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REVISED INDUSTRY CLASSIFICATION BETTER REFLECTS STRUCTURE OF BUSINESS R&D IN THE UNITED STATES

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The National Science Foundation's (NSF) Division of Science Resources Statistics (SRS) annually reports data on research and development (R&D) performed by for-profit businesses in the United States. The method used to classify these data by industry has been revised beginning with reference year 2004. This *InfoBrief* describes the effect of this revision on the distribution by industry of business R&D in the United States—the major impact being a 40% increase in the amount of R&D classified in the manufacturing sector.[1] It also provides guidance to users of these data on interpreting R&D by industry. More information on the revised methodology and underlying research will be discussed in a forthcoming working paper.

Background

NSF's R&D estimates by industry are produced from the Survey of Industrial Research and Development (SIRD). In the SIRD all of the R&D reported by a company is assigned to a single industry out of hundreds defined by the North American Industrial Classification System (NAICS). The method used to assign companies to industries has changed relatively little over the past two decades.[2] However, over this same period the industrial patterns of R&D performance reported by NSF have changed dramatically. The most notable change has been the relative growth of R&D in nonmanufacturing industries. Before 1983, nonmanufacturing industries accounted for less than 5% of total industrial R&D performance, but in 2003 they accounted for 40% (figure 1). This growth can be largely attributed to three sectors, which together accounted for over 90% of nonmanufacturing R&D in 2003: wholesale trade (NAICS 42); information (NAICS 51); and professional, scientific, and technical services (NAICS 54).

The growing share of R&D in nonmanufacturing industries corresponded with the transition of the U.S. economy from manufacturing to services. However, the growth in R&D attributed to the wholesale trade industries (accounting for $25 billion of R&D in 2003) appeared unusual because these industries were not commonly thought to perform large amounts of R&D. A review of the data underlying the R&D estimates confirmed that almost all of the R&D classified in the wholesale trade industry was an artifact of the automated industry classification methodology.[3]

Further research revealed several scenarios that resulted in companies being classified into nonmanufacturing industries such as wholesale trade; management of

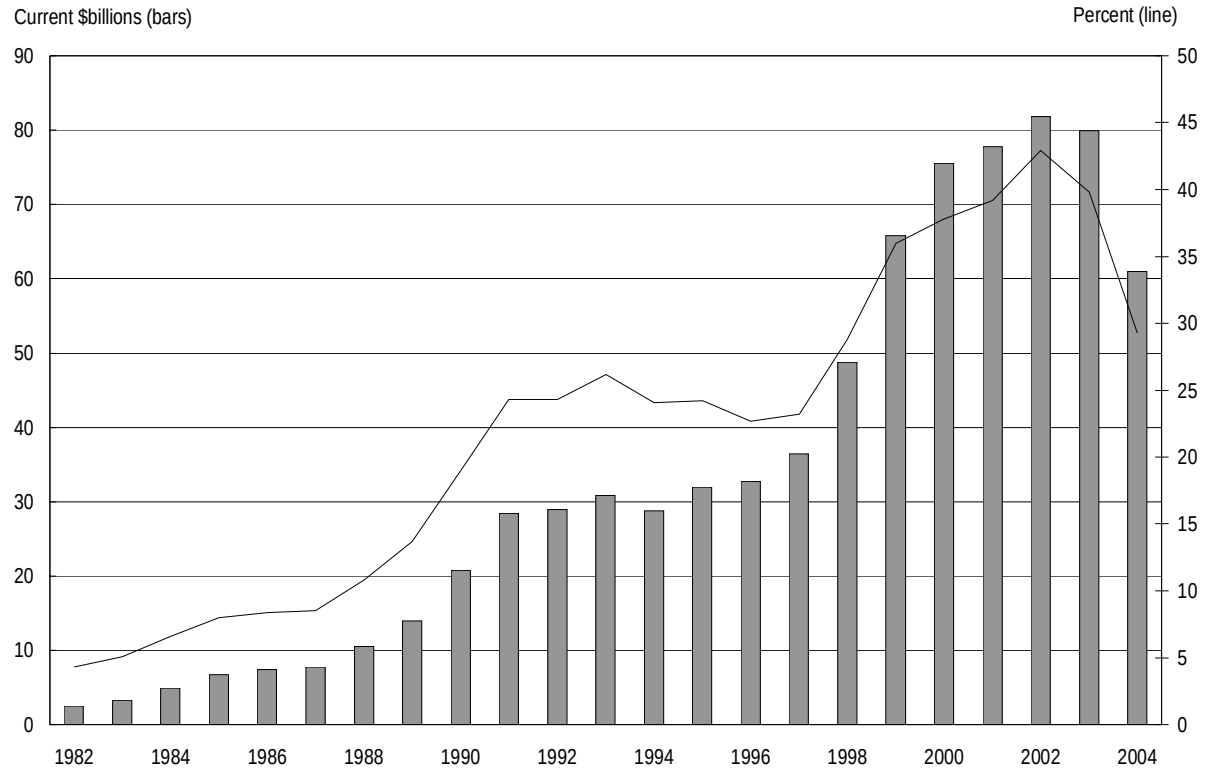
[1] The manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. For the Survey of Industrial Research and Development (SIRD) nonmanufacturing includes all other nonfarm industries. Using this definition, nonmanufacturing is not synonymous with the service sector. For example, mining and construction are included in the nonmanufacturing sector for the SIRD.

