



Tying the Ribbon:
**Science, Technology, Engineering,
Mathematics (STEM) and the
Future of the Defense Industrial Base**

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Office of Science and Technology Policy



- Science and technology for policy
- Policy for science and technology

Innovation for National Security is a Presidential Priority



“Reaffirming America’s role as the global engine of scientific discovery and technological innovation has never been more critical ... Our renewed commitment to science and technology ... will help us protect our citizens and advance U.S. national security priorities.”

National Security Strategy, May 2010



Elements of Innovation

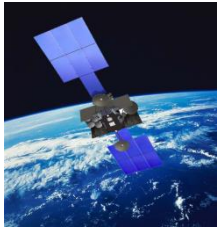
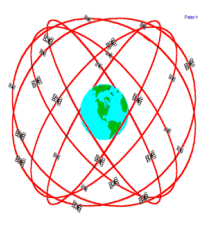
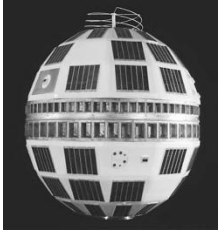
“How then is America to maintain, or preferably enhance, the future standard of living of its citizenry? The answer (and seemingly the only answer) is through innovation.

Innovation commonly consists of being **first to acquire** new knowledge through leading edge research; being **first to apply** that knowledge to create sought-after products and services, often through world-class engineering; and being **first to introduce** those products and services into the marketplace through extraordinary entrepreneurship. “

*Rising Above the Gathering Storm, Revisited –
Rapidly Approaching Category 5 (2010)*

Innovation and National Security

A track record of success....



40s	50s	60s	70s	80s	90s	00s
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... new challenges and threats in the future





“We know what it takes to compete for the jobs and industries of our time. We need to out-innovate, out-educate, and out-build the rest of the world.”

*President Obama
January 25, 2011*

President's Strategy for American Innovation

*Innovation for
Sustainable Growth
and Quality Jobs*

- Encourage high-growth and innovation-based entrepreneurship
- Promote innovative, open, and competitive markets

Catalyze
Breakthroughs for
National Priorities

- Unleash a clean energy revolution
- Accelerate biotechnology, nanotechnology, and advanced manufacturing

Spur Productive
Entrepreneurship and Promote
Efficiency

- Educate Americans with 21st century skills and create a world-class workforce
- Strengthen and broaden American leadership in fundamental research

Invest in the Building Blocks of American Innovation

① Focusing on Strategy Elements

②

Catalyze
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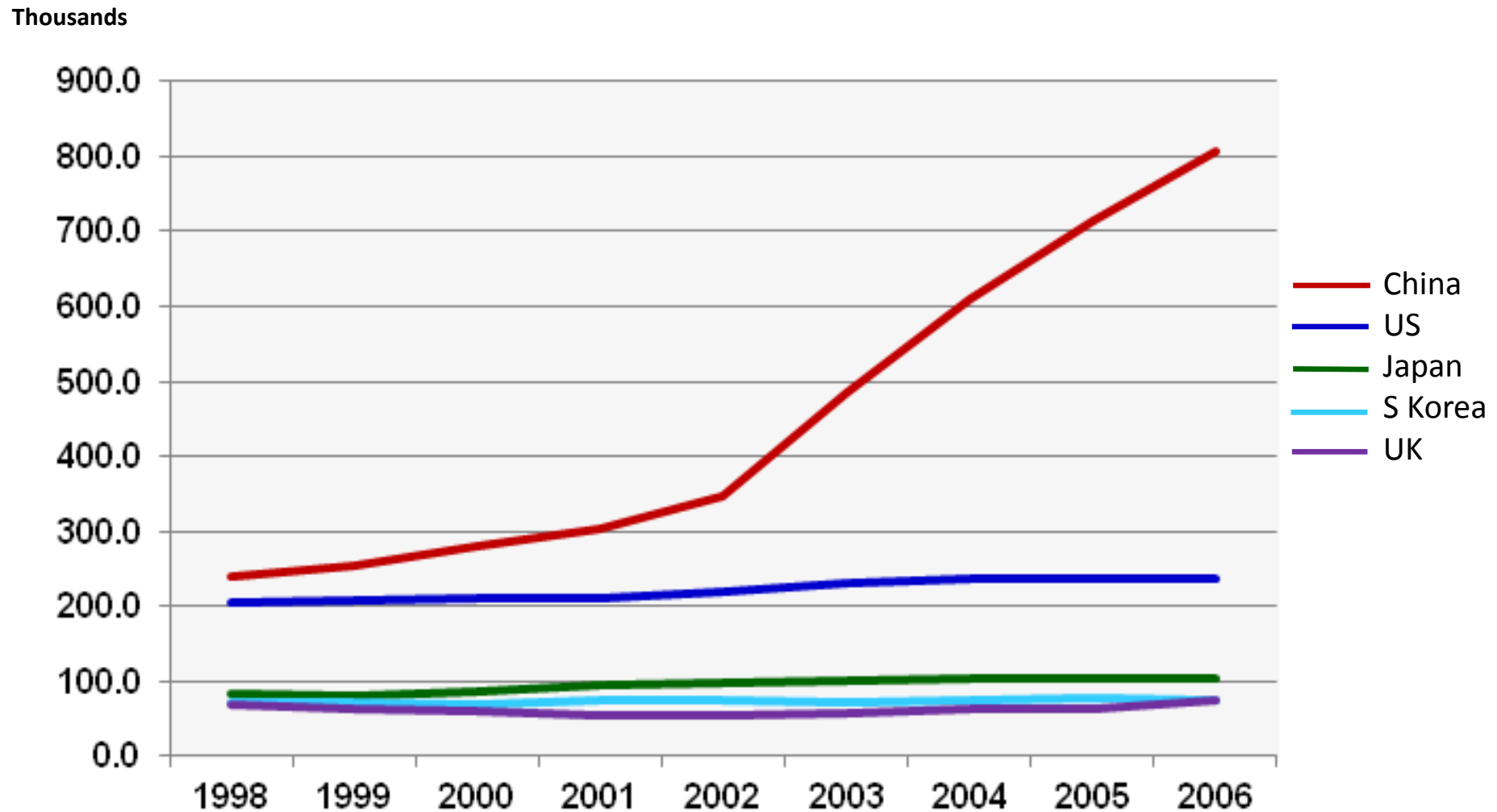
① Invest in the Building Blocks of American Innovation

