A presentation featured at the

2010 Topical Symposium:

Economic Security: Neglected Dimension of National Security?

Hosted by:
The Institute for National Strategic Studies
of
The National Defense University

24-25 August 2010

By
DAVID LEECH

INSS

INSTITUTE FOR NATIONAL
STRATEGIC STUDIES

Papers presented at NDU Symposia reflect original research by members of NDU as well as other scholars and specialists in national security affairs from this country and abroad. The opinions, conclusions, and recommendations expressed or implied within are those of the authors and do not necessarily reflect the views of the Department of Defense or any other agency of the Federal Government.

National Defense University Symposium
Economic Security is National Security
Panel 1: The Economic Element of National Power

National Security and
Economic Growth Strategy?

David Leech, *TASC FuturesGroup*
TASC, Inc
david.leech@tasc.com

Outline

- Theme
- What is the problem (w/ a focus on R&D)?
- What is DoD’s play?
- The road ahead is long and winding

Theme

- Economist I respect (Michael Porter and Gregory Tassey, specifically) have made the case that the U.S. must adopt a economic strategy to assure long-term economic prosperity
  - They worry that the political will may not be there
- What is DoD's role in fostering such a strategy?
- What resources can it bring to bear?

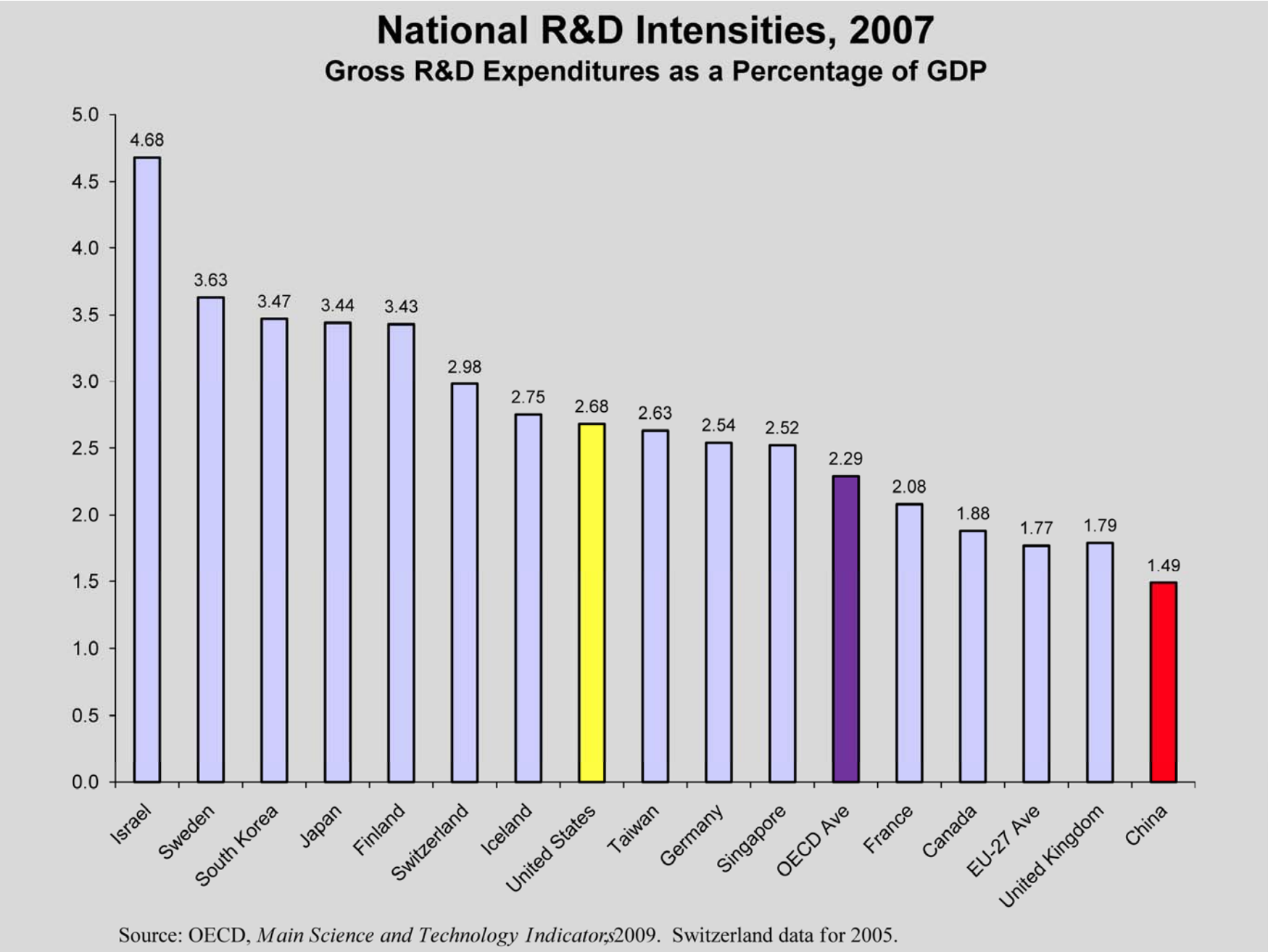
I don't have good answers to these questions but I think someone should be giving them serious consideration. We don't even have answers to some basic questions.

