NSF National Center for Science & **Engineering Statistics:** Perspectives and NCSES and Data Usage October 20, 2021

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The NSF National Center for Science and Engineering Statistics: Perspectives on NCSES Surveys and Data Usage

John E. Jankowski – Program Director, Research and Development Statistics Michael T. Gibbons – Survey Manager, Research and Development Statistics October 20, 2021 Council on Governmental Relations, October 2021 Meeting

National Center for Science and Engineering Statistics Social, Behavioral and Economic Sciences National Science Foundation

Presentation outline

- National Center for Science and Engineering Statistics
- Research and development statistics
- HERD and Research Facilities surveys
- Current and upcoming HERD activities
- Questions and answers



Organizational placement of NCSES

National Science Foundation

Directorate for Social, Behavioral and Economic Sciences

National Center for Science and Engineering Statistics



NCSES is one of thirteen principal federal statistical agencies; independent, but still a part of NSF





National Center for Science and Engineering Statistics

- Created by Congress in 1950, the National Science Foundation is an independent federal agency "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."
 - NSF is mandated "...to provide a central clearinghouse for the collection, interpretation, and analysis of data on scientific and engineering resources and to provide a source of information for policy formulation by other agencies of the Federal Government..."
 - This mandate has been fulfilled by NCSES and predecessor agencies.
- The NCSES role was further codified in the America Competes Reauthorization Act of 2010, which instructs NCSES to collect, acquire, analyze, report, and disseminate <u>statistical data related to the S&E enterprise in the United States and other nations on</u>
 - Research and development trends
 - Science and engineering workforce
 - U.S. competitiveness in science and technology (S&T) and R&D
 - Condition and progress of science, technology, engineering and mathematics (STEM) education



NCSES is the nation's leading provider of statistical data on the U.S. science and engineering enterprise

How do we do it?

- Design and conduct major surveys on the S&E enterprise
- Collect data and maintain widely accessible databases on R&D, S&E education, the S&E workforce, and related areas (including administrative data and opportunity—Big Data—sources)
- Analyze S&E-relevant data from other agencies and organizations
- Provide a global context for U.S. data that enables comparisons and benchmarking through collaboration with OECD and other international and national statistical agencies and organizations
- Produce summary and compendium publications
- Disseminate data and analyses to a broad clientele



NCSES conducts more than a dozen surveys





NCSES publishes more than 30 reports a year



https://www.nsf.gov/statistics/reports.cfm



Two reports are mandated by Congress



https://ncses.nsf.gov/indicators



https://ncses.nsf.gov/pubs/nsf19304/



NCSES provides data tables, profiles, and tools online for the public to use



Most recent data tables for all surveys available at https://www.nsf.gov/statistics/tables-by-survey.cfm



All data tools available at <u>https://www.nsf.gov/statistics/data.cfm</u>



Custom reports through the Interactive Data Tool

INSEE NCSES			HOME	EXPLORE D	ata Build) TABLE 🗸	PUBLIC USE FILES	FEEDBACK	HELP	Located at ncsesdata.nsf.gov/home
NCSES Survey Data Search or select a topic to get started. All Surveys Search for anything, like age, sex, etc.										Questions? ncsesdata@nsf.gov
	Fields of Study	P Location Colleges and Universities	Invention and Innovation	R&D Activity	R&D Funding Received and Spent Cemographics	R&D Funding by Government	,			
What can you do here? EXPLORE NCSES SURVEY DATA BUILD A CUSTOM TABLE VISUALIZE DATA Quickly discover and learn about available surveys and variables with the Data Explorer. Instantly create and export custom tables using the Table Builder. Easily generate simple line and bar graphs using the Chart Builder. National Center for Science and Engineering Statistics (NCSES) National Science Foundation Alexandria, VA Phone: (703) 292-5111 f ¥ I 20 Image: Contact Us										



R&D Areas of Policy Interest

- Government support and performance of R&D
- R&D within the Business Enterprise sector
- R&D within the Higher Education sector
- National R&D trends and patterns
- International comparisons for all sectors



The surveyed U.S. R&D enterprise (performer reported)





R&D statistics to inform policy-makers

BEA BRIEFING

Treatment of Research and Development in Economic Accounts and in Business Accounts

By Dylan G. Rassier



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BUDGET OF THE U.S. GOVERNMENT OFFICE OF MANAGEMENT AND BUDGET | OMB.GOV





Total R&D: common areas of policy interest

- What is the U.S. investment in R&D? What is the source of those funds and who is performing the R&D?
- How much of the gross domestic product attributable to R&D?
- What is the pace of expansion of total R&D performance vs. the increase of the country's GDP?
- What are the comparative trends in the shares of business R&D and higher education R&D in the U.S. R&D total?
- How much basic research is performed in the United States? And who is funding that research?
- What is the U.S. total R&D and R&D intensity as compared to those for the world's other major countries?
- What is the composition of other countries R&D, by source, by performer, by type of R&D?



