

**Table 60. Worldwide R&D paid for by the company and performed by the company and others, by business activity: 2008–23**

(Millions of U.S. dollars)

| Business activity <sup>a</sup>  | Business code <sup>b</sup> | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    | 2016      | 2017    | 2018       | 2019       | 2020       | 2021    | 2022    | 2023    |
|---|----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|---------|------------|------------|------------|---------|---------|---------|
| 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 | 801,111 | 831,670 |
| 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     | 991     |
| Mining  | 21200                      | NA      | D       | 75      | 128     | 92      | 114     | 56      | 71      | 63        | 170     | 114        | 0 - 25,025 | 114        | 102     | i 158   | i 165   |
| 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     | 881     | i 587   |
| Utilities   | 22100                      | NA      | 1,607   | 903     | 639     | 686     | 615     | 549     | 726     | 515       | 501     | 0 - 23,467 | 415        | 424        | 740     | D       | 1,161   |
| Construction  | 23000                      | NA      | 198     | 918     | 269     | 393     | i 307   | 297     | 700     | 276       | 501     | 691        | 880        | 1,069      | 746     | 750     | 859     |
| 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   | 7,650   | 7,359   |
| Beverage manufacturing  | 31210                      | 605     | 564     | 926     | 668     | 641     | 772     | 753     | 728     | 787       | i 851   | 762        | 723        | 817        | 942     | 894     | 1,217   |
| Tobacco manufacturing   | 31220                      | D       | 792     | 800     | 717     | 662     | 668     | 672     | 681     | 731       | 853     | 722        | 807        | 821        | 999     | 988     | 1,246   |
| Textile, apparel, and leather products manufacturing  | 31990                      | NA      | 673     | 658     | 712     | 759     | 787     | 780     | 847     | 1,333     | 1,093   | 1,155      | 965        | 918        | 661     | 700     | 815     |
| Wood products manufacturing   | 32100                      | 264     | 304     | 239     | 208     | D       | 244     | 336     | i 251   | 0 - 7,094 | 263     | 297        | 0 - 25,025 | 271        | 506     | 342     | 331     |
| 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   | 1,721   |
| Printing and related support activities   | 32300                      | 297     | 241     | 244     | 265     | 356     | i 391   | 390     | 321     | 340       | 286     | 359        | 468        | 395        | 360     | 403     | 615     |
| Petroleum refineries  | 32401                      | NA      | NA      | 708     | 591     | 807     | 558     | 617     | 526     | 625       | 567     | 640        | 0 - 25,025 | 0 - 26,968 | 537     | 558     | 631     |
| Asphalt paving, roofing, and saturated materials manufacturing                                      | 32402                      | NA      | NA      | 35      | 39      | 45      | 123     | 78      | 75      | 93        | 137     | 134        | 134        | 225        | 174     | D       | 145     |
| 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     | 262     |
| 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   | 4,034   | 4,150   |

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|---|----------------------------|--------|--------|---------|--------|---------|---------|---------|--------|---------|---------|---------|--------|--------|--------|--------|--------|
| 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  | 1,746  |
| 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  | 1,783  |
| Pharmaceutical, medicinal, botanical, and biological products (except diagnostic substances) manufacturing <sup>c</sup> | 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 | 88,349 | 90,911 |
| In vitro diagnostic substances manufacturing <sup>c</sup>   | 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  | 2,979  |
| 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 | 69,411 | 77,824 |
| 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  | 3,321  |
| 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  | 1,779  | 1,682  |
| 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  | 4,109  | 3,468  |
| 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  | 1,583  | 1,483  |