The Problem

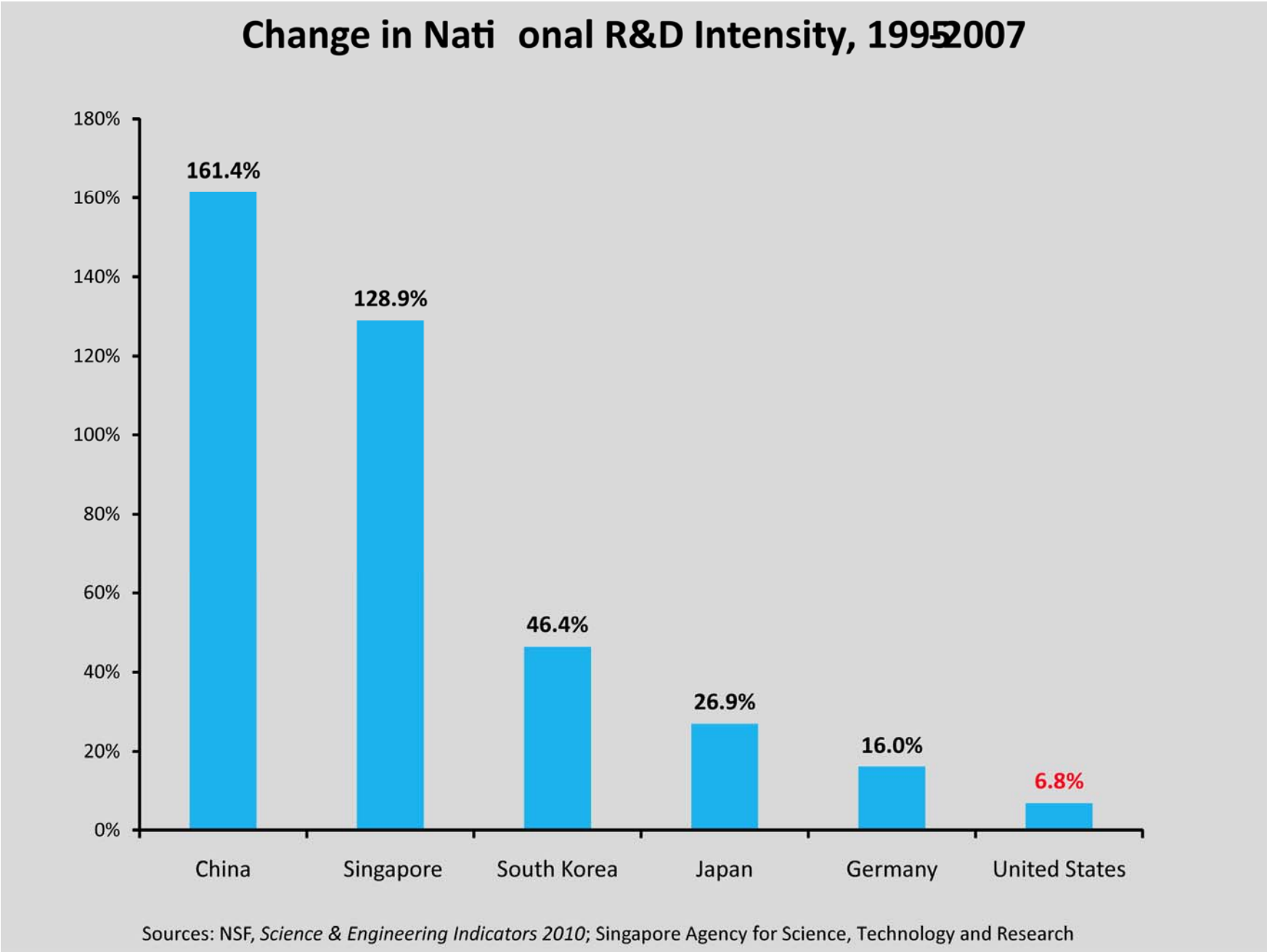
- Major economic policy debate is focused on macroeconomic issues: government spending vs. deficit reduction
- ***Inadequate attention*** is being given **to** long-term growth issues, **productivity issues**, manufacturing productivity issues
- The **technology imperative**
  - A **high-income** economy must be a **high-tech** economy
  - **U.S. global share of R&D is steadily shrinking** and U.S. R&D intensity is below the peak reached in the 1960s
  - The globally competitive **U.S. "high-tech" sector accounts for only about 7 percent of GDP**, leaving the remainder of the economy vulnerable to shifts in resources to other countries
  - **Corporate strategies** have become **truly global**, locating production, marketing *and* R&D without regard for "home base"
  - The **flat world can be tipped** by conscious and rapid creation of new technologies
  - **Technologies are increasingly systems of technologies** that require effective **integration and interdependencies** among industries (advanced materials, components, subsystems, manufacturing systems, service systems)
  - The **battle for global competitive position** is increasingly affected by the **adequacy of the technology infrastructure** (national innovation system)
  - ***To reverse current trends, the U.S. must increase R&D intensity***

