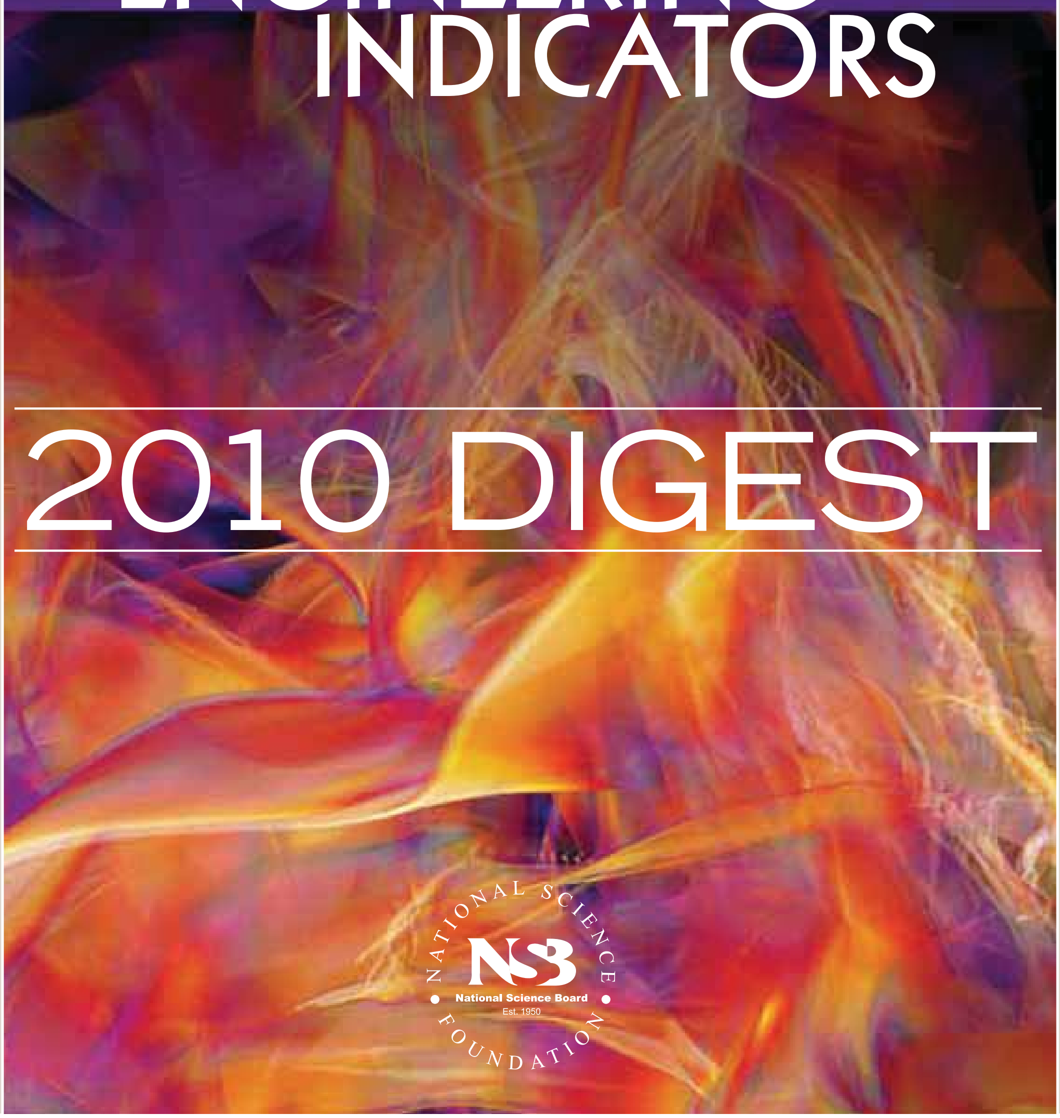
National Science Board

KEY SCIENCE AND ENGINEERING INDICATORS

2010 DIGEST



National Science Board
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NATIONAL SCIENCE FOUNDATION

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2010 DIGEST

NSB 10-02

JANUARY 2010

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 by January 15 of every even-numbered year. The report is prepared by the NSF Division of Science Resources Statistics (SRS) under the guidance of the Board. It is subject to extensive review by Board members, outside experts, interested federal agencies, and SRS internal reviewers for accuracy, coverage, and balance.

Indicators are quantitative representations—summaries—of factors relevant to the scope, quality, and vitality of the science and engineering (S&E) enterprise. *SEI* is the major authoritative source of these high-quality U.S. and international data. *SEI* is factual and policy-neutral; it neither offers policy options nor makes policy recommendations. The indicators included in the report are intended to 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 2010*, the 19th volume of this biennial series. The digest serves to draw attention to important trends and data points from across *SEI 2010* 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 is matched with the *SEI 2010* chapter or chapters from which it was drawn. The complete *SEI 2010* report and related resources are available on the Web at www.nsf.gov/statistics/indicators/.

Readers may also be interested in resources associated with *SEI 2010*, which include *Globalization of Science and Engineering Research*, the Board's companion policy piece to *SEI 2010*. The section "*SEI 2010* Online Resources" at the end of this digest provides a complete list and descriptions of these products and tools. 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 science and engineering (S&E) in the world, derived in large part from its long history of public and private investment in S&E research and development (R&D) and education. Investment in R&D, science, technology, and education correlate strongly with economic growth, as well as 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. This trend will challenge the world leadership role of the United States.

KEY S&E INDICATORS

The National Science Board has selected 31 S&E indicators for inclusion in this digest. These indicators have been grouped into six topical areas. Although each stands alone, collectively these six themes are a snapshot of U.S. R&D capacity and outputs in a global context. 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 science and technology capacities. Three others share a domestic focus, providing indicators of U.S. R&D: funding and performance, federal R&D support, and the U.S. S&E workforce. These topical indicators may vary in successive volumes of the *Science and Engineering Indicators* series as contemporary S&E policy issues emerge.

WHAT THESE INDICATORS TELL THE NATION

By selecting a set of general and topical 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 on new knowledge and technologies, contributes to national competitiveness, and furthers social welfare. Investment in research and development, a major driver of innovation, is vital in knowledge-intensive economies. R&D expenditures indicate the priority given to advancing science and technology relative to other national goals.

KEY OBSERVATIONS:

A | HOW MUCH?

R&D expenditures worldwide are estimated to have exceeded $1 trillion in 2007, up from $525 billion a decade earlier.

B | WHERE?