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|---|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|-------|------------|------------|-------|-------|-------|-------|
| Cement, concrete, lime, gypsum, and other nonmetallic mineral products manufacturing            | 32790                      | 738   | 555   | 522   | 590   | 621   | 618   | 800   | 601   | 652       | 443   | 446        | 543        | 432   | 434   | 455   | 338   |
| Primary metal manufacturing   | 33100                      | NA    | 840   | 933   | 783   | 882   | 792   | 853   | 719   | 0 - 7,094 | 714   | 808        | 849        | 987   | 1,107 | 1,270 | 871   |
| 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 | 3,649 |
| 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 | 3,149 |
| Construction machinery manufacturing  | 33312                      | 581   | 653   | 682   | 875   | 816   | 1,693 | 1,729 | 1,556 | 1,462     | 1,588 | 1,880      | 1,871      | 1,525 | 1,895 | 1,910 | 2,257 |
| Mining, oil, and gas field machinery and equipment manufacturing                                | 33319                      | NA    | 1,629 | 1,765 | 2,204 | 2,589 | 1,942 | 1,462 | 2,115 | 1,528     | 1,586 | 1,739      | 1,300      | 1,308 | 1,475 | 1,549 | 1,409 |
| Semiconductor machinery manufacturing   | 33321                      | 2,553 | 1,978 | 2,279 | 2,574 | 1,266 | 3,500 | 3,363 | 3,459 | 3,688     | 3,996 | 4,465      | 4,687      | 5,082 | 6,409 | 7,051 | 7,258 |
| 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 | 1,518 | 1,913 |
| Photographic and photocopying equipment manufacturing   | 33331                      | NA    | 852   | 270   | 757   | 25    | 108   | 25    | 114   | 59        | 52    | 67         | 0 - 25,025 | 171   | 77    | D     | 94    |
| 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 | 2,966 | 3,120 |
| Digital cameras manufacturing   | 33333                      | NA    | NA    | NA    | NA    | NA    | NA    | 33    | 587   | 519       | 571   | 274        | 458        | 364   | 303   | 238   | 264   |

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|--|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|------------|--------|--------|--------|--------|
| 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  | 3,038  | 4,179  |
| 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  | 3,479  | 2,919  |
| Computers and peripheral equipment manufacturing and magnetic and optical media <sup>d</sup>                 | 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 | 37,343 | 39,281 |
| 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 | 11,410 |
| Radio, television, and wireless communication equipment manufacturing  | 33422                      | 5,958  | 5,181  | 5,719  | 4,383  | 4,773  | 5,967  | 5,848  | 3,542  | 2,839  | 2,482  | 0 - 23,467 | 2,475      | 2,329  | 3,916  | 4,414  | 4,083  |
| 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  | 1,660  | 1,977  | 0 - 23,467 | 2,192      | 2,497  | 837    | 811    | 958    |
| 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  | 2,119  | 2,335  |
| 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 | 72,770 | 67,153 |

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|--|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|--------|--------|------------|--------|--------|-------|--------|
| 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 | 5,662  |
| 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  | 3,924 | 3,410  |
| 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  | 6,362 | 6,545  |
| 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  | 7,836 | 7,828  |
| 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 | D     | 32,283 |
| Motor vehicle body and trailer manufacturing   | 33620                      | 70     | 96     | 190    | 73     | 98     | 107    | 104    | 160    | 118       | 47     | 99     | 0 - 25,025 | 117    | 189    | 218   | 340    |
| 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  | 9,300 | 8,318  |
| Aircraft manufacturing   | 33641                      | 4,053  | 7,390  | 4,430  | 4,512  | 4,716  | 4,373  | 4,221  | 4,859  | 5,639     | 4,671  | 6,467  | 5,404      | 4,993  | 5,342  | 5,474 | 6,507  |
| Aircraft engine and engine parts manufacturing   | 33642                      | 2,433  | 1,765  | 1,978  | 2,136  | D      | 1,787  | 2,068  | D      | 0 - 7,094 | 1,455  | 1,759  | 1,474      | 1,310  | 3,223  | 2,751 | 2,829  |
| 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 | 2,443  |
| 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 | 4,315  |

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|--|----------------------------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------------|--------------|--------------|------------|---------|--------|---------|
| Railroad rolling stock manufacturing   | 33651                      | 195    | 83     | 177    | 165    | 237     | 224    | 363    | 310    | 224    | 251          | 213          | 0 - 25,025   | 299        | 246     | 330    | 307     |
| Ship and boat building   | 33660                      | 151    | 616 i  | 608 i  | 154    | 143 i   | 192    | 489    | 251    | 618    | 157          | 144          | 0 - 25,025   | 154        | 161     | 281    | 362     |
| Motorcycle, bicycle, and parts manufacturing   | 33691                      | 199    | 194    | 186    | 234    | 197     | 231    | 283    | 320    | 335    | 355          | 429          | 437          | 489        | 547     | 506    | 456     |
| Military armored vehicle, tank, and tank components manufacturing                              | 33692                      | 107    | 228    | 182    | 118    | 135     | 90     | 159    | 202    | 130    | 367 i        | 0 - 23,467 i | 381          | 275        | 437 i   | 428 i  | 303 i   |
| All other transportation equipment manufacturing   | 33699                      | 176    | 135    | 232    | 367    | 437     | 425    | 361    | 430    | 478    | 505          | 521          | 496          | 546        | 538     | 432    | 701     |
| Furniture and related products manufacturing   | 33700                      | 511    | 495    | 402    | 344    | 431     | 433    | 455    | 509    | 411    | 479          | 467          | 517          | 522        | 521     | 475    | 529     |
| 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  | 24,037 | 25,994  |
| 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  | 3,369   |
| 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 | 1,164  | 1,737 i |
| Merchant wholesalers, nondurable goods   | 42400                      | 257    | 365 i  | 348    | 605    | 699 i   | 327    | 209    | 484    | 219    | 273          | 322          | 0 - 25,025   | 529        | 734 i   | 736    | 806     |
| 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      | 169 r  | 255     |
| 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   | 431    | 902     |

