Science and Engineering Indicators: Background

- NSB's report on the state of the U.S. S&E enterprise in a global context

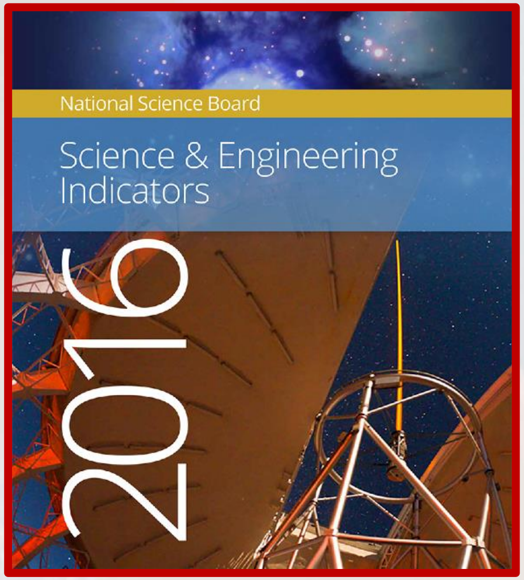
- Congressionally-mandated, biennial

  *The Board shall render to the President and the Congress no later than January 15 of each even numbered year, **a report on indicators of the state of science and engineering in the United States**.*

- Factual, policy relevant, and policy neutral

- Produced by NCSES, under the guidance of the NSB

Science and Engineering Indicators: Suite of Products

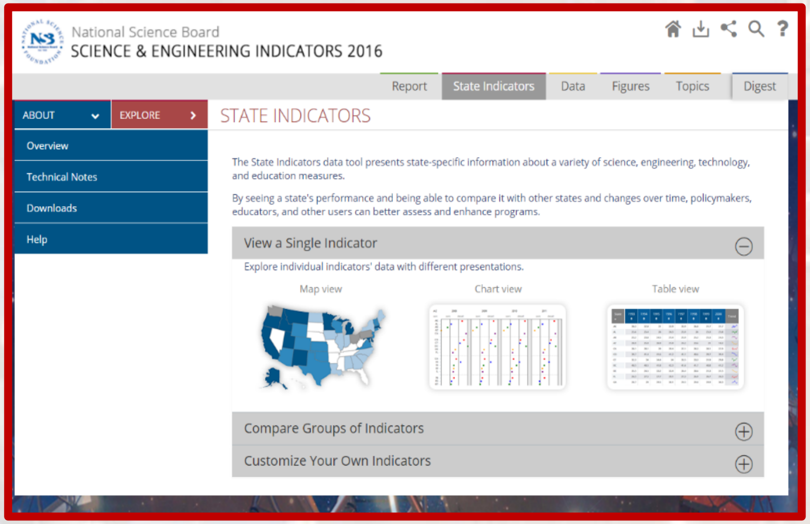


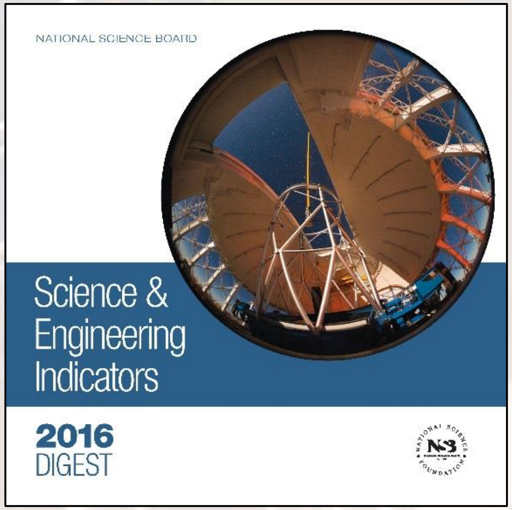
Chapters 1,2,3: K-12 science/math education; S&E higher education; workforce

