



Health and Defense Applications Account for 40% of Business R&D in the United States

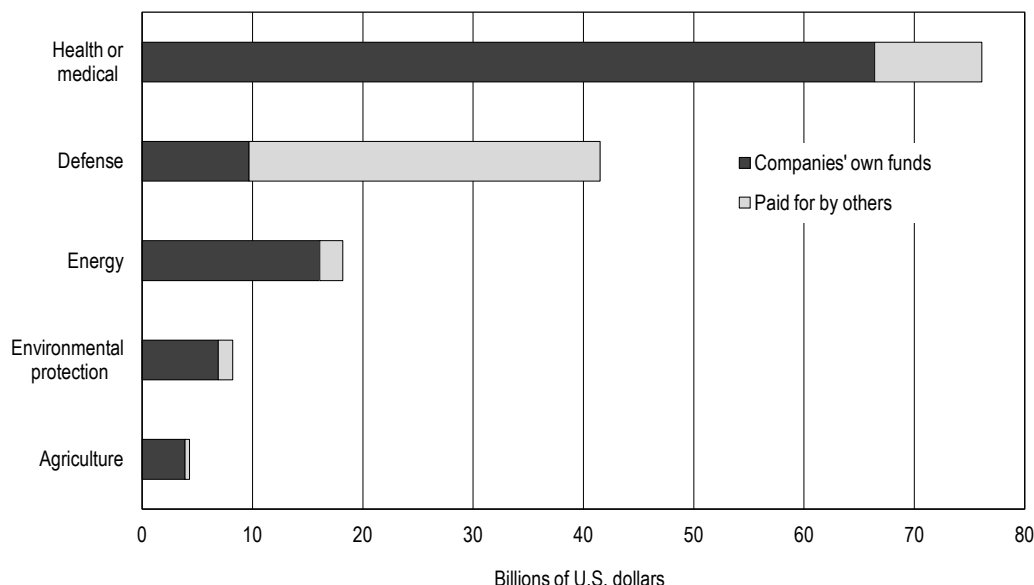
by Brandon Shackelford¹

In 2008 businesses in the United States performed \$76.1 billion of research and development with health and medical applications, out of the total \$290.7 billion of R&D they performed (figure 1). Over 86% of the health or medical R&D performed

by businesses was paid for by the reporting companies themselves (R&D expense). Defense was the next largest application area, accounting for over \$41.5 billion of business R&D in the United States. Unlike health or medical applications, most of the defense R&D

performed by companies was not paid for by the companies themselves, rather it was paid for by the federal government. These data are from the Business R&D and Innovation Survey (BRDIS), which collected a variety of information about the strategic focus

FIGURE 1. R&D performed by companies in the United States, by application area and source of funds: 2008



NOTES: Total R&D performed by companies in the United States in 2008 was \$290.7 billion. Of this amount, \$232.5 billion was paid for from companies' own funds and \$58.2 billion was paid for by others, such as business partners and customers.

SOURCE: National Science Foundation/National Center for Science and Engineering Statistics, Business R&D and Innovation Survey, 2008.

of business R&D, including areas of application and the technology focus of the R&D.

Of the \$290.7 billion spent in 2008 on business R&D, \$232.5 billion was paid for by the companies themselves (own R&D expense). These expenditures reflect company priorities and strategies and are not controlled directly by customers or business partners. The remainder of this Infobrief reports on companies' own R&D expense.

Application Areas of Company R&D

BRDIS collected information on the following five application areas, listed here in order of most to least funds spent on R&D by companies themselves.

- Health or medical applications (\$66.4 billion)
- Energy applications (\$16.1 billion)
- Defense applications (\$9.7 billion)
- Environmental protection applications (\$6.9 billion)
- Agricultural applications (\$3.9 billion)

Health or Medical Applications

Companies classified by BRDIS as being in the pharmaceuticals and medicines industry accounted for two-thirds (\$44.4 billion) of the health or medical R&D performed by businesses in 2008 (table 1). BRDIS classifies each company's R&D into one industry on the basis of its dominant business activity for domestic R&D performance, so it is possible that data reported for the pharmaceutical industry include R&D for businesses in other industries.² However, almost all (98%) of the R&D reported in the pharmaceuticals and medicines industry was for health or medical applications, indicating that

pharmaceutical companies tend not to diversify into lines of business with nonmedical applications. In contrast, over one-third of the R&D performed by companies classified in the electromedical apparatus industry went toward applications other than health or medical.³

Although most of the R&D with health or medical applications is conducted by companies classified as being in manufacturing industries, several nonmanufacturing industries perform sizeable amounts of health or medical R&D. The scientific R&D services industry, which includes many biotechnology companies as well as contract research organizations, performed \$5.6 billion of R&D with health or medical applications in 2008. In addition, companies in the software publishers industry and the computer systems design and related services industry performed a total of \$2.9 billion of R&D with health or medical applications.