A world class workforce

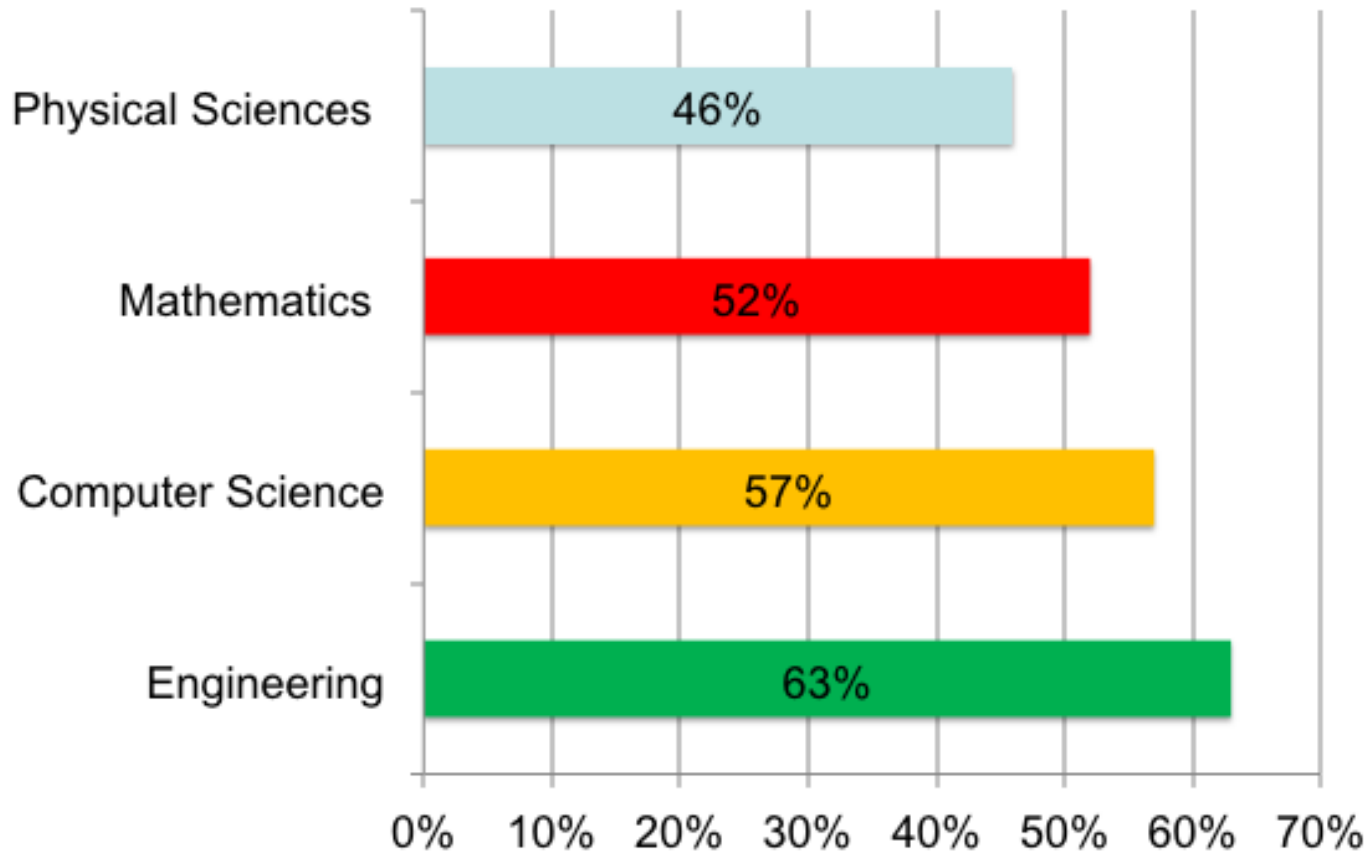
- Scientifically literate public
- Adept in the modern global economy
- Plenty of scientists and engineers



First university degrees in natural sciences and engineering, selected countries

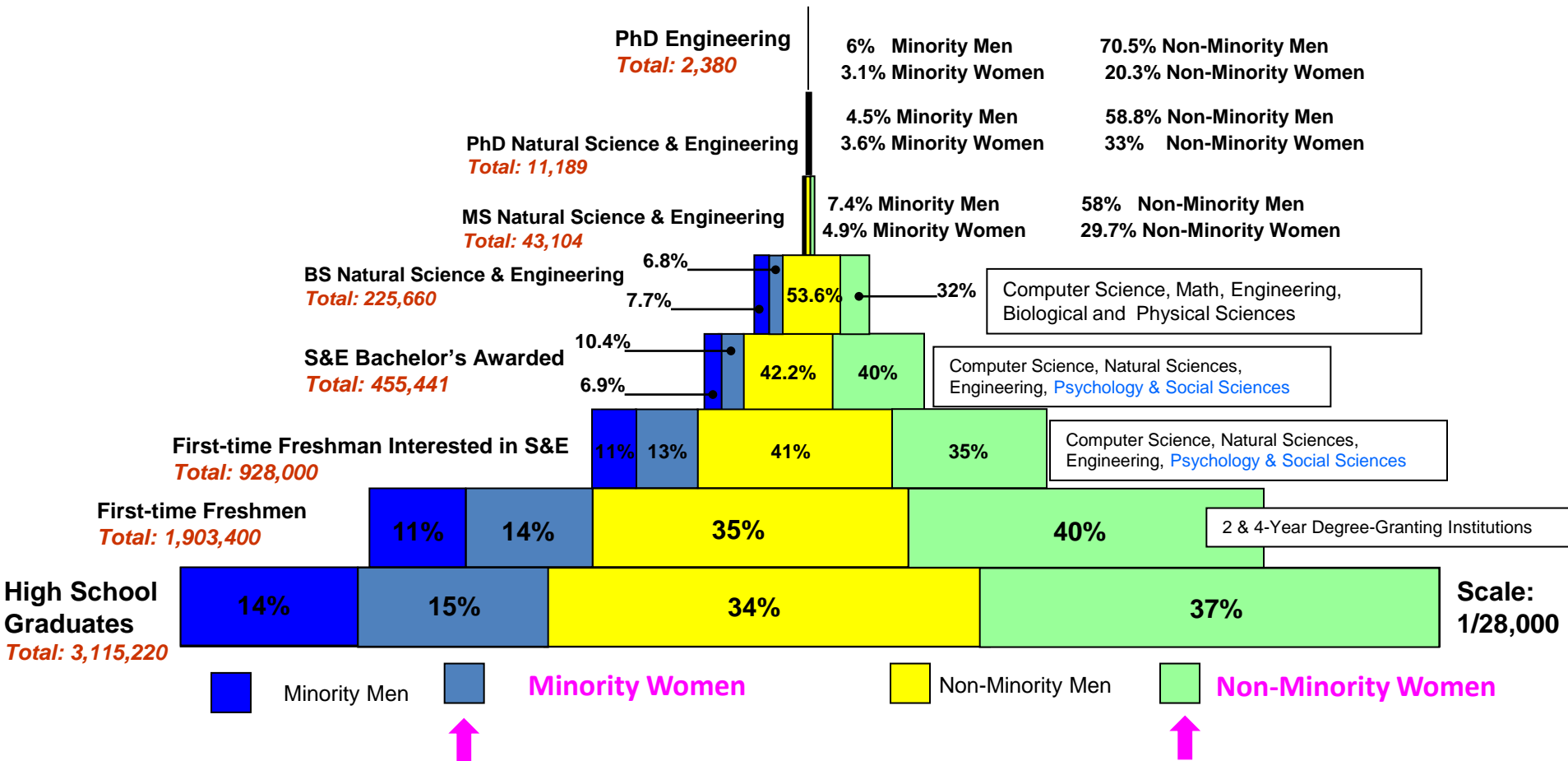


STEM Doctoral Degrees Awarded to Foreign Students (2007)



