

Survey of State Government Research and Development: FY 2016

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Technical Notes

Survey Overview (FY 2016)

Purpose. The Survey of State Government Research and Development is the only source for comprehensive, uniform statistics regarding the extent of R&D activity performed and funded by departments and agencies in each of the nation's 50 state governments, the government of the District of Columbia, and the government of Puerto Rico.

Data collection authority. The information is solicited under the National Science Foundation Act of 1950, as amended; the America COMPETES Reauthorization Act of 2010; and Title 13, United States Code, § 8(b). It is collected under Office of Management and Budget control number 0607-0933, expiration date 30 April 2019.

Survey contractor. U.S. Census Bureau, under National Science Foundation interagency agreement number NCSE-1546582, collected, processed, and tabulated the statistics in this report.

Survey sponsor. The National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation.

Key Survey Information

Frequency. Annual.

Initial survey year. FY 2006.

Reference period. State government fiscal years ending in 2016.

Response unit. State government departments, agencies, commissions, public authorities, institutions, and other entities that operate separately or somewhat autonomously from the central state government—but where the state government maintains administrative or fiscal control over their activities—with the capacity to perform or fund R&D; units are collectively referred to as *agencies*.

Sample or census. Census.

Population size. The population comprised 621 agencies from the 50 state governments, the District of Columbia, and Puerto Rico with the capacity to perform or fund R&D during FY 2016.

Sample size. Not applicable.

Survey Design

Target population. State government departments, agencies, commissions, public authorities, institutions, and other entities that operate separately or somewhat autonomously from the central state government but where the state government maintains administrative or fiscal control over their activities, as defined

by the [U.S. Census Bureau Government Finance and Employment Classification Manual](#) (see chapter 1), and which funded or performed R&D for state government fiscal years ending in 2016. Several industry-specific state commissions, which are generally chartered by state legislatures but are administered independently, are considered state agencies and included in the survey's population. State-run colleges and universities, which are canvassed as part of NCSSES's Higher Education R&D (HERD) Survey, are excluded from the survey frame. State-run laboratories or experiment stations controlled by state universities are also excluded from the respondent universe, as are any entities determined to be nonprofit or private, as defined by the U.S. Census Bureau government classification criteria. However, because agricultural experiment stations in Connecticut are legally organized as a state government-dependent agency and are not affiliated with any university system, they are included in the survey's population.

Sample frame. The total universe includes all state government-dependent units, including those for the District of Columbia and Puerto Rico, with the capacity to perform and fund R&D, identified with the aid of a state coordinator who is appointed by the governor of each state.

Sample design. The Survey of State Government R&D is a census. For the FY 2016 survey, state coordinators were provided with a list of agencies that were previously identified from the FYs 2014–15 survey cycle as having the potential to perform or fund R&D. In addition, these lists included agencies identified from a systematic review of state session laws and additional review of agencies reporting to the U.S. Census Bureau's [Census of Governments](#) program by U.S. Census Bureau and NCSSES staff members. Coordinators were asked to review this list and add agencies that they believed were involved with R&D and were not already identified. State coordinators also made adjustments to the agency universe to remove agencies that have never had any qualifying R&D to report to NCSSES, to address organizational changes within their respective states since the previous survey, and to provide updated agency contact information.

Data Collection and Processing Methods

Data collection. On 25 August 2016, a letter was sent to the office of each state governor, as well as to the governor of Puerto Rico and the mayor of the District of Columbia, asking them to appoint a state coordinator who would provide updates to the universe of state government-dependent agencies that had the capacity to perform or fund R&D during FY 2016 (see [appendix](#)). On a flow basis, as governors responded, state coordinators were sent a spreadsheet of agencies and contacts that were surveyed for the FYs 2014–15 Survey of State Government R&D and asked to add agencies that might have some R&D, remove any agencies from the survey universe that no longer perform or fund R&D or have been reorganized, and update agency points of contact. Once the state coordinators completed updates to the list of active agencies to be surveyed, they then initiated introductory e-mails to the agency respondents that they would be receiving an e-mail with their user ID and link to the electronic reporting system. The state coordinators sent the updated Excel file back to the U.S. Census Bureau. On 7 November 2016, when the electronic reporting system was launched, a total of 310 agencies had been identified. State government agency respondents would log in to a secure, Web-based survey instrument and complete the questionnaire. Upon completion by all agencies within a state, the state coordinators were provided with a spreadsheet of agency responses to review, so they could examine the survey results before they were provided to NCSSES for final analysis and dissemination.

