The Challenge of the Valley of Death

Accelerating Innovation with the U.S. SBIR Scheme

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Rebuilding the Transatlantic Bridge:
U.S.-Polish Cooperation on
Science, Technology, and Innovation
Washington DC
December 4, 2009

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The Global Innovation Imperative

Key Points

- **Innovation is Widely Recognized as Key to Growing and Maintaining a Country's Competitive Position in the Global Economy**
- **Collaboration is Essential for Innovation as Small Businesses and Universities Play a Growing Role in the Innovation Process**
- **How can we Encourage Innovation?**
  - **What are leading nations doing?**

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China's Drive for Innovation

- **Government with strong sense of national purpose**
  - **Strong investments in education and training**
  - **Strategy to move rapidly up value chain**
  - **Effective requirements for training and tech transfer**
  - **Critical mass in R&D is beginning to be deployed to generate autonomous sources of innovation & growth**
- **Government goal is to acquire technological capabilities both to grow and to maintain national autonomy.**
- **Focused, Committed, and Willing to Spend**

Modified from C. Dahlman, Georgetown University

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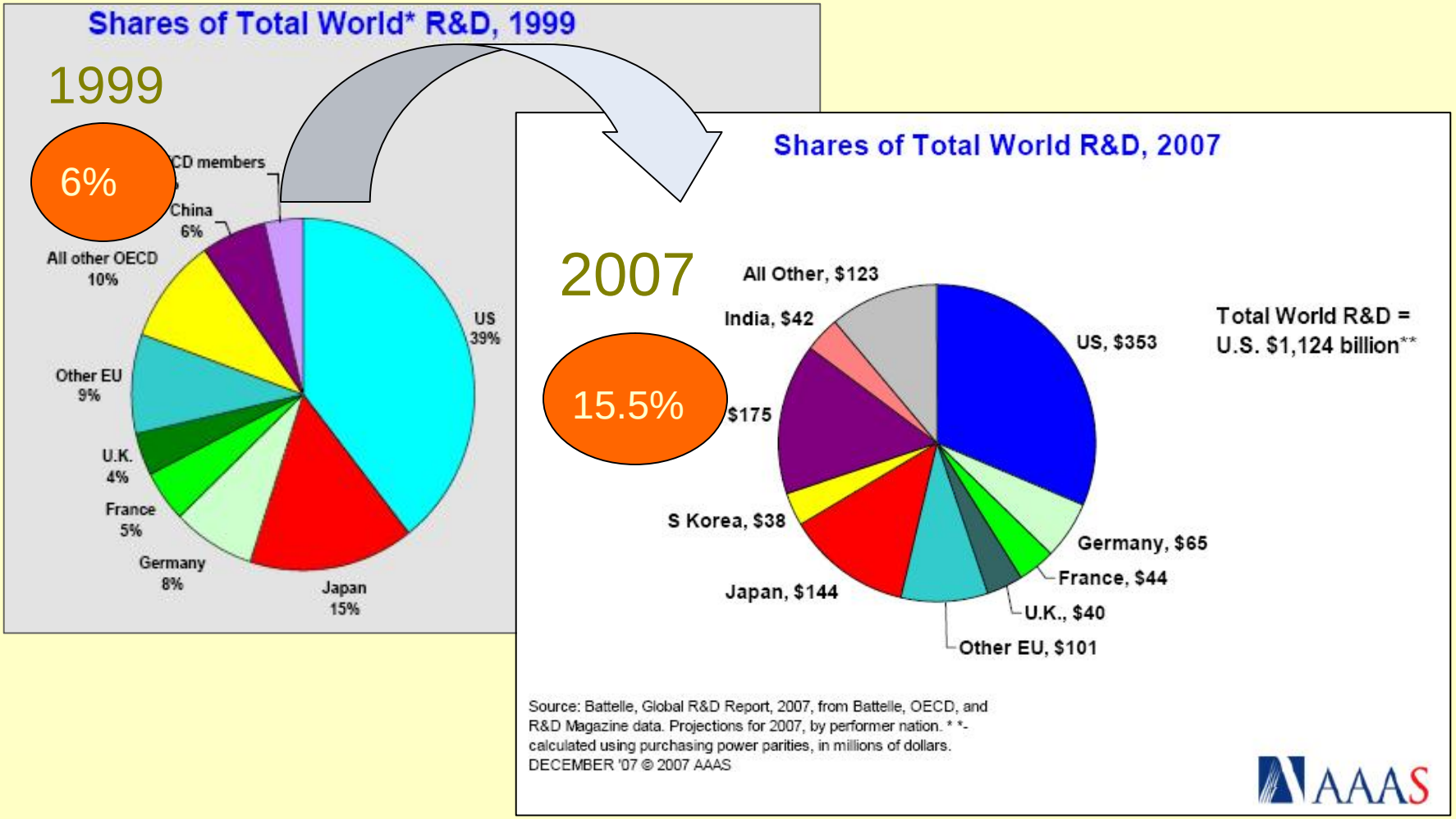
Remarkable Surge in China's R&D Investments



