017 North American Industry Classification System (NAICS) industry definitions.

^c Estimates for this business code may not be comparable to those from prior years due to the introduction of a related business code for survey year 2013 and beyond: 32543, Biotechnology-based pharmaceutical and biological products (except diagnostic substances).

^d Estimates for this business code may not be comparable to those from prior years due to the introduction of a related business code for survey year 2014 and beyond: 33333, Digital cameras manufacturing.

^e Estimates for this business code may not be comparable to those from prior years due to the introduction of a related business code for survey year 2013 and beyond: 51801, Cloud computing applications and Internet-based software services.

^f Estimates for this business code may not be comparable to those from prior years due to the introduction of a related business code for survey year 2020 and beyond: 54175, Research and development services in nanotechnology.

^g Includes data reported that were not allocated to a business activity.

Note(s):

Detail may not add to total because of rounding. 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. For survey year 2008, industry classification was based on the 2002 NAICS. For survey years 2009–13, industry classification was based on the 2007 NAICS. For survey years 2014–19, industry classification was based on the 2012 NAICS. For survey years beginning in 2020, classification was based on the 2017 NAICS. Most statistics for years prior to 2022 have been revised since original publication. Revised statistics include adjustments based on information obtained after the original statistics were prepared. An estimate range may be displayed in place of a single estimate to avoid disclosing operations of individual companies.

Source(s):

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