

Governance of Nanotechnology and the Legislation in Preparation

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Outline

- Background
- First Legislation in 2003 and International Activities
- Nanotechnology Funding since 2001
- Legislative Activity to date
- A Workshop?



Background

- On Dec. 29, 1959, Nobel Laureate Richard P. Feynman gave a talk titled “**There’s Plenty of Room at the Bottom**” at the Annual meeting of the American Physical Society at Cal Tech.
- He presented a technological vision of extreme miniaturization before the word “chip” became part of lexicon.
- He envisioned *a technology of building nano-objects atom by atom or molecule by molecule.*



- In recognition of many inventions and discoveries in fabrication of nano-objects,
National Science and Technology Council (NSTC) of the White House created the Interagency Working Group on Nanoscience, Engineering and Technology (IWGN) in 1998.
- In a January 2000 speech at Cal Tech, *former President Clinton talked about the exciting promise of “nanotechnology”* and the importance of expanding research in nanoscale science and technology.
- Later that month, he announced in his State of the Union Address an *\$497 million federal, multi-agency national nanotechnology initiative (NNI) in the fiscal year 2001 budget*



First Legislation in 2003 and International Activities

21st Century Nanotechnology R & D Act

- *In Jan. 2003, the U. S. senate introduced a bill to establish a National Nanotechnology Program.*
- *On Dec. 3, 2003, President G. W. Bush signed into law the 21st Century Nanotechnology Research and Development Act - PUBLIC LAW 108–153.*
- The bill gave NNI a permanent home in the federal government and *authorized \$3.7 billion to be spent in the four year period beginning in October 2005, for nanotechnology initiatives at five federal agencies.*
- The funds were used to provide *grants to researchers, coordinate R&D across five federal agencies - NSF, DOE, NASA, NIST, and EPA, establish interdisciplinary research centers, and accelerate technology transfer into the private sector.*



NNI had four goals:

- Advance world-class nanotechnology research and development.
- Foster the transfer of new technologies into products for commercial and public benefit.
- Develop and sustain educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology.
- Support the responsible development of nanotechnology.



- NNI created the National Nanotechnology Advisory Panel (NNAP).
 - It called for a triennial review of the NNI by the National Academies, and established a *National Nanotechnology Coordination Office (NNCO)*.
- The NNCO serves as a central point of contact for Federal nanotechnology R&D activities, and provides public outreach on behalf of the NNI.
- The NNCO Director and Deputy Director are appointed by the White House Co-Chair of the NSTC Committee on Technology.



International Activities

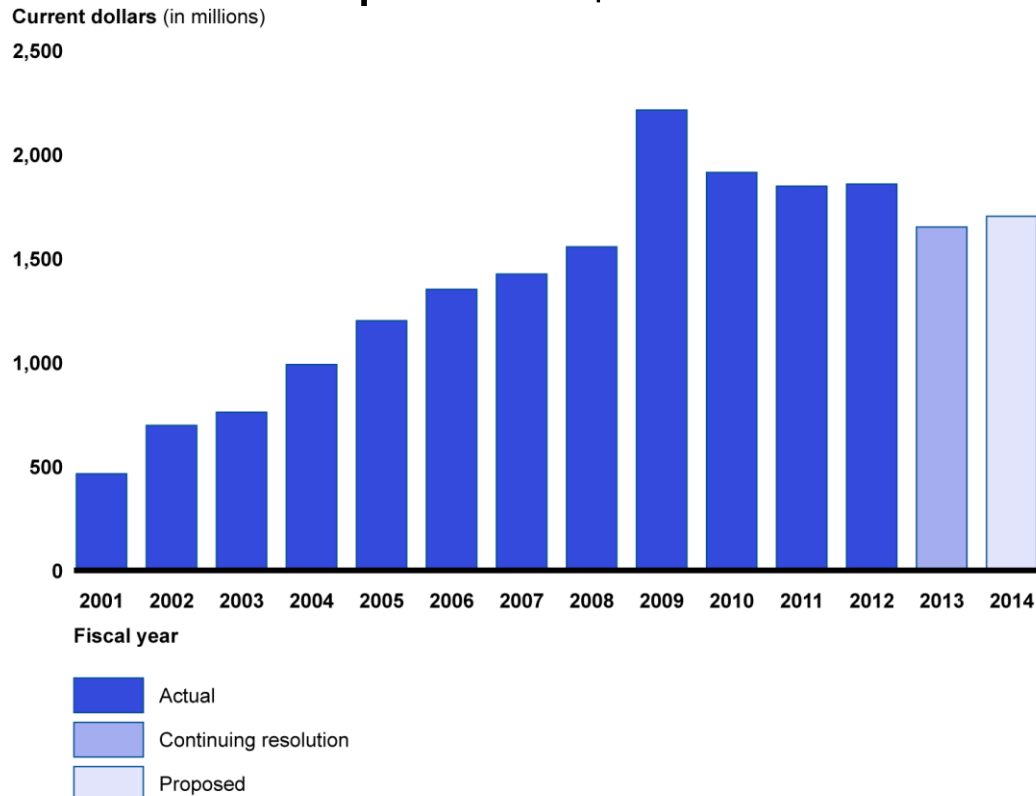
- European Union (EU) made nanosciences and nanotechnologies a priority in *Sixth Framework Program (FP6) in 2002 for a period of 2003-06*. They had also dedicated small funds in FP4 and FP5 before.
- Japan identified nanotechnology as one of its *main research priorities in 2001*. The funding levels increases sharply from \$400 million in 2001 to around \$950 million in 2004.
- In 2003, South Korea embarked upon a ten-year program with \$2 billion of public funding, and Taiwan has committed around \$600 million of public funding over six years.
- Singapore, China and Russia also started to invest.