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|---|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|------------|------------|------------|--------|--------|--------|
| Electronic shopping and electronic auctions                             | 45411                      | NA     | NA     | 753    | D      | 1,749  | 1,284  | D      | D      | 8,200  | 0 - 12,866 | 0 - 23,467 | 0 - 25,025 | 0 - 26,968 | 15,678 | 15,976 | 8,216  |
| Transportation  | 48000                      | NA     | 319    | 211    | 111    | 199    | 377    | 412    | 229    | 123    | 722        | 2,080      | 9,072      | 0 - 26,968 | 5,995  | 6,883  | 8,202  |
| Couriers, messengers, and express delivery services                     | 49200                      | D      | 14     | 6      | D      | D      | 90     | 348    | D      | 394    | 425        | 451        | 290        | 949        | 1,172  | D      | 3,963  |
| Warehousing and storage   | 49300                      | 26     | 17     | 19     | 16     | 17     | 4      | 3      | D      | 0      | 82         | 79         | 162        | 35         | 24     | D      | 50     |
| Newspaper, periodical, book, and directory publishers (except Internet) | 51110                      | 180    | 748    | 853    | 408    | 257    | 339    | 103    | 117    | 87     | 99         | 175        | 88         | 74         | 105    | D      | 14     |
| Software publishers (except Internet) <sup>e</sup>                      | 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 | 46,260 | 49,251 |
| Motion picture and sound recording (except Internet)                    | 51200                      | 104    | 135    | 93     | 67     | 67     | 38     | 83     | 12     | 20     | 42         | 155        | 0 - 25,025 | 86         | 36     | 102    | 134    |
| Broadcasting (except Internet)  | 51500                      | NA     | 89     | 100    | 115    | 165    | 179    | 206    | 306    | 347    | 460        | 424        | 500        | 0 - 26,968 | D      | 452    | 465    |
| Wired telecommunications carriers                                       | 51710                      | 673    | D      | 1,499  | 1,685  | 1,631  | 1,012  | 1,166  | 1,269  | 1,180  | 1,027      | 476        | 428        | 504        | 598    | 622    | 468    |
| Wireless telecommunications carriers (except satellite)                 | 51720                      | 532    | 186    | 724    | 815    | 860    | 1,732  | 2,500  | 1,192  | 1,458  | 1,969      | 2,439      | 2,641      | 2,414      | 2,974  | 3,065  | 2,908  |
| Satellite telecommunications  | 51740                      | 153    | 108    | 229    | 114    | 163    | 176    | 134    | 705    | 746    | 625        | 476        | 486        | 0 - 26,968 | 529    | 640    | 700    |
| Other telecommunications (not listed elsewhere)                         | 51790                      | 501    | 351    | 338    | 462    | 399    | 377    | 330    | 536    | 362    | 381        | 745        | 0 - 25,025 | 501        | 378    | 340    | 583    |
| Data processing, hosting, and related services <sup>e</sup>             | 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 | 13,616 | 14,287 |

