

Addressing the Innovation Imperative

Role of the Twenty-First Century University



14th Project Management Conference
Rzeszów, Poland
November 9, 2010

Charles W. Wessner, Ph.D.
Director, Technology, Innovation, and Entrepreneurship
The National Academies
United States of America

Today's Presentation

- Global Challenges and the Innovation Imperative
 - Poland's Opportunities and Challenges
 - Recent U.S. Policy Initiatives
- The Role of the 21st Century University
- Incentivizing Commercialization from Universities
 - Intellectual Property and Bayh-Dole
 - The Role of the SBIR Program
 - Research Parks and University-Industry Collaboration
- Fostering Innovation Universities
 - What Poland can do
- Conclusions
- Today's Presentation reflects my personal views

Current Global Mega-Challenges

- **Fostering Economic Growth through Innovation**
 - Driving domestic Growth and Employment
- **Developing New Sources of Energy**
 - Commercializing renewable alternatives to oil
 - Increasing the capacity to fuel growing global demand for electricity
- **Addressing Climate Change**
 - Growing a Green Economy; A major Growth opportunity
- **Delivering Global Health**
 - Transforming large investments in research to affordable and personalized treatment and care
- **Improving Security**
 - Through all of the above



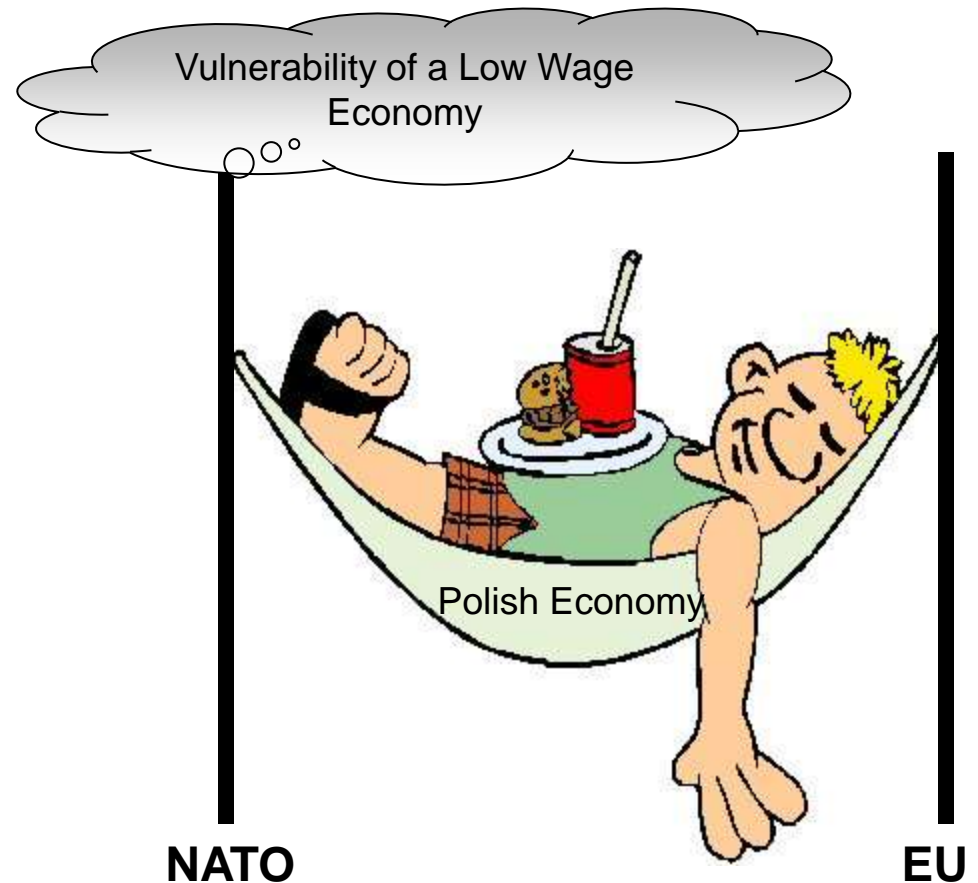
The Global Innovation Imperative

- Key Points

- **Innovation** is Key to Address Global Challenges and to Growing a Country's Competitive Position.
- **Collaboration** among Small and Large Businesses and Universities is Essential to Capitalize on Investments in Education and Research
- **New Partnerships** among Government, Industry, and Universities are needed to foster collaboration and innovation

Poland's Complacency Trap

- The Communists are gone,
- NATO is here to Protect,
- We are EU Members,
- The Structural Funds keep coming,
- So why do more?



