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U.S. Businesses Report 2008 Worldwide R&D Expense of $330 Billion: Findings from New NSF Survey

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Companies located in the United States that have research and development activities—both U.S.-owned businesses and U.S. affiliates of foreign parents—reported worldwide sales of $11 trillion in calendar year 2008 and worldwide R&D expenses of $330 billion (table 1). Most ($234 billion) of that R&D expense was for R&D conducted in companies' own facilities in the United States.

These figures are from the first Business R&D and Innovation Survey (BRDIS), developed jointly by the National Science Foundation (NSF) and the U.S. Census Bureau (Census).[2] This first survey was conducted as a full-scale pilot, mailed to a representative sample of about 40,000 companies in January 2009. These data are preliminary; final statistics from the pilot will be available in early 2011. Two additional reports scheduled for release in 2010 will present preliminary 2008 statistics on worldwide and domestic employment, including R&D employment, and on innovation, respectively.

BRDIS collects a wealth of data on business R&D and innovation activities performed in the United States that were not collected by its predecessor, the Survey of Industrial Research and Development. Among its major features, the new survey collects data for companies' worldwide activities, including separate data for their domestic and foreign operations; sales and R&D data by business activity; and R&D expense data, in addition to the R&D performance data NSF traditionally has collected. Some terms used to report BRDIS data were not used or differ from terms used to report data from its predecessor, and the two surveys use different methods to assign industry classifications. See "Definitions" and "Survey Information and Data Availability," at the end of this report, for further information.

Sales and R&D Expense

Sales

A significant feature of BRDIS is an increased focus on the worldwide activities of businesses operating in the United States. Overall, companies with R&D activity reported that 68% of their worldwide sales came from domestic business operations. Businesses classified in the pharmaceuticals and medicines industry reported that 67% of their worldwide sales came from domestic operations. Other industries reported similarly high domestic-to-worldwide sales ratios: scientific R&D services (85%), computer system design and related services (79%), aerospace products and parts (74%), motor vehicles, trailers, and parts (62%), software publishers (58%), and semiconductor and electronic components (53%). (Comparisons in this report are made among the most detailed [4-digit] industry classifications; see table 1.)

R&D Expense

R&D expense is the amount a company pays from its own funds for R&D that is done for the company's

TABLE 1. Worldwide sales, R&D expense, and R&D costs paid for by others, by selected industry: 2008
(Millions of US dollars)