The implicit policy questions...

... we do not answer

- What is the <u>right amount</u> of R&D investment in terms of national welfare, military security, technology advancement, and economic growth, productivity and competitiveness?
- <u>Who should fund the R&D?</u> <u>Who should perform the R&D?</u>
- What fields of research or technologies are <u>most important</u> to the economy, to society, or for the advancement of science?
- <u>How</u> does one incentivize R&D and basic research investments?
- R&D statistics: Policy Relevant but Policy Neutral





Note: Excludes \$4.5 billion in micro-business R&D. Source: NCSES, National Patterns of R&D Resources



How much basic research takes place in the U.S.?

U.S. 2018 Basic Research Expenditures: \$101 Billion

By Performing Sector

By Source of Funds



Note: Excludes \$0.2 billion in micro-business research. Source: NCSES, National Patterns of R&D Resources.



What are the time trends in U.S. R&D?

(by performing sector and source of funds: 1953–2018)



Source: NCSES, National Patterns of R&D Resources.







Where is the world's R&D performed? 2017 = \$2.2 trillion



PPP = purchasing power parity.

Sources: NCSES, NSF, estimates as of October 2019. Based on data from the OECD and the United Nations Educational Scientific and Cultural Organization Institute for Statistics Data Centre



How does U.S. R&D compare with other countries? US, EU, and Other Countries GERD: 1990-2017



EU = European Union; PPP = purchasing power parity.

Sources: OECD Research and Development Statistics, Gross domestic expenditure on R&D by sector of performance and source of funds and NCSES, National Patterns of R&D Resources



What is the type of R&D performed?: 1981-2017



Sources: OECD Research and Development Statistics, Gross domestic expenditure on R&D by sector of performance and source of funds and NCSES, National Patterns of R&D Resources



Higher Education

- Survey overview
 - Survey of S&E Research Facilities Survey (Facilities)
 - Higher Education R&D Survey (HERD)
- New HERD questions for FY 2020
 - COVID-impact
 - R&D personnel headcounts and FTEs
- Future HERD priorities



Survey of S&E Research Facilities Survey overview

- Congressionally mandated
- Conducted biennially from FY 1986–FY 2021
- Census of all U.S. universities and colleges with a minimum of \$1,000,000 of S&E R&D spending (N = 585 in FY 2021)
- Eligible institutions identified through the HERD survey
- Voluntary response rate at 98% or above since FY 2011



Facilities Survey content

- Types of data collected
 - Current research space (in net assignable square feet—NASF)
 - Animal research; clinical trials; medical schools
 - Shared space: with other fields; for purposes other than research
 - Condition of research space: from "superior" to "needs replacement"
 - New construction (NASF and dollars) and repairs/renovations (dollars)
 - Sources of funding
 - Planned construction and repairs/renovations
 - Deferred construction and repairs/renovations
 - Fields of science and engineering (details for most of the variables listed above)



S&E Research Space at Academic Institutions, by Field: 2009 and 2019



Source: National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.



New and Planned Construction of S&E Research Space at Academic Institutions: 2002 to 2021



Data Source: National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.



- Conducted annually since 1972
- Census of all U.S. universities and colleges with minimum of \$150,000 of separately accounted for R&D expenditures (N = 915 in FY 2020)
- Requests expenditures for all separately accounted for R&D performed at institutions during previous academic fiscal year
- Voluntary response rate has consistently been over 95%
- Data used by universities, federal and state policymakers, other researchers



HERD Survey content

- Types of data collected
 - Expenditures funded by federal (by agency) and nonfederal (by sector) sources by R&D field
 - Type of R&D expenditures (basic research, applied research, and experimental development)
 - R&D spending passed through to subrecipients or received as a subrecipient
 - Medical school and clinical trial R&D expenditures
 - Foreign sources of funding
 - Specific cost elements of R&D expenditures (salaries, software, equipment, indirect costs, etc.)
 - Spending on R&D equipment by field
 - Headcounts and FTEs of personnel paid from R&D accounts



What are the trends in higher education R&D performance? And what is the source of funding?