How are Leading Nations Responding to the Innovation Imperative?

- They are providing four things:
 - High-level Focus
 - Sustained Support for R&D: Leveraging Public and Private Funds
 - Support for Innovative SMEs
 - New Innovation Partnerships to bring new products and services to market
- Many countries are investing very substantial resources to create, attract and retain industries in leading sectors.
- Growing focus on the role of universities in commercializing research

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

Changing Shares of Global R&D Spending

	1999	2008	2009	2010
United States	39%	35.4%	35.0%	34.8%
China	6%	9.1%	11.1%	12.2%
Japan	15%	13.2%	12.5%	12.3%
Europe	26%	24.9%	24.0%	23.2%

Source: Battelle, R&D Magazine December 2009

Its not just Size but Focus!

Singapore's Innovation Strategy

- Total Focus, Commitment, and Long-Term Spending by the Government
 - Goal is to establish Singapore (**population: 4.5 million**) as Asia's preeminent financial and high-tech hub.
- A*STAR's task, with \$5 Billion in funding, is to:
 - Invest in and attracting a skilled R&D workforce
 - Attract major investments in pharmaceuticals and medical technology production
 - Invest in Public Private Partnerships: Biopolis & Fusionopolis
 - Develop new programs to address the early-stage funding challenge for innovative firms
- Generating local entrepreneurs and firm growth remain challenges

How is Poland Responding to the Innovation Imperative?



Poland's Strengths

- **Strong Education Base**
 - Outstanding Universities and Strong Intellectual Tradition
 - 20 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 supported by a wide range of stakeholders

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

Poland's Challenge is to:

- Connect Universities to Business
 - Improve Cooperation between Scientists and Business
- Build Sectoral Clusters
- Promote Business Networking
- Help SMEs increase Research, Technical Development and Innovation Potential
- These efforts requires incentives and, sometimes, new institutions

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



What about the United States?

New Focus on Applied Research to
address challenges in Energy,
Health, and the Environment

