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U.S. Business R&D Expenditures Increase in 2007; Small Companies Performed 19% of Nation's Business R&D

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Companies spent $269 billion in current-year dollars on research and development (R&D) performed in the United States during 2007 (table 1), according to estimates from the Survey of Industrial Research and Development.[2] In inflation-adjusted (2000) dollars, 2007 R&D expenditures increased $12.5 billion, or 5.9%, from 2006 levels. Funding from both the companies' own and other nonfederal sources (hereafter, company or company and other funding) and from federal sources for R&D was higher in 2007 than in 2006. Company funding during 2007 amounted to $243 billion in current-year dollars compared with $223 billion during 2006, a 5.8% change after adjusting for inflation. Federal funding amounted to $27 billion during 2007 compared with $24 billion during 2006, a 6.5% change after adjusting for inflation.

R&D Performance by Industrial Sector

In 2007, companies in manufacturing industries performed $187 billion of R&D, which accounted for 70% of all business R&D[3] performed in the United States; companies in nonmanufacturing industries performed $82 billion of R&D (table 2). Manufacturers performed $169 billion of company-funded R&D and $18 billion of federally funded business R&D; companies in the nonmanufacturing industries performed $73 billion and $8 billion, respectively. Other company and federally funded R&D costs by detailed industry are given in table 2.

Sales and Employment of R&D Performers

Net sales[4] of companies that performed R&D in the United States were $6.6 trillion in 2006 and $7.0 trillion in 2007. The R&D-to-sales ratio was 3.8% in 2007; it was 3.7% in the two previous years. Domestic employment in R&D-performing companies during 2007 was 16.7 million (table 3), compared with 16.3 million reported in 2006 (Wolfe 2008a). The number of full-time equivalent scientists and engineers who performed business R&D remained 1.1 million, as it had been each year since 2004. Other sales and employment estimates by detailed industry are given in table 3.

R&D Performance by State

During 2007, businesses in the 10 states with the most business R&D performance reported aggregate R&D expenditures of $186 billion and accounted for 69% of the business R&D performed in the United States. Businesses in California alone accounted for 23.8% of the nation's business R&D; Massachusetts, 7.2%; New Jersey, 6.6%; Michigan, 5.8%; Texas, 5.2%; Washington, 4.7%; Illinois, 4.2%; New York, 4.1%; Pennsylvania, 3.9%; and Connecticut, 3.5% (table 4).

The types of companies that carry out R&D vary considerably among the 10 leading states.[5] This variation reflects regional specialization or clusters of business activity. For example, in Michigan, the motor vehicles

TABLE 1. Funds expended for industrial R&D performance, by source of funds, size of company, and net sales: 2006 and 2007

Selected characteristic	2006	2007	2006	2007
	Current $millions		2000 constant $millions	
Total industrial R&D performance	247,669	269,267	212,271	224,732
Source of funds				
Company and other nonfederal	223,365	242,682	191,440	202,544
Federal	24,304	26,585	20,830	22,188
Size of company (number of employees)				
5–24	7,207	10,854	6,177	9,059
25–49	D	7,884	D	6,577
50–99	9,064	10,068	7,769	8,403
100–249	13,306	13,354	11,404	11,145
250–499	D	8,258	D	6,889
500–999	13,360	14,279	11,451	11,917
1,000–4,999	37,866	41,103	32,454	34,305
5,000–9,999	20,434	22,673	17,513	18,923
10,000–24,999	37,865	45,946	32,453	38,347
25,000 or more	92,925	94,848	79,644	79,161
Net sales[a]	6,642,500	7,027,049	5,693,116	5,864,818

D = suppressed to avoid disclosure of confidential information.

[a] Dollar values for goods sold or services rendered by companies that perform R&D in the United States to customers outside the company, including the federal government, less such items as returns, allowances, freight charges, and excise taxes. Excludes intracompany transfers and sales by foreign subsidiaries but includes transfers to foreign subsidiaries and export sales to foreign companies.