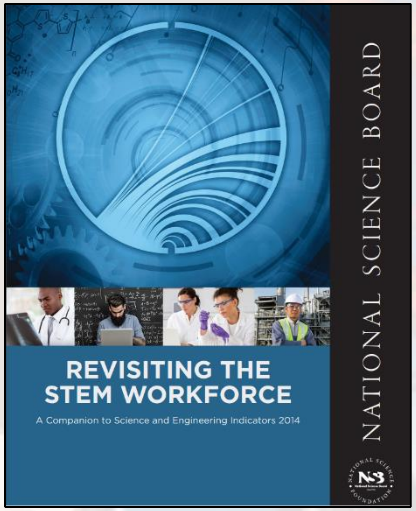
Chapters 4,5,6: R&D; academic R&D; KTI industries; innovation

Chapter 7: Public attitudes/understanding

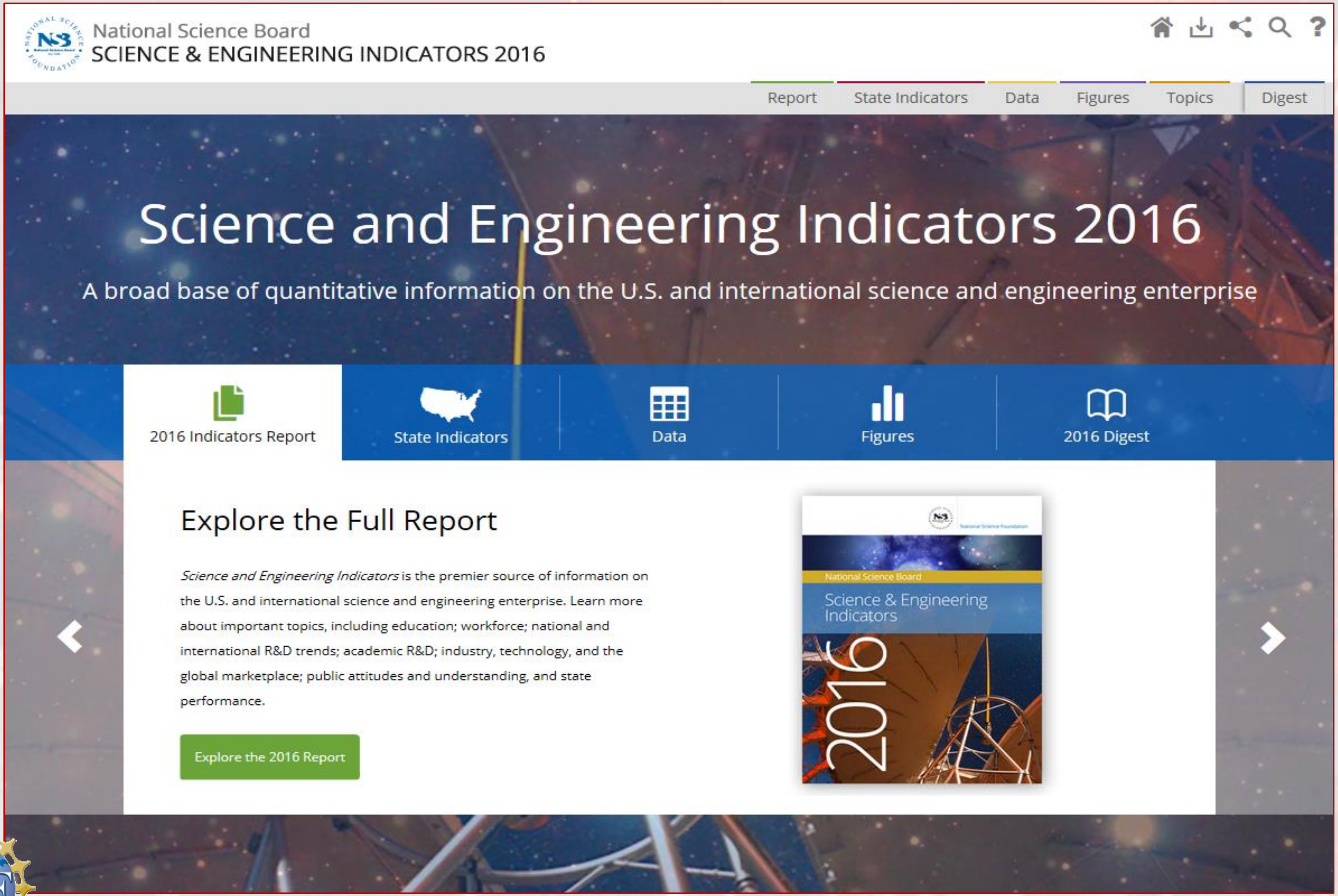
Overview of the State of U.S. S&E in a Global Context