The Best in Europe are Evolving

- **Spain, Sweden, Finland, France, and the Netherlands are among those providing:**
  - **High-level Focus**
  - **Sustained Support for R&D: Leveraging Public and Private Funds**
  - **Support for Innovative SMEs**
  - **New Innovation Partnerships to build Clusters that bring new products and services to market**
- **Poland's Innovation System is Evolving as Well**

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How is Poland Responding to the Innovation Imperative?

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Poland's Strengths

- **Strong Education Base**
  - **Outstanding Universities and Strong Intellectual Tradition**
  - **High percent of population with graduate degrees**
  - **Growing Skills base, including PhD Students**
- **Growing number of S&T Institutions**
  - **Since 2000, number of science parks, tech transfer organizations, etc have nearly doubled**
- **Broad-based consensus for innovation policy measures**
  - **New 2007-2013 innovation policy strategy drew from a wide range of stakeholders**
  - **Adopted by Council of Ministers on Sept 2006**

Source: EC: Annual Innovation Policy Trends and Appraisal Report—Poland, 2006.

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Poland's Challenge is to:

- **Build Linkages within National Innovation System connecting Universities to Business**
  - **Improve Cooperation between Science and Business**
  - **Promote Business Networking, Sectoral Clustering**
- **Increase Research, Technical Development and Innovation Potential of SME's**

Source for Challenges: European Commission: Annual Innovation Policy Trends and Appraisal Report—Poland, 2006

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How is the U.S. Responding?

New Focus on Applied Research

President Obama seeks to address challenges in Energy, Health, and the Environment

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President Obama at the National Academies—April 27, 2009

Science and innovation is "more essential for our prosperity, our security, our health, and our environment than it has ever been."

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Obama Pledges to Raise R&D and Create new Incentives for Innovation

- **"We will devote more than 3 percent of our GDP to research and development."**
  - **The U.S. joins the quest for the Lisbon Target**
- **"We will not just meet, but we will exceed the level achieved at the height of the space race, through policies that**
  - **invest in basic and applied research,**
  - **create new incentives for private innovation,**
  - **promote breakthroughs in energy and medicine, and**
  - **improve education in math and science."**

Address to the National Academy of Sciences, April 27, 2009

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National Economic Council: "A Strategy for American Innovation" September 21, 2009

- **Invest in the Building Blocks of American Innovation**
  - Investments in human, physical, and technological capital
- **Promote Competitive Markets that Spur Productive Entrepreneurship**
- **Catalyze Breakthroughs for National Priorities**
  - Develop alternative energy sources
  - Reduce costs and improve lives with health IT
  - Manufacture advanced vehicles

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New Commitments to Support Innovation

- **Doubling of federal funding for basic research over 10 years at NSF, NIST, DOE (Office of Science)**
- **New Investments in S&T Infrastructure**
- **New Financing for S&T and Innovation**
- **Making the research and experimentation tax credit permanent**

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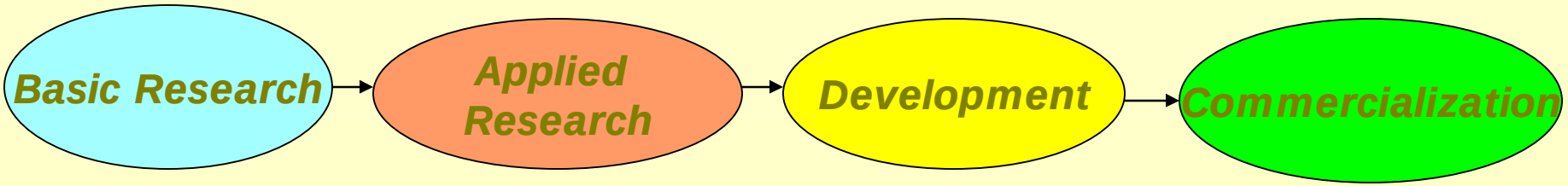
A U.S. Problem: A Focus on Inputs

Collaboration Across the Innovation Ecosystem is Necessary to Develop New Ideas into Products for the Market

The Myth of the Linear Model of Innovation



- **Reality: Innovation is a Complex Process**
  - Major overlap between Basic and Applied Research, as well as between Development and Commercialization
  - Principal Investigators and/or Patents and Processes are Mobile, i.e., not firm-dependent
  - Many Unexpected Outcomes
  - Technological breakthroughs may precede, as well as stem from, basic research
- **Many of our policies and institutions remain based on this linear model**

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Beyond Inputs:
What else will it take ?