Mode. Self-administered online questionnaire for state agency respondents. State coordinators were provided with a spreadsheet of potential state agencies and contact information to review and revise as necessary to add agencies to be surveyed, remove others from the survey as inactive, or make corrections to agency points of contact.

Response rates. Two response rates were calculated for the FY 2016 Survey of State Government R&D: one for official data verification at the state level, and one for agency-level respondents. See Technical Table A-1 for final agency response rates and also counts of agencies that identified themselves as having qualifying R&D expenditures on the FY 2016 survey.

- All 50 state governments and the District of Columbia participated in the survey. Forty-five of 52 (87%) states appointed coordinators. However, only 21 of 52 (40%) state coordinators officially responded to verify the final aggregate data for their states. Some or all agencies submitted data in those states where the coordinator did not verify data officially. The states of Alabama, Illinois, Louisiana, Massachusetts, New Mexico, Pennsylvania, and South Carolina did not appoint a coordinator. Historically, NCSSES has partnered with the Puerto Rico Institute of Statistics to collect information on R&D spending from Puerto Rico agencies. The Institute conducts its own survey of R&D activities in the territory, uses the NCSSES survey questions for its collections by government agencies, and provides the results to NCSSES. The Puerto Rico Institute of Statistics did not conduct a survey of R&D this year; thus we have no data for the 17 agencies in Puerto Rico for FY 2016.
- The final agency response was 589 of 621 agencies (95%). In addition to the 17 agencies in Puerto Rico, the following agencies failed to respond to the survey and, as a result, may contribute to an undercount in their states' public expenditures for R&D activities: California Natural Resources Agency; Georgia Department of Behavioral Health and Developmental Disabilities and the Department of Community Health; Louisiana Department of Education and the River Region Cancer Screening and Early Detection Center; North Carolina Department of Health and Human Services and the Division of Adult Corrections and Juvenile Justice; New Mexico Department of Information Technology, the Department of Cultural Affairs, and the Department of Environment; New York State Office of Children and Families Services; Ohio Department of Agriculture; Pennsylvania Department of Education; and Wyoming Department of Employment, Research, and Planning and the Department of Workforce Services. Of the 589 agencies that responded, 365 (62%) reported having some R&D activity in FY 2016.

Data editing. After all of the agencies in a state have submitted data, a spreadsheet of aggregated agency data is sent to the coordinators. They were asked to perform a final verification of aggregated agency data. Initial agency data submissions were received via the Web-based survey. Basic logical edit checks, review of respondent comments, and comparisons of data from previous surveys allowed U.S. Census Bureau and NCSSES staff to detect data errors and work with respondents to correct them. U.S. Census Bureau and NCSSES staff also conducted follow-up calls to agencies with data changes of plus or minus 50% and at least \$1 million in R&D between FY 2015 and FY 2016 to ensure the accuracy of the survey data.

Imputation. Given the high agency response rate, no statistical methods were used to account for nonresponding agencies. All state and national totals are aggregates of reported agency data. Each state government's organizational structure, laws, and delegation of powers within its purview are unique. There are no formally established methods of imputation for state government agencies that account for these structural differences, this is consistent with basic statistical methods used by the U.S. Census Bureau's Census of Governments, Survey of State Government Finance.

Weighting. Not applicable.

Variance estimation. Not applicable.

Survey Quality Measures

Sampling error. Not applicable.

Coverage error. In addition to a U.S. Census Bureau review of state session laws to identify agencies with the capacity to fund R&D, NCSES utilizes the expertise of an appointed state coordinator to assist in identifying state government agencies that have the capacity to perform or fund R&D. State coordinators are also offered the opportunity to review survey responses from their respective state agencies before results are finalized for data release. In cases where the state coordinator refused to cooperate, or where some agencies failed to respond to the survey, it is possible there may be an undercount of state government R&D activities, despite efforts by NCSES and U.S. Census Bureau staff members to conduct additional queries and outreach with state agencies. In other instances, the appointed state coordinator could misinterpret the survey definition and examples of qualifying R&D activities and thus fail to identify all state government-dependent units with the capacity to perform or fund R&D.

Nonresponse error. Of the 621 agencies in the survey universe, 589 (95%) responded to the survey. Of the 589 respondents, 365 (62%) reported having R&D activities in FY 2016. No statistical methods were used to account for nonresponding agencies.

