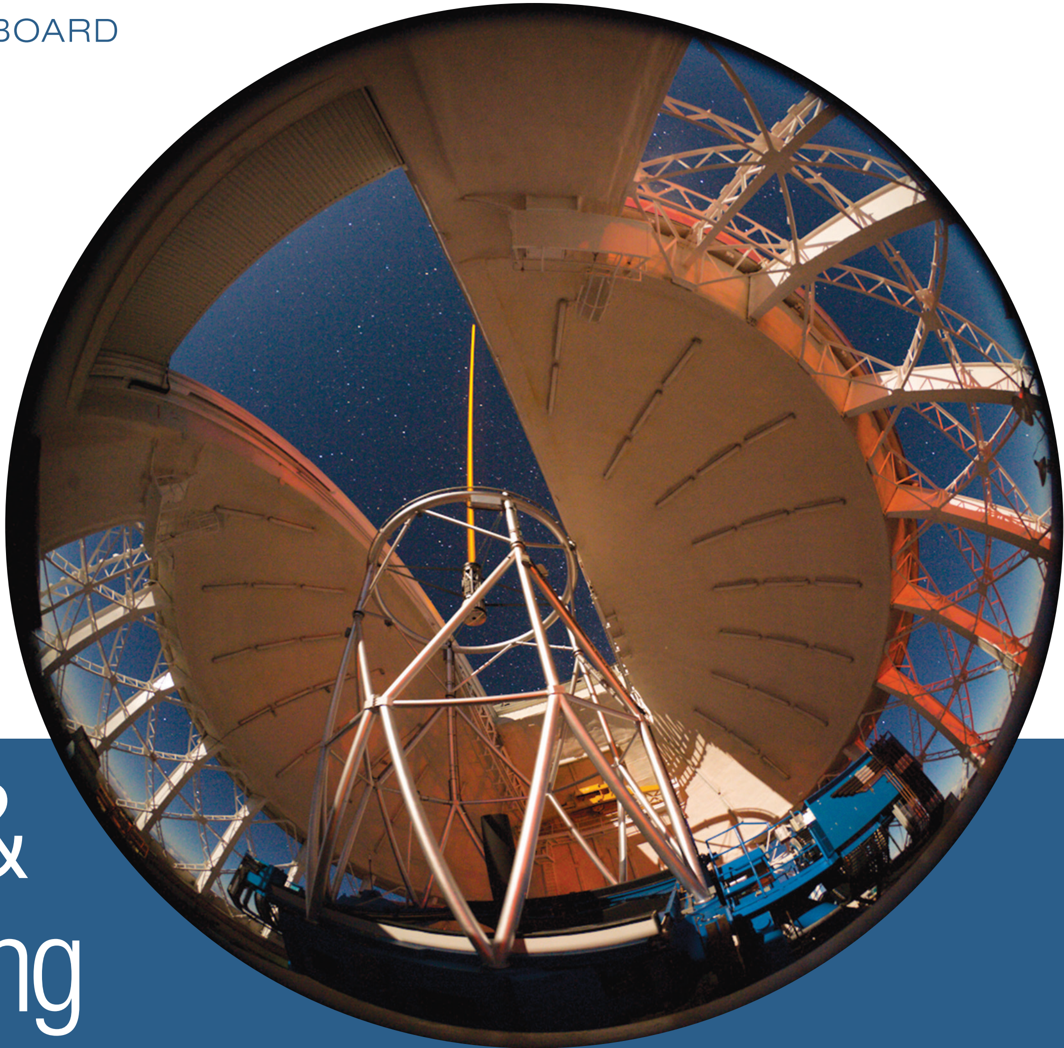
NATIONAL SCIENCE BOARD



Science & Engineering Indicators

2016 DIGEST

National Science Board
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NATIONAL SCIENCE BOARD

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PREFACE

The National Science Board (Board) is required under the National Science Foundation (NSF) Act, 42 U.S.C. § 1863 (j)(1) to prepare and transmit the biennial *Science and Engineering Indicators (SEI)* report to the President and to the Congress every even-numbered year. The report is prepared by the NSF National Center for Science and Engineering Statistics (NCSES) under the guidance of the Board. It is subject to extensive review by Board members, outside experts, interested federal agencies, and NCSES internal reviewers for accuracy, coverage, and balance.

Indicators are quantitative representations relevant to the scope, quality, and vitality of the science and engineering (S&E) enterprise. *SEI* is a factual and policy-neutral source of high-quality U.S. and international data; it neither offers policy options nor makes policy recommendations. The indicators included in the report contribute to the understanding of the current S&E environment.

This digest of key S&E indicators draws from the Board's *Science and Engineering Indicators 2016*, the 22nd volume of this biennial series. The digest serves to draw attention to important trends and data points from across *SEI 2016* and to introduce readers to the data resources available in the report. Readers are invited to explore each of the key indicators presented here in more detail in the full report. To that end, each indicator presented in this digest refers to the *SEI 2016* chapter or chapters from which it was drawn. The complete *SEI 2016* report and related resources are available on the Web at www.nsf.gov/statistics/indicators/.

Readers may also be interested in the online resources associated with *SEI 2016*. A list and description of these products appear at the end of this digest. The Board hopes that readers will take advantage of these rich sources of information.

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INTRODUCTION

The United States holds a preeminent position in S&E in the world, derived in large part from its long history of public and private investment in S&E research and development and education. Investment in R&D, science, technology, and education correlate strongly with economic growth and with the development of a safe, healthy, and well-educated society.

Many other nations, recognizing the economic and social benefits of such investment, have increased their R&D and education spending. These trends are by now well-established. A multipolar world for S&E is emerging after many decades of leadership by the United States, the European Union, and Japan.

Major S&E Indicators

The National Science Board has selected 40 S&E indicators for inclusion in this digest. These indicators have been grouped into seven themes. Although each stands alone, collectively these seven themes are a snapshot of U.S. science and engineering in the context of global trends affecting them. Exploration of areas that indicate capacity for innovation is a thread common to many of the themes presented here. As economies worldwide grow increasingly knowledge-intensive and interdependent, capacity for innovation becomes ever more critical. Three themes provide a worldwide view, picturing R&D spending, research outputs, and STEM education. Four others share a domestic focus, providing information on U.S. R&D funding and performance, the U.S. S&E workforce, research universities, and public attitudes and understanding of science and technology. Indicators may vary in successive volumes of the *Science and Engineering Indicators* series as different S&E policy issues emerge.

What These Indicators Tell the Nation

By selecting a set of indicators, the Board seeks to contribute to the assessment of the state of U.S. science and engineering and to highlight issues of current opportunity or concern. These measures address an emerging set of trends of particular interest to planners and policymakers at all levels whose decisions affect our national S&E enterprise.

GLOBAL R&D: MEASURING COMMITMENT TO INNOVATION

WHY IS THIS IMPORTANT?

Innovation in the form of new goods, services, or processes builds new knowledge and technology, contributes to national competitiveness, improves living standards, and furthers social welfare. Research and development is a major driver of innovation. R&D expenditures indicate the priority given to advancing science and technology relative to other national goals.

A. HOW MUCH?

R&D expenditures worldwide are estimated to have reached nearly $1.7 trillion in 2013, doubling from $836 billion a decade earlier.

B. WHERE?

Global R&D expenditures are highly concentrated in three regions: East/Southeast and South Asia, North America, and Europe.

The seven countries with the largest R&D expenditures together accounted for nearly three-fourths of total global R&D in 2013. The United States remains the largest R&D performer and accounted for 27% of total worldwide R&D in 2013. China is now the second largest R&D performing nation, accounting for 20% of the worldwide total.