Science and Engineering Indicators 2016: Digital Report



Key Production Steps for *Indicators 2018*

- ✓ **August 2016:** NSB review of narrative outlines
- **Fall 2016, Winter/Spring 2017:** draft content preparation; NSB and expert review.
- **May 2017 Board meeting:** Reviewer comments and proposed revisions.
- **Spring/early summer 2017:** "Orange Book" (penultimate draft), and Overview and Digest *themes* prepared.
- **Summer/early fall 2017:** Discuss "Orange Book" review; SEI review of Overview and Digest drafts.
- **Fall 2017:** Finalize content and Web production. NSB review of Overview and Digest drafts.
- **November 2017 Board meeting:** Approval of Overview, Digest and any remaining *Indicators 2018* matters.
- **January 15, 2018:** Electronic delivery of *Indicators 2018!*

Overview of Proposed Changes for *Indicators* 2018

- **New, standalone chapter/topic: "Invention, Knowledge Transfer, and Innovation"**
- **More timely State Indicators data tool**

Invention, Knowledge Transfer, and Innovation

Carol Robbins, Mark Boroush and Derek Hill

1. Patenting as a Window into Invention

- US Patent data
- Triadic patents
- Co-patenting by business and other sectors

2. Knowledge Transfer, Innovation Systems, and Funding Activities

- Venture Capital
- Small Business Innovation Research and Small Business Technology Transfer
- University programs and NSF supported programs
- Technology licensing flows

3. The Incidence and Sources of Innovation

- New Products and Processes
- Sources of Innovation
- Role of intellectual property protection for innovations

4. Economic Impact Measures of Innovation

- Total Factor Productivity
- Young, fast growing firms

Overview of Proposed Changes for 2018 State Indicators Data Tool

- Detailed, interactive, state-level data
- Web-based tool
  - Indicators are presented individually
- Key components
  - Data: Table, chart, maps, histograms
  - Visual element: Quickly grasp geographic patterns
  - Text: Description, findings

State Indicators Data Tool User Interface

8-17 : Bachelor's Degrees Conferred per 1,000 Individuals 18–24 Years Old (Degrees)

PREVIOUS INDICATOR | NEW INDICATOR | NEXT INDICATOR

Description

Findings

Map View | Chart View | Table View

prev next

State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Trend
AK	21.1	20.0	19.5	19.4	21.2	20.3	19.9	22.2	21.4	22.9	22.0	22.9	
AL	45.0	44.8	46.6	47.0	47.7	47.2	49.6	50.6	53.3	56.2	56.2	61.0	
AR	37.0	38.5	39.1	40.8	41.4	41.7	41.5	42.7	43.9	46.0	49.1	49.6	
AZ	48.7	50.3	56.1	60.8	65.5	70.7	71.7	75.1	80.6	88.2	104.0	106.6	
CA	35.9	36.7	37.8	38.8	39.7	39.9	40.7	40.2	40.6	41.7	42.3	44.1	
CO	49.1	51.1	52.6	54.4	59.0	61.8	62.0	60.7	59.3	60.2	61.9	64.4	
CT	51.8	54.8	56.4	55.0	57.9	58.8	59.1	59.0	59.4	59.2	61.5	62.8	
DC	119.6	124.7	130.4	123.8	137.4	130.7	131.3	129.0	117.2	115.0	125.7	128.3	
DE	60.7	62.3	61.2	62.3	63.6	58.6	59.9	60.8	60.3	63.6	63.1	67.6	
FL	38.8	39.0	40.6	40.8	42.3	43.7	45.1	46.3	47.8	48.7	50.8	52.6	
GA	34.2	36.2	40.0	39.5	39.6	40.2	41.1	41.8	43.5	45.2	45.4	46.7	
HI	38.4	38.9	41.8	39.6	42.7	43.1	44.3	43.5	40.2	42.1	43.4	44.7	
IA	63.2	64.2	64.0	66.3	68.6	72.8	79.0	85.5	98.9	116.2	129.2	129.8	
ID	33.5	39.7	39.7	47.6	50.6	51.8	50.9	58.4	61.3	59.1	62.9	66.3	
IL	46.7	48.0	47.5	51.4	54.9	56.4	55.9	55.6	56.8	57.5	57.8	60.3	
IN	53.7	55.2	56.7	57.3	59.6	60.4	60.6	61.0	64.0	66.2	68.6	69.7	