[2] The method used to classify companies in 2003 and earlier years is described in the technical notes of the annual reports in the Research and Development in Industry series (http://www.nsf.gov/statistics/industry/).

[3] This data anomaly was discussed in two earlier SRS publications: *National Patterns of Research and Development Resources: 2003*, NSF 05-308, Brandon Shackelford (Arlington, VA 2005) (http://www.nsf.gov/statistics/natlpatterns/) and *Increase in U.S. Industrial R&D Expenditures Reported for 2003 Makes Up For Earlier Decline*, NSF 06-305, Raymond Wolfe (Arlington, VA 2005) (http://www.nsf.gov/statistics/industry/).

Information and data from the Division of Science Resources Statistics are available on the web at http://www.nsf.gov/statistics/. To request a printed copy of this report go to http://www.nsf.gov/publications/orderpub.jsp or call (703) 292-PUBS (7827). For NSF's Telephonic Device for the Deaf, dial toll-free (800) 281-8749 or (703) 292-5090.

FIGURE 1. Industrial R&D performed by companies classified in nonmanufacturing industries: 1982–2004



NOTES: Data for 1998 and earlier years were classified using the Standard Industrial Classification (SIC) system. Data for 1999 and later years were classified using the North American Industrial Classification System (NAICS). Data for 2004 reflect results of revised industry classification methodology.

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

companies and enterprises (NAICS 55); and professional, scientific, and technical services:

- *Companies with global operations.* The SIRD relies on information from the U.S. Census Bureau to classify a company into an industry. This information covers only the U.S. operations of a company. Therefore, a company that performs its primary business activity overseas is unlikely to be classified according to that primary business activity. This company would be classified according to its primary activity in the United States—often wholesale trade for manufacturing companies.

- *Companies that outsource operations.* When classifying companies, the SIRD has no information on business activities a company may outsource, only on the activities performed in a company's own establishments. Therefore a company that relies entirely on contractors or business partners to manufacture its products would not be classified in a manufacturing industry. This company would more likely be classified in wholesale trade; management of companies and enterprises; or professional, scientific, and technical services.

- *Early-stage companies.* Companies are classified according to their primary activity. For startup companies or companies in the process of developing their first products, this activity is often research and development. Therefore these companies would be classified in the same industry (NAICS 54) as companies whose business it is to provide R&D services to their customers. Currently, the Census Bureau has no information on the industries in which the early stage companies' R&D efforts are directed.

The methodology for classifying companies has been modified by SRS and the Census Bureau to reduce the impact of these and other related scenarios on the

industry-level R&D estimates published by SRS. The changes to the methodology include the exclusion of business establishments within a company known to be sales offices of manufacturers from the automated algorithm used to determine a company's industry. In addition, R&D-performing companies classified by the automated algorithm into NAICS 55 (management of companies and enterprises), NAICS 42 (wholesale trade), or NAICS 5417 (scientific R&D services) receive additional analyst review and may be reclassified based on information available from public sources such as financial reports of public corporations and company websites. This method will also be used to produce industry-level R&D estimates for 2005, but SRS and the Census Bureau continue to investigate ways of improving the quality of these industry-level R&D estimates. These investigations may result in further refinements to the methodology in future years.