- **More Intermediating Institutions**
  - Public-private partnerships foster the collaboration needed to bring forward new technologies
- **Focus on University-Industry Collaboration**
  - More encouragement and collaboration among SMEs, MNCs and Universities
  - Better Commercialization of Research
  - Closer ties, with less overhead in University-Industry relations
- **Greater role for Small Businesses Innovation**

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Why the focus on Small Businesses?

- **Small Companies are a major source of innovation in the United States**
  - **Audretsch and Acs, 1990**
- **Yet, small companies face major funding challenges, especially for new unproven ideas.**
- **Partnerships that provide support for early-stage firms can have major payoffs in terms of growth and government needs and missions.**
- **But myths about the innovation process slow the development of innovative small firms**

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The U.S. Myth of Perfect Markets

- **Strong U.S. Myth: "If it is a good idea, the market will fund it."**
- **Reality:**
  - **Potential Investors have less than perfect knowledge, especially about innovative new ideas**
  - **"Asymmetric Information" leads to suboptimal investments**
    - **George Akerlof, Michael Spence and Joseph Stiglitz received the Nobel Prize in 2001, "for their analyses of markets with asymmetric information"**

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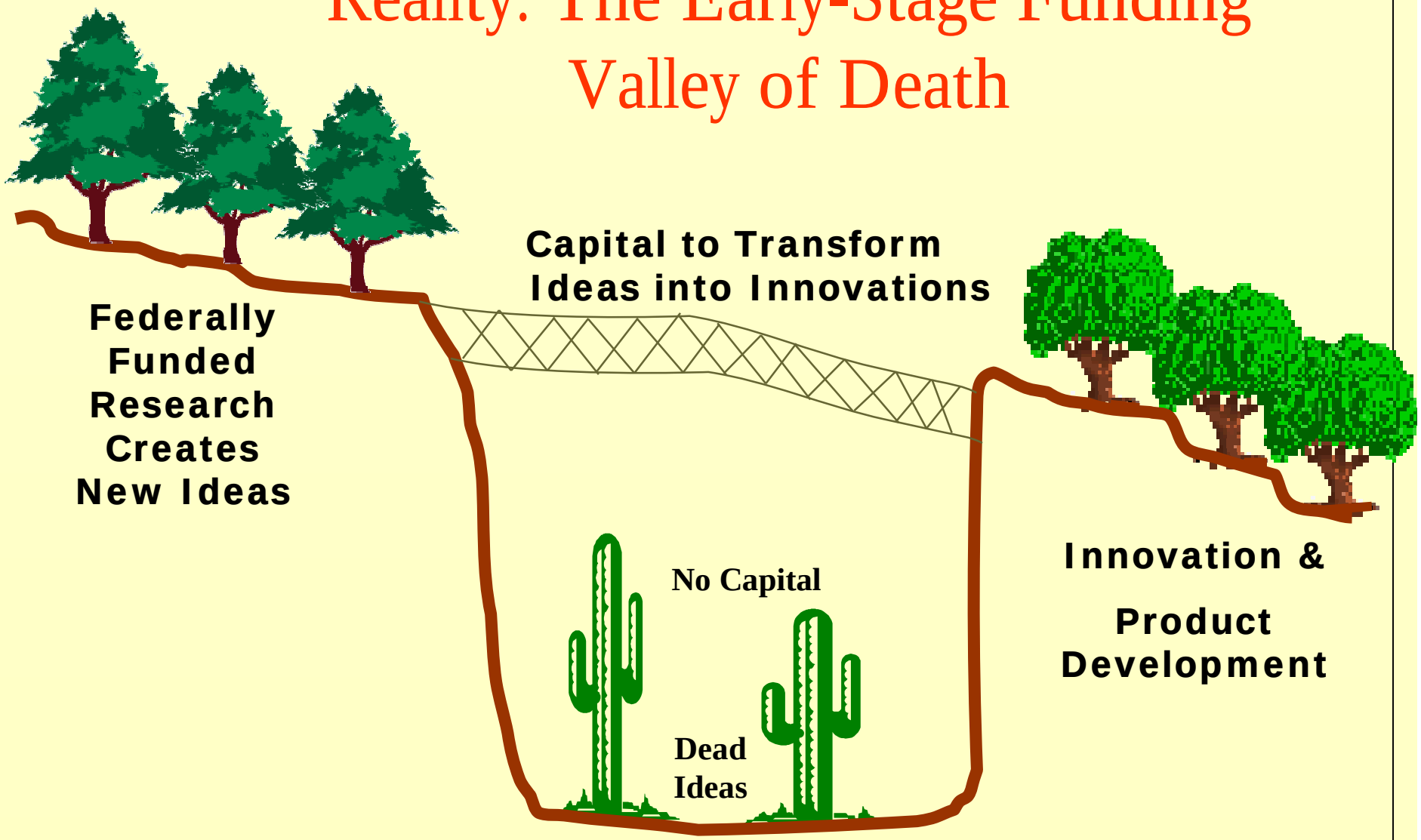
Reality: The Early-Stage Funding Valley of Death