Nanotechnology Funding since 2001

U. S.

- Since 2001, Congress has appropriated about \$18 billion for nanotechnology R & D.
- President Obama requested \$1.7 billion for FY 2014.



Source: GAO based on data from the U.S. National Science and Technology Council (2003; 2005 through 2013) and other sources.

U.S. National Nanotechnology Initiative Funding, FY 2001-14



- U.S. private sector R & D is now estimated to be twice that of public funding with a focus on translating fundamental research into commercial products.
- The U.S. remains a global leader in both investments and output as measured by the number of publications and patents.
However, other countries are slowly catching up and competing with the U.S., including China which is rapidly increasing its share of investment.
- 20 top level federal agencies with 27 including all subsidiary sub-agencies currently fund NNI related research. *About 95% of the funding is spent by 6 agencies - NIH, NSF, DOE, NIST, NASA and EPA.*



Table 1: Federal Departments and Agencies Participating in the NNI

11 Federal departments and independent agencies and commissions with nanotechnology R&D budgets

Consumer Product Safety Commission (CPSC)[†]
Department of Commerce (DOC)
 National Institute of Standards and Technology (NIST)
Department of Defense (DOD)
Department of Energy (DOE)
Department of Health and Human Services (DHHS)
 Food and Drug Administration (FDA)
 National Institute for Occupational Safety and Health (NIOSH)
 National Institutes of Health (NIH)
Department of Homeland Security (DHS)
Department of Transportation (DOT)
 Federal Highway Administration (FHWA)
Environmental Protection Agency (EPA)
National Aeronautics and Space Administration (NASA)
National Science Foundation (NSF)
U.S. Department of Agriculture (USDA)
 Agricultural Research Service (ARS)
 Forest Service (FS)
 National Institute of Food and Agriculture (NIFA)

9 other participating departments and independent agencies and commissions

Department of Education (DOEd)
Department of the Interior (DOI)
 U.S. Geological Survey (USGS)
Department of Justice (DOJ)
 National Institute of Justice (NIJ)
Department of Labor (DOL)
 Occupational Safety and Health Administration (OSHA)
Department of State (DOS)
Department of the Treasury (DOTreas)
Intelligence Community (IC)
 Office of the Director of National Intelligence (ODNI)
Nuclear Regulatory Commission (NRC)[†]
U.S. International Trade Commission (USITC)[†]

Also participating from the Department of Commerce (DOC), listed above
 Bureau of Industry and Security (BIS)
 Economic Development Administration (EDA)
 U.S. Patent and Trademark Office (USPTO)

KEY [†] Denotes an independent commission that is represented on NSET but is non-voting



NNI Budget, by Agency, 2013-15

http://www.nano.gov/sites/default/files/pub_resource/nni_fy15_budget_supplement.pdf, p. 8

(dollars in millions)