Impact of Revised Industry Classification

The revised industry classification methodology implemented for 2004 resulted in a net increase in R&D reported in manufacturing industries of $37.8 billion compared to the previous methodology. Less then 1% of this revision was the result of reclassification of federally funded industry R&D—the revision resulted in a net increase of federally funded industry R&D classified in manufacturing industries of $56 million. Because the distribution of federally funded industry R&D was largely unaffected by the reclassification, the subsequent discussion will focus on the portion of industrial R&D financed through company and other funds (excluding federal funding).[4]

Within manufacturing, the new industry classification methodology resulted in a net increase of more than $1 billion in the 2004 estimates for five industries (table 1). The largest adjustment occurred in the estimate for pharmaceuticals and medicines (NAICS 3254), which nearly doubled from $15.9 billion as estimated using the original methodology to $31.4 billion using the revised methodology. The estimate resulting from the revised methodology is more in line with private estimates such as those published by the Pharmaceutical Research and Manufacturers of America (PhRMA). The remaining four manufacturing industries with net increases over $1 billion were all computer and electronic products manufacturing industries: computers and peripheral equipment (NAICS 3341); communications equipment (NAICS 3342); semiconductor and other electronic components (NAICS 3344); and navigational, measuring, electromedical, and control instruments (NAICS 3345). The R&D of these four industries combined increased by $18.1 billion due to the new methodology. Within the manufacturing industries, the R&D of no industry decreased by more than $1 billion as a result of the new industry classification methodology.

On the whole, the net increase in manufacturing R&D for 2004 as a result of the revised methodology was balanced by a net decrease in nonmanufacturing R&D. Among the nonmanufacturing industries, five were revised by more than $1 billion each as a result of the new classification methodology. Not all nonmanufacturing industries declined as a result of the reclassification, and as shown in table 1 both the software industry (NAICS 5112) and the computer systems design and related services industry (NAICS 5415) increased by over $1 billion. Decreases resulting from the revised methodology were concentrated in three industries: wholesale trade, management of companies and enterprises, and scientific R&D services (NAICS 5417). Together, these three industries decreased by $44.9 billion as a result of the new methodology. Each of these industries had been susceptible to misclassifications in the prior methodology when companies fell into any of the scenarios described in the previous section.

Guidance for Data Users

The changes implemented in the SIRD industry classification methodology for 2004 attempt to mitigate the impact of using either incomplete or imprecise information about a company's operations when classifying a company. However, data users should be aware that conceptual errors can also occur when the categories used in the survey do not match the categories a data user wishes to employ. If inappropriate categories are used or survey information is misclassified by a data user, the resulting conclusions will be inaccurate. Therefore, it is important to understand that the SIRD attempts to classify a company's R&D according to the primary activity of the company—not the industry primarily served by the company's products. For example, a company that designs and produces computers and navigational instruments for use in airplanes would be

[4] Tables describing the impact of the revised industry classification methodology will be available in the forthcoming *R&D in Industry: 2004* Detailed Statistical Tables.

TABLE 1. Revision in industry estimates for industrial R&D funded by company and other sources for companies that performed industrial R&D in the United States, by selected industry and sector: 2004
(Millions of dollars)

Sector and industry	NAICS codes	Original methodology	Revised methodology	Difference
Manufacturing industries	31–33	94,110	131,887	37,777
Pharmaceuticals and medicines	3254	15,906	31,444	15,538
Computers and peripheral equipment	3341	2,517	5,707	3,190
Communications equipment	3342	3,356	8,433	5,077
Semiconductor and other electronic components	3344	8,821	17,524	8,703
Navigational, measuring, electromedical, and control instruments	3345	6,747	7,882	1,135
Nonmanufacturing industries	21–23, 42, 44–81	93,925	56,148	-37,777
Wholesale Trade	42	38,576	1,540	-37,036
Software	5112	15,074	16,510	1,436
Computer systems design and related services	5415	6,074	11,197	5,123
Scientific R&D services	5417	13,258	9,383	-3,875
Management of companies and enterprises	55	4,076	41	-4,035

NOTES: Only industries or sectors with R&D estimates that were revised by more than $1 billion are shown. Detail does not sum to totals.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2004.

classified in one of the computer and electronic products manufacturing industries (NAICS 334) and not in the aerospace products and parts industry (NAICS 3364). Data users should be mindful of similar relationships between industries when interpreting R&D data reported by industry. In addition, when analyzing data from the SIRD alongside data from other surveys, data users should note whether the industry classification methods of the other surveys produce results comparable to the SIRD's. Data users are encouraged to contact SRS if they have specific questions regarding industry classification of R&D data.

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