State Indicators Data Tool User Interface

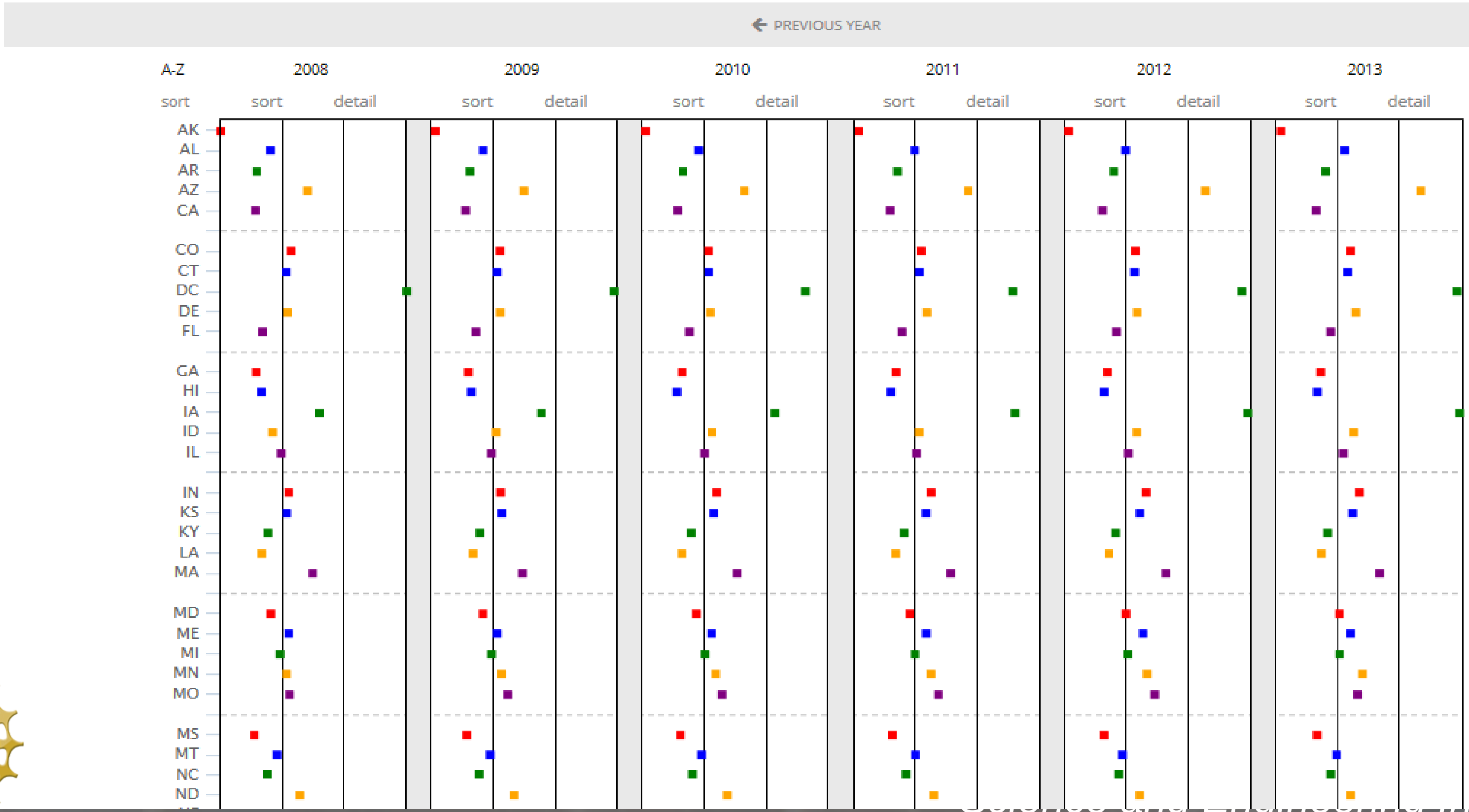
8-17 : Bachelor's Degrees Conferred per 1,000 Individuals 18–24 Years Old (Degrees)