Science and Engineering Degrees Awarded to US Citizens & Permanent Residents

By Type, Ethnicity, and Gender-- 2006



Minority = Black/African American, Hispanic, and Native American

Non-Minority = White & Asian

Demographics at the top of the pyramid

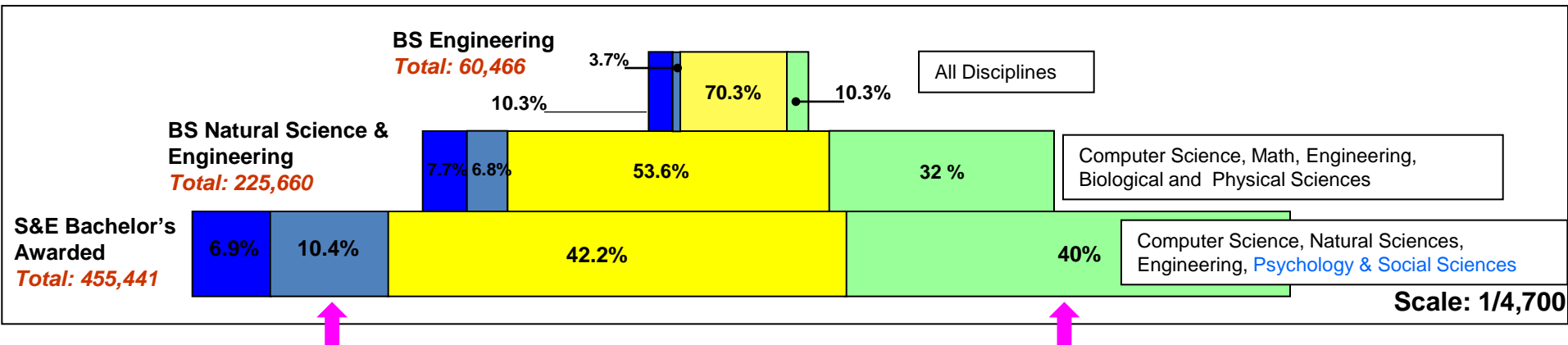
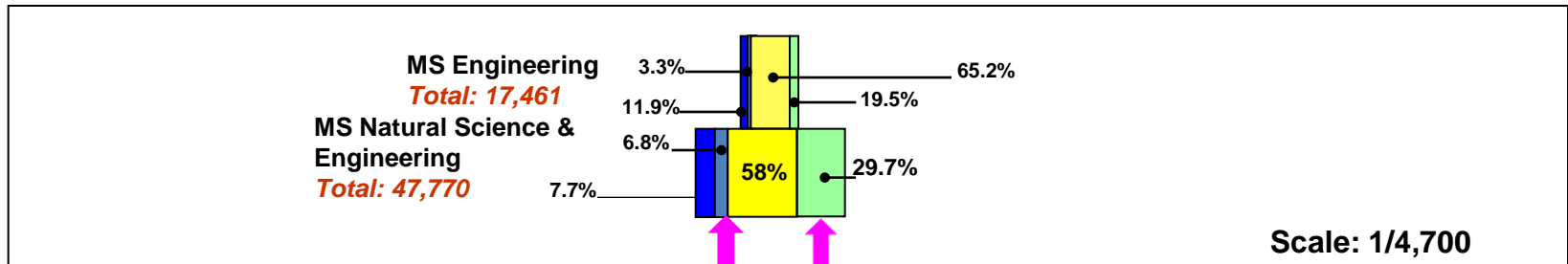
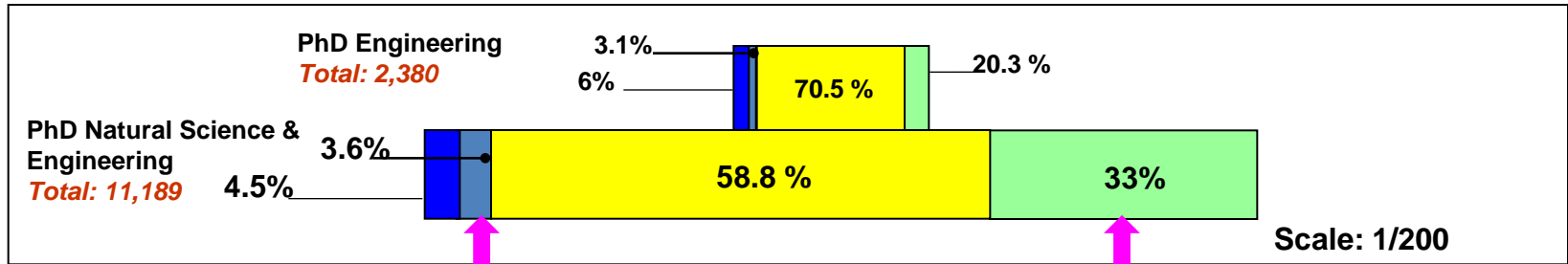


Figure courtesy of the Office of Naval Research

Our STEM priorities

- Increasing STEM literacy so all students can think critically
- Improving the quality of math and science teaching from kindergarten through college based on new knowledge about learning and brain function
- Expanding educational success and representation in all parts of the science and engineering workforce of underrepresented groups, including women and minorities

Expanding best practices



Informal Science



*Design and test of paper bag kites
at the White House Easter Egg Roll
Instructions at HowToSmile.org*

AP Training and Incentive Programs
U Teach Program
Young Leaders
Initiative for Military Families