C. GROWTH

Asian countries have led the growth in worldwide R&D expenditures over the past decade, with China accounting for about one-third of the total global growth between 2003 and 2013. The United States and the European Union (EU) together accounted for approximately another one-third of the global growth during this period.

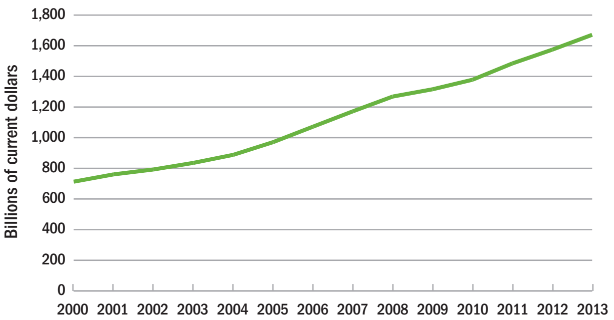
Asian countries have led the pace of R&D expansion as well. Between 2003 and 2013, China's R&D expanded the most rapidly, followed by South Korea. By comparison, the pace of growth has been much slower in the United States and the EU. Rapid R&D growth in Asia overall reflects private spending by domestic and foreign firms, as well as increased public R&D spending.

D. INTENSITY

R&D intensity is the proportion of a country's economic activity (gross domestic product, or GDP) devoted to R&D investment. China's R&D intensity has increased sharply over time, as growth in R&D outpaced a rapid expansion in GDP. China's R&D intensity now exceeds that of the EU, but it remains well below that of South Korea—which has also sharply increased its R&D intensity over time—and of the United States.

A

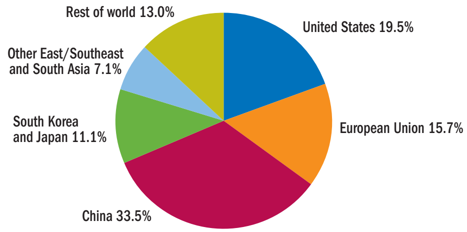
Estimated R&D expenditures worldwide: 2000–13



SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

C1

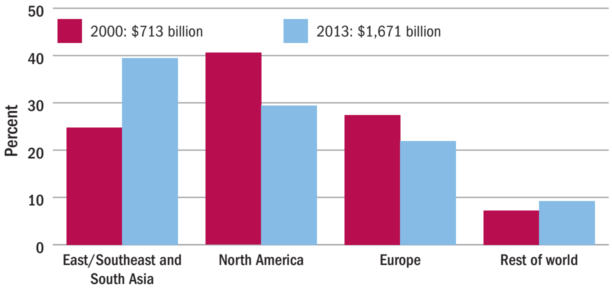
Contributions of selected countries/regions/economies to growth of worldwide R&D expenditures: 2003–13



NOTE: Other East/Southeast and South Asian countries/economies include Taiwan, Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam, India, Pakistan, Nepal, and Sri Lanka.
SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

B1

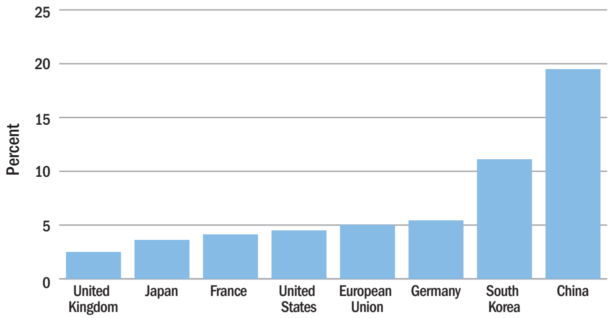
Regional share of worldwide R&D expenditures: 2000 and 2013



NOTE: East/Southeast and South Asia includes China, Taiwan, Japan, South Korea, Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam, India, Pakistan, Nepal, and Sri Lanka.
SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

C2

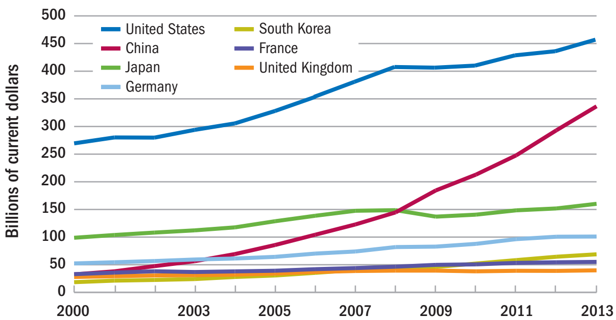
Average annual growth in domestic R&D expenditures, selected countries/regions/economies: 2003–13



SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

B2

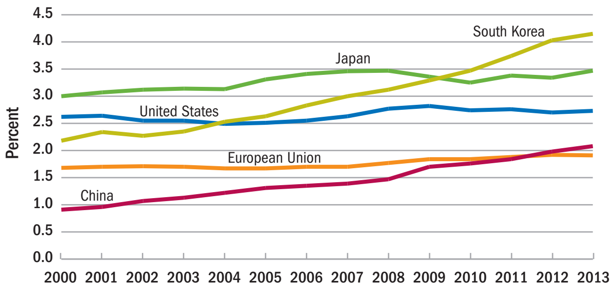
Domestic R&D expenditures, selected countries: 2000–13



SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

D

R&D expenditures as a share of economic output, selected countries/regions/economies: 2000–13



SEI 2016: **Cross-National Comparisons of R&D Performance,** Chapter 4.

U.S. R&D

WHY IS THIS IMPORTANT?

Businesses, government, academia, and nonprofit organizations all fund and perform R&D. The outcomes and benefits depend not only on the total funds devoted to R&D but also on the types of R&D these funds support—basic research, applied research, and development. The distribution of R&D funds by the U.S. federal government provides insight into the nation's broad mission priorities for public expenditures.

A. TRENDS

U.S. R&D performance totaled $456 billion in 2013. The business sector accounts for more than two-thirds of the total. Academia and the federal government are the next largest performers.

U.S. businesses, after experiencing recession-induced declines, have expanded R&D performance in recent years. Federal government R&D performance started to decline after 2011, after the incremental boost from the American Recovery and Reinvestment Act of 2009.

B. BASIC AND APPLIED RESEARCH AND DEVELOPMENT

More than 80% of U.S. R&D funds is spent on development and applied research, work that focuses on practical applications, new products, or novel processes. About 18% of U.S. R&D funds support the performance of basic research, work that primarily involves gaining comprehensive knowledge and understanding without a particular application in mind.

Different institutions bring different perspectives and approaches to R&D. Academia, with its symbiotic relationship of advanced graduate education and R&D, performs more than half (51%) of basic research. Business, with its focus on new products, services, and processes, dominates (88%) development.

C. FEDERAL R&D TRENDS

The federal budget environment affects the R&D performance of different sectors. Academic and other nonprofit institutions, which focus on basic research, have generally received steady or increasing federal support. The business sector, heavily focused on development and applied research, experienced increased federal funding during the 2000s after a decline in the 1990s. In recent years, however, federal R&D investment in these sectors has been on a downward trend, reflecting federal budget difficulties.

D. FEDERAL R&D FOCUS

Defense has long been the largest federal R&D budget priority. Since the beginning of the 2010s, the defense share of the federal R&D budget has gradually declined. About half of the federal nondefense R&D budget is devoted to health and funded primarily through the National Institutes of Health.