The United States accounted for about one-third of the $1.1 trillion 2007 worldwide R&D total—more than the EU-27 and more than the eight Asian economies with the largest R&D expenditures.

The rapidly growing R&D expenditures of the Asia-8 economies (China, India, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand) surpassed those of the EU-27 in 2003.

C | INTENSITY

R&D intensity measures how much of a country's economic activity (gross domestic product) its R&D investment represents.

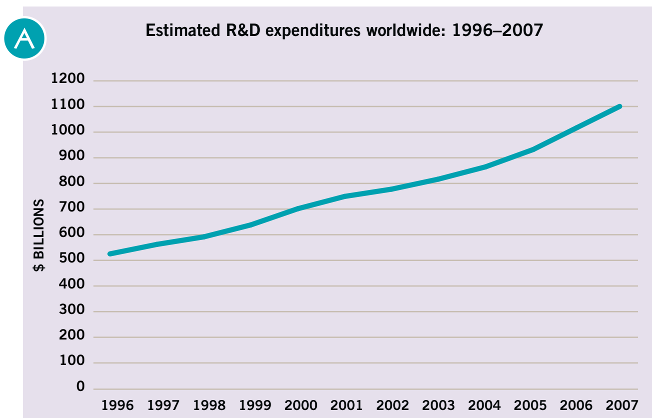
Japan committed 3.4% of its GDP to R&D in 2007, more than most other large economies, but was surpassed by South Korea. In comparison, R&D intensity was lower in the United States and the EU-27.

Over the past decade, R&D intensity has grown in Asia and has remained steady in the United States and EU-27.

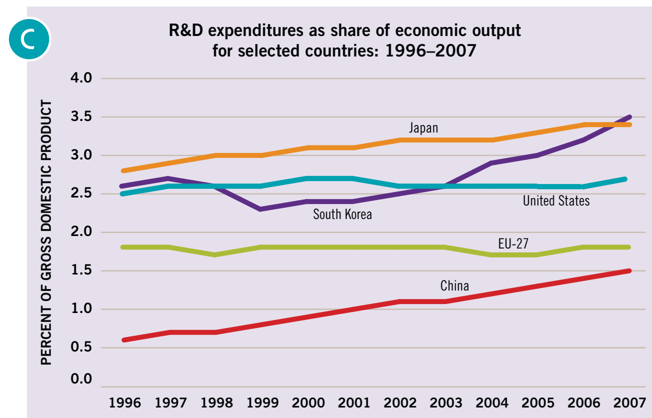
D | GROWTH

Growth of R&D expenditures in the United States and the EU-27 averaged 5%–6% annually over the period 1996–2007. Comparable R&D growth rates of the Asia-8 economies often exceeded 10%, and in China's case 20%.

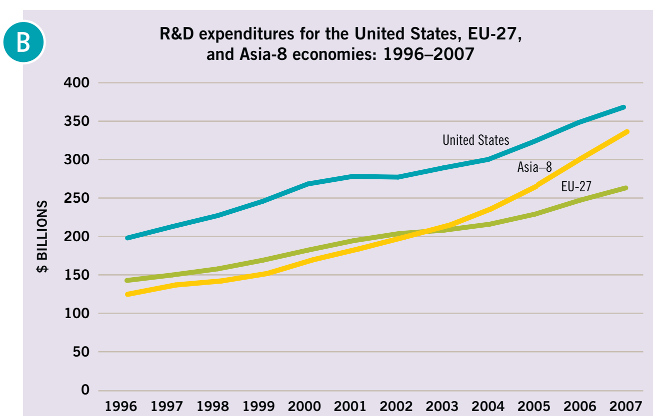
Asian R&D growth reflects rising private spending by domestic and foreign firms as well as increased public R&D spending, designed to support strategic policies that aim to raise economic competitiveness through the development of knowledge-intensive economies.



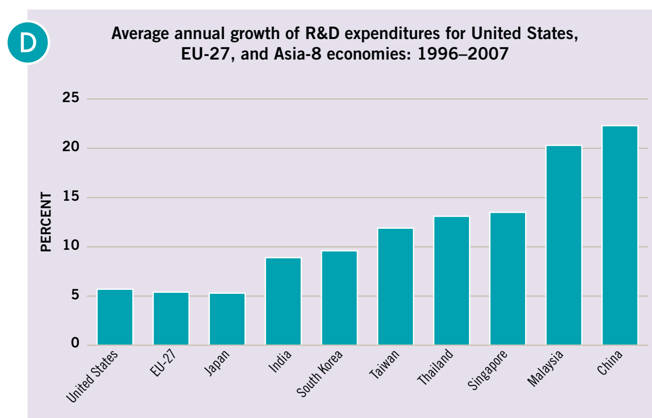
SEI 2010: **Global Patterns of R&D Expenditures,** Chapter 4.



SEI 2010: **Comparison of Country R&D Intensities,** Chapter 4.



SEI 2010: **Global Patterns of R&D Expenditures,** Chapter 4.



SEI 2010: **Global Patterns of R&D Expenditures,** Chapter 4.

U.S. R&D: FUNDING AND PERFORMANCE

WHY IS THIS IMPORTANT?

Outcomes and benefits of R&D depend not only on the total resources devoted to it but also on the types of R&D these resources support—basic research, applied research, development—and on who performs it.

KEY OBSERVATIONS:

A | FUNDING SOURCES

Industry and the federal government are the largest supporters of U.S. R&D. Industry invested $268 billion in R&D in 2008, 67% of the estimated $398 billion national total. It has been the main funding source for U.S. R&D since 1980. Federal R&D support in 2008 stood at $104 billion.

Other sources—chiefly universities and colleges and other not-for-profit organizations—added another $26 billion.

B | TYPES OF R&D

Funding sources differ by type of R&D. Industry funds the bulk of applied research and development ($256 billion of the $328 billion national total in 2008)—work that aims at practical applications, new products, or novel processes.

Basic research, directed primarily toward increasing knowledge or understanding, has long relied on the federal government for about 60% of its support ($39 billion of the 2008 $69 billion national total).