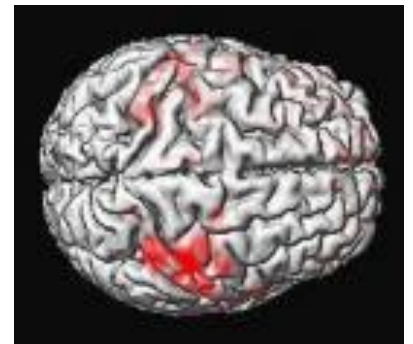
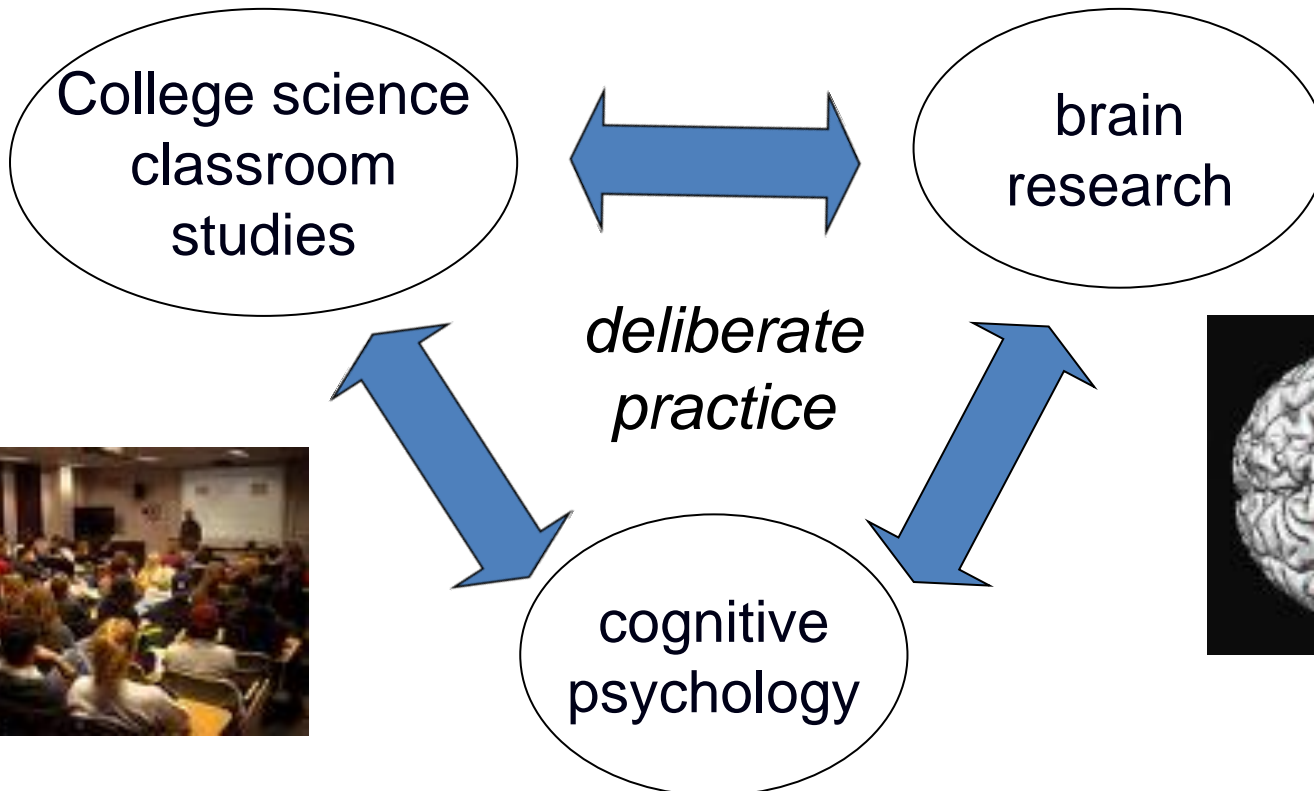


Great Teaching; Inspired
Learners; A Committed Nation
A Public-Private Partnership

Improving teaching

“Major advances have yielded a consistent picture of how to best learn to think like a scientist or engineer”

Carl Wieman – Nobel Prize winner; college science teaching innovator; OSTP Associate Director for Science



Increasing numbers and representation

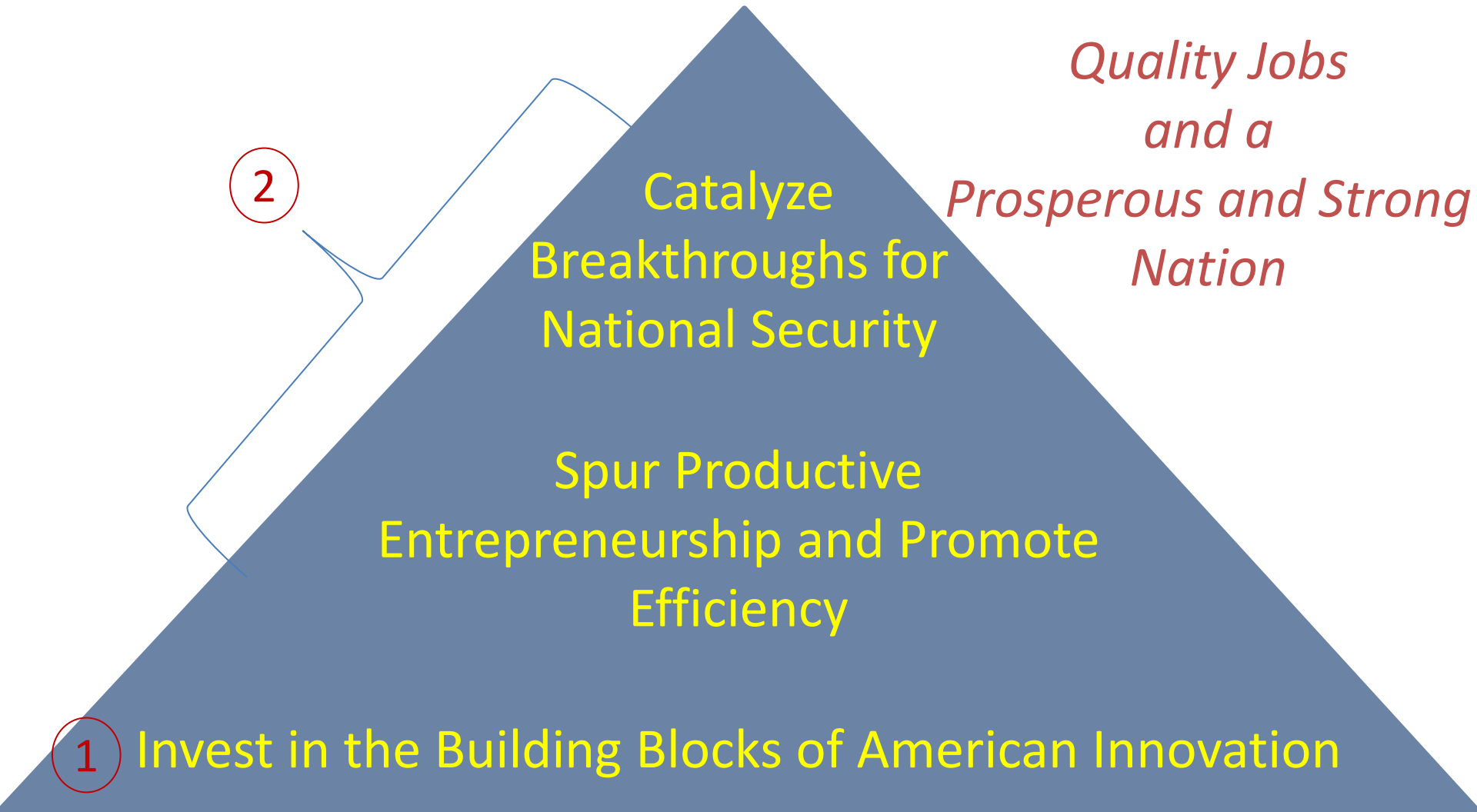


First Lady at National Science Foundation
Family-Friendly-Policies Event
September 26, 2011



President with Google Science Fair Winners
October 7, 2011

② Focusing on Strategy Elements

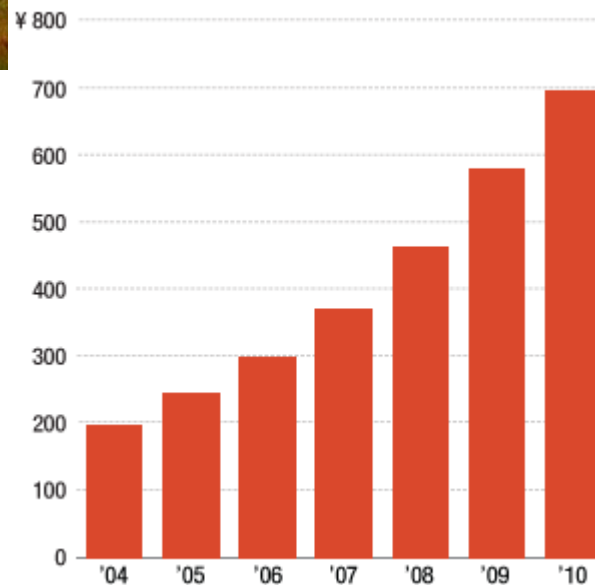


Our competitors are investing

Globalization of R&D and emerging centers-of-excellence around the world



Gross domestic expenditure on R&D (in billions of yuan)