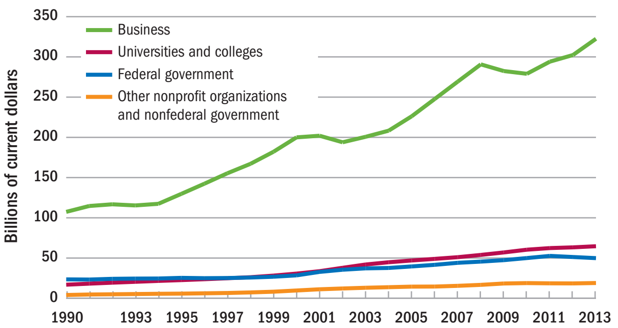
The Department of Defense accounts for about half of federal R&D spending. It focuses mostly on development, including new major systems and advanced technology. The other federal agencies with large R&D portfolios—the Departments of Health and Human Services, Energy, Commerce, and Agriculture, as well as the National Aeronautics and Space Administration and the National Science Foundation—focus primarily on basic and applied research. These seven departments and agencies account for about 96% of federal R&D spending.

E. FEDERAL RESEARCH PORTFOLIO BY S&E FIELDS

Life sciences account for about half of the federal research (basic plus applied) portfolio.

A

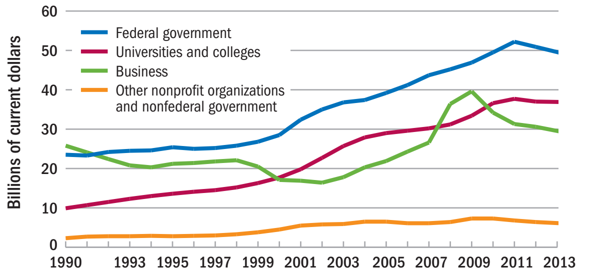
U.S. R&D performance, by performing sector: 1990–2013



SEI 2016: Recent Trends in U.S. R&D Performance, Chapter 4.

C

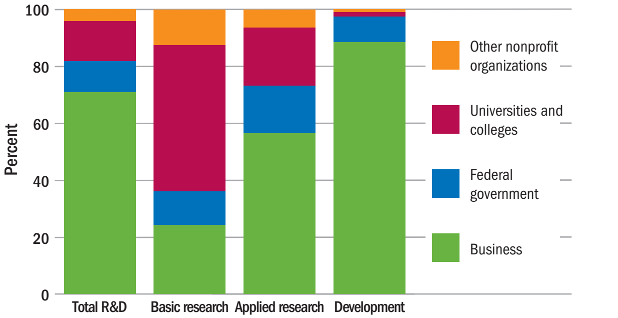
R&D performance supported by federal funding, by performing sector: 1990–2013



NOTE: Data for federal government include intramural and federally funded research and development centers.
SEI 2016: Recent Trends in U.S. R&D Performance, Chapter 4.

B

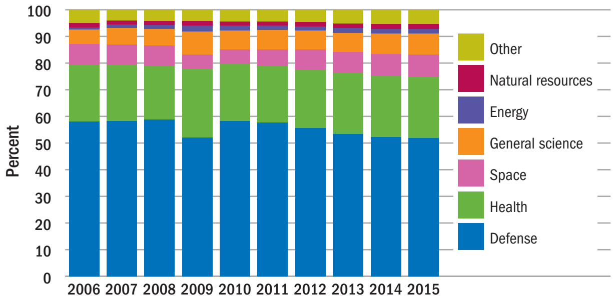
U.S. R&D performance, by type of R&D and performing sector: 2013



SEI 2016: Recent Trends in U.S. R&D Performance, Chapter 4.

D

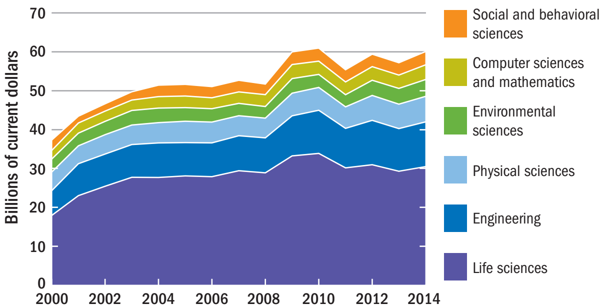
Federal budget authority for R&D, by national objectives: FYs 2006–15



NOTES: R&D data include R&D plant. Data for 2015 are preliminary.
SEI 2016: Recent Trends in Federal Support for U.S. R&D, Chapter 4.

E

Federal funds for basic and applied research, by S&E field: 2000–14



NOTE: Data for 2014 are preliminary.
SEI 2016: Recent Trends in Federal Support for U.S. R&D, Chapter 4.

U.S. AND GLOBAL STEM EDUCATION

WHY IS THIS IMPORTANT?

Education at all levels in science, technology, engineering, and mathematics—STEM—develops, preserves, and disseminates knowledge and skills that convey personal, economic, and social benefits. Higher education provides the advanced work skills needed in an increasingly knowledge-intensive, globally integrated, and innovation-based economic landscape.

A. K–12 MATHEMATICS AND SCIENCE

Over the past two decades, U.S. students' mathematics scores on national assessments have modestly improved.

However, on international tests, U.S. 15-year-olds tend to have lower scores than the international average in mathematics and have science scores about equal to or slightly lower than the international average.

B. U.S. BACCALAUREATES

U.S. output of total bachelor's degrees has increased by more than half over the past two decades. Science and engineering degrees have consistently accounted for about one-third of the total. The increases over time in certain disciplines, such as physical sciences, mathematics, and engineering degrees, generally reflect the increasing size of the college-age cohort rather than a rising tendency among students to attend college or to major in those fields. The latter are more nearly reflected in the increasing number of degrees earned in the social sciences, psychology, and biological and agricultural sciences.

C. INTERNATIONAL BACCALAUREATES

China produces more bachelor's-level degrees in science and engineering than any other country. The number of science and engineering degrees has risen much faster in China than in the United States and many other major Asian and European countries.

Science and engineering fields account for a much larger proportion of all bachelor's degrees in China than in the United States. In 2012, these fields accounted for 49% of all bachelor's degrees awarded in China, compared with 33% of all bachelor's degrees awarded in the United States.

D. INTERNATIONAL DOCTORATES

Advanced training toward the doctorate has expanded in recent years. The number of doctoral degrees in science and engineering has risen dramatically in China, whereas the numbers awarded in the United States, South Korea, and many European countries have risen more modestly.

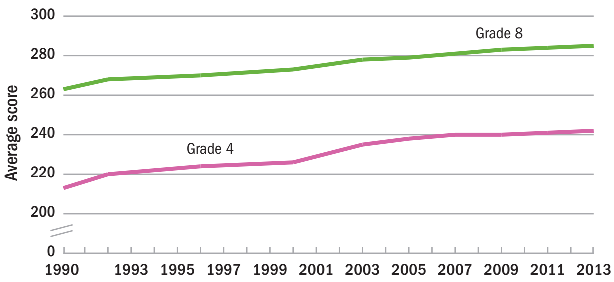
In 2012, the United States graduated more doctorate recipients in science and engineering than any other country, followed by China. However, in the United States, more than one-third (37%) of these doctorates were earned by temporary visa holders.

E. INTERNATIONALLY MOBILE STUDENTS

The United States remains the destination of choice for the largest number of internationally mobile students worldwide. Yet, the share of the world's internationally mobile students enrolled in the United States fell from 25% in 2000 to 19% in 2013, due to efforts by other countries to attract more foreign students and to growing higher education capacity around the world. Other popular destinations for internationally mobile students are the United Kingdom, Australia, France, and Germany.