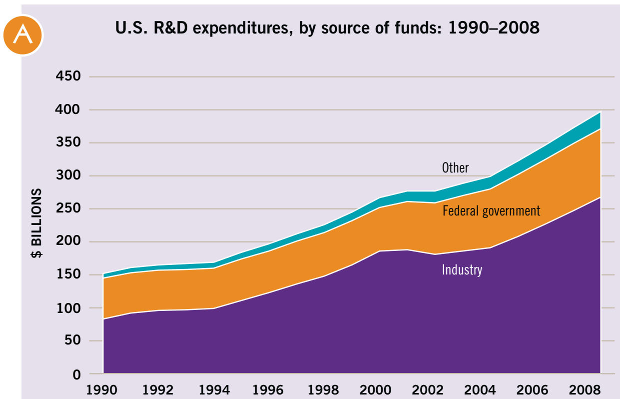
C | ACADEMIC R&D SUPPORT

The bulk of academic R&D is basic research, amounting to more than half of the nation's total basic research. Sources of support for academic R&D have been stable for nearly two decades: about 60% from the federal government, 20% from institutions' own funds. Industry funding has gradually declined from 7% to about 6%.

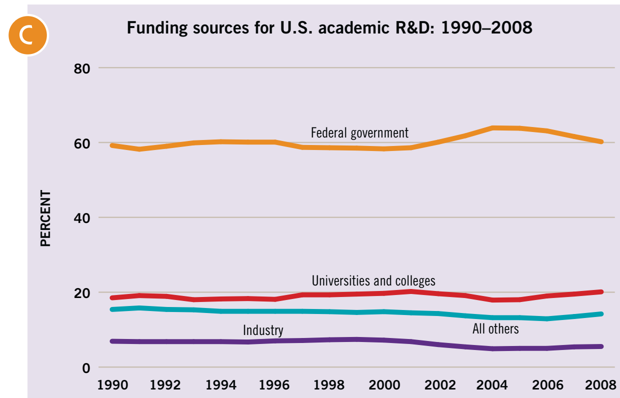
D | PERFORMERS

The nature of R&D varies by performer. Industry is the dominant performer of the nation's development and applied research; the federal government, academic institutions, and other nonprofit organizations combined perform less than 20% of that total.

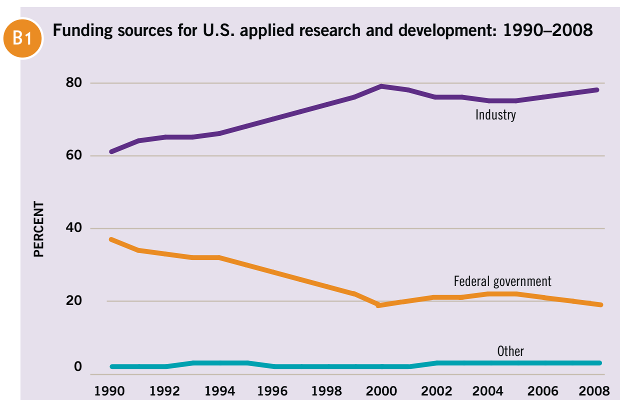
Universities and colleges are the prime performers of the nation's basic research, a role they uniquely combine with the training of new researchers. Industry's share of basic research performance has recently risen after 9 years of decline.



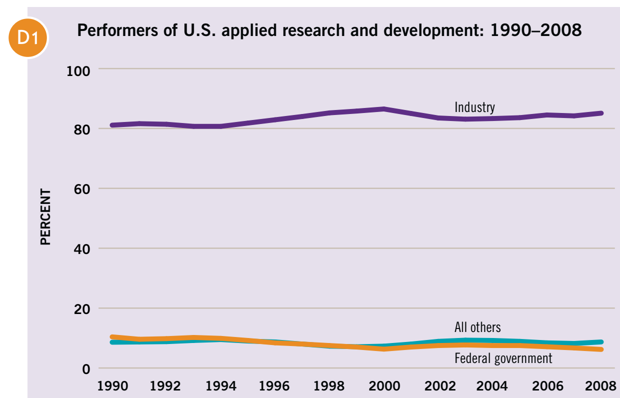
SEI 2010: **Sources of R&D Funding,** Chapter 4.



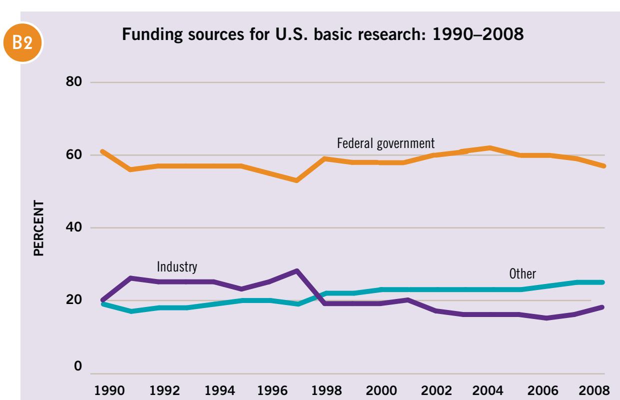
SEI 2010: **Financial Resources for Academic R&D,** Chapter 5.



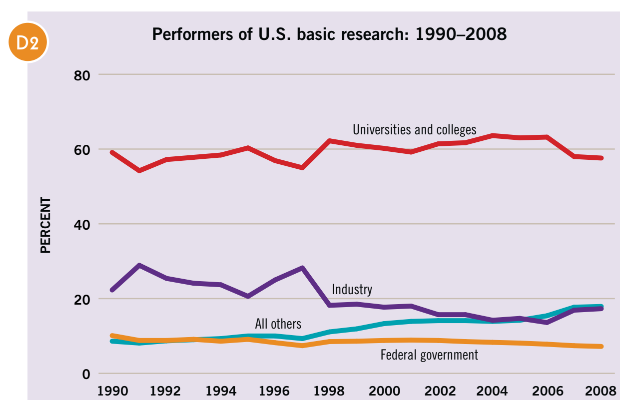
SEI 2010: **Sources of R&D Funding** and **R&D by Character of Work,** Chapter 4.



NOTES: 2008 data are preliminary. Federal government is intramural only.
SEI 2010: **Performers of R&D** and **R&D by Character of Work,** Chapter 4.



SEI 2010: **Sources of R&D Funding** and **R&D by Character of Work,** Chapter 4.



NOTES: 2008 data are preliminary. Federal government is intramural only.
SEI 2010: **Performers of R&D** and **R&D by Character of Work,** Chapter 4.

U.S. R&D: FEDERAL PORTFOLIO

WHY IS THIS IMPORTANT?

The distribution of R&D funds by the U.S. federal government provides insight into the nation's broad mission priorities for public expenditures.

KEY OBSERVATIONS:

A | TYPE OF WORK

Federal funding of R&D has more than doubled over 20 years (not adjusting for inflation). Federal basic and applied research funds have grown more rapidly than funds for development work. Consequently, research now makes up about half of federal R&D funds.

