

## **U.S. Science in a New Global Era: A View from the White House**

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### **U.S. science, technology, & innovation: Why do they matter?**

ST&I are central to meeting key challenges of

- economic growth & job creation
- biomedicine & health-care delivery
- clean, safe, reliable, & affordable energy
- climate-change mitigation & adaptation
- sustaining agricultural & other terrestrial ecosystems
- protecting the health & productivity of the oceans
- national & homeland security

as well as lifting the human spirit through discovery,  
invention, & expanded understanding.

## U.S. ST&I also matter because...

- Strength in ST&I is a magnet for ST&I talent from abroad, in a virtuous circle.
- International cooperation in ST&I, facilitated by domestic strength in these domains, helps build stable bilateral & multilateral relationships and institutions.

A "new global era": What does it mean?

## Globalization of R&D investments

Billions of U.S. PPP dollars

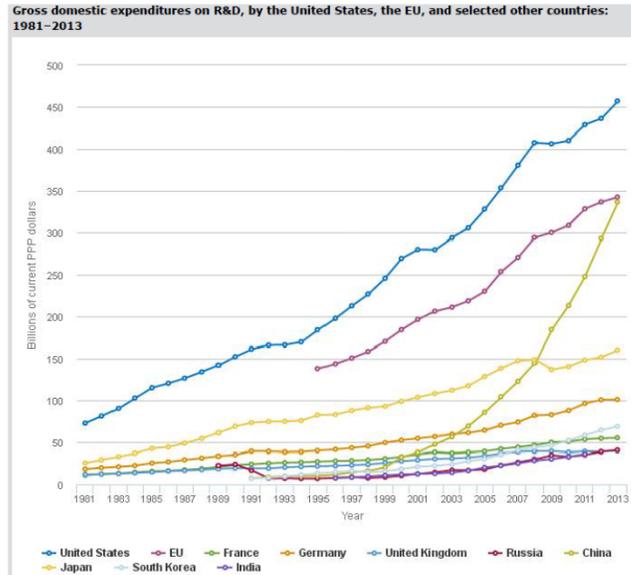
2013



SEI 2016

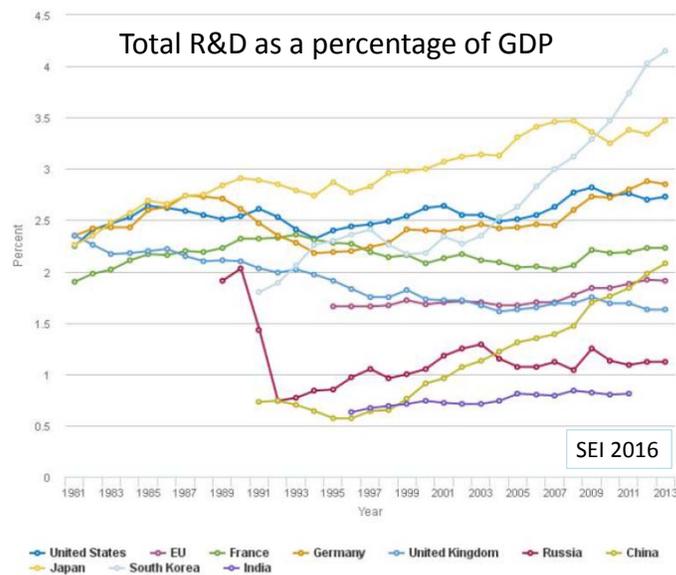
A "new global era": What does it mean?

**Globalization of R&D investments** (continued)



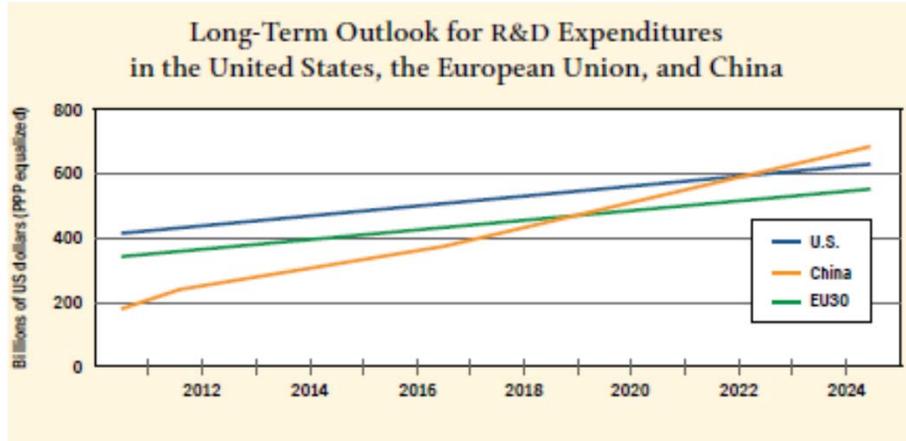
A "new global era": What does it mean?