President Obama is Focused on Innovation

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

President Obama at the National Academies—April 27, 2009

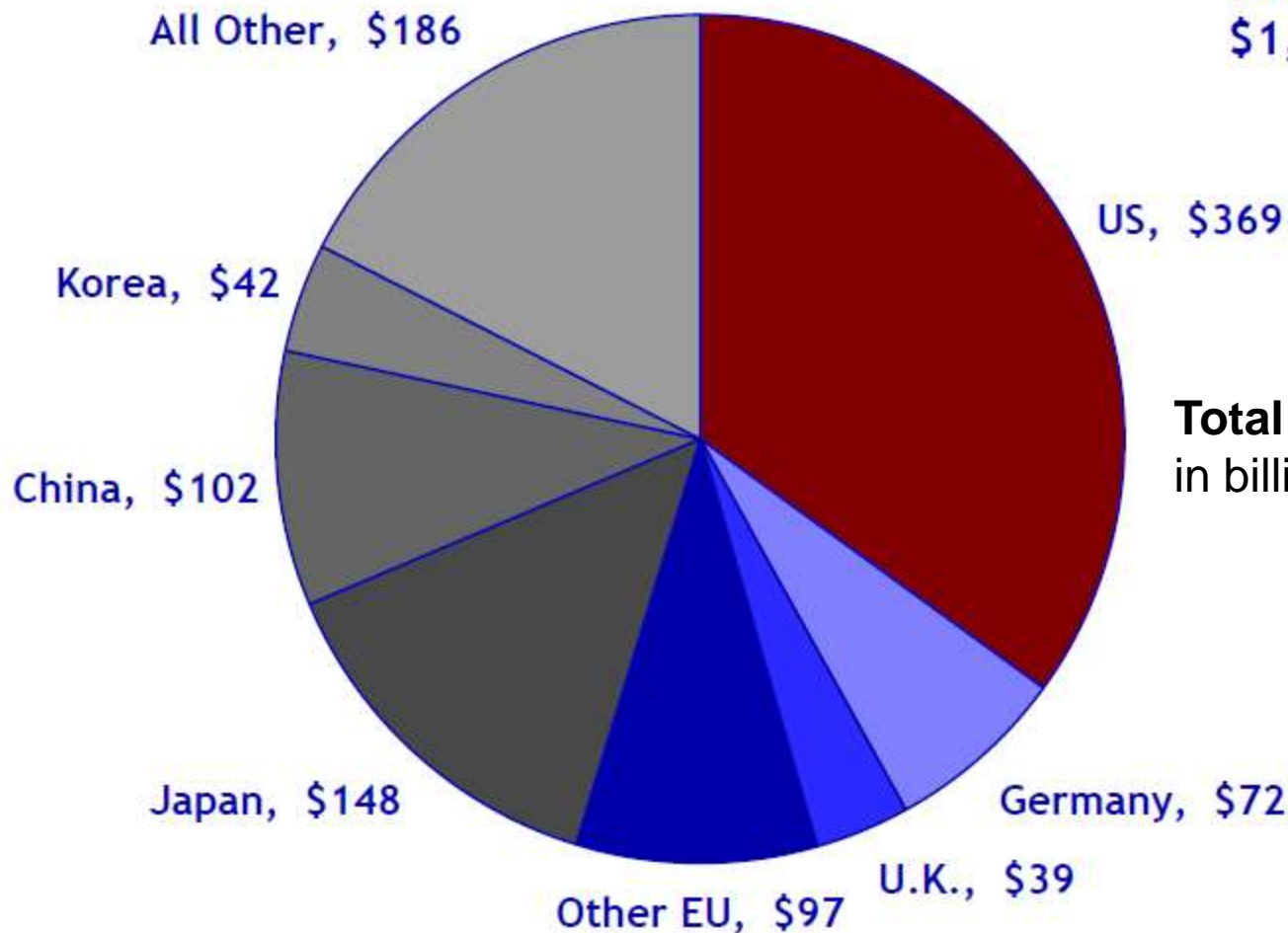


Why is
Cooperating with
the United States a
Good Idea?