B | SUPPORT FOR S&E FIELDS

The life sciences account for half of the federal portfolio of basic and applied research (development funds cannot be sorted into S&E fields), up from about 40% two decades earlier. Funding for physical, environmental, and social sciences and funding for engineering have increased at below average rates.

C | AGENCY SUPPORT

Agencies of the federal government fund R&D that supports the attainment of agency goals.

The Department of Health and Human Services funds 85% of research in the life sciences ($29.7 billion in 2008), primarily through the National Institutes of Health. The Departments of Defense and Energy and the National Science Foundation support 77% of research in math/computer sciences and physical sciences ($8.5 billion).

NSF supports research across the range of S&E fields, principally basic academic research.

DOD, DOE, and the National Aeronautics and Space Administration support about 71% of engineering research ($9.4 billion in 2008).

D | FOCUS

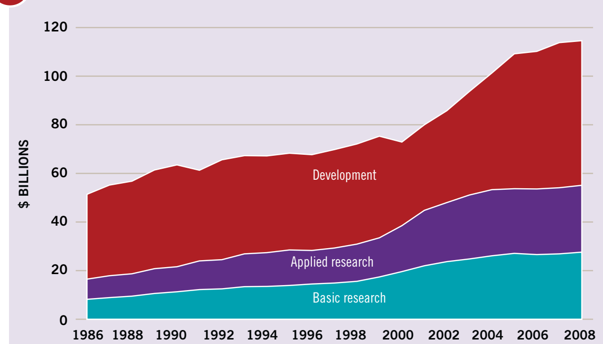
The Department of Defense, long the largest federal R&D funding agency, has increased its R&D support strongly in recent years. More than half of the federal government's R&D investment is devoted to defense. More than half of nondefense R&D is related to health, largely funded by the Department of Health and Human Services, primarily through the National Institutes of Health.

E | PERFORMERS

Different institutions bring different perspectives and approaches to R&D. Academic and nonprofit institutions, which tend to concentrate on basic research, have received steadily increasing federal support. Industry, heavily focused on development and applied research, has recently seen rising federal funding after a decade of no growth.

A

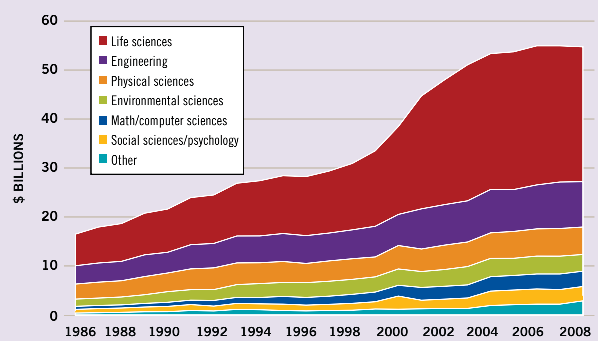
Federal R&D funds, by type of work: 1986–2008



NOTE: 2008 data are preliminary.
SEI 2010: **R&D by Character of Work,** Chapter 4; appendix table 4-19. See also NSF Survey of Federal Funds for Research and Development: 2007–09.

B

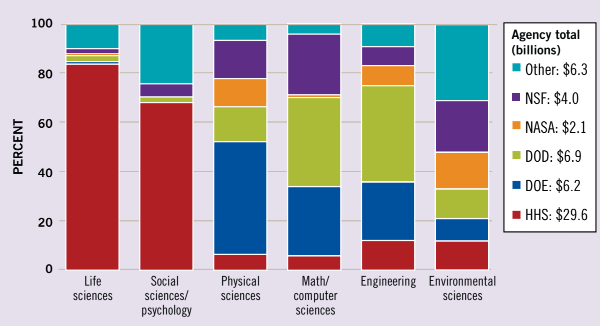
Federal basic and applied research funds, by S&E field: 1986–2008



NOTE: 2008 data are preliminary.
SEI 2010: **Federal Spending on Research by Field,** Chapter 4.

C

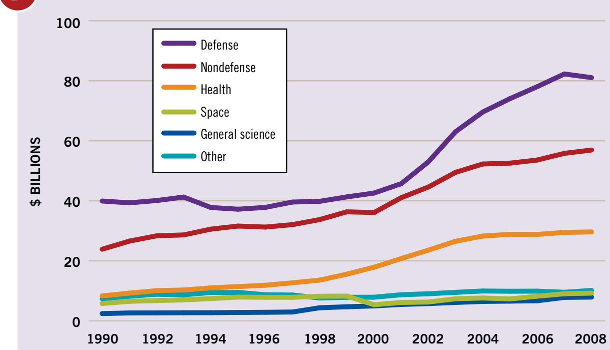
Distribution of federal agencies' research support portfolios, by field: 2008



NOTE: 2008 data are preliminary; excludes ARRA stimulus funds.
SEI 2010: **Federal Spending on Research by Field,** Chapter 4.

D

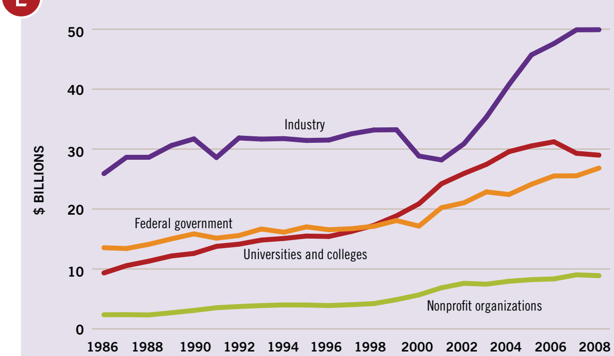
Federal R&D budget, by national objectives: 1990–2008



NOTES: 2008 data are preliminary. Budget authority.
SEI 2010: **Federal R&D Budget by National Objectives,** Chapter 4.

E

Federal spending on R&D, by performer: 1986–2008



NOTES: 2008 data are preliminary. Federal government is intramural only.
SEI 2010: **Federal Spending on R&D by Performer,** Chapter 4.

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

WHY IS THIS IMPORTANT?

A growing S&E workforce is conducive to increased capacity for innovation. As economies become more knowledge-intensive, S&E skills will be needed by those in jobs not traditionally considered part of the S&E workforce, such as managers, sales representatives, and financial analysts.

KEY OBSERVATIONS:

A | WORKFORCE GROWTH

For nearly five decades, the U.S. S&E workforce (those in S&E jobs) has grown faster than the total civilian workforce. It reached about 5.5 million in 2007.