"For most of the post-World-War-II period the barrier posed by the black box model has been overcome through substantial funding of technology research by mission oriented agencies"

Source: Gregory Tassey, *The Technology Imperative*, August 2007

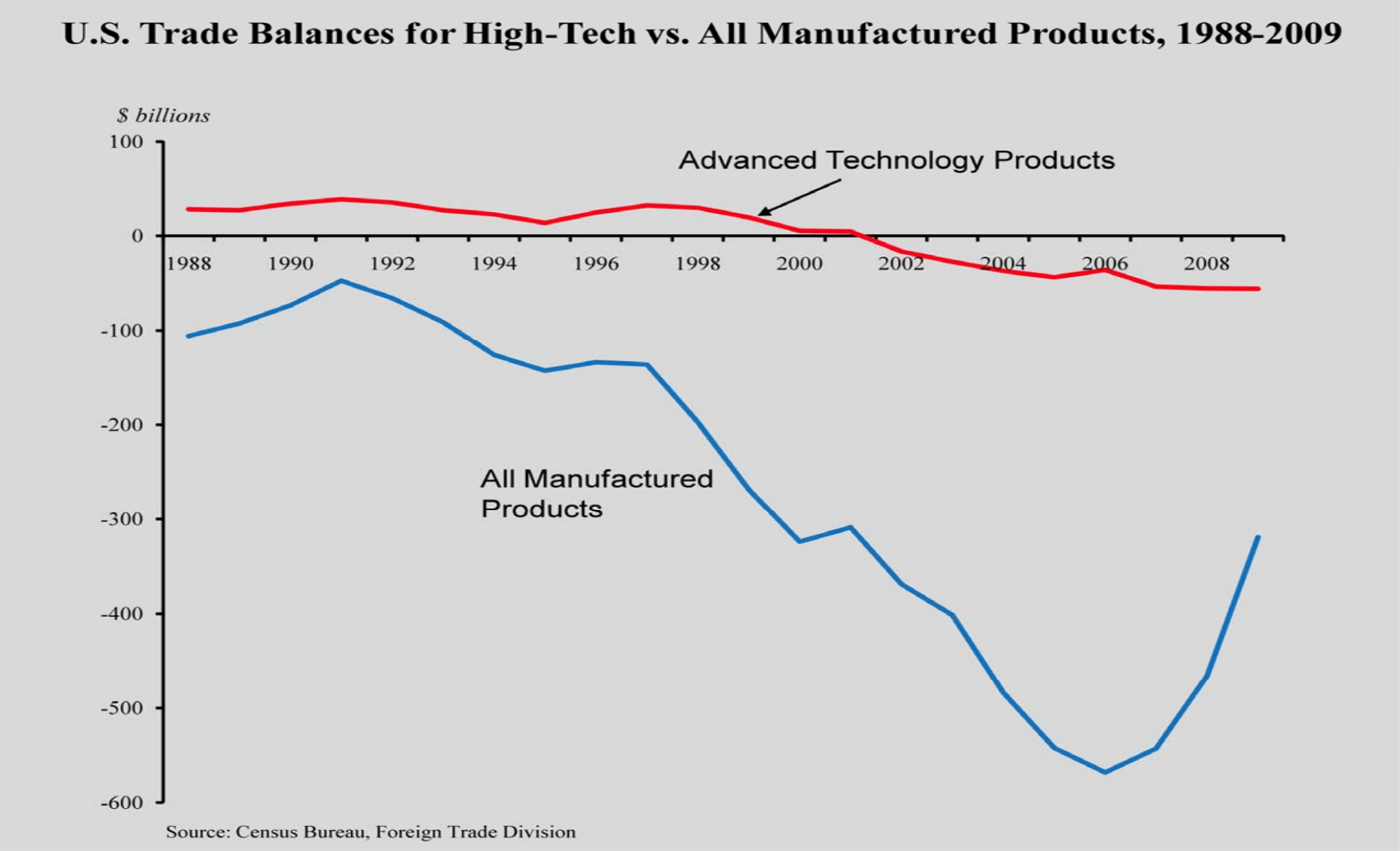


Source: Gregory Tassey, "R&D Strategies for a Global Economy," August 2010



Source: Gregory Tassey, "R&D Strategies for a Global Economy," August 2010

DoD's Play?



If the health of the U.S. manufacturing sector is in question, the health of the defense industrial base is too!

DoD's Play?