← PREVIOUS INDICATOR | NEW INDICATOR | NEXT INDICATOR →

› Description

› Findings

Map View | Chart View | Table View



State Indicators Data Tool User Interface

8-17 : Bachelor's Degrees Conferred per 1,000 Individuals 18–24 Years Old (Degrees)

← PREVIOUS INDICATOR | NEW INDICATOR | NEXT INDICATOR →

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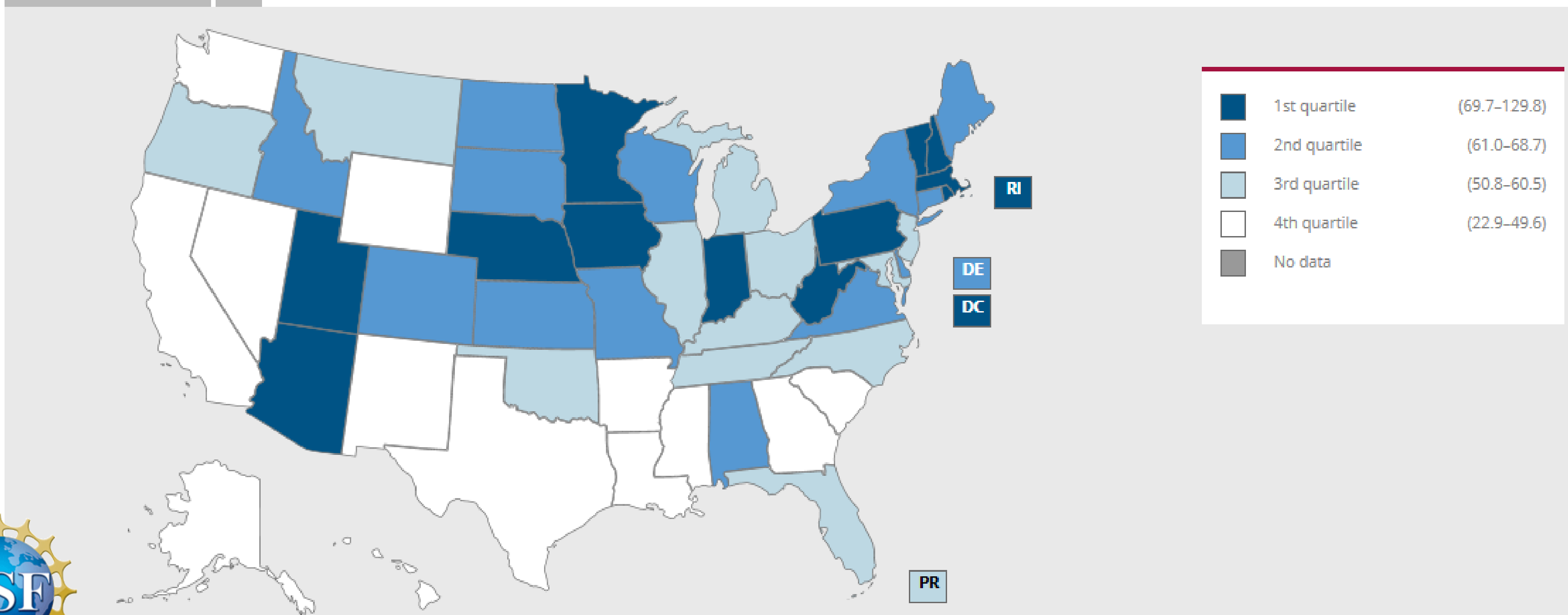
Map View | Chart View | Table View

Choose Year : 2013



State Indicators Data Tool User Interface

8-17 : Bachelor's Degrees Conferred per 1,000 Individuals 18–24 Years Old (Degrees)

Description

Higher educational attainment gives people greater opportunities to work in better-paying jobs than are generally available to those with less education. Earning a bachelor's degree also prepares them for advanced education.