National Shares of Global R&D

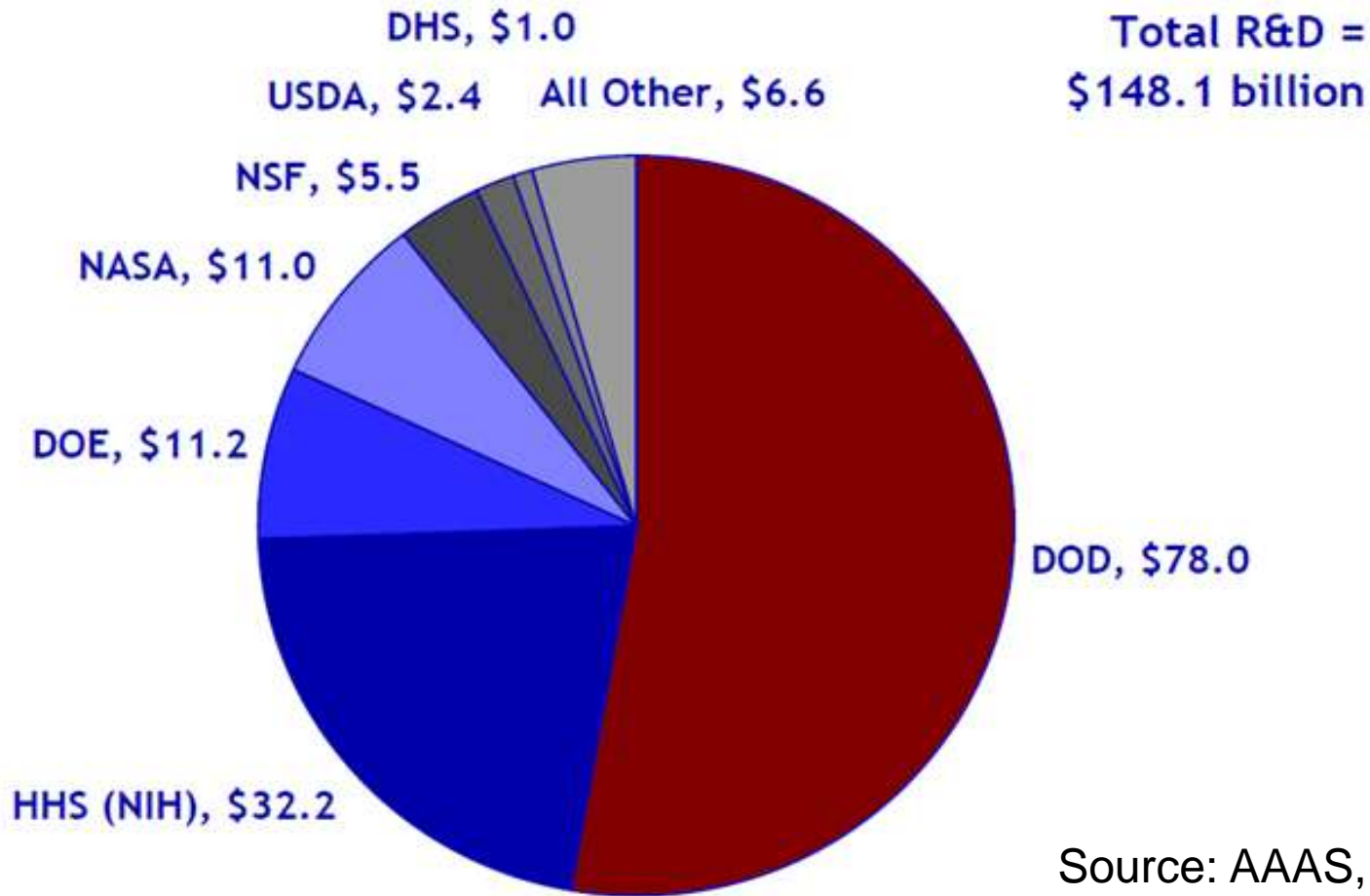
Total World R&D =
\$1,054 billion



Total World R&D, 2007
in billions of PPP \$

Source: OECD, Main Science and Technology Indicators, May 2009.

U.S. R&D Investments for 2011



Source: AAAS, 2010

New Industrial Initiatives

Major Push on Renewable Energy

- Stimulus Boost for Wind Energy
 - **\$6 billion** in **loan guarantees** for renewable energy projects and electricity transmission projects
 - **\$11 billion** in **spending and loan guarantees** to build a "smart grid"
- Stimulus Funding for Solar
 - **\$117 million** to expand the development, deployment and use of solar energy throughout the U.S
- Stimulus Funding for Batteries
 - **\$2.4 billion** in **new grants** for Advanced Battery Makers

Policy Challenge: Addressing the Demand Side

- We have the Technologies
- We have the Companies
- We have the Workforce
- **Do we have the Demand?** We need:
 - Tax Incentives
 - Grants for new Technology
 - Loan Guarantees and Tax Abatement for Manufacturing
 - Early Government Procurement

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

The Challenge

“Research converts Money into Knowledge;
Innovation Converts Knowledge into Money”

--Andrew Barnett (2008)

Universities Play an Important Role in Converting Rising Investments in R&D into New Products, Jobs, and Growth

How to do this?
Research Universities Need to Evolve

New Focus on the University

- As a **Driver of Growth** and therefore tax revenue for the Region
- As a **Source of New Ideas** for new and early-stage companies
- As a **Source of Contract Research** that educates students and professors and helps companies survive and grow
- As a **Regional Branding**— a place to live and work in a knowledge economy

From the “Ivory Tower” to Regional Innovation Hub

- “Pure” Research is not the only University Role
- Research Related to Industry Helps Generate Training and Skills Necessary for Productive Lives
 - (and the tax dollars for Research)
- Industry’s Needs and Questions can Drive Research and be a Source of Relevant Publications



Roles of the 21st Century University

- **Teach the next generation**
 - With up-to-date laboratories on real market questions
 - Focus on science needed to address current and future questions (e.g., climate change, nuclear waste)
- **Conduct Research**
 - “Curiosity-driven Research”
 - But also on Social Problems and Industry Needs
- **Commercialize**
 - New Science-led solutions to societal problems
 - New Products, Processes
- **Generate Market-ready students**
 - Create a cadre of creative and curious team players

What are the Policy Solutions to Bring University Research to the Market?

Three Best Practices

Three “Best Practices” from the U.S.