Industry and NAICS code	Sales		R&D expense				Cost of R&D paid for by others			
			Worldwide	Performed by company		Paid to others	Worldwide	Performed by company		Paid to others
	Worldwide	Domestic		Domestic	Foreign			Domestic	Foreign	
All industries, 21–33, 42–81	10,942,915	7,476,021	329,650	233,918	57,790	37,941	62,524	49,320	4,709	8,495
Manufacturing industries, 31–33	6,879,088	4,407,076	233,326	159,736	45,518	28,072	36,761	30,313	1,417	5,031
Food, 311	463,794	363,049	4,000	3,134	683	184	53	43	0	10
Beverage/tobacco products, 312	195,840	133,910	1,157	848	123	186	104	89	*	15
Textile/apparel/leather and allied products, 313–16	169,571	139,991	1,239	811	400	29	15	12	*	2
Wood products, 321	42,717	38,103	266	222	29	15	5	4	*	1
Chemicals, 325	1,243,526	762,048	79,968	49,137	12,962	17,869	5,819	3,312	546	1,962
Pharmaceuticals/medicines, 3254	529,601	353,057	69,516	42,038	10,371	17,107	5,501	3,088	487	1,926
Other 325	713,926	408,991	10,452	7,099	2,590	762	317	223	58	36
Plastics/rubber products, 326	264,978	178,750	3,335	2,524	609	202	110	100	2	7
Nonmetallic mineral products, 327	105,586	89,822	1,736	1,431 i	101	203	51	47	0	4
Primary metals, 331	194,274	151,538	830	651	100	79	48	40	0	8
Fabricated metal products, 332	185,986	150,332	2,640	2,361	196	83	66	56	1	10
Machinery, 333	455,641	267,910	12,071	9,661	1,917	493	365	242	11	112
Computer/electronic products, 334	923,113	492,327	69,737	51,781	15,461	2,496	8,143	7,256	346	541
Computers/peripheral equipment, 3341	306,605	127,639	12,549	9,074	3,220	256	258	162	42	54
Communications equipment, 3342	132,307	81,799	14,987	11,356	2,903	727	1,457	1,431 i	13	13
Semiconductor/other electronic components, 3344	192,258	101,246	28,812	21,166	6,804	842	723	527	153	43
Navigational/measuring/electromedical/control instruments, 3345	269,779	168,789	12,150	9,405	2,114	631	5,688	5,121	138	430
Other 334	22,164	12,853	1,238	780	419 i	39 i	17	15	*	2
Electrical equipment/appliance/components, 335	172,771	117,649	4,630	2,927	1,504	200	229	195	10	25
Transportation equipment, 336	1,298,507	879,829	38,221	23,559	9,797	4,865	21,232	18,532	495	2,205
Motor vehicles/trailers/parts, 3361–63	776,055	483,379	24,262	12,166	8,325	3,772	1,145	909	134	102
Aerospace products/parts, 3364	457,250	339,509	12,584	10,224	1,311	1,049	19,789	17,348	340	2,101
Other 336	65,201	56,941	1,375	1,170	161	44	298	276 i	20 i	2
Furniture/related products, 337	40,754	33,214	540	475	28	37	*	0	*	0
Manufacturing nec, other 31–33	1,122,030	608,605	12,956	10,214	1,609	1,133	523	385	8	130
Nonmanufacturing industries, 21–23, 42–81	4,063,827	3,068,945	96,324	74,182	12,272	9,869	25,762	19,007	3,292	3,464
Information, 51	924,731	574,993	45,930	36,284	7,659	1,988	928	787	56	86
Software publishers, 5112	317,084	183,430	35,070	27,612	6,353	1,106	683	561	47	75
Telecommunications/Internet service providers/Web search portals/data processing services, 517–18	501,859	316,570	9,308	7,349	1,185 i	773 i	188	168	9	10
Other 51	105,788	74,993	1,552	1,323	121	108	58	58	*	0
Finance/insurance, 52	435,237	419,026	1,310	1,154	72	84	9	8	1 i	*
Real estate/rental/leasing, 53	34,898	16,824	517	362	135	20	1	*	*	1
Professional/scientific/technical services, 54	594,424	467,509	30,639	22,438	3,193	5,007	23,891	17,570	3,213	3,108
Computer systems design/related services, 5415	259,001	204,912	11,262	8,597	2,204	461	3,987	3,559	92	336
Scientific R&D services, 5417	179,114	151,607	14,682	10,078	644	3,958	14,462	9,365	2,986	2,111
Other 54	156,308	110,990	4,695	3,763	345	588	5,443	4,646	135	662
Health care services, 621–23	30,438	27,928	1,217	1,048	6	163	428	285	*	143
Nonmanufacturing nec, other 21–23, 42–81	2,044,098	1,562,666	16,711	12,897	1,208	2,607	505	358	21	126

i = >50% of value imputed; * = < $500,000.

NAICS = North American Industry Classification System; nec = not elsewhere classified.

NOTES: Detail may not add to total because of rounding. Industry classification was based on dominant business code for domestic R&D performance where available. For companies that did not report business codes, classification used for sampling was assigned. Sales statistics are for businesses that reported either worldwide R&D expense or worldwide R&D paid for or funded by others. Sales for businesses with no R&D activity are excluded from totals.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Business R&D and Innovation Survey: 2008.

benefit (for example, R&D leading to new products or processes that may increase income). It includes company-performed R&D in both its domestic and foreign locations plus R&D the company pays others to perform.

Of the $330 billion worldwide R&D expense in 2008, $292 billion (88%) was for company-performed R&D ($234 billion performed at their domestic facilities and $58 billion at their foreign facilities). R&D expense does not include company-performed R&D paid for by others. Companies paid the remaining $38 billion of worldwide R&D expense to others (inside and outside of the United States) for the performance of R&D. The industry that paid the most to others for R&D was the pharmaceuticals and medicines industry. Of its worldwide $70 billion R&D expense, $17 billion (25%) was paid to others for R&D. Other industries that paid $1 billion or more to others for R&D were scientific R&D services ($4 billion), motor vehicles, trailers, and parts ($4 billion), software publishers ($1 billion), and aerospace products ($1 billion).