A1

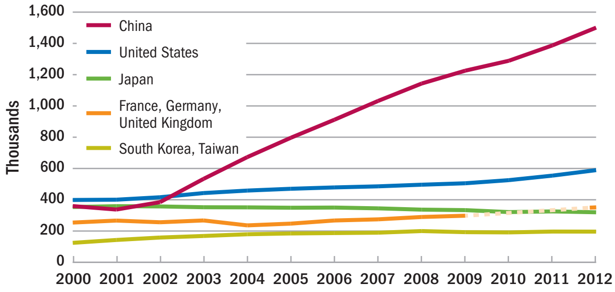
Average NAEP mathematics scores of U.S. students in grades 4 and 8: 1990–2013



NAEP = National Assessment of Educational Progress.
SEI 2016: **Student Learning in Mathematics and Science,** Chapter 1.

C

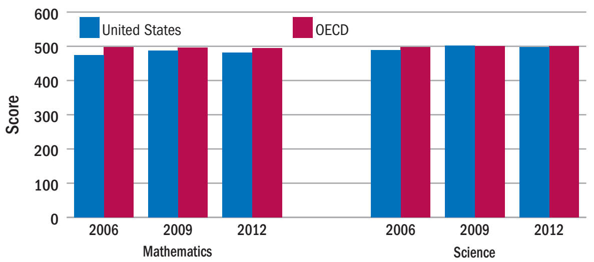
Bachelor's degrees in S&E fields, by selected country/region/economy: 2000–12



NOTES: Data are not available for all countries for all years. Dotted line connects across missing values.
SEI 2016: **First University Degrees in S&E Fields,** Chapter 2.

A2

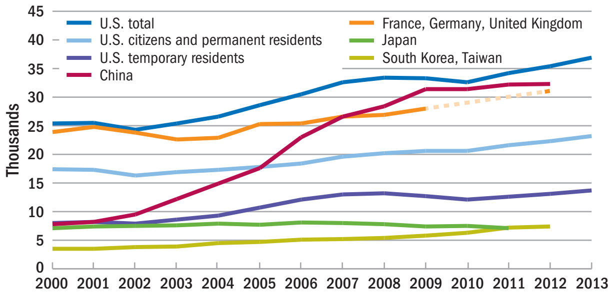
Average mathematics and science PISA test scores of 15-year-olds in the U.S. and OECD countries: 2006–12



PISA = Program for International Student Assessment; OECD = Organisation for Economic Co-operation and Development.
SEI 2016: **Student Learning in Mathematics and Science,** Chapter 1.

D

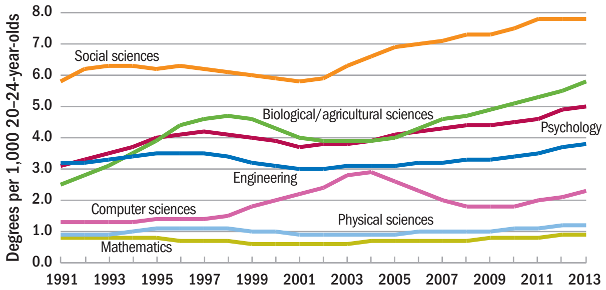
Doctoral degrees in S&E fields, by selected country/region/economy: 2000–13



NOTES: Data are not available for all countries for all years. Dotted line connects across missing values.
SEI 2016: **Global Comparison of S&E Doctoral Degrees,** Chapter 2.

B

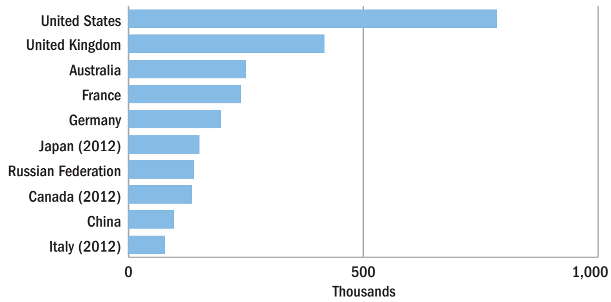
U.S. bachelor's degrees in S&E fields per 1,000 20–24-year-olds: 1991–2013



SEI 2016: **Undergraduate Degree Awards,** Chapter 2.

E

Internationally mobile students enrolled in tertiary education, by selected country of enrollment: 2013



SEI 2016: **Global Student Mobility,** Chapter 2.

U.S. S&E WORKFORCE: TRENDS AND COMPOSITION

WHY IS THIS IMPORTANT?

Workers with S&E expertise are integral to a nation's innovative capacity. Their high skill level and inventiveness provide them with the ability to advance basic scientific knowledge and to transform that knowledge into useful products and services.

A. WORKFORCE GROWTH AND EMPLOYMENT SECTOR

The U.S. S&E workforce—which includes such occupations as chemists, mathematicians, economists, and engineers—has grown faster over time than the workforce overall and now represents over 4% of all U.S. jobs. However, many others with S&E training are employed in and apply their S&E expertise in occupations not formally classified as S&E jobs. This suggests that the application of S&E knowledge and skills is widespread across the U.S. economy and not just limited to jobs classified as S&E.

Individuals in S&E occupations work for a wide variety of employers. Businesses are by far the largest employer. Educational institutions, particularly 4-year institutions, are the largest employer of those with doctorates.

B. UNEMPLOYMENT

For decades, workers in S&E occupations have almost always had lower unemployment rates than workers in other types of jobs. Among college graduates, the unemployment rate for those with S&E jobs is generally lower than for those in non-S&E occupations and is far lower than the overall unemployment rate.

However, S&E workers are not immune to business cycle effects on the job market, as the spikes in S&E unemployment in the 2001 and the 2007–09 recessions illustrate.

C. WOMEN AND UNDERREPRESENTED MINORITIES

Despite accounting for half of the college-educated workforce, women in 2013 accounted for less than one-third of S&E employment. Although the number of women in S&E jobs has risen significantly in the past two decades, the disparity has narrowed only modestly.

Similarly, although underrepresented minorities—blacks, Hispanics, and American Indians or Alaska Natives—have made substantial strides, their representation in S&E jobs remains below their proportion in the population.

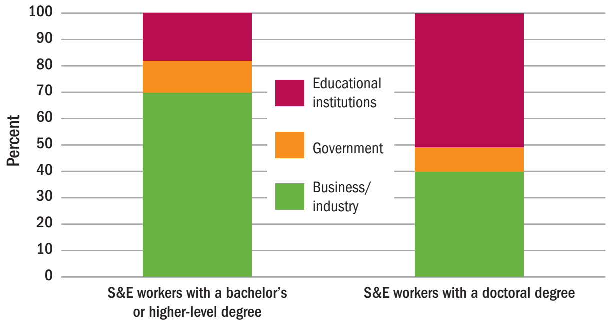
For both women and underrepresented minorities, growth in participation slowed during the 2000s. Women's presence varies widely across S&E occupations, with high concentrations in the life sciences and social and behavioral sciences. For underrepresented minorities, variation among occupations, although present, is much less pronounced.

D. FOREIGN-BORN SCIENTISTS AND ENGINEERS

Foreign-born scientists and engineers, whether educated in the United States or abroad, are a critical part of the U.S. S&E workforce. Among individuals with their highest degree in an S&E field, 34% of master's degree holders and 41% of doctorate holders are foreign born. Reliance on foreign-born scientists and engineers is greatest in the engineering, mathematics, and computer sciences fields. At least half of doctorate holders in these fields are foreign born.

