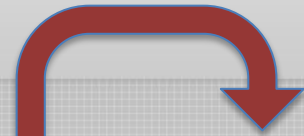


Senate Forum: *ITIF Report on “University Research Funding: Still Lagging Behind and No Signs of Improvement”*



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William B. Bonvillian
Director

MIT Washington Office

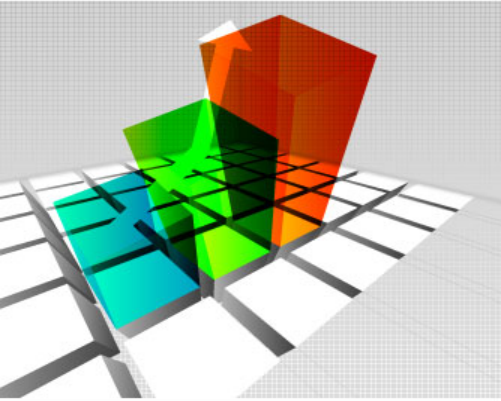
May 7, 2014



Three Stories:

- 1) Role of science and technology in overall economic growth
- 2) Role of federally-funded research in creating new economic sectors
 - Where did technology sectors come from?
- 3) Effect of declining federal R&D on economic growth

1) Role of Science and Tech in Overall Economic Growth:

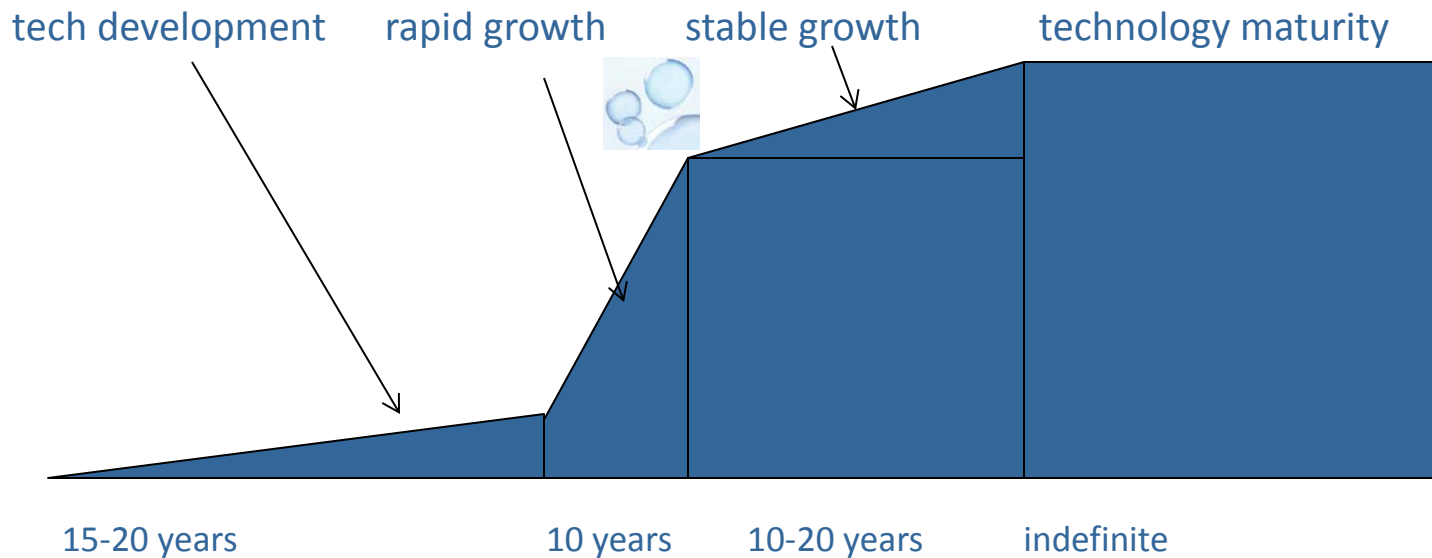


- Since WW2, the U.S. per capita income has grown exponentially
- Nobel Prize economist Robert Solow demonstrated the leading enabler for this growth was “technological and related innovation”
- This factor is responsible for 60% or more of historical U.S. economic growth
- William H. Press, “As a factor of production, technology produces wealth and produces more technological progress, enabling a virtuous cycle of exponential growth.”

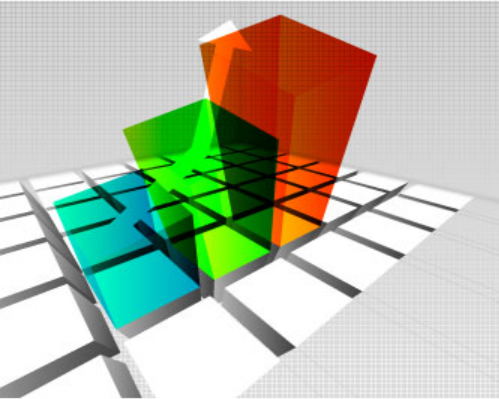
1) Innovation Wave Theory



Kondratieff growth wave:



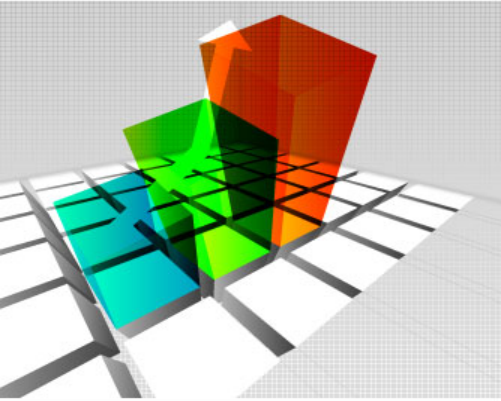
Creating New



Economic Sectors:

- Economists: R&D creates “knowledge spillovers” that multiply initial R&D investment
- BIO study: economic benefits from technology transfer of federally-funded health research from 1996 to 2010 resulted in an increase of up to \$836 billion in gross industry output, \$388 billion in GDP, and 3 million jobs (2012 study)
- Battelle Memorial study: \$797 billion economic sector, including 310,000 jobs, created based on the \$3.8b Human Genome Project led by NIH (2011 study)

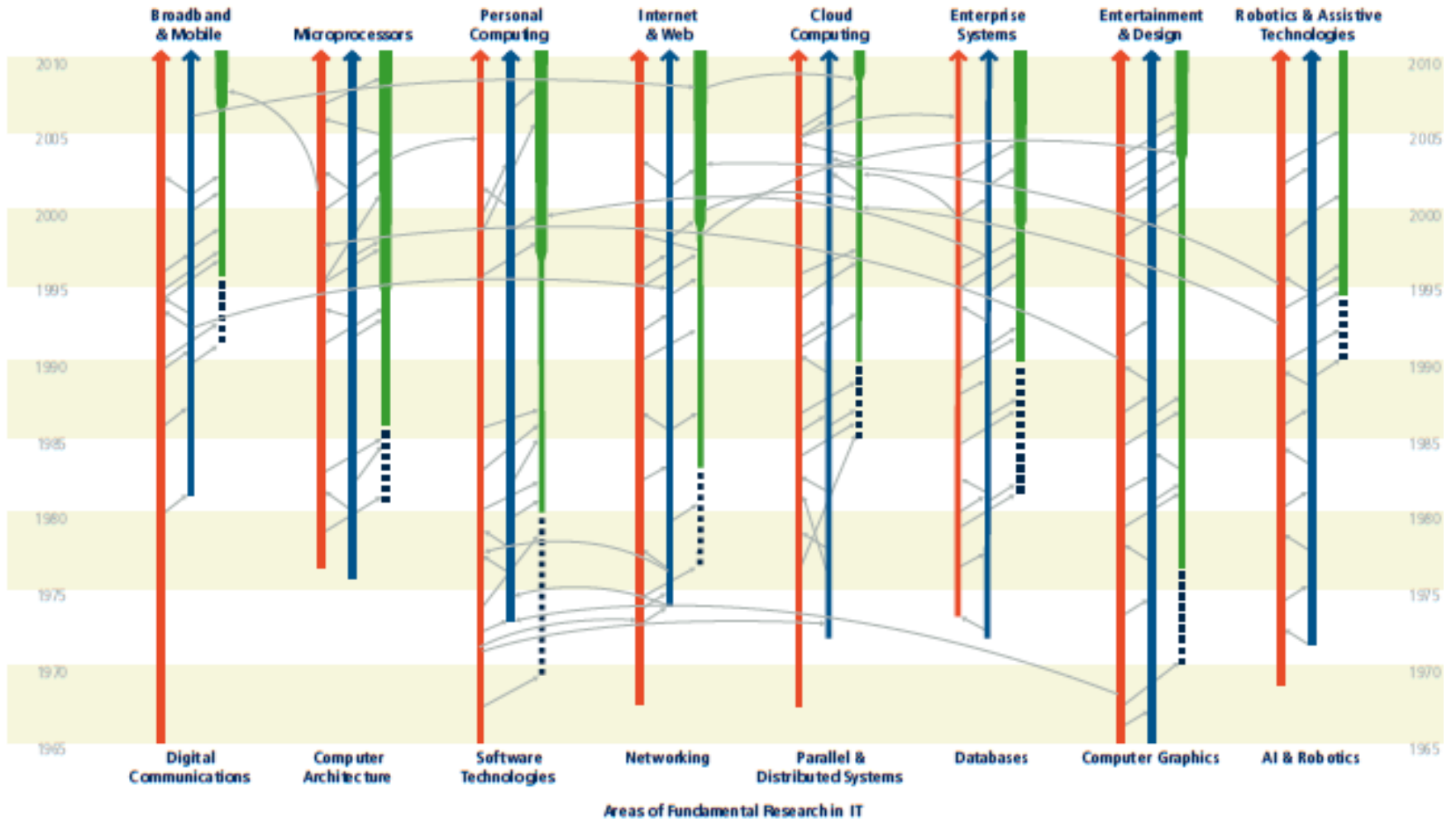
2) Federally Funded Research Creating New Economic Sectors, con't:



- Core technologies behind the smart phone traced to federal research support, for:
 - Microchip
 - Internet
 - Touch screen
 - Speech recognition (SIRI)
 - GPS
- Google search engine technology derived from NSF-funded research.
- NSF study (updated 2012) traced federal research to IT sectors valued at over \$10 billion:
 - research in digital communications helped lead to today's broadband and mobile communications,
 - in computer architecture helped lead to microprocessor advances,
 - in software helped lead to personal computing,
 - in networking helped lead to the internet and web,
 - in parallel and distributed systems helped lead to cloud computing
 - in databases helped lead to enterprise systems, and
 - in artificial intelligence helped lead to robotics and assistive technologies.

