National Center for Science and Engineering Statistics

Survey

Business Enterprise Research and Development (BERD) Survey | 2021

The BERD Survey is the primary source of information on research and development (R&D) expenditures and R&D employees of for-profit, publicly or privately held, nonfarm businesses with 10 or more employees in the United States that performed or funded R&D domestically or abroad.

Survey Description

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Survey Overview (2021 Survey Cycle)

Purpose

The Business Enterprise Research and Development (BERD) Survey and its immediate predecessors, the Business R&D and Innovation Survey (BRDIS) and the Business Research and Development Survey (BRDS), are collectively referred to as the BERD Survey in this overview. The BERD Survey is the primary source of information on research and development (R&D) expenditures and R&D employees of for-profit, publicly or privately held, nonfarm businesses with 10 or more employees in the United States that performed or funded R&D either domestically or abroad.

Data collection authority

The National Science Foundation Act of 1950, as amended, and the America COMPETES Reauthorization Act of 2010, collected under Office of Management and Budget control number 0607-0912.

Major changes to recent survey cycle

To minimize reporting burden especially for smaller companies, survey items are rotated on and off the survey on an odd- and even-numbered year schedule. Statistics on patents, intellectual property, and technology transfer activities were rotated off the survey for 2021. Items rotated on the survey for 2021 include questions on R&D performed by others by type of performer, federal R&D by government agency, and R&D by application area.

Key Survey Information

Frequency	Annual.
Initial survey year	BERD Survey data collection began for 2019. BRDS collected data for 2017–18, BRDIS collected data for 2008–16, and the Survey of Industrial R&D (SIRD) collected data for 1953–2007.
Reference period	Calendar year 2021.
Response unit	Companies with known positive R&D activity (approximately 21,000) and with unknown R&D activity (approximately 26,500).
Sample or census	Sample survey representing for-profit, publicly or privately held companies with 10 or more employees in the United States that performed or funded R&D either domestically or abroad in the manufacturing, mining, utilities, wholesale trade, transportation, information, or services industries.
Population size	A total of 1,137,000 companies.
Sample size	A total of 47,500 companies prior to data collection. The actual number of companies that remained within the scope of the survey between sample selection and tabulation was 44,000.
Key variables	Key variables of interest are listed below. • Business activity codes based on the North American Industry Classification System (NAICS) • Geographic location of domestic and foreign R&D performance of U.S.-based companies

- Industry coding based on NAICS
- R&D capital expenditures
- R&D performance (domestic and foreign R&D for U.S.-based companies)
- Sales
- Sources of R&D funding
- Technology focus areas
- Total and R&D employment
- Type of R&D cost (e.g., salaries and fringe benefits)
- Type of R&D work (basic research, applied research, and development)
- Activities with academia (data collected for odd-numbered years)
- Federal R&D by funding government agency (odd years)
- R&D by application area (odd years)
- R&D performed by others by type of performer (odd years)
- Intellectual property (even years)
- Patents (even years)
- Technology transfer activities (even years)

Survey Design

Target population

The target population consists of all for-profit nonfarm companies that are publicly or privately held, have 10 or more paid employees in the United States, and have at least one establishment that is classified in an in-scope sector based on NAICS, is in business during the survey year, and is physically located in the United States.

Sampling frame

The Business Register (BR) serves as the primary input to the sampling frame. The BR is the Census Bureau's comprehensive database of U.S. businesses. BR data are compiled from a combination of business tax returns, data collected from the economic census, and data from other Census Bureau surveys.

Sample design

The BERD Survey has a stratified sample design that uses both simple random sampling and probability proportional to size (PPS) sampling within strata. Stratification is based on R&D activity and a NAICS-based industry code. For companies with known R&D activity, PPS sampling is based on historical R&D performance. For companies with unknown R&D activity, PPS sampling is based on annual payroll. Companies known to perform large amounts of R&D and companies with large amounts of payroll are selected with certainty.

Data Collection and Processing

Data collection

The BERD Survey uses Web reporting via the Census Bureau's Centurion system with embedded electronic worksheets designed to ease respondent burden. Respondents have the option of downloading a PDF version of the questionnaire, but the overwhelming majority report via the online system (≥ 99%) and not by mail (< 1%).

Data processing

All data submitted by respondent companies are reviewed to ensure that data fields are complete and that data are internally consistent. Given the size and complexity of the BERD Survey, many survey responses contain errors that require correction or unusual patterns that require validation. Several hundred automated edit checks are applied to improve the efficiency of analyst data review and correction. Approximately two-thirds of these edit checks are designed to catch arithmetic errors and logically inconsistent responses (balance edits). The remaining edit checks are designed to flag outliers for further analyst review (analytical edits). During editing, if additional information or data corrections are needed, respondents are contacted. If additional information or corrected data cannot be obtained from respondents, data are imputed.

Estimation techniques

The general methodology used to produce estimates from the BERD Survey involves sums of weighted data (reported or imputed), in which the weights are the product of the sampling weight and the nonresponse adjustment factor. However, there are some exceptions, which are described in the technical notes in the annual reports for BRDIS, BRDS, and the BERD Survey (https://www.nsf.gov/statistics/srvyberd/).