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The Myth of U.S. Venture Capital Markets

- **Myth: "U.S. VC Markets are broad & deep, thus there is no role for government awards"**
- **Reality: Venture Capitalists have**
  - **Limited information on new firms**
  - **Prone to herding tendencies**
  - **Focus on later stages of technology development**
  - **Most VC investors seek early exit**

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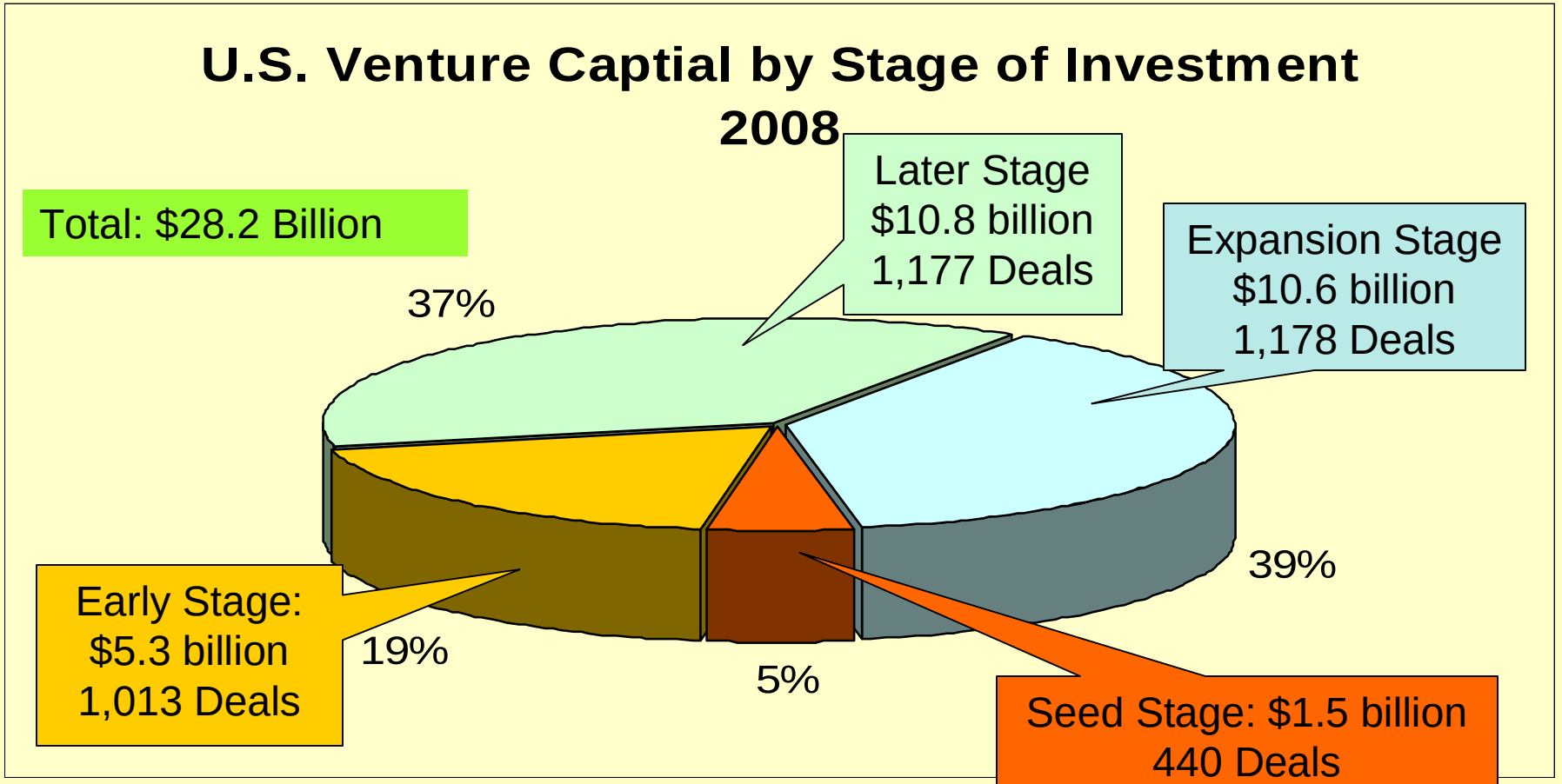
Large U.S. Venture Capital Market is Not Focused on Seed/Early-Stage Firms:



Source: PriceWaterhouseCoopers/Thompson Venture Economics/ NVCA 2009

The Venture Capital Obsession

- **Investment in Public VC Funds = Substantial Risk**
- **"Extraordinary skewness of returns" on VC Investments in the United States***
  - **About 15 percent of investments fail completely**
  - **35 percent of returns are less than 100 percent**
  - **A small group of investments give extraordinary returns.**
    - **15 percent of the firms that go public or are acquired give a return greater than 1,000 percent!**
- **Many companies live and grow without Venture Funding**
  - **"Hardly ten percent of the serial entrepreneurs took venture money in their first startups"—Duke University Survey, October, 2009 by V. Wadhwa,**

***Source: John H. Cochrane, "The Risk and Return of Venture Capital," *Journal of Financial Economics*, 75(1):3-52, 2005.**

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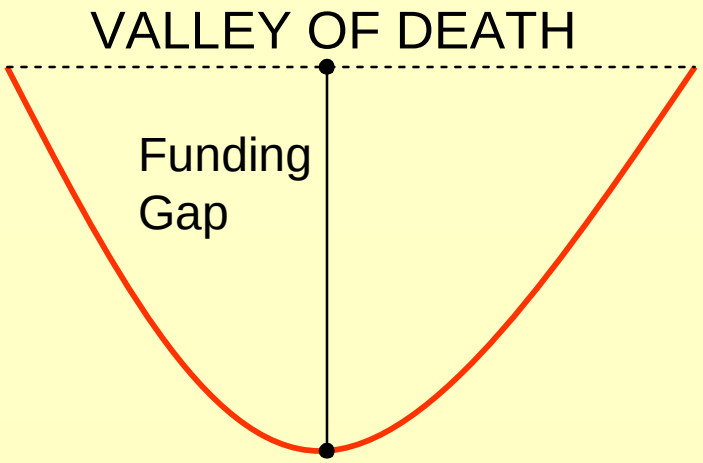
Most Companies face the Early Stage "Valley of Death"

Pre-Seed	Seed/Start-Up	Early	Later
Founders, Friends, Family & Fools	Federal SBIR Grants/Angel Investors/ Angel Groups		Venture Funds*
$25,000	$100,000	$1 to 2 million	$5 million



Adapted from: Richard Bendis and Ethan Blyer, "Creating a National Innovation Framework, *Science Progress*, 2009

* NB: Average Venture Investment is $8.3 million

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Crossing the Valley of Death is a Major Challenge

There are many paths

The Small Business Innovation Research (SBIR) Program is a Proven Approach

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What is SBIR?

- **It is a gated innovation system, providing awards to small companies to**
  - **Provide Proof of Principle**
  - **Develop Prototypes**
- **Successful Companies Attract Private Capital and/or win Public Contracts**
- **The Program converts Knowledge into Products to meet Social Needs**