- ✓ **Policy Framework:** Bayh-Dole law Allows Universities to benefit from the Commercialization of State-funded Intellectual Property
 - The IP used to be government controlled
- ✓ **Money to Start:** SBIR Encourages Faculty to Start New Firms with Innovation Awards
- ✓ **Places to Meet, Learn, and Grow:** S&T Parks Link Universities with Businesses within Research Parks that are close to Universities
 - Incubators can help—need to be close

✓ The Policy Framework:

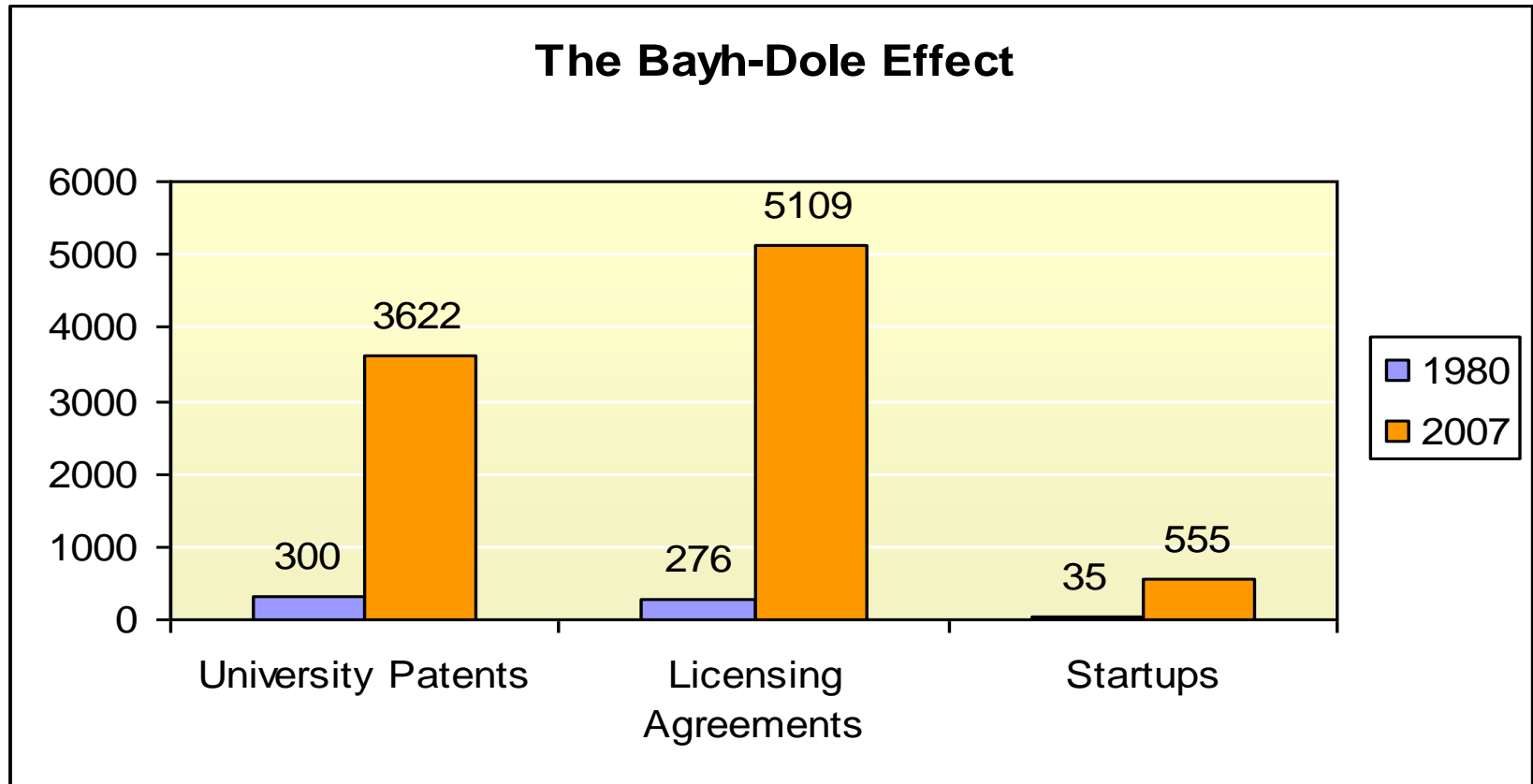
The Role of the Bayh-Dole Act
Allowing Universities to benefit from the
Commercialization of Intellectual
Property