Companies classified among the manufacturing industries reported 71% ($233 billion) of total worldwide R&D expense. Among manufacturers, the industries with the most R&D expense were pharmaceuticals and medicines ($70 billion), semiconductor and electronic components ($29 billion), motor vehicles, trailers, and parts ($24 billion), communications equipment ($15 billion), aerospace products and parts ($13 billion), and computers and peripheral equipment ($13 billion). Nonmanufacturing industries accounted for the remaining $96 billion (29%) of worldwide R&D expense, with the top contributors being software publishers ($35 billion) and scientific R&D services ($15 billion).

R&D Performance

Historically, NSF has collected and published statistics primarily on the R&D that companies performed in the United States. This domestic R&D performance was the basis for most statistics collected by the predecessor survey and, for both surveys, conforms to international guidelines on collecting R&D expenditures. A company's domestic R&D performance is the total of the amount the company paid for the R&D performed in its own domestic locations for its own benefit (the fourth data column in table 1; e.g., $234 billion for all industries) plus the amount paid for by others for R&D performed in the company's domestic locations for others' benefit (the eighth data column in table 1; e.g., $49 billion for all industries). These combined domestic R&D performance expenditures totaled $283 billion for 2008 (components summed in table 2). This compares with the 2007 domestic R&D performance expenditure total of $269 billion published from the predecessor survey.[3]

Companies in manufacturing industries performed $190 billion of R&D domestically, $160 billion from their own funds (R&D expense) and $30 billion paid for by others, which accounted for 67% of all business R&D performed in the United States in 2008. Companies in nonmanufacturing industries performed $93 billion of R&D domestically, $74 billion from their own funds and $19 billion paid for by others.

The cost of the R&D companies performed outside of the United States amounted to $62 billion, $58 billion from companies' own funds and $5 billion paid for by others. By far, the 4-digit NAICS (North American Industry Classification System) industry that performed the most R&D outside of the United States was the pharmaceuticals and medicines industry ($11 billion). Other industries with high levels of R&D performed abroad were motor vehicles, trailers, and parts ($8 billion), semiconductor and other electronic components ($7 billion), and software publishers ($6 billion).

R&D Performance by Size of Company

Statistics on sales, worldwide R&D expense, and worldwide R&D costs funded by others by size of company are given in table 3. In 2008, small companies (5–499 employees) accounted for $1 trillion (11%) of total worldwide sales. They had worldwide R&D expense of $64 billion (19% of total worldwide R&D expense) and performed $63 billion (22%) of the business R&D performed in the United States and $5 billion (8%) performed abroad. They paid others $11 billion (24%) to perform R&D.

By contrast, the largest companies, those with 25,000 or more domestic employees, accounted for $5 trillion, or 42%, of the total worldwide sales of companies that had R&D activity. They had worldwide R&D expense of $110 billion (33% of total worldwide R&D expense) and performed $92 billion (33%) of the business R&D performed in the United States and $25 billion (40%)

TABLE 2. Domestic and foreign R&D performance, by selected industry: 2008
(Millions of US dollars)