**Globalization of R&D investments** (continued)



A "new global era": What does it mean?

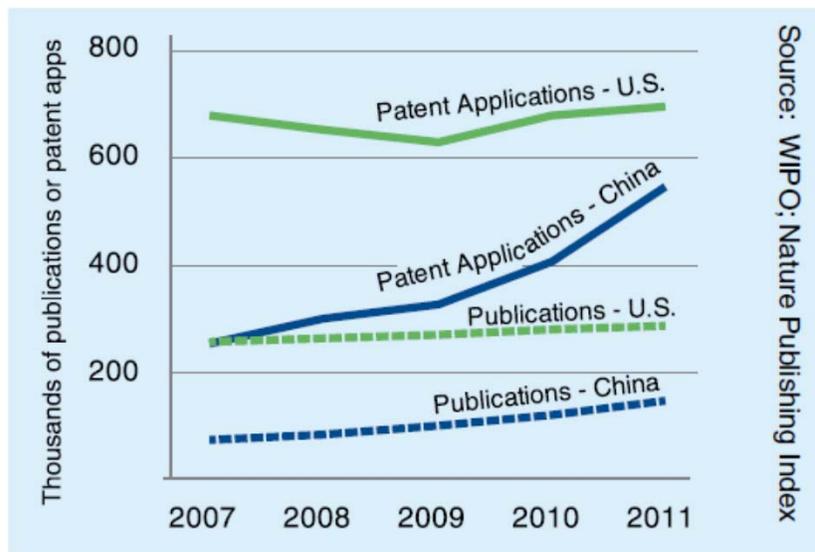
### Globalization of R&D investments (continued)



American Academy: Restoring the Foundation

A "new global era": What does it mean?

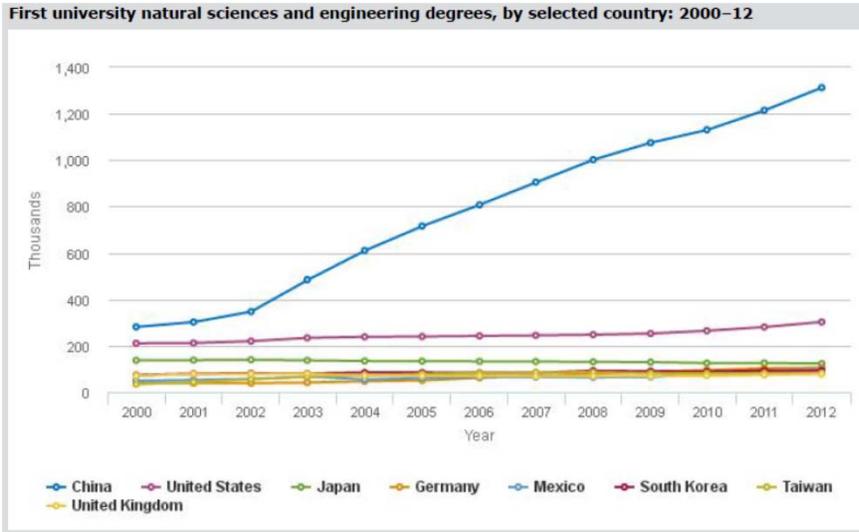
### Globalization of patents & publications



R&D Magazine

A "new global era": What does it mean?