- DoD has been, and perhaps continues to be, an important player in U.S. economic growth.
- DoD R&D, technology development, and procurement has been fundamental to the several general purpose technologies
  - General purpose technologies exert a pervasive impact across a number of industries. They are characterized by a lengthy period between their emergence and their impact and the cumulating of individual small improvements
  - For example, mass production techniques (rooted in the armory system), aircraft industry, nuclear power, computer industry, Internet, communications and earth-observing satellites, lasers, radio, food-processing, machine tools, and chemical and medical industries
- DoD's positive role as a significant force in economic growth tends to be overlooked in economic policy discussions

"The military procurement issue was sitting there in plain sight, but I had been unable or unwilling to recognize it!"
V. Ruttan, *Is War Necessary for Economic Growth?*, Oxford, 2006

Provocative Observations —Vernon Ruttan

- *"It is difficult to overemphasize the importance of the historical role that military procurement has played in the process of technology development."*

- *"In the case of general-purpose technologies that emerged as important sources of growth in the U.S. economy during the last half of the twentieth century, it was primarily military and defense demand that drove these emerging technologies rapidly down their learning curves."*

Source: Vernon Ruttan, *Is War Necessary for Economic Growth?,* Oxford, 2006;

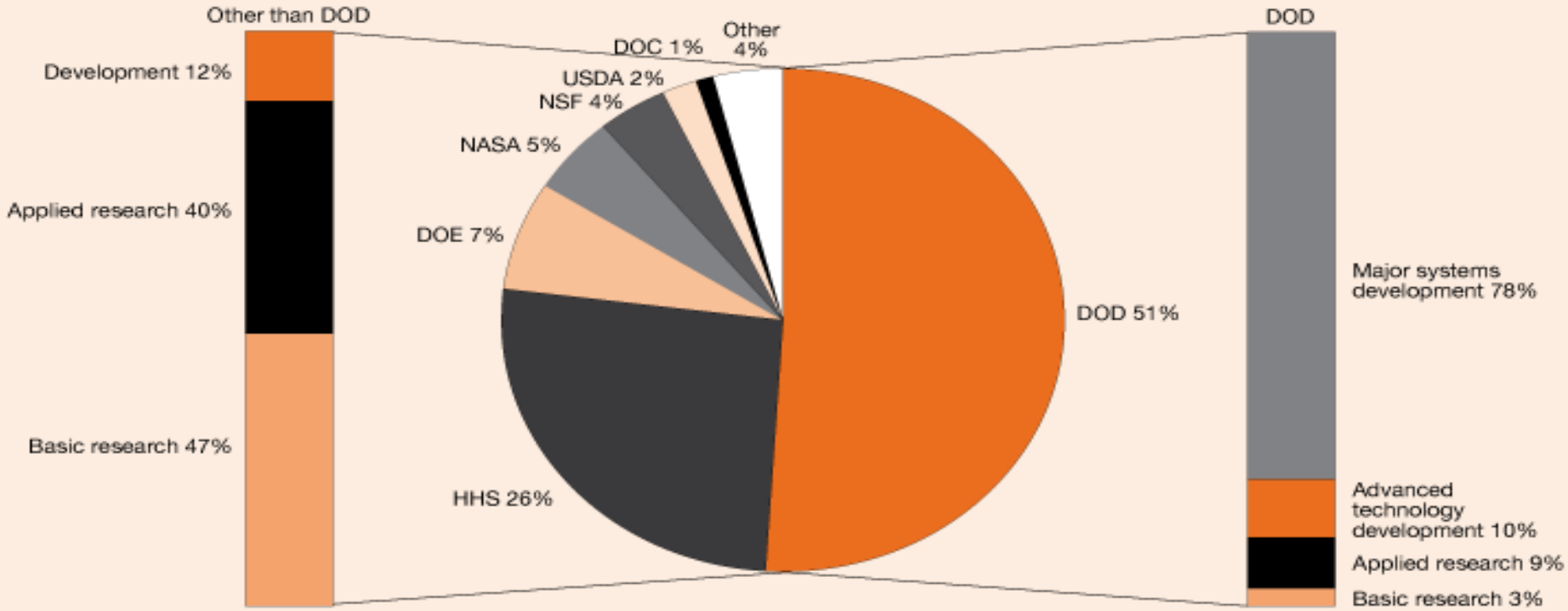
Provocative Observations —Ruttan *(Continued)*

- ***Can the private sector be relied on a source of major new general purpose technologies?*** No!
  - Each GPT Ruttan reviewed required several decades of public support, primarily in the forms of military R&D or defense-related procurement
  - Private sector decision makers almost never have access to patient capital
- **Will an aggressive policy of public support for commercially-oriented R&D become an important source of new GPTs?** Skeptical.
  - Public support for industrial technology is rarely forthcoming in the absence of an aggressive procurement program
  - In spite of a number of promising initiatives (citing SEMATECH, TRP, ATP, CRADA legislation), skeptical that public support can be depended upon.
- **Can military and defense-related R&D again become a source of major new GPTS?** Doubtful.
  - Doubtful in the absence of a major war or the threat of a major war capable of mobilizing scientific, technical and financial resources necessary to sustain
  - DoD' objectives have shifted to enhancing capacity to respond to shorter-term engagements

Source: Vernon Ruttan, *Is War Necessary for Economic Growth?,* Oxford, 2006;

How Important Is DOD R&D?