NOTES: Detail may not add to total because of rounding. Excludes data for federally funded research and development centers. 2000 gross domestic product implicit price deflators were used to convert current to constant dollars.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2006 and 2007.

industry accounted for 75% of business R&D in 2007, whereas it accounted for only 6% of the nation's total business R&D. The computer and electronic products manufacturing industries performed 22% of the nation's total business R&D, but they performed a larger share of the business R&D in Massachusetts (45%), Illinois (33%), California (33%), and Texas (32%). About two-thirds of R&D performed in the United States by computer and electronic products companies in 2007 was located in these four states. The R&D of chemicals manufacturing companies was considerable in New Jersey, Connecticut, and Pennsylvania, all of which are home to prominent pharmaceutical and chemical industries. Together these three states represented more than 41% of the nation's R&D in this sector. The R&D services sector, which consists largely of biotechnology companies, contract research organizations, and early-stage technology firms, is also somewhat geographically concentrated, with California, Massachusetts, and New Jersey accounting for more than 42% of R&D in this sector.

R&D Performance by Size of Company

R&D performance, sales, and employment statistics by size of company are given in table 5. In 2007, small companies[6] performed 19% of the nation's total business R&D, accounted for 8% of the sales of R&D-performing companies, and employed 13% of those who worked for R&D-performing companies. Of the 1.1 million R&D scientists and engineers employed by companies in the United States, 24% worked for small companies during 2007. Among the top 10 business R&D-performing states, small companies in California and New York accounted for 20% and 23%, respectively, of the business R&D performance state totals.[7]

TABLE 2. Funds expended for industrial R&D performed in the United States, by source, by industry: 2007
(Millions of dollars)

Industry	NAICS codes	All R&D	Federal	Company and other
All industries	21–23, 31–33, 42, 44–81	269,267	26,585	242,682
Manufacturing industries	31–33	187,477	18,170	169,307
Food	311	D	D	2,722
Textiles, apparel, and leather	313–16	806 i	10	796 i
Paper, printing, and support activities	322, 323	D	D	2,596
Petroleum and coal products	324	D	D	1,718
Chemicals	325	D	D	55,319
Basic chemicals	3251	3,234	76	3,158
Resin, synthetic rubber, fibers, and filament	3252	963	12	951
Pharmaceuticals and medicines	3254	D	D	47,624
Other chemicals	other 325	3,601	14	3,587
Plastics and rubber products	326	D	D	2,072
Fabricated metal products	332	1,709	115 i	1,594
Machinery	333	9,865	69	9,796
Computer and electronic products	334	58,599	8,838	49,760
Computers and peripheral equipment	3341	D	D	6,869
Communications equipment	3342	11,654	219	11,435
Semiconductor and other electronic components	3344	18,683	368	18,315
Navigational, measuring, electromedical, and control instruments	3345	20,438	8,176	12,262
Other computer and electronic products	other 334	D	D	879
Electrical equipment, appliances, and components	335	2,708	90	2,617
Transportation equipment	336	D	D	30,974
Motor vehicles, trailers, and parts	3361–63	D	D	16,034
Aerospace products and parts	3364	18,436	5,040	13,397
Other transportation equipment	other 336	D	D	1,543
Miscellaneous manufacturing	339	6,410	66	6,344
Medical equipment and supplies	3391	5,176	60	5,116
Other miscellaneous manufacturing	other 339	1,234	6	1,228
Other manufacturing	312, 321, 327, 331, 337	D	D	2,999
Nonmanufacturing industries	21–23, 42, 44–81	81,790	8,415	73,375
Wholesale trade	42	2,294	16	2,277
Retail trade	44, 45	2,530	12	2,517
Information	51	D	D	28,767
Publishing, including software	511	20,900	22	20,878
Telecommunications	517	D	D	3,107
Internet service and data processing providers	518	D	D	4,190
Other information	other 51	593	0	593
Finance, insurance, and real estate	52, 53	2,021	0	2,021
Professional, scientific, and technical services	54	40,533	7,608	32,924
Architectural, engineering, and related services	5413	5,882	1,885	3,997
Computer systems design and related services	5415	14,407	804	13,603
Scientific R&D services	5417	16,849	4,831	12,017
Other professional, scientific, and technical services	other 54	3,394	87	3,307
Health care services	621–23	1,280	7	1,274
Other nonmanufacturing	21-2, 48-9, 55-6, 61, 624, 71-2, 81	1,857	D	3,595

D = suppressed to avoid disclosure of confidential information; i = more than 50% of the value is imputed; NAICS = North American Industry Classification System.