Industry and NAICS code	Domestic performance			Foreign performance		
	Total	R&D paid for by company	R&D paid for by others	Total	R&D paid for by company	R&D paid for by others
All industries, 21–33, 42–81	283,238	233,918	49,320	62,499	57,790	4,709
Manufacturing industries, 31–33	190,049	159,736	30,313	46,935	45,518	1,417
Food, 311	3,177	3,134	43	683	683	0
Beverage/tobacco products, 312	937	848	89	123	123	*
Textile/apparel/leather and allied products, 313–16	823	811	12	400	400	*
Wood products, 321	226	222	4	29	29	*
Chemicals, 325	52,449	49,137	3,312	13,508	12,962	546
Pharmaceuticals/medicines, 3254	45,126	42,038	3,088	10,858	10,371	487
Other 325	7,322	7,099	223	2,648	2,590	58
Plastics/rubber products, 326	2,624	2,524	100	611	609	2
Nonmetallic mineral products, 327	1,478	1,431	47	101	101	0
Primary metals, 331	691	651	40	100	100	0
Fabricated metal products, 332	2,417	2,361	56	197	196	1
Machinery, 333	9,903	9,661	242	1,928	1,917	11
Computer/electronic products, 334	59,037	51,781	7,256	15,807	15,461	346
Computers/peripheral equipment, 3341	9,236	9,074	162	3,262	3,220	42
Communications equipment, 3342	12,787	11,356	1,431	2,916	2,903	13
Semiconductor/other electronic components, 3344	21,693	21,166	527	6,957	6,804	153
Navigational/measuring/electromedical/ control instruments, 3345	14,526	9,405	5,121	2,252	2,114	138
Other 334	795	780	15 i	419	419	*
Electrical equipment/appliance/ components, 335	3,122	2,927	195	1,514	1,504	10
Transportation equipment, 336	42,091	23,559	18,532	10,292	9,797	495
Motor vehicles/trailers/parts, 3361–63	13,075	12,166	909	8,459	8,325	134
Aerospace products/parts, 3364	27,572	10,224	17,348	1,651	1,311	340
Other 336	1,446	1,170	276	181	161	20 i
Furniture/related products, 337	475	475	0	28	28	*
Manufacturing nec, other 31–33	10,599	10,214	385	1,617	1,609	8
Nonmanufacturing industries, 21–23, 42–81	93,189	74,182	19,007	15,564	12,272	3,292
Information, 51	37,071	36,284	787	7,715	7,659	56
Software publishers, 5112	28,173	27,612	561	6,400	6,353	47
Telecommunications/Internet service providers/Web search portals/data processing services, 517–18	7,517	7,349	168 i	1,194	1,185	9
Other 51	1,381	1,323	58	121	121	*
Finance/insurance, 52	1,162	1,154	8	73	72	1 i
Real estate/rental/leasing, 53	362	362	*	135	135	*
Professional/scientific/technical services, 54	40,008	22,438	17,570	6,406	3,193	3,213
Computer systems design/related services, 5415	12,156	8,597	3,559	2,296	2,204	92
Scientific R&D services, 5417	19,443	10,078	9,365	3,630	644	2,986
Other 54	8,409	3,763	4,646	480	345	135
Health care services, 621–23	1,333	1,048	285	6	6	*
Nonmanufacturing nec, other 21–23, 42–81	13,255	12,897	358	1,229	1,208	21

i = >50% of value imputed; * = < $500,000.

NAICS = North American Industry Classification System; nec = not elsewhere classified.

NOTES: Detail may not add to total because of rounding. Industry classification was based on the dominant business code for domestic R&D performance where available. For companies that did not report business codes, classification used for sampling was assigned.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Business R&D and Innovation Survey: 2008.

TABLE 3. Worldwide sales, R&D expense, and R&D costs paid for by others, by company size: 2008
(Millions of US dollars)

Company size (domestic employees)	Sales		R&D expense				Cost of R&D paid for by others			
				Performed by company		Paid to others		Performed by company		Paid to others
	Worldwide	Domestic	Worldwide	Domestic	Foreign		Worldwide	Domestic	Foreign	
All companies	10,942,915	7,476,021	329,650	233,918	57,790	37,941	62,524	49,320	4,709	8,495
Small companies	1,210,686	1,018,110	63,952	50,377	4,753	8,823	15,067	12,200	491	2,377
5–24	309,964	268,174	15,407	12,117	368	2,922	5,307	4,407	135	765
25–49	103,258	83,588	10,827	8,844	695	1,288	2,962	2,499	164	299
50–99	190,076	170,782	10,014	7,621	981	1,413	2,312	2,064	20	228
100–249	350,338	284,372	16,472	12,980	1,561	1,932	2,551	1,650	113	788
250–499	257,050	211,194	11,232	8,815	1,148	1,269	1,935	1,579	59	296
Large companies	9,732,230	6,457,911	265,698	183,541	53,037	29,118	47,456	37,120	4,218	6,118
500–999	392,440	261,439	13,443	10,116	1,693	1,631	2,853	2,207	73	573
1,000–4,999	1,471,011	1,032,277	56,121	39,381	11,180	5,560	7,922	6,078	718	1,126
5,000–24,999	3,234,744	2,271,948	86,461	59,392	15,687	11,381	17,004	11,060	2,972	2,972
25,000 or more	4,634,035	2,892,246	109,673	74,652	24,476	10,546	19,678	17,776	454	1,448

NOTES: Detail may not add to total because of rounding. Industry classification was based on dominant business code for domestic R&D performance where available. For companies that did not report business codes, classification used for sampling was assigned. Sales statistics are for businesses that reported either worldwide R&D expense or worldwide R&D paid for by others. Sales for businesses with no R&D activity are excluded from totals.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Business R&D and Innovation Survey: 2008.

of the business R&D performed abroad. They paid others $12 billion (26%) to perform R&D.

Definitions

Company. A business organization of one or more establishments under common ownership or control. A company includes all subsidiaries and divisions in which there is more than 50% ownership, no matter where the subsidiary or division is located.