A

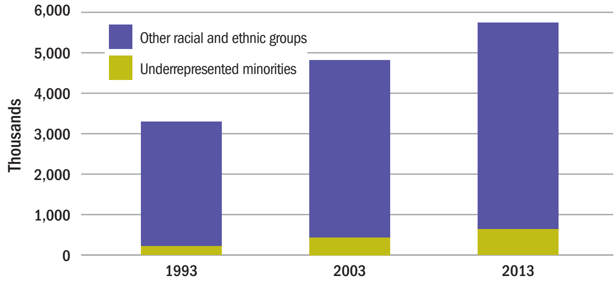
Employment sector of individuals in S&E occupations: 2013



SEI 2016: **S&E Workers in the Economy,** Chapter 3.

C2

Underrepresented minorities and other racial and ethnic groups in S&E occupations: 1993, 2003, and 2013

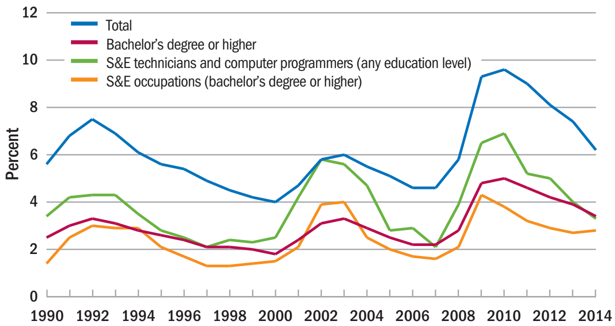


NOTE: Underrepresented minorities comprise blacks, Hispanics, and American Indians and Alaska Natives in 2003 and 2013 and blacks and Hispanics in 1993.

SEI 2016: **Women and Minorities in the S&E Workforce,** Chapter 3.

B

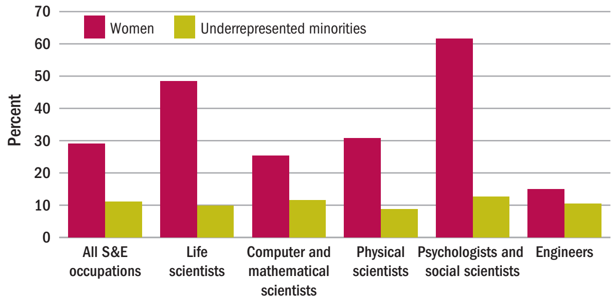
Unemployment rate, by selected groups: 1990–2014



SEI 2016: **S&E Labor Market Conditions,** Chapter 3.

C3

Women and underrepresented minorities in S&E occupations: 2013

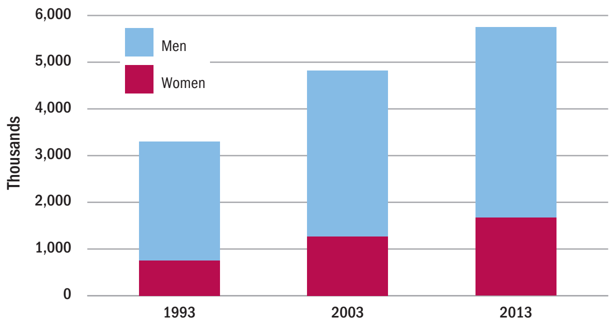


NOTE: Underrepresented minorities comprise blacks, Hispanics, and American Indians and Alaska Natives.

SEI 2016: **Women and Minorities in the S&E Workforce,** Chapter 3.

C1

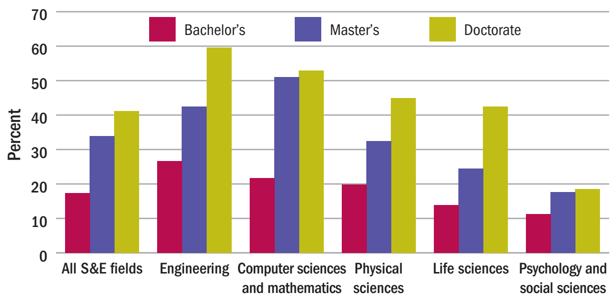
Men and women in S&E occupations: 1993, 2003, and 2013



SEI 2016: **Women and Minorities in the S&E Workforce,** Chapter 3.

D

Foreign-born graduates whose highest degree is in S&E, by level and field of degree: 2013



SEI 2016: **Immigration and the S&E Workforce,** Chapter 3.

KNOWLEDGE, INTELLECTUAL PROPERTY, AND ECONOMIC OUTPUT

WHY IS THIS IMPORTANT?

Research produces new knowledge, products, or processes. Research publications reflect contributions to knowledge, and patents indicate useful inventions. S&E knowledge is increasingly a key input to production. Knowledge- and technology-intensive production processes, both in manufacturing and services, help countries compete and integrate in the global marketplace.

A. PUBLICATIONS

The United States and China publish the most S&E articles of any single country. The rising number of publications in China, albeit from a low base, reflects the country's intent to rapidly develop its scientific capabilities.

B. BIOMEDICAL SCIENCES AND ENGINEERING ARTICLES

The subject emphasis of scientific research varies somewhat across the globe. Biomedical sciences and engineering—two fields vital to knowledge-intensive and technologically advanced economies—account for 58% of global S&E publications. In 2013, the United States and the EU produced significant shares of global biomedical sciences articles, each larger than China's share. China produced a substantial portion of engineering articles, surpassing the U.S. and the EU shares. As in other fields, however, U.S. and European articles continue to receive more citations than those from China.

C. PATENTS

Patents protect the property rights of inventors. As knowledge-intensive economic activity expands worldwide, patent awards are rising. Inventors from around the globe seek patents in the United States because of its large and open market. U.S. inventors now account for under half (48%) of all U.S. patents.

Individuals in Japan and the EU receive the most U.S. patents awarded to non-U.S. inventors; growing percentages are also going to inventors in South Korea. Although growing, the percentage of U.S. patents awarded to inventors in China and India remains modest.

D. KNOWLEDGE- AND TECHNOLOGY-INTENSIVE INDUSTRIES

Industries that intensely embody new knowledge and technological advances in their production account for 29% of global economic output. They span manufacturing (air-and spacecraft, pharmaceuticals, computers, semiconductors and communications equipment, and scientific instruments) and services sectors (education, health, financial, business, and communications).

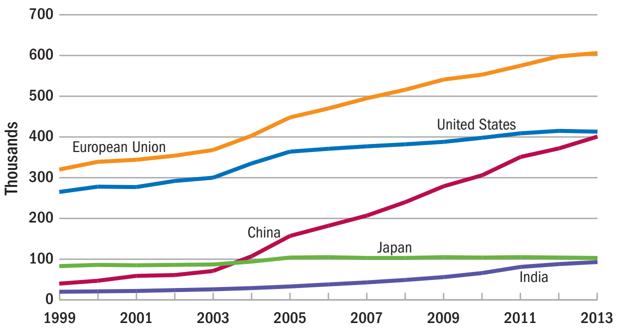
Almost 40% of U.S. gross domestic product derives from high-technology manufacturing and knowledge-intensive service industries, higher than any other country. In the United States, these industries received about 60% of all U.S. patents issued to the business sector in 2012.

In commercial knowledge-intensive services (financial, business, and communications), the United States remains the largest and a growing producer while the EU struggles with the aftermath of the Great Recession. China is relatively weak in this area but is making rapid progress.

In high-tech manufacturing, rapid growth has brought China to near-parity with the United States, the global leader. Information and communications technologies drive China's increased output. China's high-tech manufacturing relies heavily on lower value-added activities, such as assembly of foreign components.