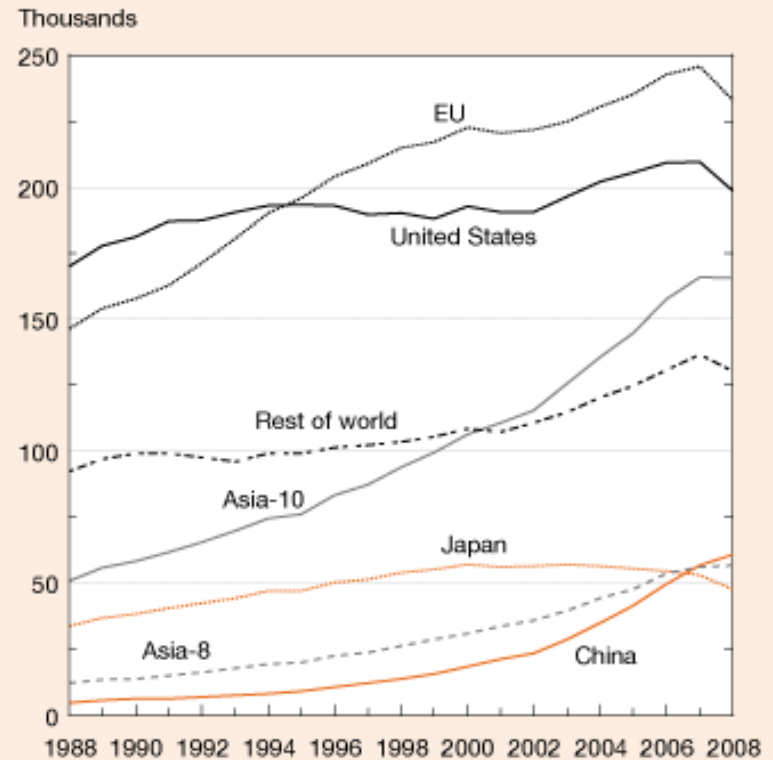


698 billion yuan equals \$108 billion U.S..

Source: China Science & Technology Statistics Data Book

Credit: Christina Baird/NPR

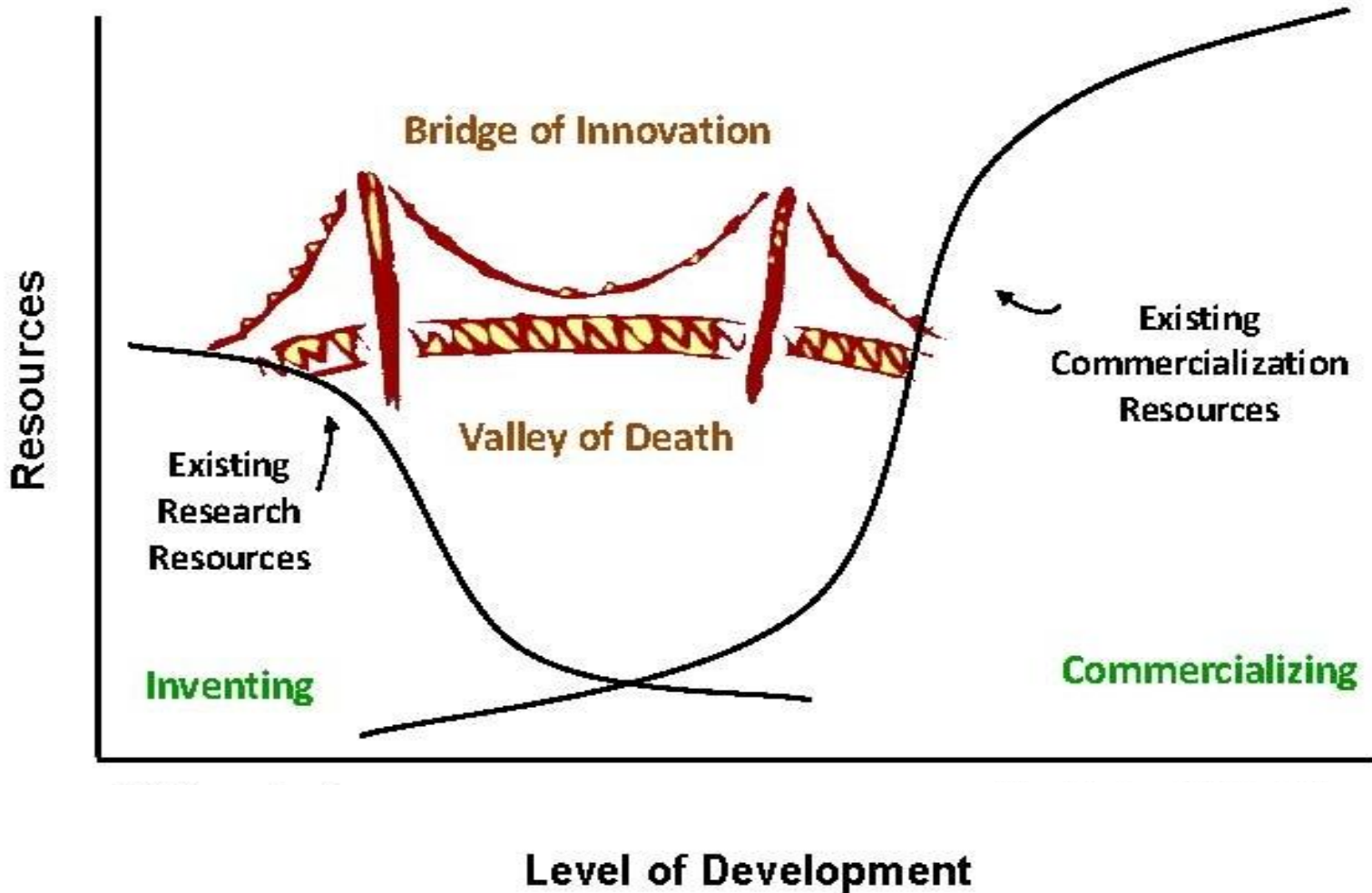
Figure O-13
S&E journal articles produced by selected regions/countries: 1988–2008