Domestic locations. The 50 states and the District of Columbia.

Foreign parent. An entity, other than a holding company, located outside of the United States that owns more than 50% of the company. In BRDIS, the foreign parent and the parent's affiliates are treated the same as is an unaffiliated customer or business partner.

Industry. Industry refers to 2-, 3-, or 4-digit NAICS codes or group of NAICS codes used to publish statistics resulting from the survey.

Innovation. In BRDIS, innovation relates to companies' responses to questions on the introduction of new or improved goods, services, manufacturing methods, logistics, or support activities. These questions serve as the foundation for expansion of innovation inquiry in future cycles of the survey.

Others. Other companies; U.S. federal, state, or foreign government agencies or laboratories; universities; colleges; or academic researchers. R&D performed by others is also referred to as contracted-out R&D, even though grants and instruments other than contracts are used, or outsourced R&D.

R&D expenditures. The cost of R&D the company performed, no matter who paid for it or who benefited from it. The predecessor to BRDIS focused on domestic R&D expenditures (i.e., R&D performed in the United States).

R&D expense. A company's costs paid from its own funds for R&D undertaken to benefit the company, regardless of performer. It is an accounting concept defined by the accounting standards used by the reporting company. It does not include R&D paid for by others for others' benefit. For more information, see Financial Accounting Standards Board (FASB) Statement of Accounting Standards No. 2 (Accounting for Research and Development Costs) at http://www.fasb.org/home.

R&D paid for or funded by others. R&D performed by the company that is paid for by other entities not owned by the company (i.e., entities in which there is a less than 50% ownership). These entities include, but are not limited to, other companies, U.S. federal or state government agencies or labs, and foreign government agencies or labs located within or outside of the United States.

Sales. Also net sales or operating revenue, the dollar value for goods sold or services rendered by companies to customers outside the company, including the federal government, less such items as returns, allowances, freight charges, and excise taxes. For BRDIS, sales include revenues from domestic operations and from foreign operations and subsidiaries. For foreign-owned companies, sales to the foreign parent and affiliates not owned by the company are included. Sales for businesses without any R&D activity are not included.

Small company. Companies having from 5 to 499 employees. The upper bound is based on the U.S. Small Business Administration's definition of a small business; the lower bound reflects that BRDIS does not include companies with fewer than five employees.

United States. The 50 states and the District of Columbia.

Survey Information and Data Availability

The sample for BRDIS was selected to represent all for-profit companies with five or more domestic employees, publicly or privately held, that perform or fund R&D or engage in innovative activities in the United States. Because the statistics from the survey are based on a sample, they are subject to both sampling and nonsampling errors.

For 2008, 39,553 companies were sampled representing 1,926,012 companies in the population. The estimated number of companies with worldwide R&D expense was 58,304 and the estimated number with R&D paid for by others was 11,453. The estimated number with both worldwide expense and R&D paid for by others was 7,679. The overall response rate was 77.4%; the response rate for the top 500 domestic R&D-performing companies was 92.6%. Industry classification was based on the dominant business activity for domestic R&D performance where available. For companies that did not report business activity codes for R&D, the classification used for sampling was assigned.

More detailed information about the survey sample and methodology will be available in the forthcoming survey description at http://www.nsf.gov/statistics/srvyindustry/. Copies of the BRDIS questionnaires and comparisons of BRDIS with the predecessor survey are available at http://www.nsf.gov/statistics/srvyindustry/about/brdis/. Coefficients of variation and imputation rates for the statistics in this report are available from the author.

Two additional reports, one on employment and one on innovation, are being prepared and will present additional preliminary BRDIS data for 2008. Detailed tables for 2008 will be available in the report *R&D and Innovation in Business: 2008* at http://www.nsf.gov/statistics/industry/ in early 2011. Individual tables may be available in advance of publication of the full report. For further information, please contact the author.

Notes

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2. For information about the planning and preparation of BRDIS, see SRS InfoBrief, *NSF Announces New U.S. Business R&D and Innovation Survey* (NSF 09-304) at http://www.nsf.gov/statistics/infbrief/nsf09304/.

3. Wolfe R.M. 2009. *U.S. Business R&D Expenditures Increase in 2007; Small Companies Performed 19% of Nation's Business R&D*. InfoBrief NSF 09-316.Arlington, VA: National Science Foundation, Division of Science Resources Statistics. Available at http://www.nsf.gov/statistics/infbrief/nsf09316/.

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