NOTES: Detail may not add to total because of rounding. Excludes data for federally funded research and development centers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2007.

TABLE 3. Sales and employment for companies performing industrial R&D in the United States, by industry: 2007

Industry	NAICS codes	Net sales	Domestic employment[a]	R&D scientists and engineers[b]
		$millions	Thousands	
All industries	21–23, 31–33, 42, 44–81	7,027,049	16,737	1,130.5
Manufacturing industries	31–33	4,594,252	9,598	717.1
Food	311	405,129	985	12.3
Textiles, apparel, and leather	313–16	47,573	197	6.3
Paper, printing, and support activities	322, 323	205,991	418	D
Petroleum and coal products	324	510,798	154	D
Chemicals	325	699,520	1,101	139.6
Basic chemicals	3251	144,565	191	13.8
Resin, synthetic rubber, fibers, and filament	3252	50,517	63	4.9
Pharmaceuticals and medicines	3254	374,517	513	103.0
Other chemicals	other 325	129,920	333	17.9
Plastics and rubber products	326	138,972	470	12.6
Fabricated metal products	332	102,467	387	16.0
Machinery	333	264,841	822	58.8
Computer and electronic products	334	589,918	1,397	276.5
Computers and peripheral equipment	3341	135,239	156	D
Communications equipment	3342	78,043	146	55.1
Semiconductor and other electronic components	3344	152,990	393	91.8
Navigational, measuring, electromedical, and control instruments	3345	201,270	652	90.4
Other computer and electronic products	other 334	22,377	51	D
Electrical equipment, appliances, and components	335	87,972	279	15.6
Transportation equipment	336	1,005,804	2,015	121.4
Motor vehicles, trailers, and parts	3361–63	655,250	1,070	D
Aerospace products and parts	3364	263,321	659	42.9
Other transportation equipment	other 336	87,233	286	D
Miscellaneous manufacturing	339	205,763	430	29.1
Medical equipment and supplies	3391	172,473	305	20.1
Other miscellaneous manufacturing	other 339	33,290	125	9.0
Other manufacturing	312, 321, 327, 331, 337	329,504	943	D
Nonmanufacturing industries	21–23, 42, 44–81	2,432,797	7,139	413.4
Wholesale trade	42	122,878	234	15.1
Retail trade	44, 45	295,850	1,098	14.7
Information	51	562,929	1,568	139.1
Publishing, including software	511	128,622	402	100.5
Telecommunications	517	343,618	832	D
Internet service and data processing providers	518	43,685	153	D
Other information	other 51	47,005	182	2.8
Finance, insurance, and real estate	52, 53	524,874	1,067	19.3
Professional, scientific, and technical services	54	345,529	1,192	196.1
Architectural, engineering, and related services	5413	49,091	214	44.7
Computer systems design and related services	5415	204,946	523	80.3
Scientific R&D services	5417	40,075	188	54.8
Other professional, scientific, and technical services	other 54	51,417	268	16.4
Health care services	621–23	28,319	123	7.7
Other nonmanufacturing	21-2, 48-9, 55-6, 61, 624, 71-2, 81	552,418	1,857	21.4

D = suppressed to avoid disclosure of confidential information; NAICS = North American Industry Classification System.

[a] Data recorded on March 12, 2007 represent employment figures for the current year.

[b] Data recorded in January 2008 represent employment figures for the previous year.

NOTES: Detail may not add to total because of rounding. Excludes data for federally funded research and development centers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2007.