Agency	2013 Actual	2014 Estimated*	2015 Proposed
CPSC	1.3	2.0	2.0
DHS	14.0	24.0	32.4
DOC/NIST	91.4	97.8	82.6
DOD	170.1	175.9	144.0
DOE**	314.2	303.3	343.1
DOT/FHWA	2.4	2.0	1.5
EPA	14.6	15.5	16.8
DHHS (total)	485.4	469.5	469.6
FDA	16.1	17.0	17.0
NIH	458.8	441.5	441.5
NIOSH	10.5	11.0	11.1
NASA	16.4	17.9	13.7
NSF	421.0	410.6	412.4
USDA (total)	19.5	19.1	18.8
ARS	2.0	2.0	2.0
FS	5.0	4.0	4.0
NIFA	12.5	13.1	12.8
TOTAL***	1,550.2	1,537.5	1,536.9

* 2014 numbers are based on 2014 enacted levels, and may shift as operating plans are finalized.

** Funding levels for DOE include the combined budgets of the Office of Science, the Office of Energy Efficiency and Renewable Energy (EERE), the Office of Fossil Energy, and the Advanced Research Projects Agency for Energy (ARPA-E).

*** In Tables 2-6, totals may not add, due to rounding.

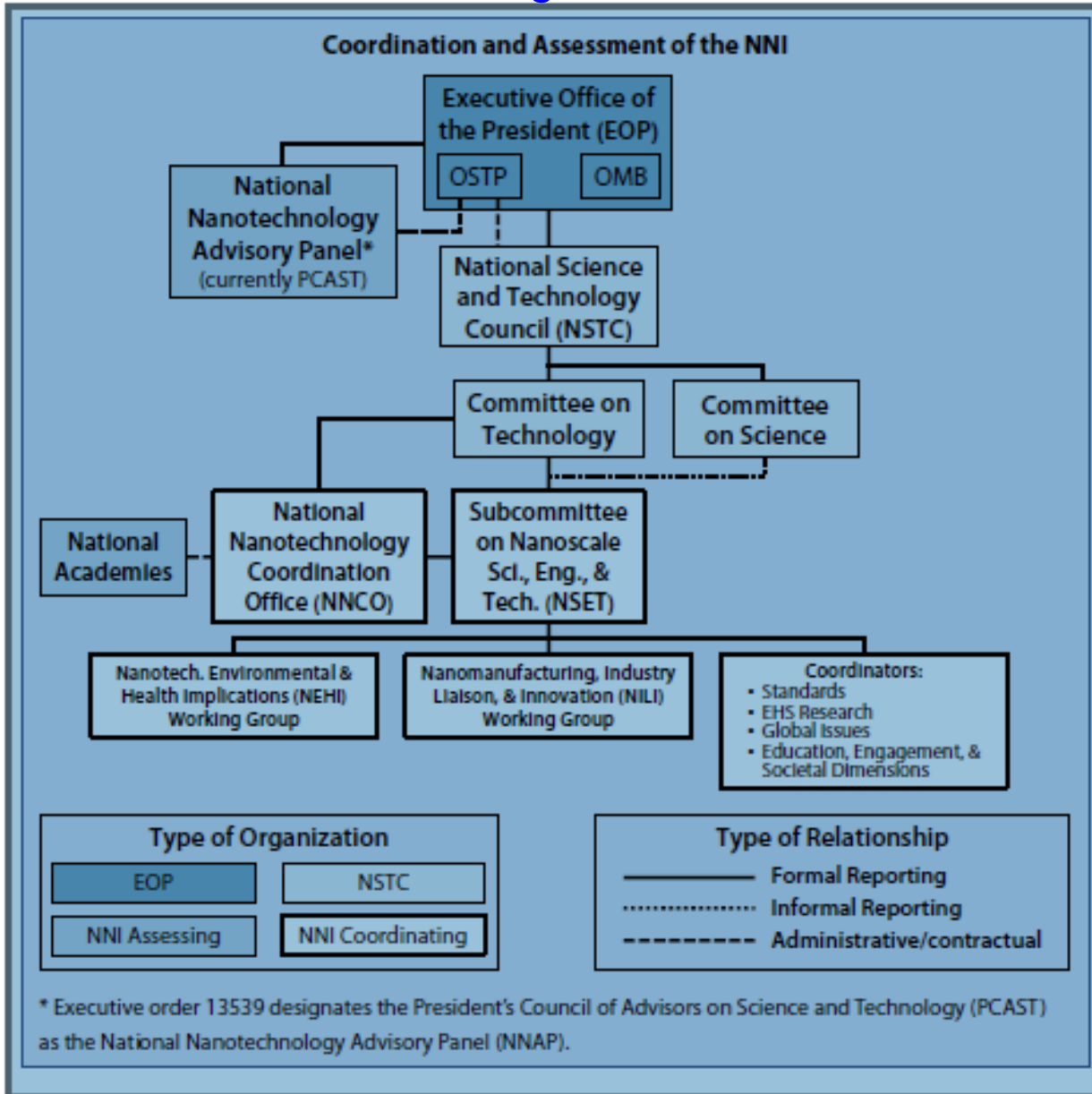
- Currently, the NNI investments are guided by a strategic plan published by OSTP in February 2014.
- Priorities for NNI funding by Program Component Area are:
 - Foundational Research (35% of NNI funding);
 - Applications, Devices, and Systems (24%);
 - Signature Initiatives (19%);
 - Infrastructure & Implementation (16%);
 - Environment, Health, and Safety (7%).