IT Sectors With Large Economic Impact

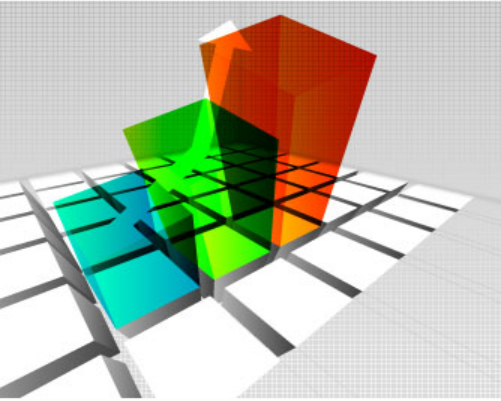
Motorola — AMD Intel — eBay Akamai Yahoo! — BM — Electronic Arts
 Qualcomm — HP Symantec Juniper Facebook Twitter VMware HP Adobe Autodesk Nuance
 Texas Instruments — Apple — Cisco — Amazon — Microsoft — Oracle nVidia Pkar Xbox
 iPhone — Dell — Google — iRobot Intuitive Surgical



■ University
 ■ Industry R&D
 ■■■ Products
 ■ \$1 Billion Market
 ■ \$10 Billion Market



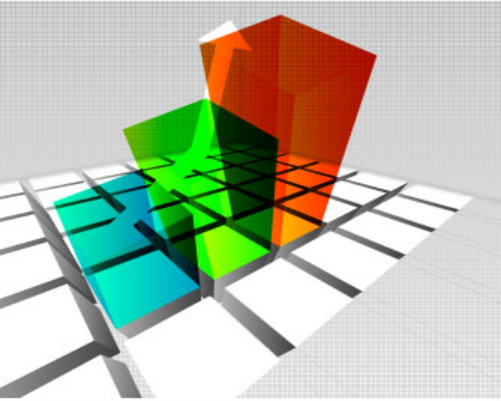
2) Federally Funded Research Creating New Economic Sectors, con't:



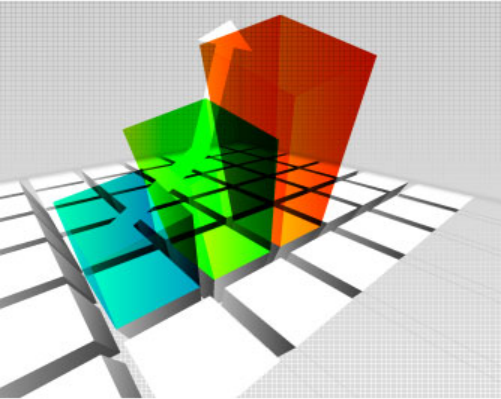
- Energy
 - The Shale Gas Revolution
 - Seismic Imaging
 - Visible LED Lighting Technology
- Health
 - Magnetic Resonance Imaging (MRI)
 - Advanced Prosthetics
 - The Human Genome Project
 - HIV/AIDS
- Mathematics
 - Reverse Auctions
 - Kidney Matching Program
- Transportation
 - Civilian aviation
- Agriculture
 - Hybrid Corn
 - Lactose Free Milk

Source: Peter L. Singer, *Federally Supported Innovations: 22 Examples of Major Technology Advances that Stem from Federal Research Support* (ITIF Feb. 2014)
<http://www2.itif.org/2014-federally-supported-innovations.pdf>

3) Effect of Declining Federal R&D on Economic Growth



- Long term, cuts in federal R&D spending will result in lower long-term GDP growth; potentially halts U.S. historic trend of exponential tech based growth.
- Sequestration: cuts of up to 9.4% for defense spending and 8.2% for non-defense spending, lasting for a decade FY13-23; modified for FY14-15; resumes in FY16.
- AAAS: federal R&D has already declined under Sequestration from \$158.8 in 2010 to \$133.2 billion in 2013 (in constant 2013 dollars).
- ITIF: Between 2013 and 2021 loss in U.S. GDP as a result of Sequestration cuts to R&D will range from \$203 billion to \$860 billion; projects 450,000 jobs will be cumulatively lost or not created in that period.
- Longer term impacts beyond 2021 are more difficult to project but will be more significant in terms of lost technology opportunity gains.



Federal R&D is a major input into innovation-based economic growth...

- Over 60 percent of all U.S. basic research, and 31 percent of all U.S. basic research/applied research/development is federally-funded. (2012 data)
- Industry funds development, feds fund research
- Cut a major input and over time you affect output (i.e., growth)