From NSF, Science and Engineering Indicators, 2010

Between Invention and Commercialization

Innovation Program to Bridge the Valley of Death

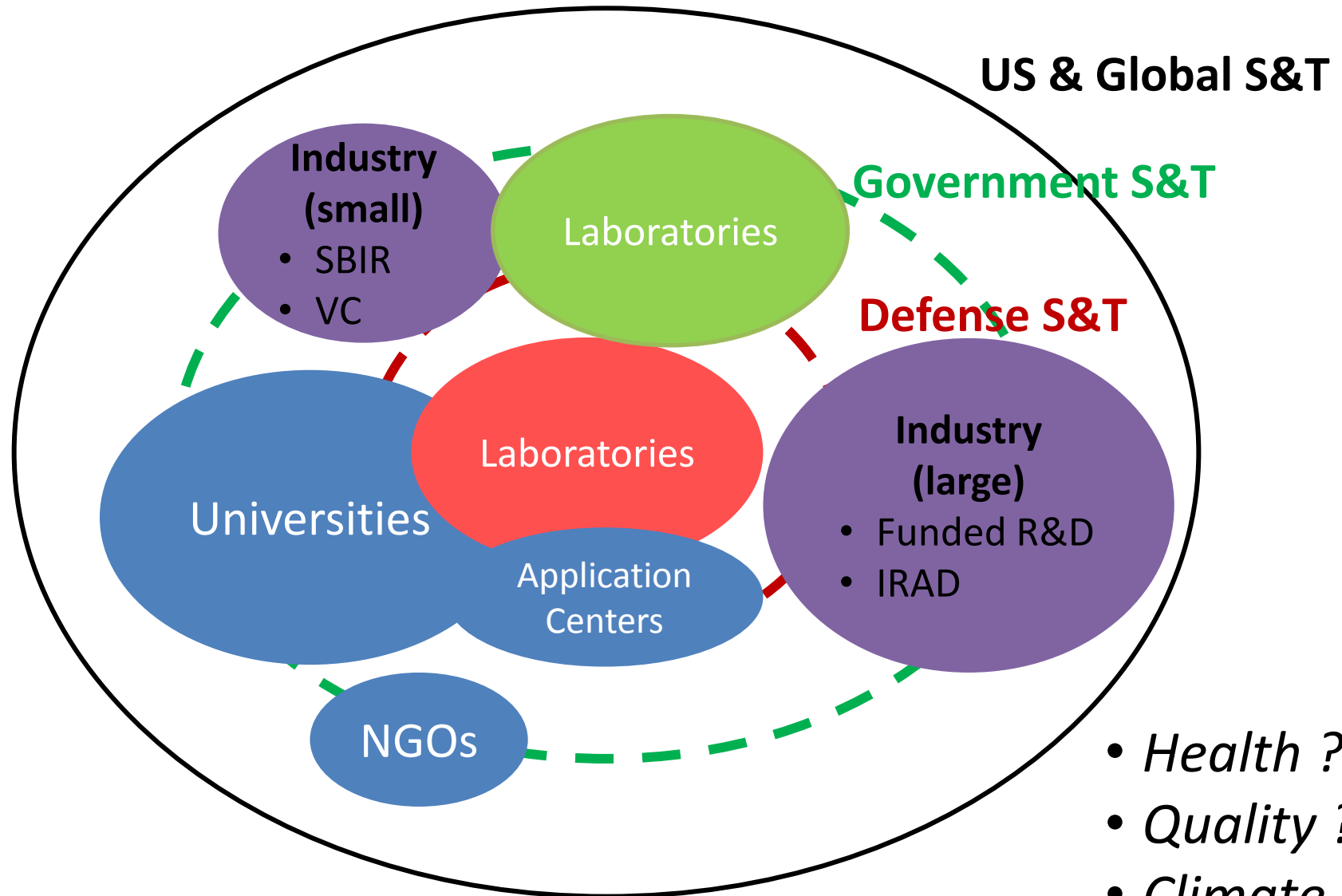


Bridging the *Missing Middle*

The *Missing Middle* – a gap in access to capital or other key resources at a crucial step in the development of new businesses or new technology.

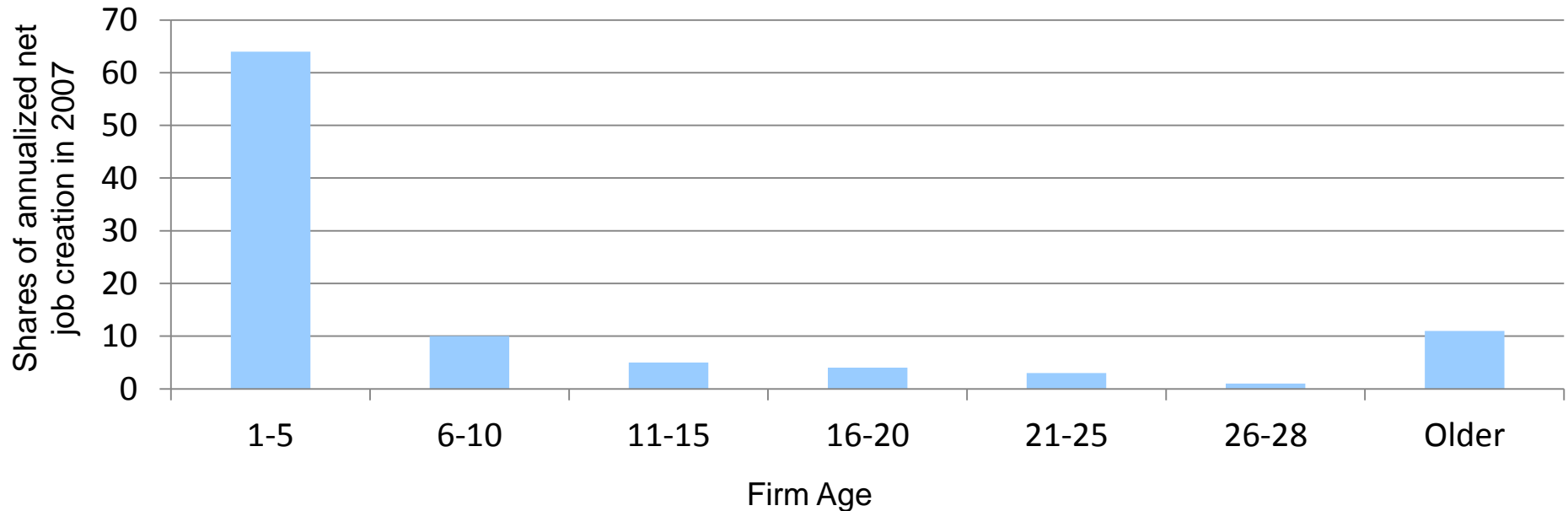
The gap often occurs at the stage of development where opportunity and uncertainty are both high, or where there is little marketplace interest such as for capabilities exclusively for national security applications

Currently, research and invention occurs in a rich science and technology (S&T) ecosystem of performers