Survey Quality Measures

Sampling error

Estimates based on the total sample have small relative standard errors (RSEs). An RSE is the standard error of the survey estimate divided by the survey estimate and then multiplied by 100. For 2021, RSEs for domestic R&D performance paid for by the company, paid for by others, and total were 0.20%, 0.48%, and 0.18%, respectively. Estimates of sampling errors associated with each cell in the detailed statistical tables are available by request.

Coverage error

Coverage error is minimal because the BR, the source for the BERD Survey, is continually updated and contains comprehensive coverage of all domestic businesses.

Nonresponse error

The unit response rate was 69% for 2020. Except for estimates of company counts, unit nonresponse is handled by adjusting weighted reported and imputed data by multiplying each company's sampling weight by a nonresponse adjustment factor. For estimates of company counts, other adjustments for nonresponse are made. Detailed descriptions of the adjustments for nonresponse are available in the annual reports containing detailed statistical tables.

Measurement error

Known sources of measurement error include differences in respondent interpretations of the definitions of R&D activities; differences in accounting procedures, specifically, the characterization and reporting of R&D activities by large defense contractors funded by the U.S. federal government; the reporting of R&D activities by companies classified in the scientific research and development services industry, NAICS 5417; and differences in how companies count and report numbers of

employees in various categories, including whether they work on R&D full time or part time. No quantitative metrics of measurement error are produced, but ongoing efforts to minimize measurement error include questionnaire pretesting, improvement of questionnaire wording and format, inclusion of more cues and examples in the questionnaire instructions, in-person and telephone interviews and consultations with respondents, and post-survey evaluations.

Data Availability and Comparability

Data availability

Statistics from the BERD Survey for 2019–21 are available at https://ncses.nsf.gov/surveys/business-enterprise-research-development/. Statistics produced from BRDS for 2017 and 2018, BRDIS for 2008–16, and SIRD for 1991–2007 are available at https://www.nsf.gov/statistics/industry/. Statistics from SIRD dating to 1953 are available at https://www.nsf.gov/statistics/iris/.

Data comparability

The BERD Survey is a cross-sectional survey designed to produce annual estimates of R&D performance and related statistics, as were its predecessors, BRDS, BRDIS, and SIRD. However, many of the companies that perform large amounts of R&D are included in the survey each year. Thus, there is a longitudinal aspect to the survey. Because of this and the generally low sampling variability of the annual level estimates, estimates of year-to-year changes are generally precise. Estimates for changes covering a longer time span generally will be less precise.

Beginning in survey year 2018, companies that performed or funded less than $50,000 of R&D were excluded from tabulation. In prior years, companies that performed or funded any amount of R&D were tabulated. This change has affected the comparability of these estimates to those published for years prior to 2018. These companies in aggregate represented a very small share of total R&D expenditures in prior years, but they accounted for a larger share of count estimates. Had the companies under this threshold been included in the 2019 estimates, they would have contributed approximately $90 million to overall R&D expenditures and would have added around 7,500 to the estimated number of U.S. companies with R&D expenditures. It is assumed that this group of companies would have contributed similar levels of R&D and number of companies to the 2020 estimates.

In survey year 2017, the employment threshold for inclusion in the target population, described above, was increased from 5 employees to the current threshold of 10 employees for international comparability.

Except for the discontinuance of the collection of business innovation data by BRDIS and the transfer of the production of business innovation statistics to the Annual Business Survey beginning with the 2017 cycles of both, the transition from BRDIS to BRDS to the BERD Survey produced no breaks in the series for the items common to all surveys.

There is no conclusive evidence that the redesign of SIRD to create BRDIS caused breaks in the series for the items common to both surveys because no substantial changes in scope and methodology were introduced. Significant efforts were made to preserve the comparability of the data series and to minimize the effects of (1) changes in the assignment of companies to industry strata, (2) the inclusion of data on worldwide activities, (3) changes in the measurement of employment, and (4) changes because of the use of a modular survey questionnaire. Nonetheless, possibly because of improved reporting instructions, an unanticipated drop in the number of full-time equivalent scientists and engineers was reported between the last cycle of SIRD (2007) and the first cycle of BRDIS (2008).

Data Products

Publications

BERD Survey data are published in NCSES InfoBriefs and reports containing detailed statistical tables in the following series: ***Business Research and Development***, ***Business R&D and Innovation***, and ***Industrial R&D***. Data from the BERD Survey are also used in the National Science Board's congressionally mandated report ***Science and Engineering Indicators*** and in ***National Patterns of R&D Resources***.

Electronic access

Results from SIRD are available at NCSES' Industrial Research and Development Information System historical data website (**https://www.nsf.gov/statistics/iris/**).

The BERD Survey contains confidential data that are protected under Title 13 and Title 26 of the U.S. Code. Restricted microdata can be accessed at the secure Federal Statistical Research Data Centers (FSRDCs) administered by the Census Bureau. FSRDCs are partnerships between federal statistical agencies and leading research institutions. FSRDCs provide secure environments supporting qualified researchers using restricted-access data while protecting respondent confidentiality. Researchers interested in using the microdata can submit a proposal to the Census Bureau, which evaluates proposals based on their benefit to Census, scientific merit, feasibility, and risk of disclosure. To learn more about the FSRDCs and how to apply, please visit **https://www.census.gov/about/adrm/fsrdc.html**.