Educational attainment varies by several demographic characteristics including age. The cohort 18–24 years old was chosen to approximate the age range of most students who are pursuing an undergraduate degree. This indicator represents the extent to which the 18–24 year old population has earned a bachelor's degree.

The number of bachelor's degrees awarded is an actual count provided by the National Center for Education Statistics. Estimates of the population ages 18–24 years are provided by the U.S. Census Bureau. Small differences in the indicator value between states or across time generally are not meaningful.

A high value for this indicator may suggest the successful provision of educational opportunity at this level. Student mobility after graduation is not accounted for, which may make this indicator less meaningful in predicting the qualifications of a state's future workforce. A state's value for this indicator may also be high when its higher education system draws a large percentage of out-of-state students, a situation that sometimes occurs in states with small resident populations and in the District of Columbia.

Findings

- In 2013, more than 1.8 million bachelor's degrees were conferred nationally in all fields, which is up from 1.3 million in 2003 and corresponds to an increase of 36%.
- Between 2003 and 2013, the number of bachelor's degrees conferred per 1,000 individuals 18–24 years old in the population increased by 25% nationwide (from 46.6 in 2003 to 58.4 in 2013).
- In 2013, state values varied greatly. They ranged from 22.9 to 129.8 bachelor's degrees conferred per 1,000 individuals 18–24 years old.
- The number of bachelor's degrees conferred per 1,000 individuals 18–24 years old increased in all states and the District of Columbia between 2003 and 2013.
- Iowa had the largest increase from 2003 to 2013, with more than twice the number of bachelor's degrees conferred per 1,000 individuals 18–24 years old in 2013 than in 2003.

Chapter 6
Industry, Technology, and the Global Marketplace
Derek Hill

1. **Patterns and Trends of Knowledge and Technology-Intensive (KTI) industries**
   - KTI Industries in the Global Economy
   - Public Knowledge-Intensive (KI) Services
   - Commercial KI Services
   - Technology-Intensive Manufacturing Industries

2. **Trade in KTI services and products**
   - Commercial KI services
   - Technology-Intensive Products

3. **Investment and Patenting in Clean Energy Technologies**
   - Public Research, Development, and Demonstration (RD&D) Expenditures in Clean Energy and Other Non-Fossil Fuel Technologies
   - Early Stage Private Financing of Clean Energy
   - Private Investment in Clean Energy Technologies
   - Patenting of Clean Energy and Pollution Control Technologies

KTI industries

Knowledge-intensive services

- Public
  - Education
  - Health
- Commercial
  - Business
  - Communications
  - Health

Technology-intensive manufacturing

- Aircraft
- Automobiles
- Chemicals exc. Pharmaceuticals
- Communications and semiconductors
- Computers and office machinery
- Electrical Machinery
- Other Machinery and Equipment
- Pharmaceuticals
- Scientific Instruments
- Railroad equipment

Chapter 4
R&D: U.S. Trends and International Comparisons
Mark Boroush

1. Recent trends in U.S. R&D performance (expenditures) and funding and U.S. overall R&D along with key sectoral breakdowns (e.g., businesses, the federal government, higher education) and by type of R&D (basic research, applied research, experimental development)

2. Cross-national comparisons of U.S. R&D; key indicators of U.S. overall R&D performance, intensity (R&D to GDP ratio), and growth trends in comparison with the indicators of the other large R&D-performing countries and regions.

3. U.S. business R&D with detail on R&D activity in the U.S. business sector; comparisons with other large R&D-performing countries and regions.

4. Recent trends in federal government support for U.S. R&D with detail on R&D performance and funding by the federal government, with comparisons to that of the national governments other large R&D-performing countries and regions.