Measurement error. The most common source of nonsampling error in the Survey of State Government R&D is in respondents' interpretation of the survey definition of qualifying R&D activities. To mitigate any potential misinterpretations several steps were taken. NCSES provided a series of examples specific to the types of activities performed or funded by state government agencies in the survey questionnaire's definitions and examples. Before officially submitting data, state coordinators performed a final verification of aggregated agency data. All responses, including the initial agency data submissions and final state coordinator verifications, were received via the Web form or e-mail. U.S. Census Bureau staff performed basic logical edit checks and reviewed respondent comments, allowing staff to detect errors and work with state respondents to correct them. Despite these efforts, some of the data reported could include expenditures for non-R&D activities, such as non-R&D salaries, commercialization, environmental testing, or routine survey or monitoring work.

Data Comparability (Changes)

State government R&D totals can display considerable volatility between survey cycles. For example, state agency expenditures are influenced by several national and state-specific factors, and large changes (either increases or decreases) are not unusual, especially for discretionary spending items such as R&D. States often will create special funds to support specific research activities for a limited time. These funds may have a one-time appropriation from the legislature and expire within 2–5 fiscal years; state agencies obligate those funds for specific R&D projects, depending on availability and expiration of funding authority as well as other program-specific and administrative considerations. Data reported are agency direct expenditures for R&D in a given fiscal year, not obligations; as such, in the case of multiyear grants to extramural performers, an agency's expenditures for that fiscal year may be greater than its obligations because expenditures may include spending from the previous year's appropriations, depending on the specific budget authority granted by the legislature. Given that state governments have comparatively little experience in tracking and measuring R&D specifically, it is likely that some portion of the reported changes reflects measurement and coverage errors. In the case of R&D funds for extramural performers, some agencies were able to report only obligations made in a given fiscal year and were not able to provide detailed expenditures for each fiscal year.

The survey asked about state agencies' expenditures for R&D as of the end of FY 2016. Most states have a fiscal-year period that begins 1 July and ends the following 30 June. For example, FY 2016 is the state

fiscal period beginning on 1 July 2015 and ending on 30 June 2016. There are, however, four exceptions to the 30 June fiscal-year end: New York (ends 31 March), Texas (ends 31 August), Alabama (ends 30 September), and Michigan (ends 30 September). Puerto Rico's fiscal year begins 1 July and ends on 30 June, whereas the District of Columbia follows the federal government fiscal year, which ends on 30 September. For comparability, all states, the District of Columbia, and Puerto Rico are surveyed at the same time.

A state's R&D priorities may be shaped by the state's unique legislative and budgeting processes. State budget practices vary considerably due to both political and historical reasons. Nineteen states enact biennial budgets. Of these states, Montana, Nevada, North Dakota, and Texas have both biennial legislative sessions and biennial budgets. The remaining 15 states of Connecticut, Hawaii, Indiana, Kentucky, Maine, Minnesota, Nebraska, New Hampshire, North Carolina, Ohio, Oregon, Virginia, Washington, Wisconsin, and Wyoming hold annual legislative sessions but maintain biennial budgeting. Only North Dakota and Wyoming enact consolidated 2-year budgets; other biennial budget states enact two annual budgets at one time. As such, the nature of a state's budget priorities for R&D may be determined on a biennial basis in some states; in others, however, it may be determined on an annual basis. In states with biennial budgets, the legislatures will often make supplemental appropriations to the second-year budget, which may result in further changes to the initial funding priorities.

The data exclude R&D expenditures by state governments that did not flow through state agencies' budgets. The state totals do not include direct appropriations from state legislatures to colleges and universities. For FY 2016, universities and colleges reported expending \$4.0 billion on separately budgeted R&D activities that were funded from all sources of state and local government support (see the HERD Survey). For FY 2015, state agencies reported \$868 million in expenditures used to support R&D performance by academic institutions. A major factor for the difference between totals reported in NCSSES's HERD Survey and the Survey of State Government R&D is direct appropriations or grants to state-run universities that are included in the former but not in the latter. Another likely factor is the exclusion of R&D at agricultural experiment stations from the state survey totals because they are generally associated with land-grant colleges and universities and are canvassed on the HERD Survey.

Direct comparison of state agency expenditures should also be viewed with caution because state governments often reorganize departments and agencies such that some divisions and offices that were part of one agency may be moved to another agency. In other instances, entire departments may be reorganized into newly created departments. Although the FY 2016 Survey of State Government R&D encountered several instances of these organizational changes in several states, the survey itself is not designed to measure specific changes in state government organization. To account for these and other changes in the data, U.S. Census Bureau and NCSSES staff conducted follow-up calls for agencies with data changes of plus or minus 50% and at least \$1 million between FY 2015 and FY 2016 to ensure the accuracy of the survey data.

Data specific to state government agencies were first released with the FY 2009 survey results and are also included in the FY 2016 data tables. Specific agency-level data for FY 2006 and FY 2007 are not available.