The Role of Young, High-Growth Firms

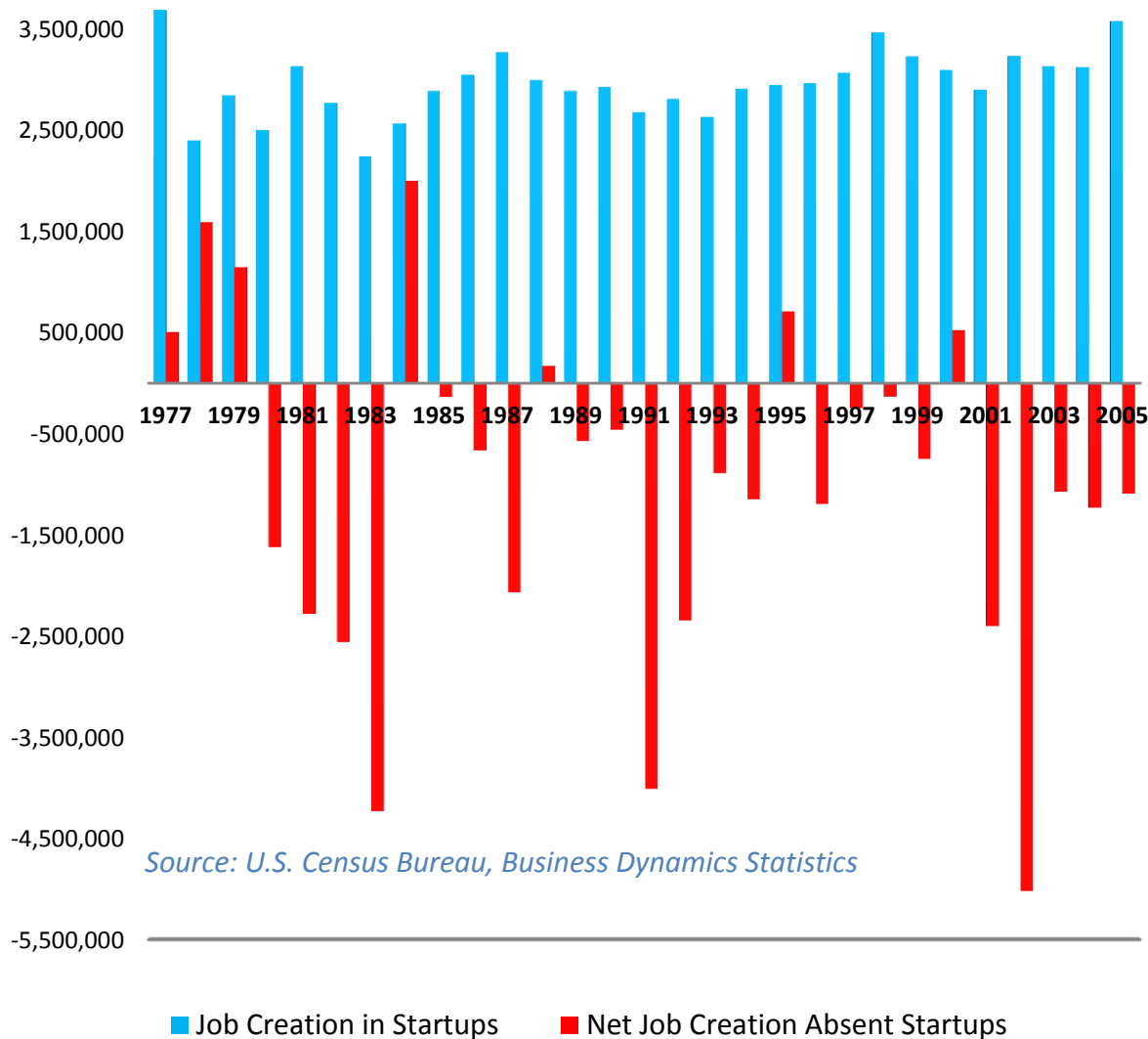
Young Firms Account for the largest Share of Job Creation



What to Do?

- focus on creating new firms
- remove barriers to emergence of high-growth companies
- target areas that are resources for high-growth firms:
immigrants and universities

Net Job Creation within Startups and without Startups



- High-growth firms or “gazelles” account for a disproportionate share of job creation in any given year, generating roughly 40 percent of new jobs in any given year.
- The fastest-growing young firms (between the ages of three and five) account for less than 1 percent of all companies in the economy, yet generate 10 percent of new jobs each year.

Source: Kauffman Foundation
Research Series: Firm Formation and Economic Growth High-Growth Firms and the Future of the American Economy, March 2010.

Revitalizing American Manufacturing

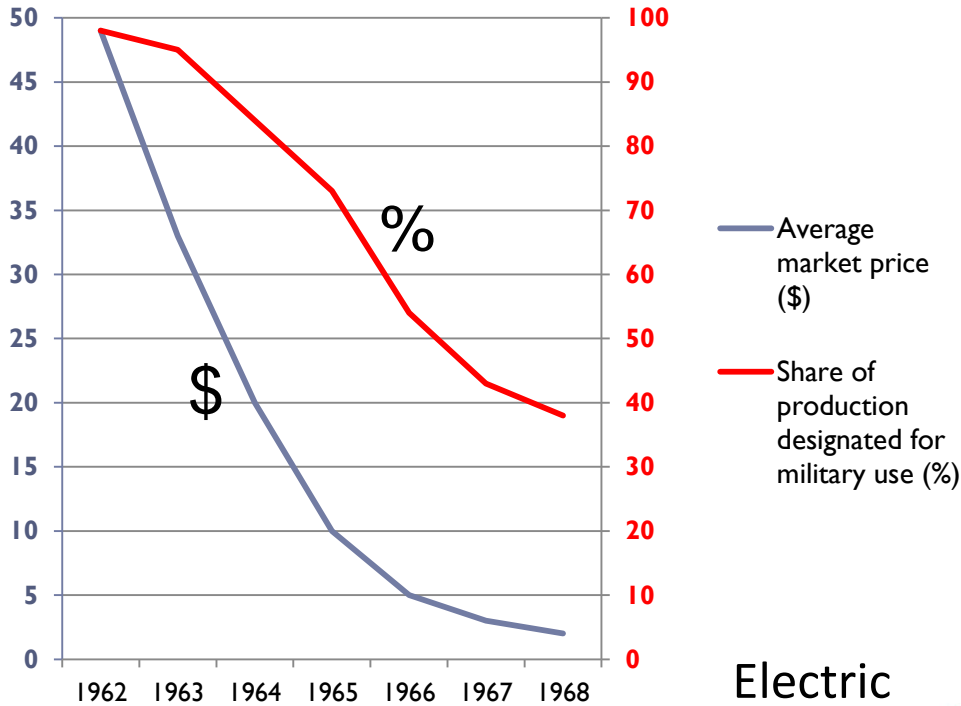
Advanced Manufacturing Partnership:

- National Robotics Initiative
- Materials Genome Initiative
- PCAST Report on Advanced Manufacturing
- Public-Private Partnerships in Manufacturing
- Defense Manufacturing and Industrial Base Investments



Government Procurement as a Catalyst

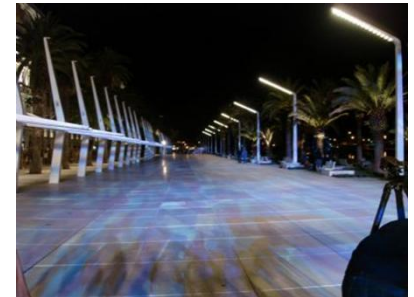
US Semiconductor Market Price and Military Use, 1962-1968



Source: ¹Morris, Peter Robin. *A history of the world semiconductor industry*. 1990, pg 75; ²Defense Science Board, "High Performance Microchip Supply", 2005.