The Nanotechnology Signature Initiatives are its own Program Component Area in the FY 2015 Budget Supplement with the following priorities defined by Office of Science and Technology Policy as:

- Nanotechnology for Solar Energy Collection and Conversion;
- Sustainable Nanomanufacturing;
- Nanoelectronics for 2020 and Beyond;
- Nanotechnology Knowledge Infrastructure; and
- Nanotechnology for Sensors and Sensors for Nanotechnology



Organizational Structure for Management of NNI



EU

- EU in 2014 launched Horizon 2020 (2014-2020) after conclusion of EU Framework Program 7. Total budget is Euro 77B.
 - In the Horizon 2020, they have identified six key areas: Nanotechnology, Advanced Manufacturing, Advanced Materials, Nanoelectronics, Photonics, and Biotechnology.
 - They plan to spend *Euro 6.6 B over a six year period, about 1.1 B Euros per year..* In addition, they plan to spend Euro 5 Billion in public-private partnerships. It should be noted that, in addition to EU expenditure, each country will invest additional moneys on research.

Japan

- Japan plans to spend on nanotechnology Yen 550B over a five year period which translates to about **\$1.1B per year.** Japanese companies invest about 90% of total R &D in nanotechnology.
- It appears that investment by US for about **\$1.7 B** is slightly higher than that by EU or Japan.



Legislative Activities to date

- After the enactment of the Public law 108-153 on Dec. 3, 2003, to date *NNI has not been reauthorized by Congress.*
- Two bipartisan reauthorization bills were passed by the House in 110th and 111th Congress; the Senate did not take any action on these bills. One bill was introduced by Senate in 111th Congress and died in the committee.

110th Congress, 2nd session, H. R. 5940, National Nanotechnology Initiative Amendments Acts of 2008, bipartisan

111th Congress, 1st session, H. R. 554, National Nanotechnology Initiative Amendments Acts of 2009, bipartisan

111th Congress, 1st session, S. 1482, National Nanotechnology Initiative Amendments Act of 2009, Democrats

- Following bills were introduced in 113th Congress (Year 2013 and 2014):

Nanotechnology Advancement and New Opportunities Act, H.R. 394, 1st session, Democrats, not referred to committee.

NNI reauthorization was included as one of the title in a bill on America Competes Reauthorization Act of 2014, H. R. 4159, 1st session introduced by Democrats, and S. 2757, 2nd session, Democrats. They both died in the committee.

National Nanotechnology Initiative Amendments Act of 2014, S.????, 2nd session, submitted by Democrats (Mark Pryor). It died.



Few Comments on The Legislative Process²

- A bill takes a complex path before it becomes Law.
- *A bill with an identical language must pass by both chambers and signed by the President to become (Public or Private) Law.*
- Appropriations Committees of both Houses authorize funding.

²K. S. White and J. P. Carrey, *Working with Congress: A Scientist's Guide to Policy*, AAAS, Washington, D. C., 2011.