A

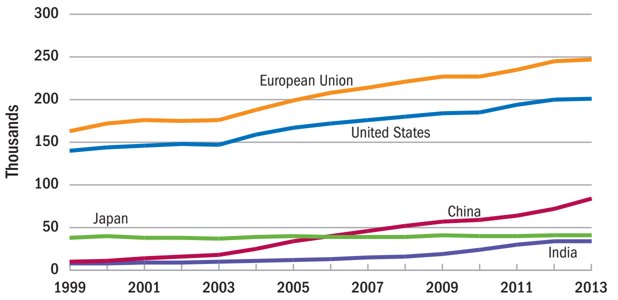
S&E articles, by selected country/region/economy: 1999–2013



SEI 2016: **S&E Publication Output**, Chapter 5.

B1

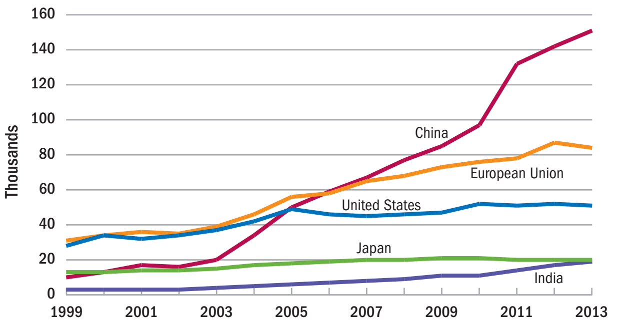
Biological, medical, and other life sciences articles, by selected country/region/economy: 1999–2013



SEI 2016: **S&E Publication Output**, Chapter 5.

B2

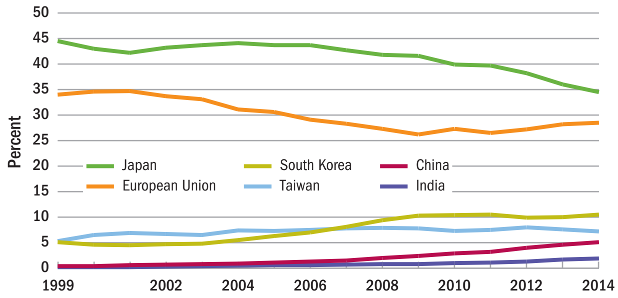
Engineering articles, by selected country/region/economy: 1999–2013



SEI 2016: **S&E Publication Output**, Chapter 5.

C

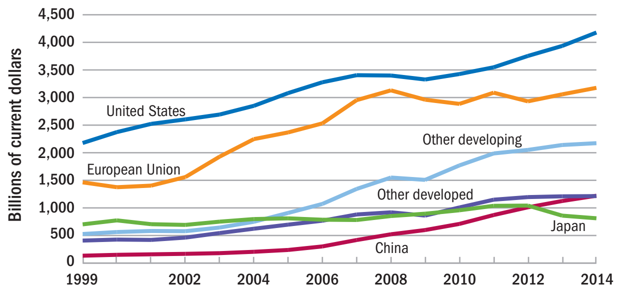
U.S. patents granted to non-U.S. inventors, by selected country/region/economy: 1999–2014



SEI 2016: **Global Trends in Patenting**, Chapter 6.

D1

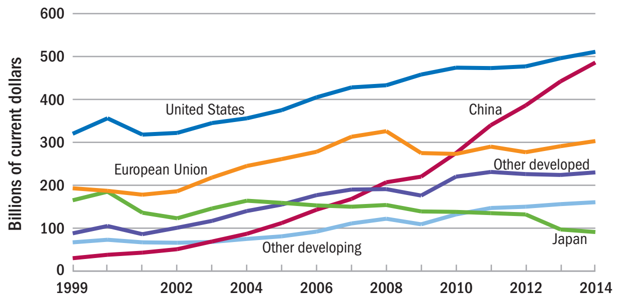
Value added output of commercial knowledge-intensive services, by selected country/region/economy: 1999–2014



SEI 2016: **Worldwide Distribution of Knowledge- and Technology-Intensive Industries**, Chapter 6.

D2

Value added output of high-technology manufacturing industries, by selected country/region/economy: 1999–2014



SEI 2016: **Worldwide Distribution of Knowledge- and Technology-Intensive Industries**, Chapter 6.

RESEARCH UNIVERSITIES

WHY IS THIS IMPORTANT?

America's private and public research universities are vital to achieving national, state, and regional goals in STEM education, advanced graduate training, and R&D, along with their translation into economic gain and competitiveness. Rising costs and growing enrollments, coupled with slowing or declining state funds, pose formidable challenges to the mission of many public research universities.

A. DEGREES

Research universities are the leading producers of S&E degrees in the United States. The more numerous public research universities grant a significant share of the S&E degrees awarded by these universities, particularly at the doctorate level.

B. R&D

Among the 100 top universities in S&E R&D expenditures, two-thirds are public universities located in many states across the country. Along with their private counterparts, public universities play an essential role in the production of academic research, S&E publications, and patent awards.

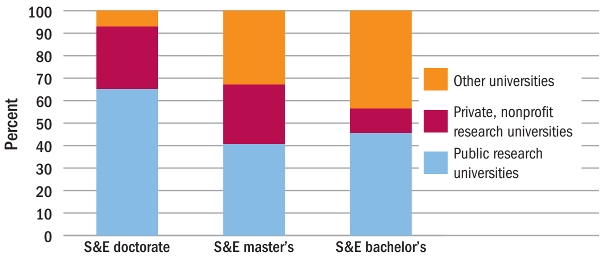
C. TUITION AND REVENUE

Public institutions, as part of their mission, have traditionally offered access to high-quality education for in-state students. In the past decade, the cost of attending public research universities has risen, coinciding with a decline in state and local appropriations, a considerable source of institution revenue. After adjustment for inflation, net tuition and fees per full-time student rose 80% between 1999 and 2012 in the most research-intensive public universities; state and local appropriations per full-time student fell 36% in that period.

Among dependent undergraduate students attending public research universities, out-of-pocket tuition and fees have increased for families at both lower and higher income brackets.

A

S&E degrees produced by research and other universities, by level of degree: 2013

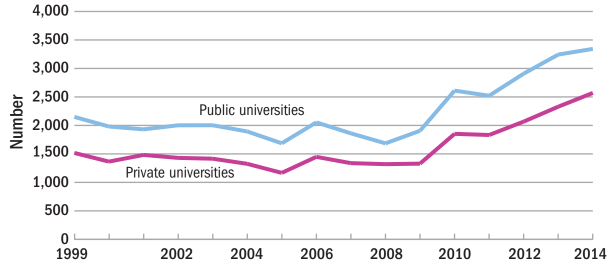


NOTE: Other universities include for-profit private universities, master's- and bachelor's-awarding universities and colleges, special focus institutions, associates colleges, tribal colleges, and not classified.

SEI 2016: **Institutions Providing S&E Education,** Chapter 2.

B3

U.S. utility patent awards for public and private universities: 1999–2014

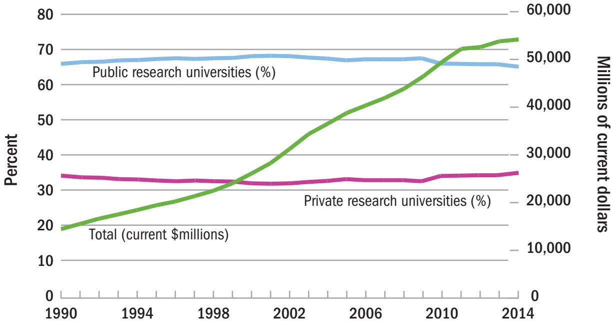


NOTES: Data include top 200 universities ranked by the sum of their patents from 1999 to 2014. Data include institutions affiliated with academic institutions, such as university and alumni organizations, foundations, and university associations. Data are not provided separately for research universities.