Figure 4-8
Projected federal obligations for R&D, by agency and character of work: FY 2008



DOC = Department of Commerce; DOD = Department of Defense; DOE = Department of Energy; HHS = Department of Health and Human Services; NASA = National Aeronautics and Space Administration; NSF = National Science Foundation; USDA = Department of Agriculture

NOTE: Detail may not add to total because of rounding.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Federal Funds for Research and Development: Fiscal Years 2007–09. See appendix table 4-30.

Science and Engineering Indicators 2010

System Development & Demonstration (6.4-6.5) as always dwarfed R&D (6.1-6.3). But no one knows if the technology transfers to non-defense uses. Ruttan hypothesized that it did.

Provocative Observations — Block & Kelly

- The lion's share of the R&D 100 Award-winning U.S. innovations in the 1970s came from corporations acting on their own
  - Approximately 80 percent of the award-winning U.S. innovations were private, solo
- **Most** of the R&D 100 **Award-winning U.S. innovations** in the last two decades have come from partnerships involving business and government, including federal labs and federally funded university research.
- Today, approximately two-thirds of the award-winning U.S. innovations involve some kind of inter-organizational collaboration
  - Reflects the more collaborative nature of the innovation process and the *greater role in private sector innovation by government agencies, federal laboratories, and research universities*. (Often through CRADAs.)

Source: and F. Block and M. Keller, "Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006, ITIF, 2008.

Provocative Observations — Block & Kelly *(Continued)*

- **Given the importance of the questions of where innovation comes from** and what role, if any, government has played in the development of innovations, it is perhaps **surprising that *relatively little empirical evidence has been brought to bear* on them**.

- If innovation policies are to be effective, it's critical that they be based on an accurate understanding of the U.S. innovation system—in particular, an understanding of where U.S. innovations come from.

Source: and F. Block and M. Keller, "Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006, ITIF, 2008.

What I had hoped to do….

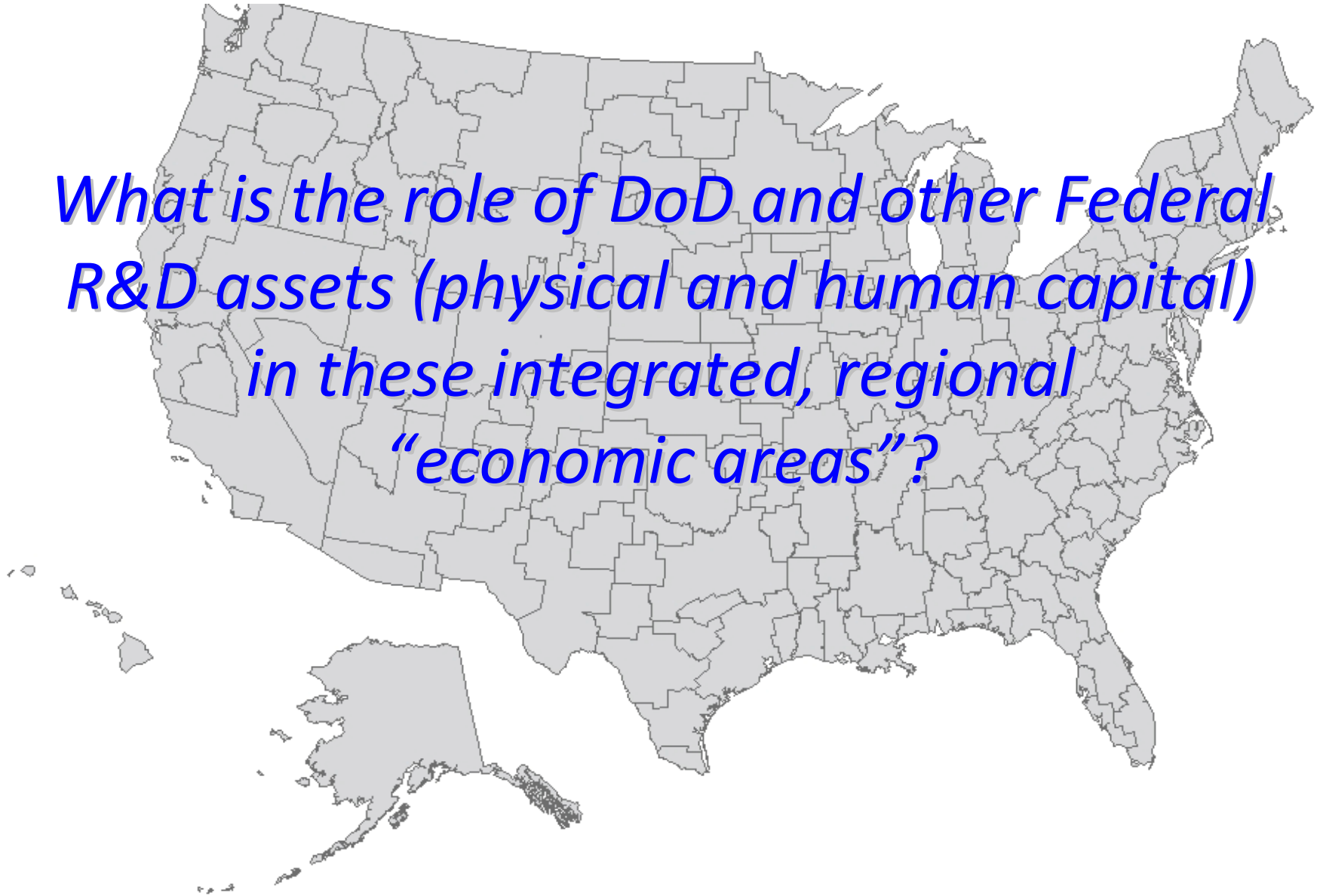
- Characterize and map the the DoD S&T infrastructure in terms of cumulative investment and technological composition