Energy Applications

R&D with energy applications was less concentrated by industry than was R&D with health or medical applications. The two industries estimated to have performed the most R&D with energy applications in 2008 (\$3.0 billion each) were the automobile/bodies/trailers/parts industry and the semiconductor and other electronic components industry (table 1). Nearly one-quarter of the automobile/bodies/trailers/parts industry's R&D performance had energy applications in 2008, possibly reflecting ongoing work to improve fuel efficiency and explore alternatives to the internal combustion engine. Energy application R&D in the semiconductor industry could include both R&D focused on improving the energy efficiency of microprocessors and other electronic devices and R&D for the development of new and improved solar cells.

The two industries most commonly associated with energy, the petroleum and coal products industry and the mining/extraction/support industry, together performed \$1.9 billion of R&D with energy applications in 2008. Among the remaining industries, the electrical equipment/appliances/components industry devoted the largest share of its R&D to energy applications (33%), followed closely by the architectural/engineering/related services industry (29%) (table 1).

Defense Applications

As noted earlier, the majority of defense-related R&D in the business sector is directly paid for by the federal government, but companies themselves paid for and performed \$9.7 billion of R&D that had defense applications. Most of this R&D with defense applications is performed by companies classified in the computer and electronic products or aerospace industries.⁴ Although this R&D is not paid for directly by the federal government, many defense-oriented companies are able to recoup a portion of their own R&D expense from future government contracts.⁵

Environmental Protection Applications

Three industries performed over \$1 billion of R&D with environmental protection applications in 2008: the machinery industry, the automobile/bodies/trailers/parts industry, and computer and electronic products. The machinery industry—which includes manufacturers of heating and air conditioning equipment; air purification/scrubbing equipment; and steam, hydraulic, gas, and wind turbines—accounted for one-quarter of all business environmental protection R&D. The automobile/bodies/trailers/parts industry, which faces the possibility of stricter emissions requirements in the future, devoted 9% of its R&D to

TABLE 1. R&D performed and paid for by companies in the United States, by application area and selected industry: 2008
(Millions of U.S. dollars)

Industry and NAICS code	Application area of R&D					
	Total	Agriculture	Defense	Energy	Environmental protection	Health or medical
All industries, 21–33, 42–81	232,505	3,869	9,718	16,107	6,923	66,404
Manufacturing industries, 31–33	164,386	3,159	7,315	12,539	6,197	56,156
Petroleum and coal products, 324	D	25	1	762	227	D
Chemicals, 325	55,042	1,271	235	595	646	44,743
Pesticide/fertilizer/other agricultural chemicals, 3253	941	849	1	12	24	13
Pharmaceuticals and medicines, 3254	45,169	193	115	18	48	44,369
Soap/cleaning compound/toilet preparations, 3256	2,099	9	4	26	232	192
Other 325	6,833	220	115	539	342	169
Fabricated metal products, 332	2,362	42	296	264	131	123
Machinery, 333	9,846	908	120	1,121	1,762	193
Agricultural implements, 33311	1,181	778	D	D	39	*
Engine/turbine/power transmission equipment, 3336	1,280	10	9	164	388	28
Other 333	7,385	120	D	D	1,335	165
Computer and electronic products, 334	52,912	404	3,425	4,337	1,057	4,383
Communications equipment, 3342	11,484	3	722	152	118	100
Semiconductor and other electronic components, 3344	21,588	28	888	2,996	194	477
Navigational/measuring/electromedical/control instruments, 3345	10,463	371	1,271	872	557	3,628
Electromedical apparatus, 334510, 334517	4,896	198	85	210	339	3,139
Search/detection/navigation/guidance instruments, 334511	2,803	6	1,043	247	80	38
Other 3345	2,764	166	144	414	138	450
Computer equipment/other electronic products, 3341, 3343, 3346	9,377	3	544	317	188	178
Electrical equipment/appliances/components, 335	2,947	66	249	963	342	150
Automobiles/bodies/trailers/parts, 3361–63	12,234	15	118	3,024	1,076	6
Aerospace products and parts, 3364	10,371	6	2,509	931	432	888
Medical equipment and supplies, 3391	5,179	8	44	12	8	4,953
Manufacturing nec, other 31–33	D	414	318	530	516	D
Nonmanufacturing industries, 21–23, 42–81	68,118	710	2,403	3,568	726	10,249
Mining/extraction/support activities, 21	1,478	2	1	1,187	42	*
Software publishers, 5112	27,665	86	640	566	54	1,871
Internet service providers/Web search/data processing services, 518	6,493	9	10	235	4	47
Professional/scientific/technical services, 54	20,539	393	1,625	1,334	506	6,963
Architectural/engineering/related services, 5413	1,378	3	433	401	129	66
Computer systems design and related services, 5415	8,569	167	499	456	179	1,065
Scientific research and development services, 5417	8,708	170	462	399	168	5,623
Other 54	1,884	54	231	78	29	209
Health care services, 621–23	1,032	0	6	0	*	1,015
Nonmanufacturing nec, other 21–23, 42–81	10,911	220	121	246	120	353