The 1980 Bayh-Dole Act Created Incentives for Commercialization

- Bayh-Dole encouraged universities to patent results of federally funded research*
 - Transferred rights to intellectual property generated under federal grants to the universities
 - Academicians can profit from the market transfer of their work.
 - Universities can earn royalties by licensing research innovations to private companies

* M Feldman, I Feller, J Bercovitz, R Burton - Management Science, 2002

Impact of Bayh-Dole Took Time, but Change is Now Clear for U.S. Universities



Source: AUTM U.S. Licensing Activity Survey, 2007

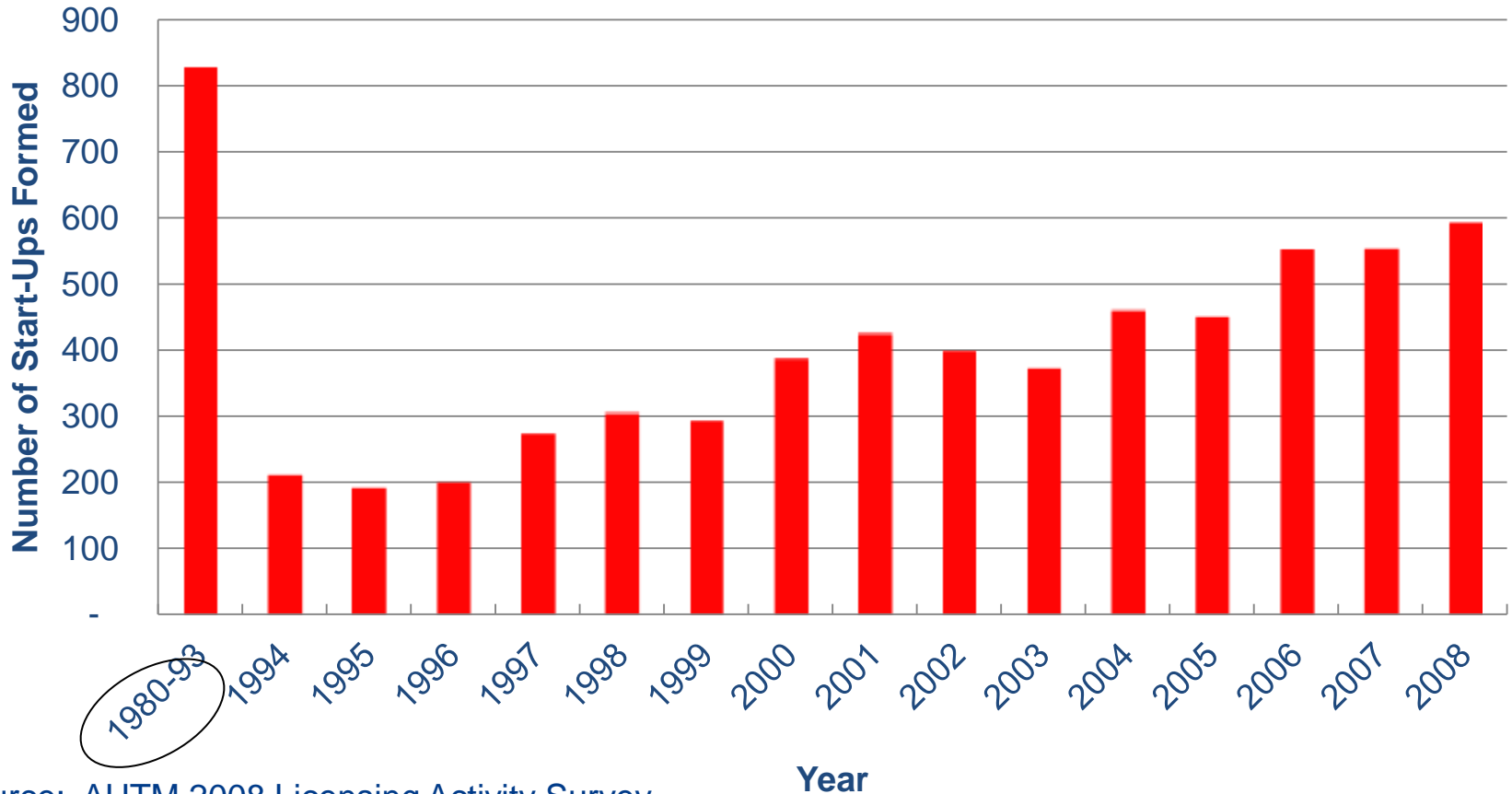
Benefits of University Patenting

- **Growth:** \$187 Billion impact on U.S. GDP from 1996-2007
- **Jobs:** 279,000 new jobs created as a result of university inventions
- **Products:** Inventions include a hepatitis-B vaccine, the prostate antigen test, FluMist, not to mention Google