- Distinguish DoD S&T facilities that play an important role in the economic growth and development of regional economic vitality
  - CRADAs should play a role as a vehicle of collagoration

- Map those S&T assets relative to globally important clusters of U.S. economic activity

Alas, I had a very hard time just finding relevant data.

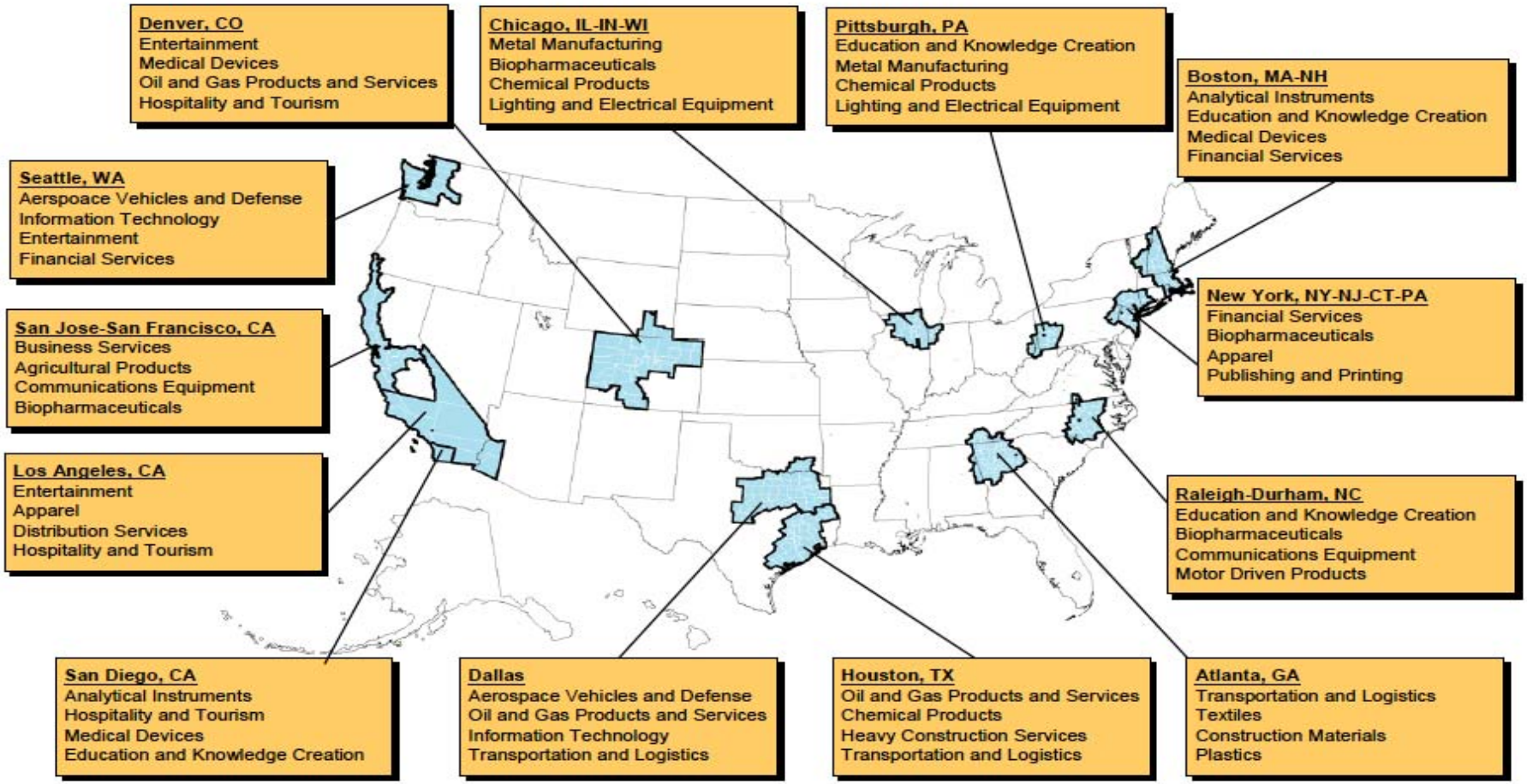
BEA "Economic Areas"