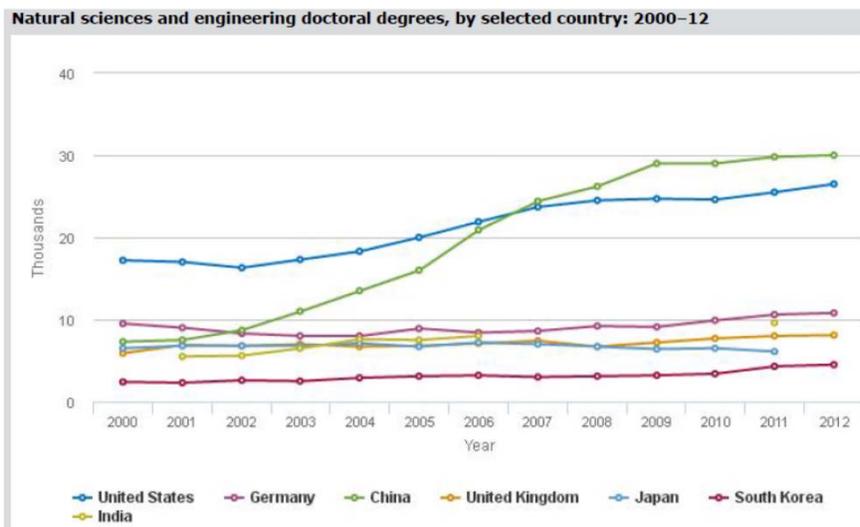
**Globalization of S&T education**



SEI 2016

A "new global era": What does it mean?

**Globalization of S&T education (continued)**



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A "new global era"

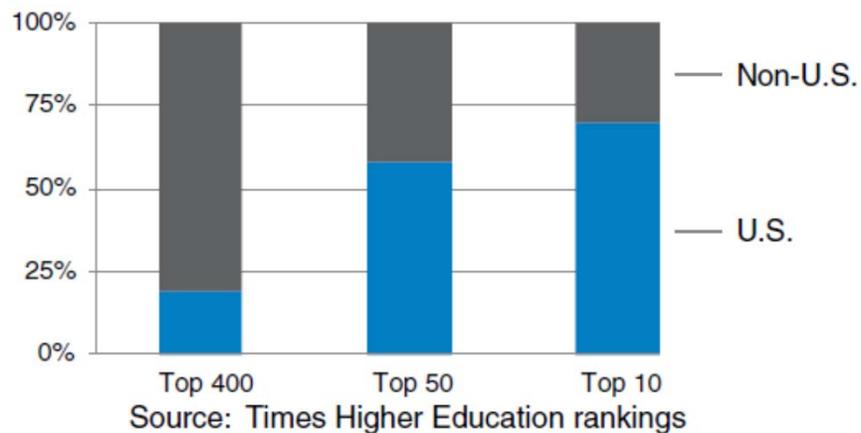
## Do we need to be worried?

- **Globalization of ST&I is not all bad**
  - It raises standards of living in the developing world
  - It increase competition, which lifts everybody's game
  - It increases opportunities for productive collaboration
- **But it does pose some real challenges for the USA**
  - Potential erosion of economic competitiveness
  - Potential erosion of our edge in defense technologies

SEI 2016

## The USA remains a world leader in S&T

### U.S. Standing Among World's Top Universities



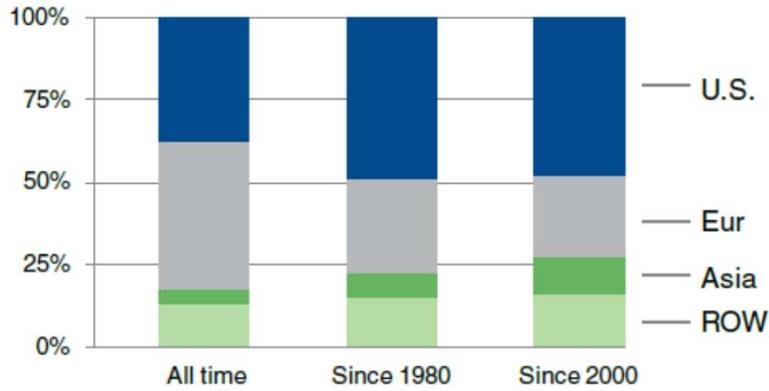
R&D Magazine

## Leading the world in S&T (continued)

### Nobel Prizes in Science & Medicine

European and U.S. shares accommodating emerging regions

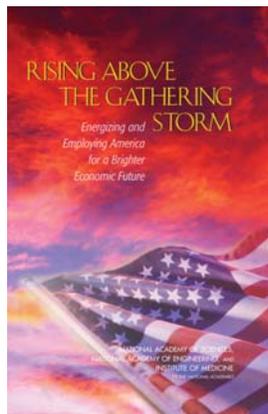
R&D Magazine



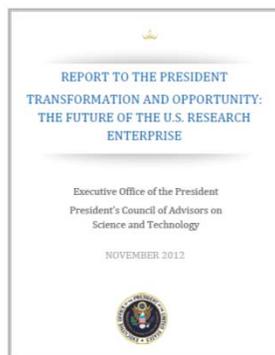
### A "new global era"

But there are some actions we should take.