Prosthetics



Solid State Lighting

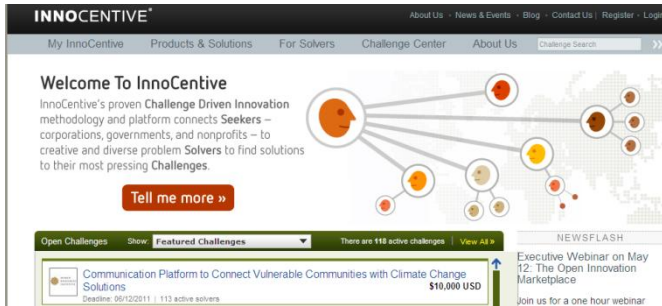
Electric Vehicles



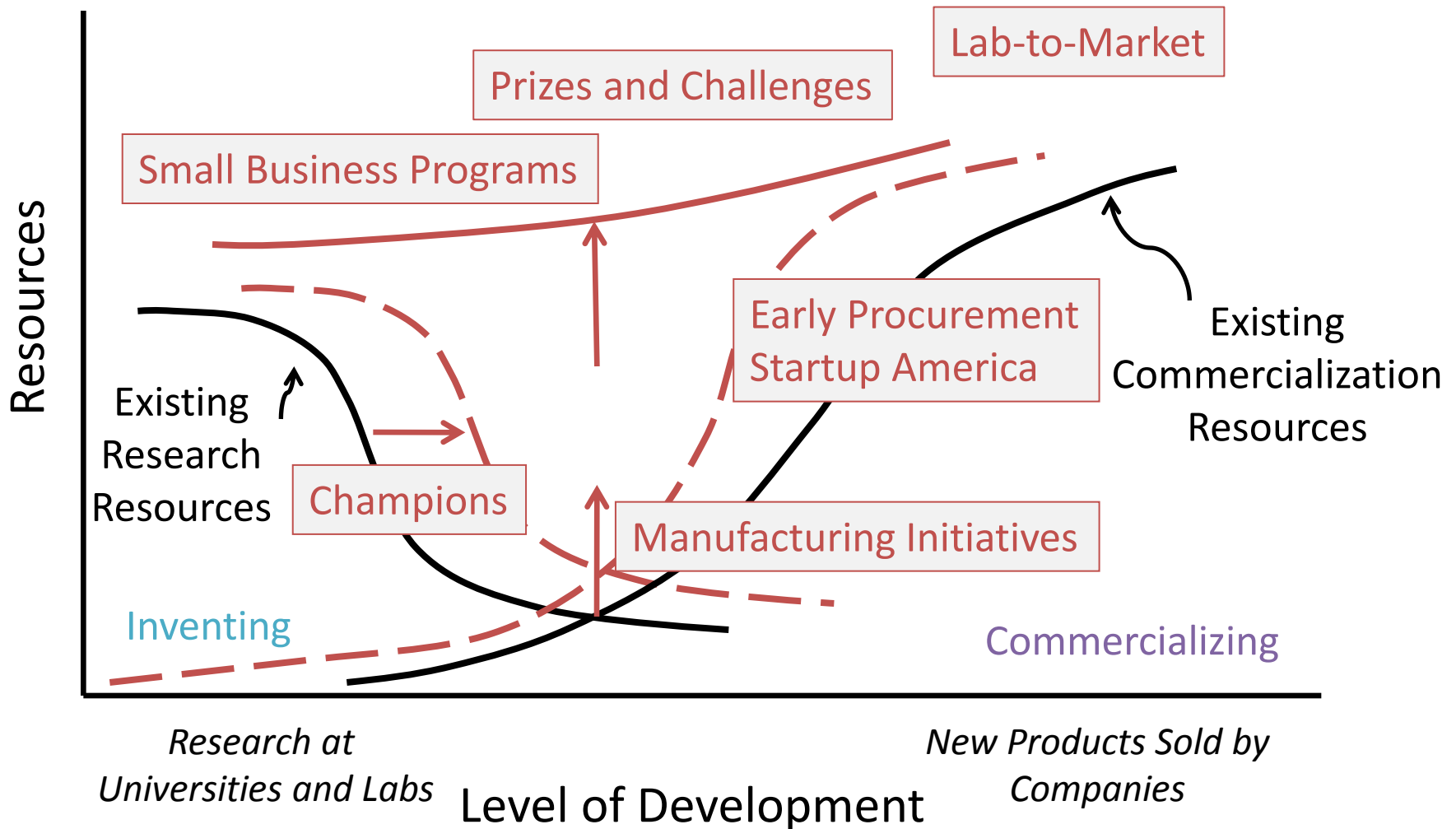
BioFuels



Strengthening the Defense Industrial Base

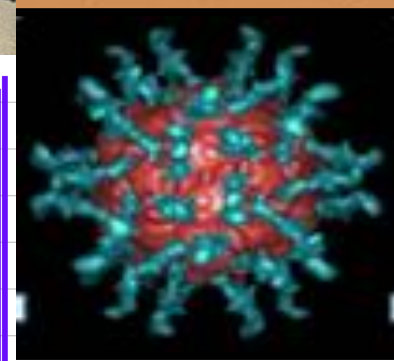
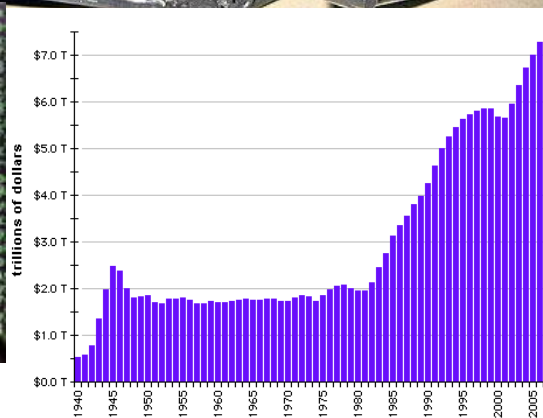
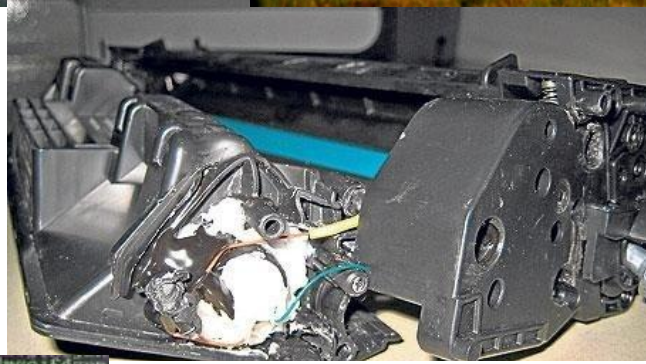
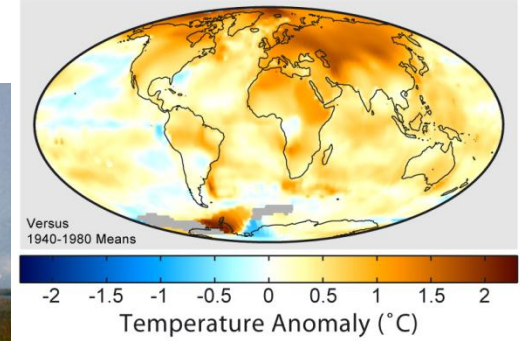


Shrinking the Missing Middle for Prosperity and Strength



Many Challenges Remain

1999-2008 Mean Temperatures



Source: U.S. National Debt Clock