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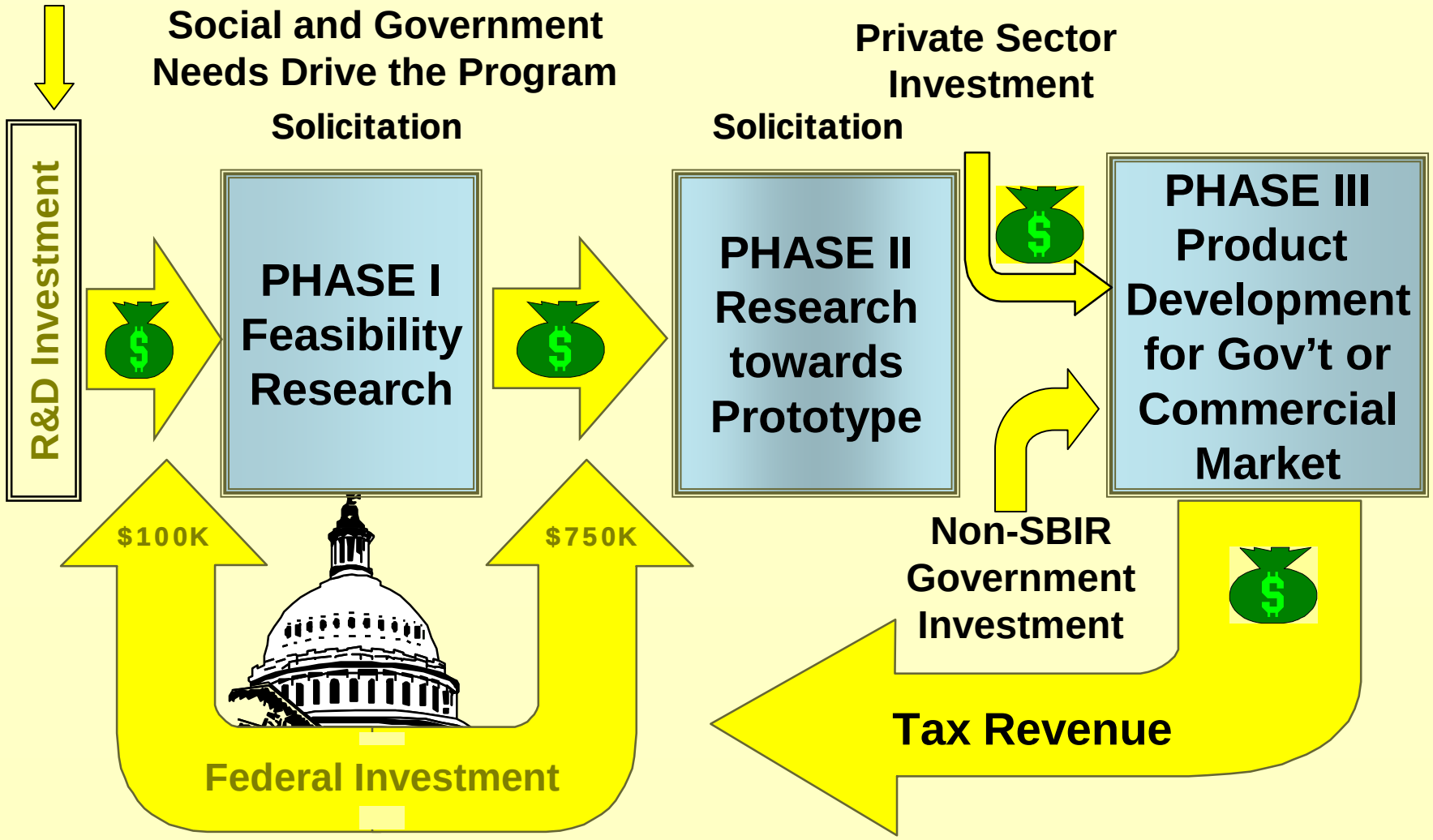
The SBIR "Open Innovation" Model



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SBIR: Key Features

- **Large Scale: Largest U.S. Innovation Partnership Program:**
  - Currently a $2.3 billion per year
- **Modest Award Amounts**
  - Small initial contract or grant followed by a larger Phase II award
  - Follow-on acquisition in Phase III
  - Speculation permitted
- **Needs driven: Participants vary**
  - Government missions addressed by start-up firms, contract researchers, and high-growth gazelles

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SBIR and Public Procurement

- **Government agencies post challenges on the Web**
  - **Needs driven solicitations describe challenges faced by agency**
- **Small Businesses across the country are invited to provide Solutions. They:**
  - **Answer questions**
  - **Provide technical solutions**
  - **Create new products and services**
- **SBIR brings the ingenuity of small businesses to address the mission challenges of government agencies**

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SBIR's Advantages for Government

- **A low-cost technological probe**
  - Enables government to explore more cheaply ideas that may hold promise
  - Identifies dead-ends before substantial investments are made
- **Quick reaction capability**
  - Solicitation topics can respond rapidly to urgent national needs
  - Anthrax attacks led NIH to seek and get innovative bio-defense technologies
- **Diversifies the Government Supplier-base**
  - Brings in competition, low-cost solutions, new approaches to address mission needs

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Decentralized SBIR Adapts to Agency Needs

- **SBIR is administered separately by multiple institutes, centers, laboratories, and agencies.**
  - **NIH alone has 23 separate institutes & centers using SBIR**
- **SBIR has adapted to Missions, Culture, and Technology needs of different Agencies**
  - **Research Agencies (NIH, NSF, and parts of DOE) focus on developing technologies for the public sector**
  - **Mission Agencies (DOD, NASA) focus primarily on developing technologies for their own use**

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After nearly 20 years of operation, the U.S. Congress asked the Academies:

How well is SBIR Working Overall?