The current Survey of State Government R&D has been conducted for FY 2006, FY 2007, FY 2009, FYs 2010–11, FYs 2012–13, FYs 2014–15, and FY 2016. (No survey was conducted for state governments in FY 2008.) Data presented in trend tables in this report are from the most recently completed survey cycle. References to prior-year data should be restricted to those published in this report for two reasons: (1) when completing the current year's survey, survey respondents may revise

their prior year's data, and (2) NCSSES reviews data for prior years for consistency with current-year responses and, if necessary, may revise these data in consultation with respondents.

NSF has collected state government R&D data for FY 1964, FY 1965, FY 1967, FY 1968, FY 1972, FY 1973, and FY 1977 in collaboration with the U.S. Census Bureau's Census of Governments and related programs. For FY 1987, FY 1988, and FY 1995, data collections of state government R&D were conducted by nonfederal organizations that were supported by NSF grants. As a result of differences in the survey populations, in definitions of covered R&D activities, and in collection methods over time, the results of these historical surveys are not comparable with the statistics collected for the FY 2006 and subsequent Surveys of State Government R&D.

Changes in survey coverage and/or population. Each year, state coordinators update the universe of agencies most likely to have funded or performed R&D based on changes in funding authority, organization changes within the government, or other initiatives by the legislature. No survey was conducted for state governments in FY 2008. Beginning with the FY 2009 survey cycle, state coordinators were no longer able to overwrite the aggregate R&D data reported by state agencies to correct or modify the state total. Any changes or revisions are now required to be made at the state government agency level.

Changes in questionnaire.

- FY 2009. The FY 2009 questionnaire changed from the FY 2007 version to collect state government R&D activities by governmental functions of agriculture, environment and natural resources, health, transportation, and other.
- FYs 2010 and 2011. The survey was reorganized as a biennial survey and collected two fiscal years of data on one questionnaire. In addition, the energy category was added to the list of specific government functions of R&D.
- FYs 2012 and 2013. A minor change to the instructions in question 1 for extramural performers was made from "R&D done for your department/agency" to "R&D funded by your department/agency" to ensure that all R&D-related projects that the agency funds regardless of the end result (i.e., grants) were properly included.
- FYs 2014 and 2015. The survey was revised to collect additional detail about R&D funding and performance to better align with the Organisation for Economic Co-operation and Development (OECD) 2002 Frascati Manual, the most recent edition available at survey launch. These changes include source of funds for extramural R&D performance supported by federal funds, state funds, or other funds. For all federal funds received for both intramural and extramural R&D, respondents were asked how much was received from specific federal agencies. For intramural R&D performance, respondents were asked how much of federal and state and other funding was classified as basic research, applied research, or experimental development.
- FY 2016. Survey reporting period changed from a biennial to annual survey. Questions remained the same with some minor additions to examples and wording changes. A remarks box was added for respondents to provide comments.

Changes in reporting procedures or classification. None.

Definitions

- *Applied research.* Research conducted to gain the knowledge or understanding to meet a specific, recognized need.
- *Basic research.* Research undertaken primarily to acquire new knowledge without any particular application or use in mind.
- *Construction and acquisition of facilities used primarily for R&D.* Includes major costs for construction and purchase of buildings to be used primarily as R&D facilities; also includes new construction, major renovations, and purchase of land or buildings.
- *Experimental development.* The systematic use of knowledge or understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes.
- *Performers, extramural.* Those outside the department or agency who perform R&D under the administrative oversight or control of that department or agency. This may include projects for the department or agency as well as the department's or agency's extramural research programs. Extramural performers include the following:
 - *Academic institutions.* Public or private universities and colleges.
 - *Companies and individuals.* Include performers under contract for research projects or that received grants for research projects.
 - *Other.* Nonprofit organizations, including foundations; other departments or agencies within the state; other state governments; county, municipal, township, or other local governments; and the federal government.
- *Performers, intramural.* Department's or agency's own employees who perform R&D, which includes R&D performed by those employees and services performed by others in support of an internal R&D project (e.g., laboratory testing).
- *Research and development.* Creative work conducted systematically to (1) extend scientific knowledge or (2) devise new or improved applications, including materials, products, devices, processes, systems, or services. Sources and examples of R&D funding include the following:
 - *Federal government.* Grants, awards, contracts, and appropriations from the U.S. government.
 - *State.* Appropriations from the state legislature, agricultural commodity assessments, bond funds, general funds, restricted funds, revenue funds, state grants, tobacco settlement funds, lottery proceeds, and funds from other agencies within the state.
 - *Other.* Grants and contracts from companies, nonprofit organizations (including foundations), other state governments, and city, county, regional, or other local governments.