Source: Biotechnology Industry Organization 2009 Study

Growth in US University Start-ups

Start-Ups Formed



Source: AUTM 2008 Licensing Activity Survey

Small Companies Drive High-Technology Innovation

- Small Companies are Key Players in Bringing New Technologies to Market (Audretsch & Acs)
 - Large returns to national economic and strategic capabilities can result from relatively small national investments
- But Money to Start is an Obstacle
- Myths about “Perfect Markets” are a barrier to policies that encourage small business innovation

How to Grow Small Companies?

✓ Money to Start:

Innovation Awards like SBIR are
a Proven Way to Move New Ideas
from the University to the Market

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”

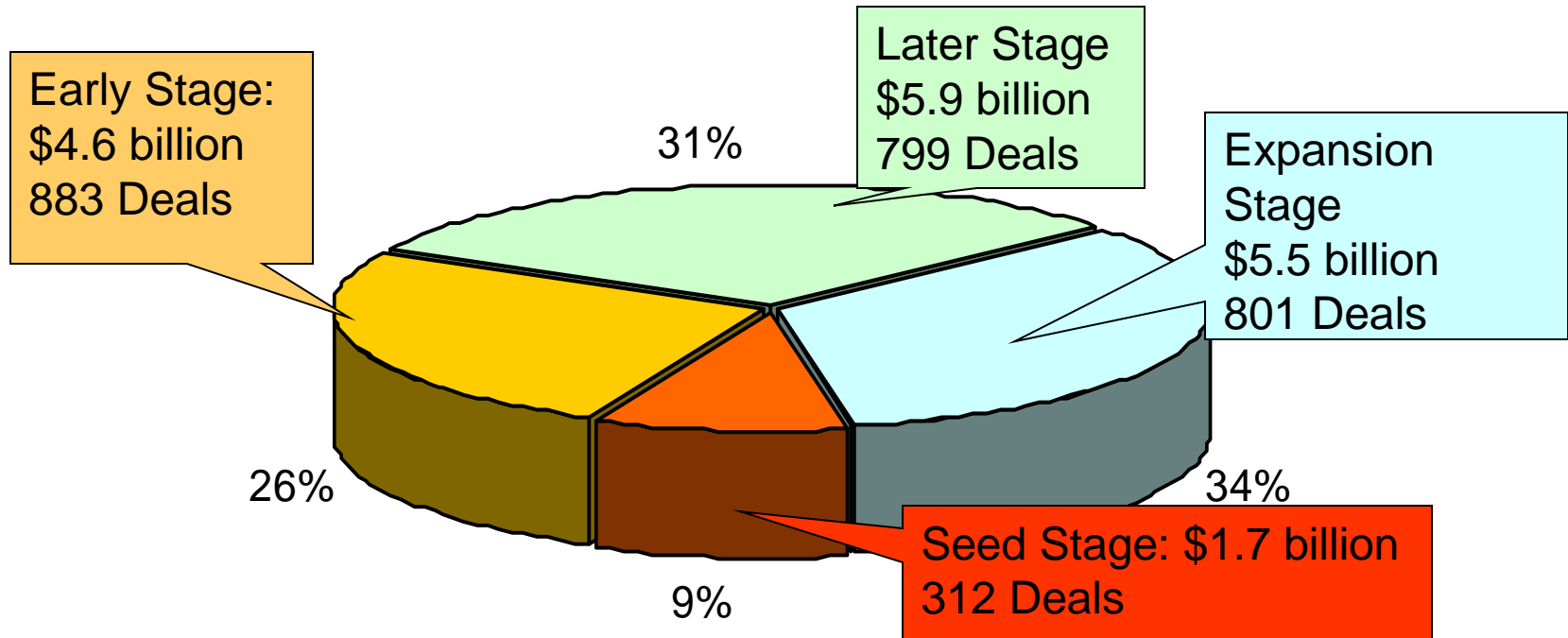
What about Venture Capital?

