

Survey of State Government Research and Development: FY 2018

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Technical Notes

Survey Overview (FY 2018 survey cycle)

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-1802996 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. 2006.

Reference period. State governments' fiscal year ending in 2018.

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 759 agencies from the 50 state governments, the District of Columbia, and Puerto Rico with the capacity to perform or fund R&D during FY 2018.

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's *Government Finance and Employment Classification Manual* (see chapter 1), and which funded or performed R&D for state government fiscal year ending in 2018. 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 NCSES's Higher Education Research and Development (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 Research and Development is a census. For the FY 2018 survey, state coordinators were provided with a list of agencies that were previously identified from the FY 2017 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 NCSES staff. 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 NCSES, 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 1 August 2018, 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 2018 (see Appendix). On a flow basis, as governors responded, state coordinators were sent a spreadsheet of agencies and contacts that were surveyed for the FY 2017 Survey of State Government Research and Development and asked to add agencies that might have some R&D, remove 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 stating that respondents would be receiving an e-mail with instructions and the survey form to be completed and e-mailed back to the U.S. Census Bureau. The state coordinators sent the updated spreadsheet of agencies and contacts back to the U.S. Census Bureau. After receiving the list of updated agencies, agencies identified as having the potential to perform or fund R&D were then e-mailed the survey form. Upon completion by all agencies within a state, the state coordinators were provided with a spreadsheet of agency responses to review the survey results before they were provided to NCSES for final analysis and dissemination.

Mode. State agencies were e-mailed a fillable form with auto summations and edits built in and were asked to complete the form. State coordinators were given 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. Response rates were calculated for the FY 2018 Survey of State Government Research and Development and are available in table A-1.

All 50 state governments and the District of Columbia participated in the survey. A total of 39 of 52 states appointed coordinators. However, only 11 of 52 state coordinators officially responded to verify the final aggregate data for their states. For those agencies that did not have a coordinator appointed, final aggregate data files were sent to staff at NCSSES for review. Some or all agencies submitted data in those states where the coordinator did not verify data officially. A coordinator was not appointed in Arizona, Colorado, Louisiana, Massachusetts, New Mexico, New York, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia, Puerto Rico, and the District of Columbia. 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 and uses the NCSSES survey questions for its collections of government agencies and provides the results to NCSSES. Puerto Rico's Governor's Office did not appoint a coordinator for the 2018 survey cycle, and the Puerto Rico Institute of Statistics did not respond to multiple request for information. As a result, Puerto Rico did not participate, and no data were collected for FY 2018 from the 17 agencies in Puerto Rico that previously provided data to NCSSES.

The final agency response was 706 of 759 agencies (93.0%). In some cases where agencies were unable to answer the survey request, staff from the U.S. Census Bureau and NCSSES compiled R&D estimates from publicly available financial statements in lieu of a direct response when such materials were available. This includes data for the following state agencies: California Mental Health Services Oversight, Illinois Nutrient Research and Education Council, the Massachusetts Department of Mental Health, and the North Dakota Agricultural Products Utilization Commission.

In addition to the 17 agencies in Puerto Rico, the following agencies did not respond to the survey and as a result may contribute to an undercount in their states' public expenditures for R&D activities:

- California Department of Public Health, Center for Health Care Quality; Department of Public Health, Center for Environmental Health Food and Drug Branch; Department of Public Health, Food and Drug; Department of State Hospitals; and the Department of Toxic Substances Control;
- Colorado Department of Agriculture;
- District of Columbia Department of Behavioral Health, Department of Forensic Sciences, and Office of Planning and Economic Development;
- Georgia Southern Regional Education, and Department of Natural Resources Wildlife Resources Division;
- Kentucky Education Professional Standards, Energy Development and Independence, and Public Service Commission;
- Louisiana Department of Education;
- Massachusetts Department of Developmental Services, Life Sciences Center, and Technology Park Corporation;
- Maine Department of Environmental Protection;

- Michigan Next Energy Authority, the Licensing and Regulatory Affairs, and Department of Technology Management;
- Minnesota Department of Natural Resources, Department of Health, and Housing Finance Authority;
- North Carolina Division of Adult Corrections and Juvenile Justice;
- New Jersey Economic Development Authority;
- New Mexico Energy, Minerals, and Natural Resources; Public Education Department; and Sentencing Commission;
- Oklahoma Department of Labor;
- Rhode Island Department of Transportation;
- South Carolina Department of Disabilities and Special Needs, and Public Service Authority;
- Virginia Recreational Facilities Authority; and
- Washington State's Innovate Washington.