SEI 2016: **Outputs of S&E Research: Publications and Patents,** Chapter 5.

B1

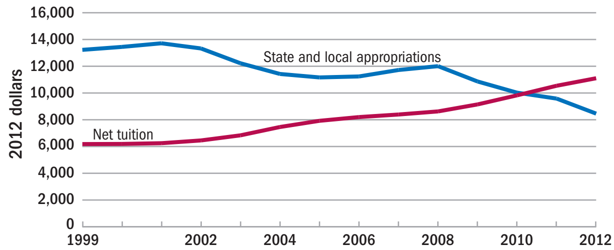
S&E R&D expenditures of U.S. research universities: 1990–2014



SEI 2016: **Academic R&D by Public and Private Institutions,** Chapter 5.

C1

Tuition and state and local appropriations in U.S. public research universities: 1999–2012

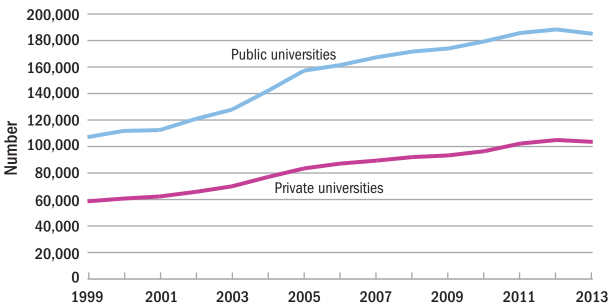


NOTES: Data are per full-time equivalent student and for the most research-intensive universities. Net tuition data reflect tuition after subtracting institutional grant aid.

SEI 2016: **Trends in Higher Education Expenditures and Revenues,** Chapter 2.

B2

S&E publications for U.S. public and private universities: 1999–2013

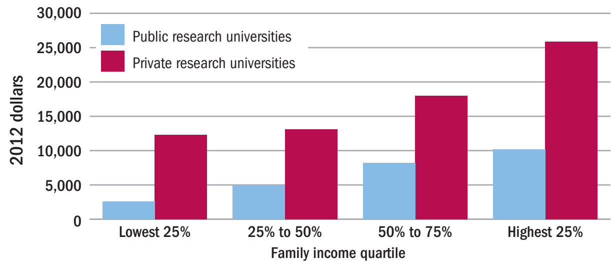


NOTE: Data are not provided separately for research universities.

SEI 2016: **Outputs of S&E Research: Publications and Patents,** Chapter 5.

C2

Average net tuition, by family income quartile and institution type: academic year 2011–12



NOTES: Data are for undergraduate students who are enrolled full-time, full-year. Net tuition data reflect tuition and fees after subtracting all aid.

SEI 2016: **Cost of Higher Education,** Chapter 2.

SCIENCE AND TECHNOLOGY: PUBLIC ATTITUDES AND UNDERSTANDING

WHY IS THIS IMPORTANT?

Advances in science and technology drive the rapid transformation of the global economy, with deep effects on people's lives and cultures. Varying perceptions of such changes, regardless of their scientific and technical bases, affect the social acceptance of these innovations and people's attitudes toward science and technology.

A. CONFIDENCE IN INSTITUTIONAL LEADERS

Americans have high confidence in the scientific community. Amid a long decline in public confidence in most U.S. institutions, many Americans continue to have a "great deal of confidence" in the scientific community. This perception has endured over three decades and is now second only to confidence in the military.

B. VIEW OF SCIENCE

Americans overwhelmingly agree that science creates more opportunity for the next generation, that its benefits outweigh risks, and that the federal government should provide funds for scientific research. Substantial numbers also think it makes life change too fast.

C. KNOWLEDGE OF SCIENCE

Americans' knowledge of basic scientific facts remains incomplete but appears to be improving gradually over time, as measured by a set of nine knowledge items that respondents answered.

D. INFLUENCE OF EDUCATION

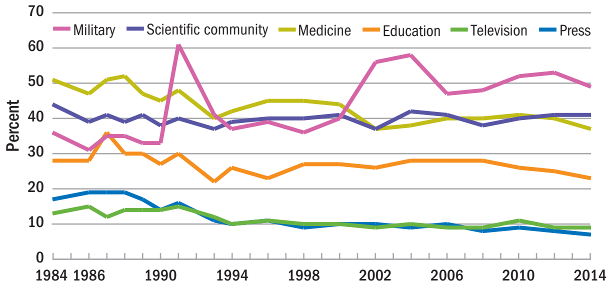
Attitudes toward and knowledge of science are influenced by level of education. Perceived benefits of science for future generations and belief in federal support of science are shared by the bulk of respondents at all education levels. However, confidence in scientific leaders and interest in new scientific findings are more common among those with advanced education.

E. VIEW ON THE ENVIRONMENT

The proportion of Americans indicating that they are worried about global warming or climate change fell to a relatively low point after the Great Recession; it has been higher in recent years.

A

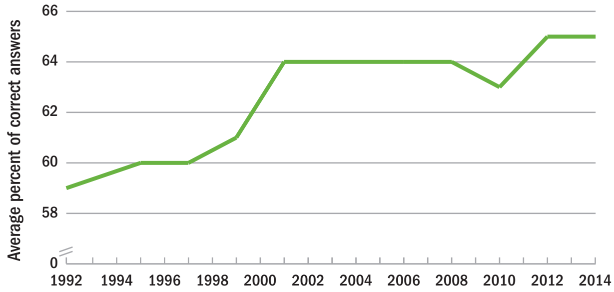
Public confidence in institutional leaders, by type of institution: 1984–2014



SEI 2016: **Confidence in the Science Community's Leadership,** Chapter 7.

C

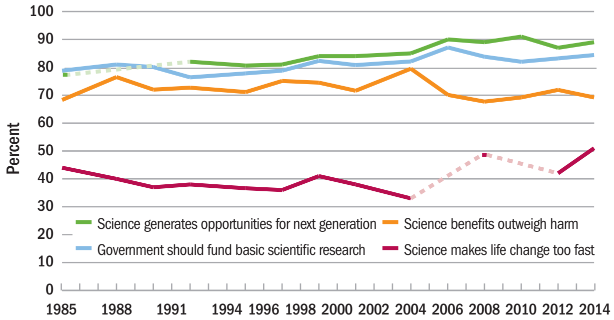
Americans' responses to the factual knowledge of science scale: 1992–2014



SEI 2016: **Understanding Scientific Terms and Concepts,** Chapter 7.

B

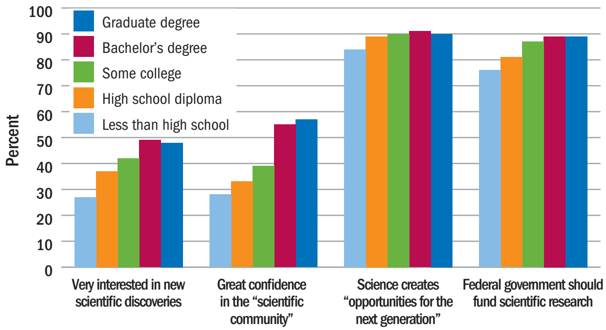
Americans' views of science: Selected years, 1985–2014



NOTES: Data are not available for all items for all years. Dotted line connects across missing values.
SEI 2016: **Public Attitudes about S&T in General,** Chapter 7.