What is the role of DoD and other Federal R&D assets (physical and human capital) in these integrated, regional "economic areas"?

Specialization by Traded Clusters

Selected U.S. Economic Areas, 2006



Source: Prof. Michael E. Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.

While “local industries” account for the majority of employment, “traded industries” are fundamental to prosperity. Traded industries also have higher wages, growth, much higher productivity and much higher patenting rates.

How Important? — R&D Fixed Assets

- What is the $ value of DoD's intramural P&E outlays for R&D? (NSF only has data at the DoD-level)
- Where are all labs located, physically (The FLC doesn't have the data organized for easy access.)
- Can we distinguish lab assets that have utility to the commercial sector?
- What role to labs play in their local economic areas? (Harvard Cluster Mapping Project is too aggregated to tell, but they are interested is the issue.)

These basic questions are very difficult to answer. Basic data sources are not well-developed or standardized.

Very Tentative Observations — Based on Limited Data and Analysis

"Top 10" Labs by Two Measures of Collaboration*
AIR FORCE RESEARCH LAB WRIGHT-PATTERSON AFB OH
ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS
ARMY INST OF SURGICAL RESEARCH FORT SAM HOUSTON TX
ARMY MEDICAL RESEARCH INST OF INFECTIOUS DISEASES FORT DETRICK MD
ARMY MISSILE RESEARCH DEVELOPMENT AND ENGINEERING CENTER REDSTONE ARSENAL AL
CLINICAL INVESTIGATION REGULATORY OFFICE FORT SAM HOUSTON TX
COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH
NAVAL AIR WARFARE CENTER WEAPONS DIV CHINA LAKE CA
NAVAL MEDICAL CENTER SAN DIEGO CA
NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND BETHESDA MD
NAVAL RESEARCH LAB WASHINGTON DC
NAVAL UNDERSEA WARFARE CENTER DIV NEWPORT RI
WALTER REED ARMY INST OF RESEARCH WASHINGTON DC

• An estimate of the number of collaboration partners and an estimate of foreign collaboration partners.

- Number of DoD/DHS labs = 136
- Number of DoD/DHS labs w/ open CRADAs = 97
- Estimated number of collaborative partners = 664 for 97 labs
- Estimated number of partners = 1418 for 97 labs

Very Tentative Observations *(Continued)*

"Top 10" Labs by Two Measures of Collaboration*	Composition of U.S. Industry by Type		
	Traded 31.8%	Local 67.4%	Natural Endowment Dependent 0.8%
AIR FORCE RESEARCH LAB WRIGHT-PATTERSON AFB OH	32.9	66.8	0.3
ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS	22.7	72.5	4.8
ARMY INST OF SURGICAL RESEARCH FORT SAM HOUSTON TX	24.7	74.9	0.4
ARMY MEDICAL RESEARCH INST OF INFECTIOUS DISEASES FORT DETRICK MD	30.3	69.4	0.3
ARMY MISSILE RESEARCH DEVELOPMENT AND ENGINEERING CENTER REDSTONE ARSENAL AL	33.8	62.6	3.6
CLINICAL INVESTIGATION REGULATORY OFFICE FORT SAM HOUSTON TX	24.7	74.9	0.4
COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH	29.2	68	2.8
NAVAL AIR WARFARE CENTER WEAPONS DIV CHINA LAKE CA	31.3	68.5	0.1
NAVAL MEDICAL CENTER SAN DIEGO CA	28.3	70.5	1.2
NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND BETHESDA MD	30.3	69.4	0.3
NAVAL RESEARCH LAB WASHINGTON DC	30.3	69.4	0.3
NAVAL UNDERSEA WARFARE CENTER DIV NEWPORT RI	29.2	68	2.8
WALTER REED ARMY INST OF RESEARCH WASHINGTON DC	30.3	69.4	0.3
	29.08	**69.56**	**1.35**