Chapter 5
Academic Research and Development
Katherine Hale, Carol Robbins, and Michael Gibbons

1. Academic R&D expenditures

- Spending sources
- Spending by field
- Spending by institution type

2. Infrastructure for academic R&D

- Research facilities; research equipment; cyberinfrastructure

3. Doctoral scientists and engineers in academia

- Tenure status
- Women in the academic S&E workforce
- Minorities in the academic S&E workforce
- Academic researchers

4. Academic S&E research outputs: articles and patents

- Academic S&E research output
- Collaboration in S&E research articles
- Citation patterns in S&E research articles
- Citations to research articles in patents
- Academic patenting

Chapter 7
Science and Engineering Workforce
John Besley and Peter Muhlberger

1. S&T Information sources, interest, and involvement

- Sources of the public's S&T information
- Interest in S&T information
- Involvement in S&T related activities (museum attendance, etc.)

2. Public knowledge about S&T

- Knowledge of basic facts
- Understanding of scientific process
- Rejection of pseudoscience

3. Public attitudes about S&T in general

- Promise and reservations about S&T
- Views about scientists
- Support for federal funding of scientific research.

4. Public attitudes about specific S&T-related issues

- Environment and climate change; energy, including nuclear power; stem cell research and human cloning; synthetic biology; genetically engineered foods; nanotechnology; animal research ethics; and perceptions of STEM education

Chapter 1
Elementary and Secondary Education
Authors of RTI International

1. **Student Achievement in Mathematics and Science**
   - National Trends
   - Growth in Elementary Student Mathematical and Science Achievement
   - International Comparisons

2. **High School Coursetaking in STEM**
   - Coursetaking Patterns in the Graduating Class of 2013
   - Trends in Advanced Placement Program Participation and Passing Rates
   - Racial and Ethnic Differences in Access to Advanced Courses.

3. **Teachers of Mathematics and Science**
   - Implications of the new ESSA policy initiative for teachers
   - International Comparisons of Teacher Pay

4. **Instructional Technology and Digital Learning**
   - Technology Use in Mathematics and Science Education
   - Effectiveness of Instructional Technology

5. **Transition to Higher Education**
   - High School Completion
   - Immediate Enrollment in Postsecondary Education
   - Postsecondary Enrollment in an International Context

Chapter 2
Higher Education in Science and Engineering
Jaquelina Falkenheim

1. Structure of the U.S. higher education system

- Institutions providing S&E education
- Financing of higher education

2. Undergraduate education (associate's and bachelor's levels)

- Trends in undergraduate enrollment by demographics
- Trends in undergraduate S&E degree awards by demographics (sex, citizenship status, and race and ethnicity)

3. Graduate education (master's and doctoral levels)

- Trends in graduate S&E enrollment by field and citizenship status
- Trends in master's and doctoral degree awards by demographics

Topic	By	2016	2018
Graduate enrollment	field	Yes	Yes
	sex	Yes	No
	race and ethnicity	Yes	No
	citizenship status	Yes	Yes
Graduate degree awards	field	Yes	Yes
	sex	Yes	Yes
	race and ethnicity	Yes	Yes
	citizenship status	Yes	Yes

4. International S&E higher education

- International comparisons of higher education expenditures
- International comparisons of bachelor's and PhD degree awards
- International student mobility

Chapter 3
Science and Engineering Workforce
Amy Burke

1. U.S. S&E Workforce: Definition, Size and Growth
- Trends in the size and growth of the S&E workforce
- Educational and occupation distribution of the S&E workforce
- The relationship between jobs and degrees

2. S&E Workers in the Economy
- Trends in employment by sector, size, industry, and metropolitan area of employment
- Innovation-related activities of scientists and engineers

3. S&E Labor Market Conditions
- Trends in unemployment, earnings, recent S&E graduates and working involuntarily out of one's field of highest degree

4. Demographic overview of the S&E workforce
- Age differences among occupations and degree fields
- Retirement
- Women and minorities in the S&E workforce, including salary differences for women and racial and ethnic minorities

5. Immigration and the Global S&E workforce
- Characteristics of foreign-born scientists and engineers and new foreign-born workers
- Trends in the size and growth of the global S&E labor force