Of the 706 agencies that responded, 372 (52.7%) reported having some R&D activity in FY 2018.

Data editing. After all of the agencies in a state have submitted responses, 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 fillable forms e-mailed to the U.S. Census Bureau analyst. Basic logical edit checks, review of respondent comments, and comparisons of data from previous surveys allowed U.S. Census Bureau and NCSES staff to detect data errors and work with respondents to correct them. U.S. Census Bureau and NCSES 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 2017 and FY 2018 to ensure the accuracy of the survey data.

Imputation. 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. Therefore, R&D expenditures may be underestimated in states where agencies failed to respond. When agency financial reports were publicly available, some agency research expenditures were compiled by staff from the U.S. Census Bureau and NCSES.

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 were 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. The undercount may occur despite efforts by NCSES and U.S. Census Bureau staff to conduct additional queries and outreach with state agencies that did not appoint a state coordinator. 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 759 agencies in the survey universe, 706 (93.0%) responded to the survey. Of the 706 respondents, 372 (52.7%) reported having R&D activities in FY 2018. No statistical methods were used to account for nonresponding agencies.

Measurement error. The most common form of nonsampling error in the Survey of State Government Research and Development 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. All responses, including the initial agency data submissions and final state coordinator verifications, were received via e-mail or phone. 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. Similarly, some state data may also exclude minor R&D expenditure amounts from agencies not surveyed.

Data Comparability

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. 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 multi-year obligations rather than single-year expenditures.

The survey asked about state agencies' expenditures for R&D at the end of FY 2018. Most states and Puerto Rico have a fiscal year that begins 1 July and ends the following 30 June. For example, FY 2018 is the state fiscal period beginning on 1 July 2017 and ending on 30 June 2018. 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). 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 2018, universities and colleges reported expending \$4.3 billion on separately accounted for R&D activities that were funded from all sources of state and local government support (see the HERD Survey). For FY 2018, state agencies reported \$1.0 billion in expenditures used to support R&D performance by academic institutions. A major factor for the difference between totals reported in NCSES's HERD Survey and the Survey of State Government Research and Development 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 2018 Survey of State Government Research and Development 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 NCSES staff conducted follow-up calls for agencies with data changes of plus or minus 50% and at least \$1 million between FY 2017 and FY 2018 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 2018 data tables. Specific agency-level data for FY 2006 and FY 2007 are not available.

The current Survey of State Government Research and Development has been conducted for FY 2006, FY 2007, FY 2009, FYs 2010–11, FYs 2012–13, FYs 2014–15, FY 2016, FY 2017, and FY 2018. (No survey was conducted for state governments for 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) NCSES reviews data for prior years for consistency with current-year responses and, if necessary, may revise these data in consultation with respondents.

NCSES 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 Research and Development.

Changes in survey coverage and 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' 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 were now required to be made at the state government agency level.

Changes in questionnaire.

- FY 2009. The FY 2009 questionnaire was the first 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, 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.
- FY 2017. Question 4: The "other" category for Internal Sources of R&D was split into multiple categories: non-federal government funds, nonprofit organizations, businesses, and higher education institutions.
- FY 2018. No changes were made.

Changes in reporting procedures or classification.

- FY 2018. Online reporting was replaced with a fillable PDF with automated summations and edits built in to the survey instrument.

Definitions

Applied research. Original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily toward a specific, practical aim or objective.

Basic research. Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Construction and acquisition of facilities used primarily for R&D. Includes the acquisition of, construction of, and major repairs or alterations to structures, works, equipment, facilities, or land for use in R&D activities. Construction and acquisition of land and facilities used primarily for R&D includes major costs for construction and purchase of buildings to be primarily used as R&D facilities.

Experimental development. Systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or 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.* 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; 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. Comprise creative and systematic work undertaken in order to increase the stock of knowledge—including knowledge of humankind, culture, and society—and to devise new applications of available knowledge. Sources and examples of R&D funding include the following:

- *Federal government.* Grants, contracts, awards, 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, funds from other agencies within the state, and revenue from charges, fees, or fines.

- *Nonprofit organizations.* Includes funding from foundations.
- *Non-federal government.* Funding from other state governments, county, city, regional, or other local governments.
- *Businesses.* Grants and contracts from companies.
- *Higher education institutions.* Funding from public or private universities and colleges.