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|---|----------------------------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|------------|------------|------------|--------|--------|---------|
| 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 | 64,378 | 64,671  |
| Other information services, including Internet publishing, broadcasting, and Web search portals <sup>e</sup>        | 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 | 95,073 | 109,947 |
| 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 | 12,144 | 19,982  |
| 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  | D      | 6,043   |
| 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  | 2,530  | 3,143   |
| Real estate   | 53100                      | 20    | 32    | 3     | 13    | 27     | 105    | 199    | 288    | 440    | 253    | 380        | 0 - 25,025 | 372        | 680    | 793    | 342     |
| Rental and leasing services   | 53200                      | NA    | 129   | 146   | 51    | 59     | 94     | 80     | 80     | 106    | 571    | 699        | 1,067      | 2,925      | 1,525  | 1,739  | 2,054   |
| Lessors of nonfinancial intangible assets, including patent licensing   | 53300                      | 80    | 259   | 268   | 369   | 437    | 100    | 97     | 104    | 45     | 97     | 24         | 71         | 75         | 95     | D      | 108     |
| Legal, accounting, tax preparation, bookkeeping, and payroll services   | 54111                      | NA    | D     | 505   | 705   | 535    | 696    | 1,128  | 1,587  | 1,052  | 1,130  | 1,426      | 2,040      | 2,611      | 2,960  | 3,821  | 4,097   |
| 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  | 3,865  | 3,405   |
| Specialized design services   | 54140                      | 75    | 76    | 65    | 283   | 157    | 81     | 42     | 13     | 26     | 133    | 0 - 23,467 | 0 - 25,025 | 0 - 26,968 | 97     | D      | 50      |

**Table 60. Worldwide R&D paid for by the company and performed by the company and others, by business activity: 2008–23**

(Millions of U.S. dollars)

| Business activity <sup>a</sup>   | Business code <sup>b</sup> | 2008   | 2009   | 2010   | 2011   | 2012   | 2013     | 2014   | 2015   | 2016      | 2017       | 2018       | 2019       | 2020         | 2021    | 2022    | 2023    |
|--|----------------------------|--------|--------|--------|--------|--------|----------|--------|--------|-----------|------------|------------|------------|--------------|---------|---------|---------|
| Computer systems design and related services <sup>e</sup>  | 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  | 21,958  | 24,415  |
| 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   | 3,467   | 3,756   |
| 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      | 28      | 14      |
| Research and development services in biotechnology <sup>c,f</sup>  | 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   | 3,466   | 2,614   |
| 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   | 5,023   | 4,410   |
| Research and development services in nanotechnology  | 54175                      | NA     | NA     | NA     | NA     | NA     | NA       | NA     | NA     | NA        | NA         | NA         | NA         | 122          | i 173   | 224     | 313     |
| Advertising and related services   | 54180                      | 37     | 1,950  | 422    | 97     | 375    | i 390    | 424    | 452    | 373       | 412        | 1,160      | i 1,262    | i 0 - 26,968 | i 2,493 | i 2,395 | i 1,454 |
| 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   | 2,034   | 2,048   |
| 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       | 54      |
| Administrative and support services  | 56100                      | NA     | 419    | 640    | 348    | 609    | 589      | 459    | 375    | 588       | 1,558      | 2,668      | 3,575      | 3,806        | 3,369   | 4,422   | 4,905   |
| 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 5     | 31      |

**Table 60. Worldwide R&D paid for by the company and performed by the company and others, by business activity: 2008–23**

(Millions of U.S. dollars)

| Business activity <sup>a</sup>  | Business code <sup>b</sup> | 2008   | 2009   | 2010    | 2011 | 2012  | 2013  | 2014  | 2015 | 2016        | 2017       | 2018       | 2019       | 2020       | 2021  | 2022    | 2023  |
|---|----------------------------|--------|--------|---------|------|-------|-------|-------|------|-------------|------------|------------|------------|------------|-------|---------|-------|
| Offices of physicians   | 62110                      | 40     | 37     | 371     | 36   | 42 i  | 43    | 39    | 28   | 70          | 102 i      | 113        | 196        | 195        | 143   | D       | 214   |
| 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 | 3,520   | 2,179 |
| 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     | 668   |
| 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       | 7     |
| Social assistance services  | 62400                      | NA     | D      | 15      | 13   | 36    | 47    | 17    | 2    | 2           | 6          | 13         | 0 - 25,025 | 0 - 26,968 | D     | 7       | 4     |
| Arts, entertainment, and recreation   | 71000                      | NA     | 161    | 137     | 85   | 70    | 29    | 103 i | 50   | 45          | 42         | 45         | 479        | 0 - 26,968 | 90    | D       | 280   |
| 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       | 264   |
| 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     | 8,734 i | 662   |
| Undistributed <sup>g</sup>  | –                          | 10,660 | 14,175 | 5,373 i | D    | 491   | 359 i | 69    | 0    | 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.

<sup>a</sup> Business activity 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.

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

<sup>c</sup> 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).

<sup>d</sup> 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.

<sup>e</sup> 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.

<sup>f</sup> 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.

<sup>g</sup> Undistributed 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 2023 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.