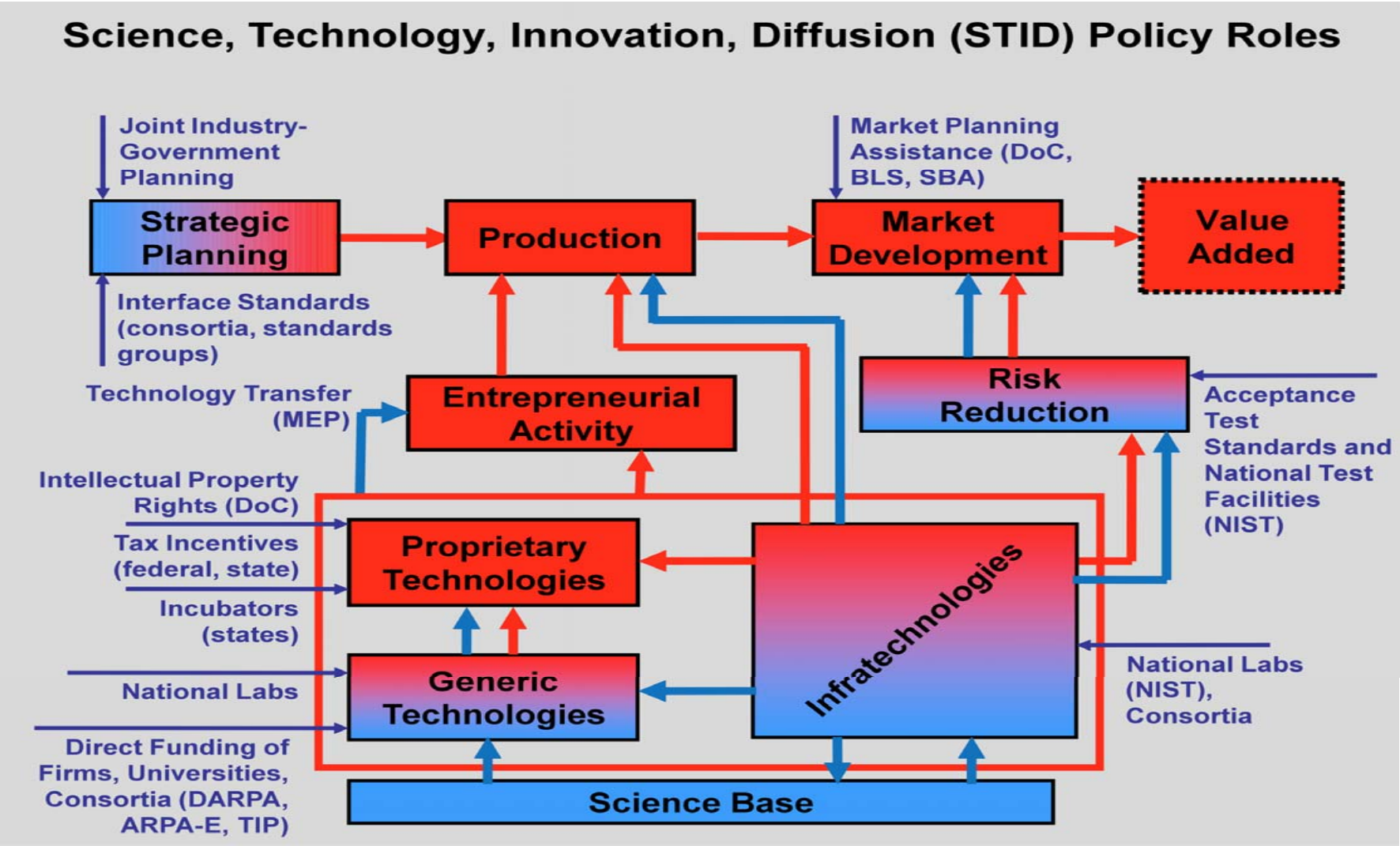
• An estimate of the number of collaboration partners and an estimate of foreign collaboration partners.

Are the "Top 10" collaborators different in terms of the Industrial clusters in which they participate?

The Road Ahead

- We understand the importance of S&T for economic growth
- We increasingly understand the complexities of national innovation systems
- Where does the DoD's vast S&T infrastructure fit in all this?
- What is DoD potential role in fostering high-tech growth, especially in "traded clusters"?

The Road Ahead *(Continued)*



Source: Source: Gregory Tassey, "R&D Strategies for a Global Economy," August 2010

The formulation of technology policy is complicated by a more realistic model

The Road Ahead *(Continued)*

- Over the long haul, DoD has an interest in using its S&T resources and S&T infrastructure
  - First, to achieve its mission
  - Secondly, to foster technology spillover to complementary industries in the regions where DoD R&D assets are located
- What does effective technology transfer mean?
- How does it happen?
- Where does it happen?
- How is it assessed and measured?
- How is it incentivized?
- Do DoD's R&D "fixed plant" assets contribute to "traded cluster" competitiveness?
- How is DoD S&T infrastructure related to the S&T infrastructures of other Federal agencies, e.g., NASA and DoE?

I think its fair to say that we barely have a clue about these issues. Effective economic growth policy, and DoD's role in it, can't be assessed without some good answers