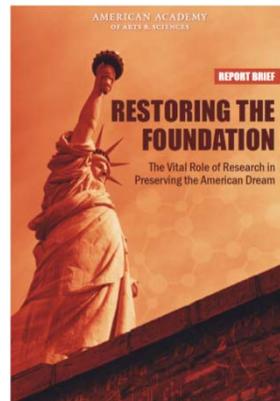
- Many studies have offered recommendations



2007



2012



2015

What should we do?

### **The recommendations have been consistent**

- Improve STEM education
  - recruit, train, & reward more high-quality K-12 teachers
  - engage, inspire, & support girls and underrepresented minorities
  - revamp college STEM teaching to make it more effective, engaging, relevant, inquiry-based
- Boost investment in R&D
  - put basic research on a rapidly rising trajectory again
  - encourage high-risk / high-return research in key applied domains
  - extend & increase tax incentives for private-sector R&D

What should we do?

### **Consistent recommendations** (continued)

- Invest in broadband & other IT/networking/computing infrastructure
- Reduce unnecessary bureaucratic burdens on Federally funded researchers
- Reform immigration policies to make them more friendly to ST&I talent from abroad
- Bolster government / private sector / academic partnerships to exploit comparative advantages and speed the path from discovery to wide application.

A "new global era"

## What have we done?

- The Obama Administration has taken the advice of the ST&I community to an extraordinary degree, subject to constraints of budget, starting on Inauguration Day 2009.



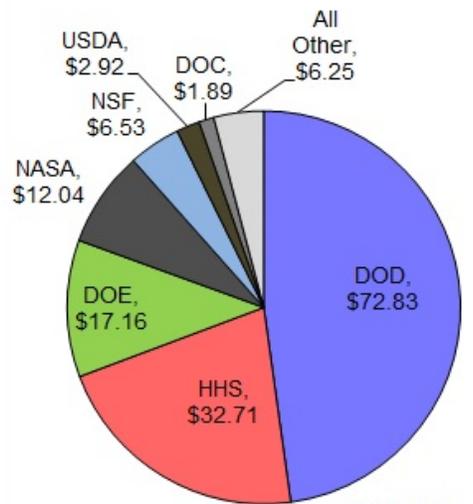
## Federal S&T budgets under President Obama

- \$100B boost for S&T in the Recovery Act.
- S&T investment goals: make the Research & Experimentation Tax Credit permanent; lift public + private investment in R&D to  $\geq 3\%$  of GDP.
- The President's 2010 Budget put us on track to meet the goals, and FY2011 would have continued the trend.
- There were setbacks in 2011-2015 appropriations because of Budget Control Act spending caps.
- Despite setbacks, S&T has fared better in 2011-2015 appropriations than most other sectors.

### R&D from FY15 to the President's FY17 Budget

Budget authority in billions of current dollars	FY15 actual	FY16 enacted	FY17 POTUS	Change FY16-17
Total R&D	138.3	146.1	152.3	4.2%
<i>defense</i>	71.7	76.6	80.0	4.4%
<i>nondefense</i>	66.5	69.5	72.4	4.1%
Research	66.0	68.9	72.8	5.7%
<i>defense</i>	10.9	10.9	11.8	7.9%
<i>nondefense</i>	55.2	58.0	61.0	5.2%
Development	69.7	74.5	76.7	3.0%
<i>defense</i>	60.5	65.3	67.6	3.5%
<i>nondefense</i>	9.2	9.1	9.1	-0.8%

**Total R&D by Agency, FY 2017**  
budget authority in billions of dollars



Source: OMB.  
Includes discretionary and mandatory funding. © 2016 AAAS

## Initiatives: STEM education

- Set ambitious National goals: Move American kids from middle to top of the pack of international rankings on science & math tests; prepare 100,000 excellent STEM teachers and graduate 1 million more STEM college graduates over next 10 years; expand achievement in STEM fields to women and underrepresented minorities.
- Incorporate into overall education reform strategy: Administration's more than \$4 billion *Race to the Top* program included preference to states whose proposals emphasize innovation in STEM education.
- Build strong "all hands on deck" effort that includes business, non-profits, foundations: Launched *Educate to Innovate* —garnered commitments by 100+ CEOs to coordinate under *Change the Equation*; over 150 organizations committing to goal 100,000 excellent STEM teachers, with over \$50M raised; over \$100M invested toward goal of 1M more STEM college graduates.