TABLE 4. Funds expended for industrial R&D performed in the United States, by state, by source of funds: 2007
(Millions of dollars)

State	All R&D	Federal	Company and other
United States	269,267	26,585	242,682
Alabama	1,771	928	844
Alaska	58 e	12	46 e
Arizona	3,846	393	3,453
Arkansas	339	18	321
California	64,187	4,817 i	59,370
Colorado	5,223	179	5,044
Connecticut	9,444	1,763	7,681
Delaware	1,472	17	1,455
District of Columbia	379	205	173 e
Florida	4,569	1,257 i	3,312
Georgia	2,788	150	2,637
Hawaii	218	97	121
Idaho	726	13	712
Illinois	11,362	218	11,145
Indiana	4,939	314 i	4,625
Iowa	1,202	15 e	1,187
Kansas	1,304	22 e	1,282
Kentucky	890	15 e	875
Louisiana	373 e	38	335 e
Maine	265	19	247
Maryland	3,665	1,064	2,601
Massachusetts	19,488	6,249	13,238
Michigan	15,736	264	15,472
Minnesota	6,636	254	6,383
Mississippi	279	59	219
Missouri	2,736	101	2,635
Montana	134	36 i	98
Nebraska	489	28	461
Nevada	567	53	514
New Hampshire	1,814 i	D	D
New Jersey	17,892	523	17,369
New Mexico	568	277	290
New York	10,916	582	10,334
North Carolina	6,829	218	6,611
North Dakota	126	3 e	124
Ohio	7,265	744	6,521
Oklahoma	527	44	483
Oregon	3,629 i	41 e	3,588 i
Pennsylvania	10,387	274	10,113
Rhode Island	411	26	385
South Carolina	1,426	111	1,315
South Dakota	132	D	D
Tennessee	1,638	129	1,510
Texas	13,889	1,165	12,724
Utah	1,764	468	1,295
Vermont	413	43	370
Virginia	4,840	2,051	2,789
Washington	12,687	189	12,499
West Virginia	233	46	187
Wisconsin	3,411	92	3,319
Wyoming	37 e	3 e	34 e
Undistributed funds[a]	3,347 i	107 i	3,240 i

D = data withheld to avoid disclosing operations of individual companies; e = more than 50% of the cell value is imputed due to raking of state data; i = more than 50% of the cell value is imputed.

[a] Includes data reported on Form RD-1 not allocated to a specific state. Data reported on the Form RD-1A, the questionnaire sent to small companies or companies new to the survey, were allocated to the state in the address on the company's survey form, which is usually the company's headquarters.

NOTES: Detail may not add to totals because of rounding. Excludes data for federally funded research and development centers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2007.

Data Notes

Estimates in this InfoBrief were derived from the annual Survey of Industrial Research and Development. The survey is cosponsored by the National Science Foundation and the U.S. Census Bureau, and Census is the collection and tabulation agent for the survey. The survey is a nationally representative sample of all for-profit companies, publicly or privately held and with five or more employees that performed R&D within the 50 United States and the District of Columbia. For 2007, 31,766 companies were surveyed and the overall response rate was 80.8%.[8] The primary focus of the survey is U.S. industry as a performer of research and development rather than as a source of funds.

Beginning in 1989, the amount of federally funded R&D reported by performers began to diverge from the amount reported by federal agencies. For 2007, federal agencies reported obligations of $112.8 billion

TABLE 5. Funds expended for industrial R&D, sales, and employment for companies performing industrial R&D in the United States, by company size: 2007

Company size (employees)	Funds			Domestic net sales	Domestic employment[a]	R&D scientists and engineers[b]
	All R&D	Federal	Company and other			
	$millions				Thousands	
All companies	269,267	26,585	242,682	7,027,049	16,737	1,130.5
5–24	10,854	1,671	9,183	68,796	250	69.3
25–49	7,884	615	7,269	48,623	243	40.5
50–99	10,068	760	9,308	106,287	415	48.6
100–249	13,354	1,264	12,090	176,457	674	66.2
250–499	8,258	556	7,702	184,423	633	46.5
500–999	14,279	662	13,617	313,263	888	64.2
1,000–4,999	41,103	1,287	39,816	973,112	2,322	181.7
5,000–9,999	22,673	1,516	21,157	738,398	1,515	105.7
10,000–24,999	45,946	1,930	44,016	1,337,729	2,459	187.5
25,000 or more	94,848	16,325	78,523	3,079,961	7,339	320.3

[a] Data recorded on March 12, 2007 represent employment figures for the current year.
[b] Data recorded in January 2008 represent employment figures for the previous year.