The increasing number of U.S. S&E degrees earned and rising numbers of foreign-born scientists and engineers have contributed to this growth.

B | S&E EDUCATION

For nearly two decades, about one-third of all U.S. college freshmen have indicated plans to pursue an S&E degree. Freshman intentions are a leading indicator of future degree distribution.

After about 2000, preferences for the social sciences, psychology, and the biological sciences began rising, and preferences for computer sciences began a steep decline. Engineering dropped sharply after 2004 but rebounded in 2008.

C | FIELD OF DEGREE

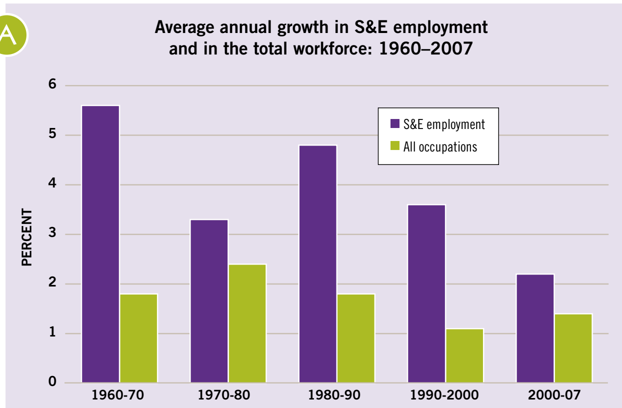
The changing field composition of new S&E degrees is gradually altering the composition of S&E jobs and the larger U.S. workforce. And emphasis on higher-level S&E skills is growing: advanced S&E degrees have risen faster (70%–75%) than bachelor's degrees (about 50%) over the past two decades.

Across degree levels, the physical sciences, computer sciences, mathematics, and engineering have had weaker-than-average growth, but engineering doctorates have set records. Bachelor's and master's degrees in computer sciences have pulled back from their 2004 record highs to near levels set in 2000. The biological sciences and psychology have shown the strongest gains.

D | NATIONALITY

The U.S. S&E workforce continues to rely heavily on attracting foreign-born scientists and engineers, who are most highly represented in engineering, mathematics, and computer sciences, especially at advanced degree levels.

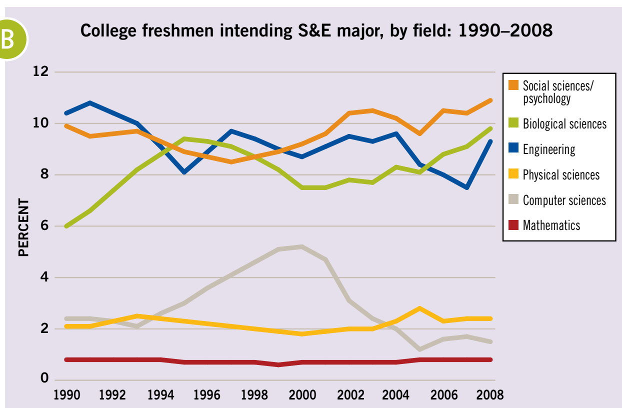
A



Average annual growth in S&E employment and in the total workforce: 1960–2007

SEI 2010: **Growth of the S&E Workforce,** Chapter 3.

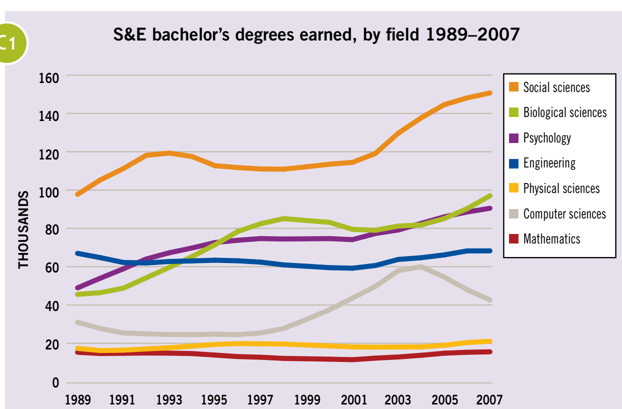
B



College freshmen intending S&E major, by field: 1990–2008

SEI 2010: **Undergraduate Enrollment in the United States,** Chapter 2.

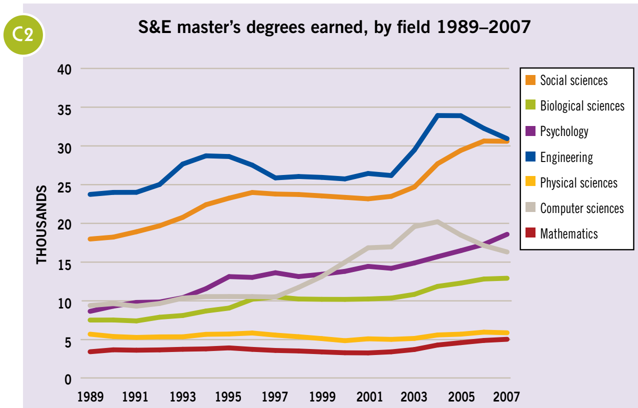
C1



S&E bachelor's degrees earned, by field 1989–2007

NOTE: Data for 1999 extrapolated.
SEI 2010: **Undergraduate Degree Awards,** Chapter 2.

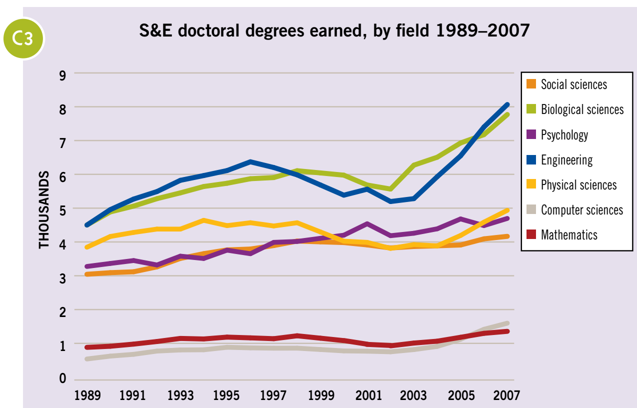
C2



S&E master's degrees earned, by field 1989–2007

NOTE: Data for 1999 extrapolated.
SEI 2010: **S&E Master's Degrees,** Chapter 2.