## Initiatives: STEM education (continued)

- Deploy President's personal passion for STEM: Hosted the first-ever White House Science Fairs (5 so far), to celebrate students winners of math, science, and robotics competitions just as we celebrate sports champions. Hosted the first-ever Maker Faire to get more kids and adults making things, not just consuming things.
- Institutionalize cross-agency efforts: Mobilized Federal agencies to work together to produce and now implement the STEM Education 5-Year Strategic Plan (agencies include USDA, Commerce, DOD, Education, DOE, HHS, Interior, DOT, EPA, NASA, NSF, Smithsonian Institution).
- Focus on inclusion of under-represented groups: Worked with White House Council on Women and Girls, Domestic Policy Council, My Brother's Keeper Initiative, & numerous minority-serving institutions on inspiration, preparation, opportunity, support.

## Initiatives: infotech & innovation

- Presidential Innovation Fellows: cohorts of 18-36 IT superstars come to DC for 6-12 months to work in teams on IT-linked innovation challenges
- Open Government : web-based public participation
- ConnectED: \$2B from FCC, \$1B+ from private sector to provide broadband access & computers for classrooms
- Big Data: managing & manipulating large datasets for new insights and applications
- Data.gov: making gov't datasets available in support of innovation, entrepreneurship
- National Strategic Computing Initiative: accelerating arrival & application of capable exascale computers

## Partnerships w the private sector

- Launched Jan 2011, Startup America bolsters entrepreneurship by increasing success of high-growth startups that create economic growth and quality jobs
  - accelerates the transfer of new ideas from labs to the market
  - creates new opportunities for small business financing
  - improves regulatory environment for starting and growing new businesses
  - spawned the nonprofit Startup America Partnership, whose private-sector CEOs have raised \$1B to help startups
- Jumpstart Our Business Startups (JOBS) Act — signed Spring 2012 — allows crowdfunding, expands mini-public offerings, creates “IPO on-ramp”.

## Partnerships w the private sector (continued)

- The Wireless Innovation and Infrastructure Initiative (Wi3) is an ambitious blueprint to connect 98 percent of the US population with 4G wireless.
- The Advanced Manufacturing Partnership, linking research universities, high-tech companies, and the Federal government, is investing in emerging technologies to create high-quality manufacturing jobs. The President's National Robotics Initiative and Materials Genome Initiative reinforce this goal.
- NSF's new Innovation Corps is getting scientists out of the lab to start new companies.

## S&T priorities in the President's 2<sup>nd</sup> term

- S&T for the economy: advancing economic recovery and job creation through S&T-based innovation to drive advanced manufacturing and new/improved products
- S&T for biomedicine and health: S&T for Ebola response; combatting antimicrobial resistance; precision medicine
- S&T for energy and climate: advancing the coupled agendas of clean, efficient, reliable, affordable energy and climate-change mitigation/preparedness/resilience
- S&T for open government: using information science & technology to improve access to government data & services and increase public participation in government
- STEM education: strengthening the next generation of discoverers, innovators, workers, and citizens

## The challenges ahead

- Sustaining support for S&T under budget caps
  - Particularly difficult will be sustaining support for...
  - NASA (advanced technology, commercial crew, Earth Science)
  - NOAA (polar-orbiting satellites, marine science)
  - DOE (CO<sub>2</sub> capture, fusion)
  - NSF (basic research, social sciences, earth sciences)
  - USDA (peer-reviewed agricultural science)
  - EPA & FDA (regulatory science)
  - USGCRP (climate science, sustainability science)
  - international cooperation in S&T

## The challenges ahead (continued)

- Accelerating translation of scientific & engineering advances into economic and social benefits through closer public-private-academic partnerships
- Advancing a coherent energy-climate policy with increased public & private investments in both mitigation and adaptation
- Addressing systemic weaknesses in STEM-ed weak teacher competence in K-12, inertia w respect to adopting more effective methods at college level
- Getting key messages across why science & engineering matter (to economy, health, environment, security), how science works

## On this session's "vision" theme

VISION HAS THREE ELEMENTS

- Seeing where you need and want to go
- Charting a practical path to get there
- Walking the walk

In his vision for science, this President has mastered all three.





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