NOTES: Detail may not add to total because of rounding. Excludes data for federally funded research and development centers.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2007.

and outlays of $106.3 billion in total R&D to all R&D performers and obligations of $46.5 billion to business R&D performers (NSF/SRS 2008a). These totals compare with $98.3 billion in federal funding reported by all performers of R&D (NSF/SRS 2008b) and with $26.6 billion reported by business R&D performers. Although NSF has not found a definitive explanation for this divergence, the National Research Council notes that comparing federal outlays (as opposed to obligations) for R&D to performer expenditures results in a smaller discrepancy (National Research Council 2006).

Title 13 of the United States Code and a pledge of confidentiality to respondents prohibit publication or release of data or statistics that may reveal information about individual companies. Therefore, the data in some table cells have been suppressed and replaced with D, which occurs when a small number of companies account for a large percentage of the estimate in a particular data cell. Although publication of certain cells may be withheld, the estimates in the cells are always included in totals.

Some surveyed firms do not choose to return the questionnaire or return it with one or more blank items. Missing data for major data items were estimated using mathematical algorithms developed from industry comparisons, data from previous cycles of the survey, and other information. Therefore, the statistics in some table cells may be accompanied by the notation i, which indicates that the imputation rate—the percentage of the statistic not reported by respondents and consequently estimated—exceeds 50% for that item. In such cases, the estimate may be statistically unreliable. Beginning with 2001, the methodology to produce statistics by state was modified to address the recurring problem of large year-to-year variation in many state estimates. This variability was caused by many factors including the potential inefficiency of the sample at state levels, the rarity of R&D expenditures, and the large weights often associated with companies that report R&D in the survey for the first time. Under the new methodology, a portion of the amount of R&D reported by some companies not selected for the sample with certainty is allocated (or raked) among all the states in which there was industrial activity. Cells are flagged with the notation e if more than 50% of the estimate was imputed because of raking.

This InfoBrief is the last to signal a data release from NSF's Survey of Industrial Research and Development. A new Business R&D and Innovation Survey (BRDIS) was launched in January 2009 that collects a broad range of R&D data from both manufacturing and

service companies and that begins to collect innovation data with an eye toward increasing the number and breadth of innovation-related items in the future. From the first cycle NSF expects to release aggregate estimates for the traditional R&D items. In addition, depending on the quality of the data, NSF hopes to release a variety of statistics in new topical areas. For more information see Wolfe (2008b) and visit the BRDIS website at http://www.nsf.gov/statistics/srvyindustry/about/brdis/.

The full set of detailed tables from this survey will be available in the report *Research and Development in Industry: 2007* at http://www.nsf.gov/statistics/industry/. Individual detailed tables from the 2007 survey are available in advance of publication of the full report. For further information, contact the author.

Notes

1. Raymond M. Wolfe, Research and Development Statistics Program, Division of Science Resources Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230 (rwolfe@nsf.gov, 703-292-7789).

2. *Company* is defined as a business organization of one or more establishments under common ownership or control. All estimates from the survey are subject to both sampling and nonsampling errors (see technical notes in the annual reports at http://www.nsf.gov/statistics/industry/).

3. Throughout the text and tables in this InfoBrief *business R&D* and *industrial R&D* are used synonymously.

4. *Net sales* is defined as dollar values for goods sold or services rendered by companies that perform R&D in the United States to customers outside the company, including the federal government, less such items as returns, allowances, freight charges, and excise taxes. Excludes intracompany transfers and sales by foreign subsidiaries but includes transfers to foreign subsidiaries and export sales to foreign companies.

5. Statistics by detailed industry will be available in the annual report *Research and Development in Industry: 2007*, forthcoming at http://www.nsf.gov/statistics/industry/. Prior to publication of the annual report, tables are available upon request from the author.

6. Defined as having from 5 to 499 employees; the NSF Survey of Industrial Research and Development does not include companies with fewer than 5 employees.

7. R&D statistics by state and industry are available upon request from the author.

8. For more detailed information about the survey sample and methodology, see survey description at www.nsf.gov/statistics/survey.cfm.

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