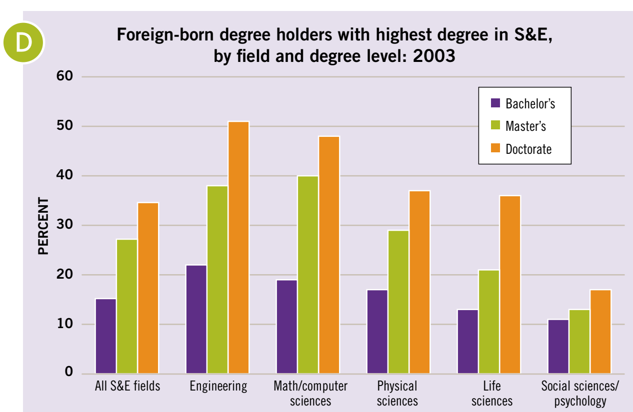
C3



S&E doctoral degrees earned, by field 1989–2007

NOTE: Data for 1999 extrapolated.
SEI 2010: **S&E Doctoral Degrees,** Chapter 2.

D



Foreign-born degree holders with highest degree in S&E, by field and degree level: 2003

SEI 2010: **Migration to the United States,** Chapter 3.

RESEARCH OUTPUTS: PUBLICATIONS AND PATENTS

WHY IS THIS IMPORTANT?

Research produces new knowledge, products, or processes. Research publications reflect contributions to knowledge, patents indicate useful inventions, and citations on patents to the scientific and technical literature indicate the linkage between research and practical application.

KEY OBSERVATIONS:

A | PUBLICATIONS

The EU-27 leads the world in numbers of S&E articles published, but the United States continues to be the top country producer.

China, with a rapidly developing science base, produced 8% of the world's research publications in 2008, becoming the second largest single-country producer. It ranked 14th in 1995, with 2% of world share.

B | RESEARCH PORTFOLIOS

The distribution of a country's research publications across different fields broadly reflects its research priorities and relative strengths, as well as its ability to absorb advances achieved elsewhere.

More than half of U.S. articles report on research in the medical and life sciences. In contrast, more than half of the research articles published by Asian scientists and engineers are in the natural sciences and engineering.

C | PATENTS

Patents protect the property rights of inventors. Patent awards are rising as knowledge-intensive economic activity expands worldwide.

Inventors from around the globe seek patent protection in the United States because of its large and open market. U.S. patents awarded to foreign inventors offer a broad indication of the distribution of inventive activity around the globe.

Inventors in the United States, the EU-27, and Japan produce almost all of these patents. U.S. patenting by Asian inventors is on the rise, driven by activity in Taiwan and South Korea, but Chinese and Indian patenting remains modest.

D | SCIENCE-PATENT LINKAGE

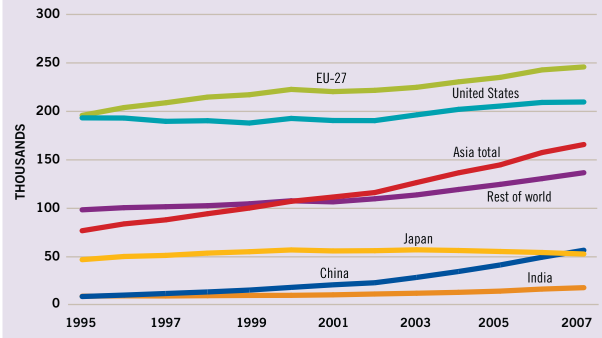
Patents list the prior scientific and technological knowledge on which they are built. Increasingly, U.S. patent applications have cited scientific articles as one such source.

Article citations have risen from 92,000 in 1998 to 110,000 in 2008, with 68% of these patent citations being to literature in the biological and medical sciences. About half of the 2008 citations were to non-U.S. articles.

Over 60% of the U.S.-authored articles cited on U.S. patents have academic scientists and engineers as authors, indicating the link between academic research and valuable inventions.

A

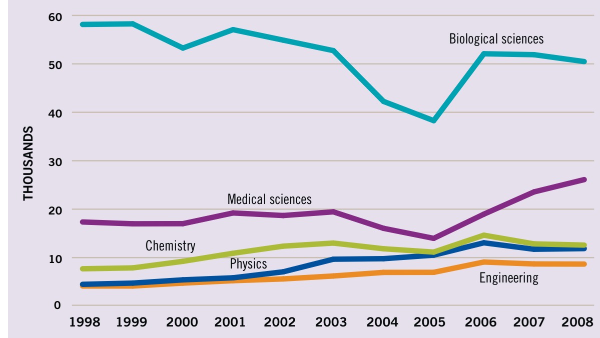
Science and engineering articles, by selected countries/regions: 1995–2007



SEI 2010: **S&E Article Output,** Chapter 5.

D1

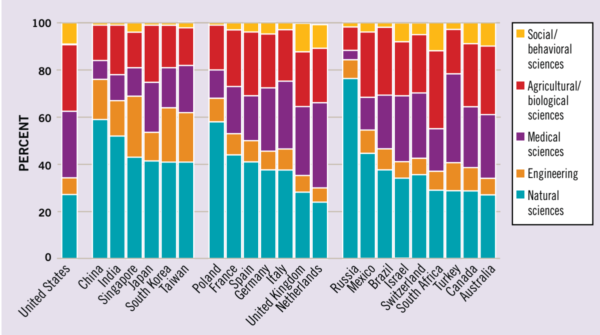
Citations in U.S. patents to S&E articles, by selected article field: 1998–2008



NOTE: Citation counts lag articles' publication year; for example, articles cited in 2008 patents were published in 1998–2003.
SEI 2010: **Patent-to-Literature Citations,** Chapter 5.

B

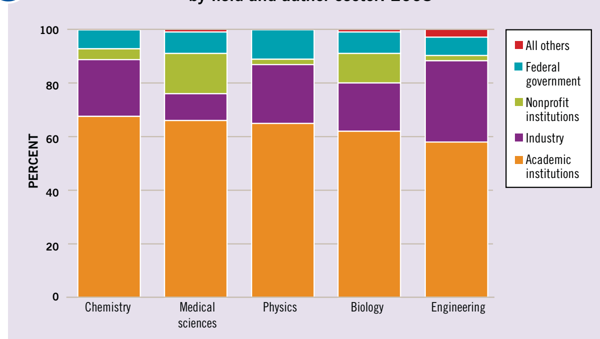
Field shares of research articles, by selected locations: 2007



NOTE: Natural sciences include astronomy, chemistry, physics, geosciences, mathematics, and computer sciences.
SEI 2010: **S&E Article Output,** Chapter 5.