Source: National Center for Science and Engineering Statistics, Higher Education Research and Development Survey, FY 2019.



Which Federal agencies provide R&D funding to U.S. universities and colleges?



FY 2019: \$83.5 billion, of which \$44.5 billion came from the Federal government

Source: National Center for Science and Engineering Statistics, Higher Education Research and Development Survey, FY 2019.



Which fields have seen the most growth in HERD?







COVID-19 Impact Questions

- Why were questions added?
 - Provide a different perspective on pandemic impacts beyond expenditure totals
 - Provide context for survey data quality control reviews
- How will data be used and published?
 - Only aggregated totals displayed in analytical reports
 - No institutional-level data in data tables
- What are the questions?
 - Three qualitative questions on the impacts to R&D as of June 2020



HERD COVID-19 questions

Three qualitative questions for FY 2020 HERD survey

- In June 2020, to what degree were your institution's expected R&D activities disrupted as a result of the COVID-19 pandemic?
- In FY 2020, were any R&D funds diverted from their originally intended research focus as a result of the COVID-19 pandemic?
 - About what percentage of R&D funds did your institution divert for this purpose?
- In FY 2020, did your institution receive new funds for R&D as a result of the COVID-19 pandemic?
 - What were the external sources of funds?



HERD survey question outcomes

- Overall COVID response rate was 94% (or 98% for those who completed the survey)
- Data results
 - One-third could perform all or almost all R&D by June 2020
 - Largest institutions were more likely to effectively perform R&D
 - Smaller institutions (less than \$1M) experienced the greatest negative impacts
 - Half of institutions with at least \$1M in R&D received new funds
 - About 90% of institutions in the top one-third received new funds



R&D personnel questions

- Why were questions added?
 - Greater details on personnel demographics and effort (FTE) that are not available elsewhere
 - Better totals for international comparability of R&D statistics
- How data will be used and published?
 - Only aggregated totals displayed in data tables and analytical reports
 - No institutional-level data in data tables
- What were the questions?
 - R&D personnel headcounts and FTEs for three functions
 - Researchers, R&D technicians, R&D support staff
 - Demographics
 - Sex and citizenship for the three functions
 - Highest level of education for researchers



Future HERD priorities

- Presenting all historical data (1972–2019) in the NCSES table builder
- Ensuring data quality and timeliness
- Exploring a survey data upload mechanism
- Developing national totals for capital R&D expenditures and depreciation





NCSES

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FY 2020 HERD appendix slides on COVID-19

The following 3 slides are the COVID-19 impact questions from the FY 2020 HERD survey, which are presented for reference.



HERD COVID-19 impact questions (A)

Question A

In June 2020, to what degree were your institution's expected R&D activities disrupted as a result of the COVID-19 pandemic?

- Think about all R&D activities, including on-campus and off-campus activities
- Your best estimate is acceptable

(Select one)

- Could not perform any R&D
- Could perform very little R&D
- Could perform some R&D
- Could perform almost all R&D
- Could perform all expected R&D



HERD COVID-19 impact questions (B)

Question B

1. In FY 2020, were any R&D funds diverted from their originally-intended research focus as a result of the COVID-19 pandemic?

- Think about all R&D funds including sponsored research, unrestricted gifts, and institutionally financed R&D.
 - If Yes, go to Question B2
 - If No, go to Question C

2. About what percentage of R&D funds did your institution divert for this purpose?

• Your best estimate is acceptable

(Select one)

- 81 100%
- 61-80%
- 41-60%
- 21-40%
- 1-20%



HERD COVID-19 impact questions (C)

Question C

1. In FY 2020, did your institution receive new funds for R&D as a result of the COVID-19 pandemic?

- This could include funding for R&D that is indirectly related to COVID-19 (e.g., effects of virtual learning on student performance, economic impacts of community job loss) or supplemental funding for ongoing R&D (e.g., modifications to support extended timelines or purchases of additional safety equipment).
- Funds need not be spent in FY 2020.
 - If Yes, go to Question C2. If No, section complete

2. What were the external sources of funds?

• If needed, see Question 1 of the survey for more information about what is included in each source.

(Select all that apply)

- Federal government
- State or local government
- Business
- Nonprofit organization
- Other sources, including foreign governments, other universities and gifts