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$5 Million NRC Study of SBIR

Unprecedented Large Scale Original Field Research

- **Surveys: Over 7000 Projects Surveyed**
  - **Phase I Award Survey targeted 3000 firms**
  - **Survey on Phase II Awards (1992-2002) involved over 4000 firms**
  - **Program Manager Survey**
  - **Technical Manager Surveys (TPOCs and COTRs)**
- **Case Studies**
  - **Approximately 100 case studies conducted**
  - **Case Study selection reflects program diversity**
- **Surveys & Case Studies Developed in Consultation with Agencies & SBIR users**

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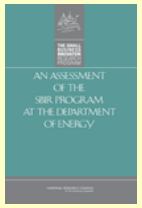
National Academies SBIR Reports

An Assessment of the SBIR Program at NSF

An Assessment of the SBIR program at NASA



An Assessment of the SBIR Program at DOE

An Assessment of the SBIR Program at NIH

An Assessment of the SBIR Program at DoD

An Assessment of the Small Business Innovation Research Program (Overview Report)

SBIR Program Diversity and Assessment Challenges

SBIR and the Phase III Challenge of Commercialization

Venture Funding and the NIH SBIR Program

Revisiting the DoD SBIR Fast Track Initiative

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SBIR Awards Have a Substantial Impact on Participating Companies

- **Company Creation: 20% of responding companies said they were founded as a result of a prospective SBIR award—25% at Defense**
- **Research Initiation: SBIR awards played a key role in the decision to pursue a research project (70% claimed as cause)**
- **Company Growth: Significant part of firm growth resulted from award**
- **Partnering: SBIR funding is often used to bring in Academic Consultants & to partner with other firms**

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SBIR Awards Result in “Crowding-in" Additional funds from Private Investors

Awards Act as a Quality Guarantee and a Signal of Commercial Potential

- **Angel Investors**: 37 percent of Academies survey respondents attracted additional investment from Angels and other sources
- **Venture Funding**: SBIR is a signal of research quality and commercial potential. Over $1.5 billion in added VC investments between 1992 and 2005
- **Acquisition**: e.g., Philips acquisition of Optiva for $1 billion
  - Acquisitions understate program results

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SBIR Success takes Many Forms

- **NASDAQ Success**
  - SBIR investments contributed to success of companies like Qualcomm, ATMI, Martek, Luna
- **Innovation Success**
  - New products, like the electric toothbrush, brought to market by Optiva—now acquired by Philips
- **Government Mission Success**
  - Simulation Software for Navy Seals saves lives and costly equipment
  - NASA Mars Rover uses SBIR-funded Lithium-ion batteries to power the Mars Rover at low temperatures
- **Employment Success**
  - SBIR helps new Start ups grow, creating high quality jobs of the future