D2

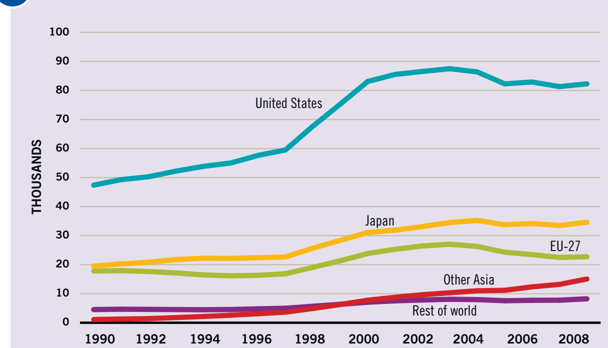
U.S. patent citations to U.S.-authored articles, by field and author sector: 2008



SEI 2010: **Patent-to-Literature Citations,** Chapter 5.

C

U.S. patents granted, by country/region of inventor: 1990–2008



NOTES: "Other Asia" is China, India, Indonesia, South Korea, Philippines, Singapore, Taiwan, Thailand, Vietnam. Three-year moving average.
SEI 2010: **Global Trends in Patenting,** Chapter 6.

GEOGRAPHY OF S&T: GLOBALIZATION OF CAPABILITIES

WHY IS THIS IMPORTANT?

Today's interdependent economies rely on science, engineering, and technology for innovations that will keep them competitive. To that end, many governments have adopted policies to build or improve national S&T capabilities.

KEY OBSERVATIONS:

A | R&D DISTRIBUTION

The distribution of R&D expenditures has shifted from 1996 to 2007. Asia's share has risen to nearly one-third, driven mostly by China's rapid R&D growth.

B | RESEARCHERS

The estimated number of researchers grew from about 4 million in 1995 to about 5.8 million in 2007, rising more rapidly in developing than in industrialized countries.

The combined U.S./EU-27 share of researchers declined from 51% to 49%; Japan's share dropped from 17% to 12%. The combined shares of South Korea, Taiwan, China, and Singapore rose from 16% to 31%.

C | CROSS-BORDER R&D

Overseas R&D expenditures by foreign affiliates of U.S. multinational companies (MNCs) rose from $12.6 billion in 1995 to $28.5 billion in 2006. Europe's share of these overseas expenditures fell from 73% to 65%, and Asia's share increased from 15% to 20%.

Foreign MNCs spent $34 billion in the United States in 2006, up from $15 billion in 1995. European-owned companies' share of these expenditures was little changed at 75%.

D | HIGH TECHNOLOGY MANUFACTURING

The U.S. and EU-20 shares of world high technology manufacturing output have remained at high levels for more than a decade, measured in value-added terms (broadly, final product sales less the cost of intermediate goods and services).

China's rapid growth in high-technology output has driven its substantial world share gain; output decline in Japan in that sector has resulted in a steep share loss.

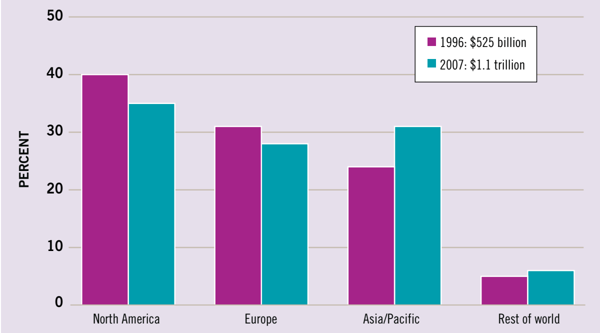
E | HIGH TECHNOLOGY EXPORTS

Exports of high technology products (excluding intra-EU trade) expanded from $732 billion in 1995 to $2.3 trillion in 2008, resulting in major shifts in countries' export positions.

U.S. and Japan's world high technology export shares fell by about one-third and one-half over the period, respectively; the EU-27's share was stable.

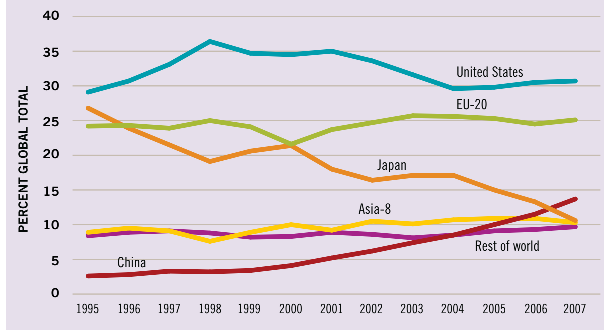
China's share more than tripled, reaching 20%. Exports of the Asia-8 economies, steady at about 28%, included substantial intermediate goods trade with China and other Asian economies.

A Location of estimated worldwide R&D expenditures: 1996 and 2007



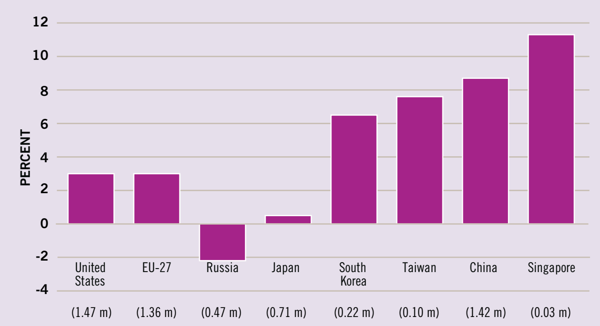
SEI 2010: **Global Patterns of R&D Expenditures,** Chapter 4.

D High-technology manufacturing value-added share, by country/economy: 1995–2007



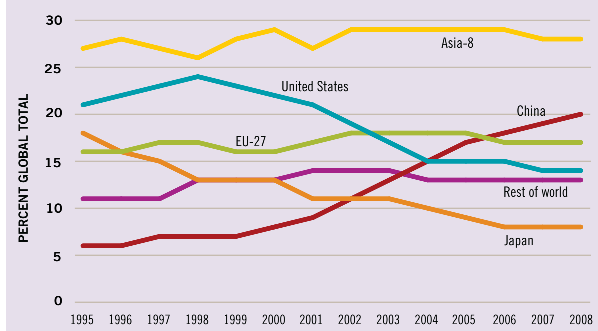
NOTE: China includes Hong Kong.
SEI 2010: **High-Technology Manufacturing Industries,** Chapter 6.