D

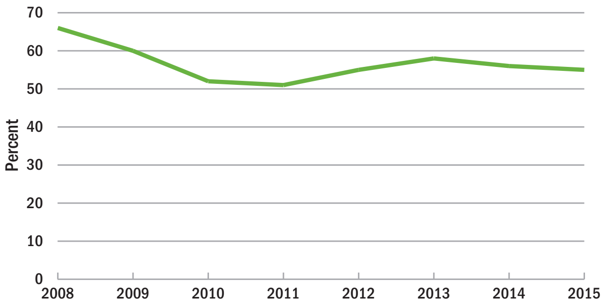
Americans' attitudes toward science, by education level: 2014



SEI 2016: **Public Attitudes about S&T in General,** Chapter 7.

E

Americans who worry a "great deal" or "fair amount" about global warming or climate change: 2008–15



SEI 2016: **Public Attitudes about Specific S&T-Related Issues,** Chapter 7.

GLOSSARY AND KEY TO ACRONYMS

Applied research. Systematic study to gain knowledge or understanding to meet a specific, recognized need.

Basic research. Systematic study to gain more comprehensive knowledge or understanding of the subject under study without specific applications in mind.

Development. Systematic use of the 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.

European Union (EU). As of September 2015, the EU comprised 28 member nations: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. Unless otherwise noted, data on the EU include all 28 member countries.

GDP. Gross domestic product. The market value of all final goods and services produced within a country within a given period of time.

Knowledge- and technology-intensive (KTI) industries. Industries that have a particularly strong link to science and technology. These industries include high-technology (HT) manufacturing and knowledge-intensive (KI) service industries. HT manufacturing industries include those that spend a relatively high proportion of their revenue on R&D, consisting of aerospace, pharmaceuticals, computers and office machinery, semiconductors and communications equipment, and scientific (medical, precision, and optical) instruments. KI service industries include those that incorporate science, engineering, and technology into their services or the delivery of their services, consisting of business, information, education, financial, and health services. Commercial KI services are generally privately owned and compete in the marketplace without public support. These services are business, information, and financial services.

NCSES. National Center for Science and Engineering Statistics, National Science Foundation.

NSB. National Science Board.

NSF. National Science Foundation.

Organisation for Economic Co-operation and Development (OECD). An international organization of 34 countries headquartered in Paris, France. The member countries are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Estonia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Among its many activities, the OECD compiles social, economic, and science and technology statistics for all member and selected non-member countries.

R&D. Research and development.

R&D intensity. R&D as a proportion of gross domestic product.

Research university. The Carnegie Classification of Institutions of Higher Education considers doctorate-granting universities that award at least 20 doctoral degrees per year to be research universities. The 2010 Carnegie Classification includes three subgroups of research universities based on the level of research activity: very high research activity (108 institutions), high research activity (99 institutions), and doctoral/research universities (90 institutions).

S&E. Science and engineering.

S&E occupations. Biological, agricultural, and environmental life scientists; computer and mathematical scientists; physical scientists; social scientists; and engineers. S&E managers and technicians, and health-related occupations are categorized as S&E-related and are not included in S&E.

S&T. Science and technology.

SEI. Science and Engineering Indicators.

EXPLORE FURTHER

To read more about the themes presented in this digest, please see the Overview chapter as well as the more detailed analysis and fuller discussion of the related topics presented in *SEI 2016*. Each theme is matched with its source *SEI 2016* chapter or chapters in the list below. *SEI 2016* also provides a wealth of detailed information on state-level comparisons of selected science and engineering indicators (State Data Tool).

Global R&D: Measuring Commitment to Innovation

- Chapter 4. Cross-National Comparisons of R&D Performance

U.S. R&D

- Chapter 4. Recent Trends in U.S. R&D Performance
- Chapter 4. Recent Trends in Federal Support for U.S. R&D

U.S. and Global STEM Education

- Chapter 1. Student Learning in Mathematics and Science
- Chapter 2. Undergraduate Degree Awards
- Chapter 2. First University Degrees in S&E Fields
- Chapter 2. Global Comparison of S&E Doctoral Degrees
- Chapter 2. Global Student Mobility

U.S. S&E Workforce: Trends and Composition

- Chapter 3. S&E Workers in the Economy
- Chapter 3. S&E Labor Market Conditions
- Chapter 3. Women and Minorities in the S&E Workforce
- Chapter 3. Immigration and the S&E Workforce

Knowledge, Intellectual Property, and Economic Output

- Chapter 5. S&E Publication Output
- Chapter 6. Global Trends in Patenting
- Chapter 6. Worldwide Distribution of Knowledge- and Technology-Intensive Industries

Research Universities

- Chapter 2. Institutions Providing S&E Education
- Chapter 2. Trends in Higher Education Expenditures and Revenues
- Chapter 2. Cost of Higher Education
- Chapter 5. Academic R&D by Public and Private Institutions
- Chapter 5. Outputs of S&E Research: Publications and Patents

Science and Technology: Public Attitudes and Understanding

- Chapter 7. Confidence in the Science Community's Leadership
- Chapter 7. Public Attitudes about S&T in General
- Chapter 7. Understanding Scientific Terms and Concepts
- Chapter 7. Public Attitudes about Specific S&T-related Issues

SEI 2016 ONLINE RESOURCES

Beginning in 2016, SEI will be published as a Web-based digital report. The complete *SEI 2016* report and its related resources, described below, are available on the Web at www.nsf.gov/statistics/indicators/. An interactive version of this digest is available online at www.nsf.gov/statistics/digest/.

Companion piece. The Board's companion pieces are "companion" policy statements to *SEI 2016*. The Board focuses on trends that it believes raise important policy concerns and should be brought to the attention of the President, Congress, and the public.

State Indicators. The State Indicators online data tool allows interactive exploration of U.S. state-specific indicators in science and technology education, workforce, finance, and R&D. Users have the ability to choose and explore a single indicator in depth, compare multiple indicators for preselected groups, customize their own graphics, or download data tables.

Downloads. The complete content of *SEI 2016* is downloadable as a PDF, with data tables and source data for figures available in both PDF and spreadsheet (MS Excel) formats. In addition, figures are also available in a presentation-style format.

ACKNOWLEDGMENTS

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Cover Image

A 180-degree fisheye view of the Gemini North Telescope on Mauna Kea, Hawaii, as it is lit by moonlight and the red glow of a passing automobile's taillights shining through the wind-vent gates. At the top of the seven-story-high telescope structure, the laser guide star (LGS) can be seen extending into the sky where it creates an artificial star used by an adaptive optics system, to correct for distortions caused by turbulence in the Earth's atmosphere.

The Gemini Observatory consists of twin, eight-meter optical/infrared telescopes located on two of the best sites on our planet for observing the universe. Together, these telescopes can access the entire sky. The Gemini South Telescope is located at almost 9,000 feet on a mountain in the Chilean Andes called Cerro Pachon. The Frederick C. Gillett Gemini North Telescope is located on Hawaii's Mauna Kea. It is part of the international community of observatories that have been built to take advantage of the superb atmospheric conditions on this long dormant volcano that rises almost 14,000 feet into the dry, stable air of the Pacific.

Gemini was built and is operated by a partnership of seven countries, including the United States, United Kingdom, Canada, Chile, Australia, Brazil, and Argentina. Any astronomer in each partner country can apply for time on Gemini, which is allocated in accordance with the amount of financial support provided by each country. To learn more about Gemini, visit the observatory's website at www.gemini.edu/. (Date of image: June 2007.)

Credit: Gemini Observatory

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