D = data withheld to avoid disclosing operations of individual companies; * = amount < \$500,000.

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

NOTES: The application area totals are not additive, mutually exclusive, or exhaustive. The same R&D could be reported in multiple application areas, and some R&D is not included in any of the five application areas listed in the table. Detail within application areas 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.

SOURCE: National Science Foundation/National Center for Science and Engineering Statistics, Business R&D and Innovation Survey, 2008.

environmental protection applications. Computer and electronic products devoted 2% of its R&D to environmental protection applications. Of the remaining industries, the soap/cleaning compound/toilet preparation industry and the electrical equipment/appliances/components industry each had environmental protection applications account for more than 10% of their total U.S. R&D performance.

Agricultural Applications

Companies performed \$3.9 billion of R&D with agricultural applications in 2008. The chemicals industry and the agricultural implements industry accounted for about one-half of this agricultural application R&D.

Data Sources and Limitations

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.

For 2008 a total of 39,553 companies were sampled, representing 1,926,012 companies in the population. Because the statistics from the survey are based on a sample, they are subject to both sampling and nonsampling errors.

The BRDIS questionnaire asked companies to report the percentage of

their R&D that supported five specific application areas (health and medical, defense, energy, environmental protection, and agriculture). If a company's R&D supported multiple applications, it could be reported in more than one application area; that is, the application areas are not mutually exclusive. Further, companies could have R&D that supported application areas other than those asked on the survey; that is, the application areas are not exhaustive.

For an overview of worldwide R&D data collected by BRDIS see the following InfoBrief from the National Center for Science and Engineering Statistics: *Business R&D Performed in the United States Cost \$291 Billion in 2008 and \$282 Billion in 2009* (NSF 12-309) at <http://www.nsf.gov/statistics/infbrief/nsf12309/>. Detailed tables for the 2008 and 2009 BRDIS are forthcoming and will be available at <http://www.nsf.gov/statistics/industry/>. Individual tables may be available in advance of publication of the full report.

Notes

1. Brandon Shackelford is principal consultant at Twin Ravens Consulting, Austin, TX. For further information, contact Raymond M. Wolfe, Research and Development Statistics Program, National Center for Science and Engineering Statistics, National Science

Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230 (rwolfe@nsf.gov; 703-292-7789).

2. Business classifications used in this InfoBrief are based on the North American Industry Classification System (NAICS). NAICS uses a hierarchical structure to differentiate between broader and finer categories of classification. "Industry" as used in this InfoBrief refers to the aggregation of NAICS codes presented in the statistical tables and may refer to different levels of the NAICS hierarchy. For more information on NAICS structure see http://www.census.gov/econ/census07/www/business_classification/naics_structure.html.

3. BRDIS coverage of R&D by application area is not exhaustive.

4. Most (73%) of the defense R&D paid for by others was performed by companies classified in the aerospace products and parts manufacturing industry (NAICS 3364).

5. The federal government indirectly supports business R&D in areas of strategic interest by allowing companies to recoup some of their costs through indirect charges on government contracts. These R&D costs are called independent research and development, or IR&D.

RETURN THIS COVER SHEET TO ROOM P35 IF YOU
DO NOT WISH TO RECEIVE THIS MATERIAL OR
IF CHANGE OF ADDRESS IS NEEDED INDICATE
CHANGE INCLUDING ZIP CODE ON THE LABEL (DO
NOT REMOVE LABEL).

National Science Foundation
ARLINGTON, VA 22230
OFFICIAL BUSINESS

NSF 12-329