B Average annual growth rates in number of researchers, by country/economy: 1995–2007



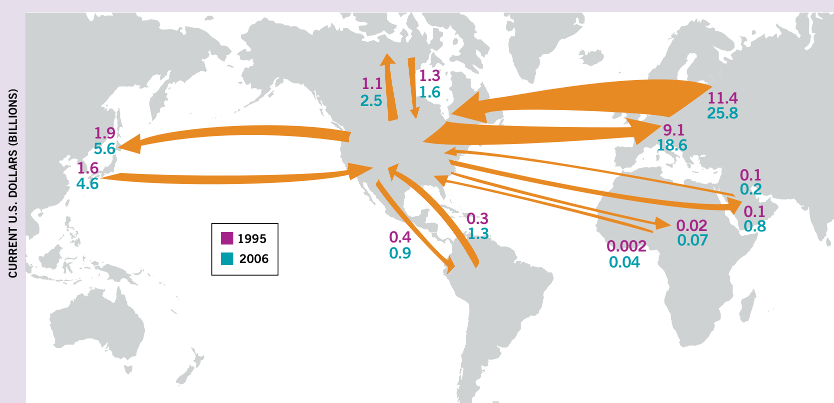
NOTE: Estimated number of researchers (in millions) is for 2007 and shown below country/economy. U.S. 2007 estimate based on long-term growth rate.
SEI 2010: **Global S&E Labor Force,** Chapter 3.

E Exports of high-technology manufactured goods, by country/economy: 1995–2008



NOTES: China includes Hong Kong. Excludes intra-EU trade.
SEI 2010: **Trade of High-Technology Goods,** Chapter 6.

C R&D performed in the United States by U.S. affiliates of foreign companies, by investing region, and R&D performed abroad by foreign affiliates of U.S. MNCs, by host region: 1995 and 2006



NOTE: Data are for majority-owned affiliates only.
SEI 2010: **R&D by Multinational Companies,** Chapter 4.

GLOSSARY AND KEY TO ACRONYMS

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

ARRA. American Recovery and Reinvestment Act of 2009.

Asia-8. China, India, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand.

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.

DOD. Department of Defense.

DOE. Department of Energy.

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

EU-20. The 20 European Union member nations with substantial high technology manufacturing: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, United Kingdom.

EU-27. The 27 member nations of the European Union: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

HHS. Department of Health and Human Services.

High technology manufacturing. Manufacturing in five industries, identified by the Organization for Economic Co-operation and Development, that have particularly strong linkages to science and technology: aerospace, communications and semiconductors, computers and office machinery, pharmaceuticals, and scientific instruments.

Knowledge-intensive economy. Economies in which research, its commercial exploitation, and intellectual work play a substantial role.

Majority-owned affiliate. Affiliates in which the ownership stake of parent companies exceeds 50%.

MNC. Multinational company.

NASA. National Aeronautics and Space Administration.

NSB. National Science Board.

NSF. National Science Foundation.

R&D. Research and development.

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

S&E. Science and engineering.

S&T. Science and technology.

SEI. Science and Engineering Indicators.

SRS. Division of Science Resources Statistics, National Science Foundation.

Value-added. Sales minus the cost of purchased domestic and foreign inputs and materials.

EXPLORE FURTHER

To read more on the themes presented in this digest, please see the detailed analysis and fuller discussion of each of the key indicators presented in *SEI 2010*. Each theme is matched with its source *SEI 2010* chapter or chapters in the list below. *SEI 2010* also provides a wealth of detailed information on U.S. mathematics and science education at the elementary and secondary levels (Chapter 1), public attitudes and understanding of science and engineering (Chapter 7), and state-level comparisons of selected science and engineering indicators (Chapter 8).

GLOBAL R&D: MEASURING COMMITMENT TO INNOVATION

Chapter 4. Research and Development: National Trends and International Linkages

U.S. R&D: FUNDING AND PERFORMANCE

Chapter 4. Research and Development: National Trends and International Linkages

Chapter 5. Academic Research and Development

U.S. R&D: FEDERAL PORTFOLIO

Chapter 4. Research and Development: National Trends and International Linkages

Chapter 5. Academic Research and Development

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

Chapter 2. Higher Education in Science and Engineering

Chapter 3. Science and Engineering Labor Force

RESEARCH OUTPUTS: PUBLICATIONS AND PATENTS

Chapter 5. Academic Research and Development

Chapter 6. Industry, Technology, and the Global Marketplace

GEOGRAPHY OF S&T: GLOBALIZATION OF CAPABILITIES

Chapter 3. Science and Engineering Labor Force

Chapter 4. Research and Development: National Trends and International Linkages

Chapter 6. Industry, Technology, and the Global Marketplace

www.nsf.gov/statistics/indicators/

SEI 2010 ONLINE RESOURCES

The complete *SEI 2010* 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 also available online at www.nsf.gov/statistics/digest/.

Companion piece. The Board's companion piece, *Globalization of Science and Engineering Research* (NSB 10-03), is a "companion" policy statement to *SEI 2010*. The Board focuses in this document on trends that it believes raise important policy concerns and should be brought to the attention of the President, Congress, and the public.

State data tool. This interactive data tool is associated with Chapter 8, "State Indicators." By selecting indicators and states, data users can create custom tables.

Presentation graphics. Presentation graphics, in PowerPoint slide and image (JPEG) formats, accompanied by their supporting data (Excel), are based on figures in the full *SEI 2010* text. Selected figures are modified to fit the presentation-slide format, and slides can be previewed using the thumbnail view.

Source data. Data supporting each figure, table, and appendix table in *SEI 2010* are available for download in Excel format. Links are provided on the *SEI 2010* main page to the lists of figures, tables, and appendix tables, each organized by chapter.

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Proprietary data in "Research Outputs: Publications and Patents" were provided by Thomson Reuters, Science Citation Index and Social Sciences Citation Index, http://thomsonreuters.com/products_services/science/; analytical support for article and patent data was provided by The Patent Board™, http://patentboard.com/. Proprietary data in "Geography of S&T: Globalization of Capabilities" were provided by IHS Global Insight, World Industry Service database, and World Trade Service database.

COVER IMAGE

The cover design is based on a computer-simulated visualization of Mach 1 homogeneous turbulence, created by the passage of strong shock fronts through gas. Regions having the weakest vorticity are blue. As the vorticity increases in strength, regions become red, yellow, and, finally, white. The dynamic visualization was created at the Laboratory for Computational Science and Engineering (LCSE), a facility in the University of Minnesota's Digital Technology Center, where innovative hardware and system software solutions to problems in computational science and engineering can be tested and applied. Work in the LCSE has been supported by a series of National Science Foundation equipment grants (most recently CNS 07-08822). *(Credit: Paul Woodward, Laboratory for Computational Science and Engineering, University of Minnesota.)*

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