Nanotechnology Hearings held in 2013-14, co-organized by BB

Two Information Hearings

- **“Nanotechnology: From Laboratories to Commercial Products”** on May 20, 2014, Organized by House Committee on Science, Space, and Technology
- **“Nanotechnology: Understanding How Small Solutions Drive Big Innovation”** on July 29, 2014, Organized by House Committee on Energy and Commerce.

On a Bill

- “Frontiers in Innovative Research, Science, and Technology (FIRST) Act (H.R. 4186) which reauthorizes funding for NSF, NIST, OSTP and Interagency STEM Programs” on Nov. 13, 2013. Included NNI component.



Future of Legislation in 114th Congress (2015-2016)

- Composition of Senate and party control has changed to Republican party.
- House has become more Republican.
- Given that both Houses are now controlled by Republican party, all Democratic legislation will die and new Republican legislations may be introduced?
- Stay tuned!

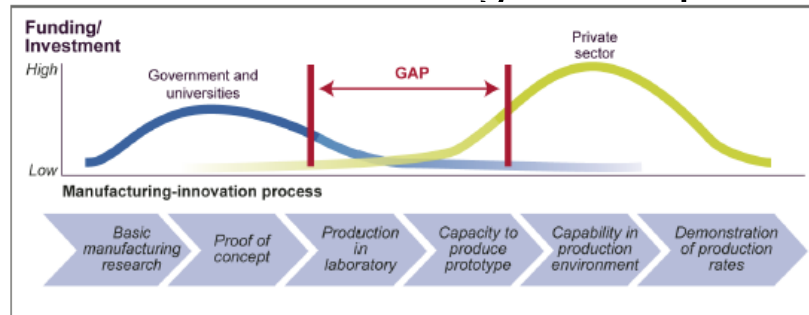


Need of a Reauthorization Bill to address various concerns

- In a report on *Triennial Review of the NNI* conducted by National Academies, released in 2013 stated that five crosscutting recommendations should be implemented within six month:
 - *The lack of information at the project level on who is performing research, where, and on what has many implications.*
 - *Planning, management, and coordination can be enhanced by developing and implementing interagency plans for focused areas, i.e., the signature initiatives and the working groups. It implies lack of technology transfer.*
 - *A website (such as www.nano.gov) has to effectively serve all the various stakeholder groups.*
 - *Current advances in technology and methods, e.g., for data collection and social network analysis, can be used effectively to develop test metrics for assessing progress toward goals and for informing program leadership.*
 - *There are benefits from identifying, sharing, and implementing best practices, such as those described in this report, especially relating technology transfer and commercialization.*



- At the request of Chairman of the House Science, Space and Technology Committee, GAO conducted a study and released *a report entitled “Nanomanufacturing: Emergence and Implications for U.S. Competitiveness, the Environment, and Human Health”* in Feb. 2014.
- It examined current issues related to nanotechnology and nanomanufacturing. The report identified various concerns, including:
 - *The valley of death* – gaps in funding or support for technology development and manufacturing development;



Source: GAO adapted from Executive Office of the President, 2012, page 21.

- *The lack of participation in setting standards* for nanomanufacturing and nanotechnology;
- *The lack of national vision* for nanomanufacturing capability; and
- The need for integrated framework to help assess and address the *environmental, health and safety implications*.

It is believed that there are excessive reporting requirements.

- *The NNI reporting requirements include:*
 - an annual supplemental report submitted with the President's budget
 - a triennial strategic plan (year 1)
 - a triennial assessment by the NNI Advisory Panel (NNAP which is part of PCAST) (year 2)
 - a triennial assessment of the program by the National Academies (year 3)

Frequency of reports should be decreased (every four years) as proposed in the new Senate Democratic bill introduced in July 2014.



A Workshop?

Need for a Workshop to Address Many Concerns in Execution of NNI

- It is widely recognized in Congress that :Nanotechnology is a general purpose technology which is having impact in many important areas.
 - They like to get to some *quantitative data* on scientific impact, no. of companies started, no. of jobs created, and over all scientific and economic impact. They would like to get this info from a reliable source - OSTP/NNCO - rather than from a third party.
 - There is concern about technology transfer, what are grand challenges, etc.?
 - Should they reprioritize funding?
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- There have bene many workshops and studies. None is done under the umbrella of OSTP/NNCO. A such need exists.



Scope

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Final Thoughts

Some of us need to spend some time in DC to champion the need for R & D investment. It is critical to our future and our kids' future.

Thank you.

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