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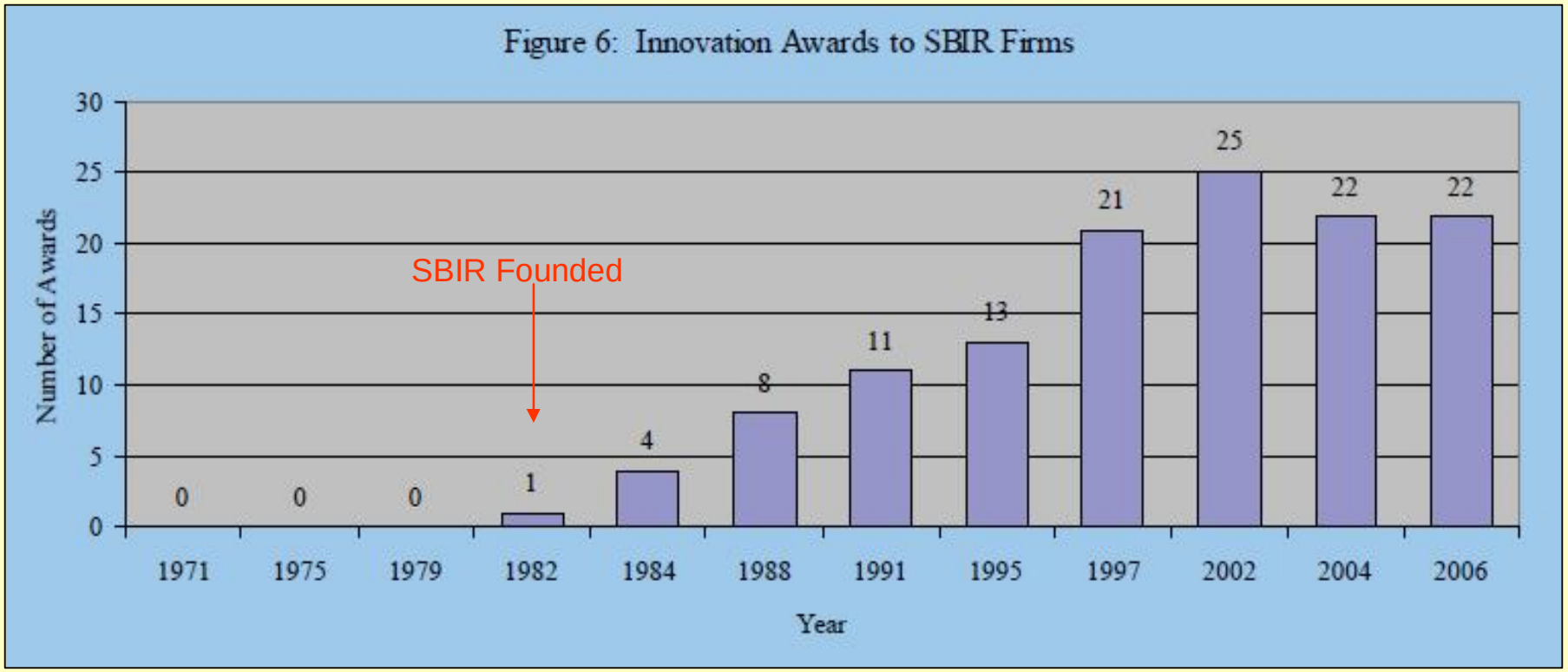
"The SBIR program has become a key force in the innovation economy of the United States"



- **SBIR now accounts for nearly a quarter of all 'U.S. R&D 100' winners, an annual list of top 100 innovations**
  - **Source: Block and Keller, "Where do innovations come from?" ITIF July, 2008**

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SBIR is not a Panacea & does not Operate in a Vacuum

Importance of Policy Framework

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Easing the Path to Innovation

- **Get the Basics Right**
  - Protect IP
  - Gentle Bankruptcy Laws allow a second try
  - Reward entrepreneurship
- **Move Past the Myths**
  - Innovation is complex and collaborative, not linear
  - Perfect Markets exist only in Economics Textbooks
- **Address Capital Shortages**
  - Merit based funding to help innovations cross the Valley of Death
- **Build Intermediating Institutions and Support them**
  - SBIR is an example of global best practice

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The Innovation Award Advantage

- **SBIR Capitalizes on Existing R&D Investments and Procurement Funds**
- **Focus on Valley of Death—Key Point of Vulnerability for Firms and Products**
- **Bottom-up Approach to Tech Transfer**
  - **Contributes to Innovative Solutions as well as Growth and Job Creation**
- **A National Program to Meet National Needs**
- **What else to do?**

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Our Common Challenge

- **The Challenge for Poland and the United States is to Adjust to the new Globalization Dynamic**
- **This involves initiating change through competitive incentives:**
  - **Incentives for entrepreneurial activity for Small Firms, Large Firms, and Universities**
  - **Incentives (not mandates) for cooperation among all actors**
- **Transatlantic Learning and Cooperation are Essential for our Common Future**

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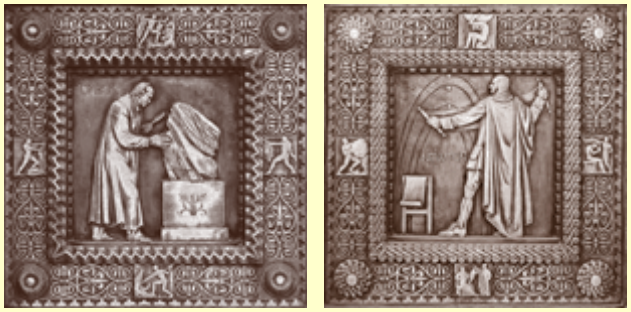
Thank You



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