Is Venture Funding the Solution?

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

U.S. Venture Investments Down 37% in 2009

U.S. Venture Capital by Stage of Investment 2009



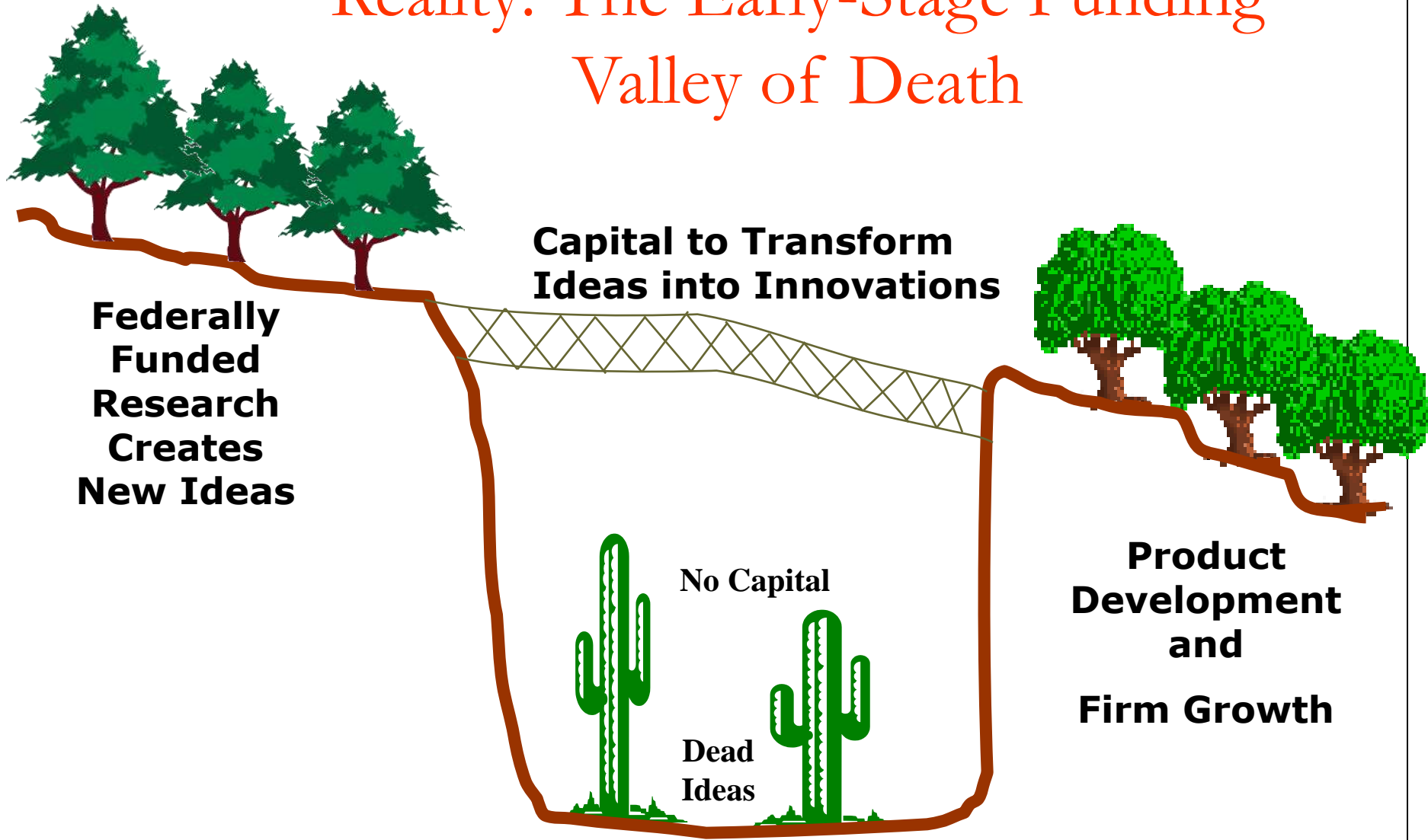
Total: 17.7 Billion, 2795 deals

Source: PWC-MoneyTree Report

The Limits of Venture Capital

- 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
- Investment in Public VC Funds = Substantial Risk
- Why? High skew in returns on VC Investments
 - Many funds lose money or make very modest returns
 - Source: John H. Cochrane, “The Risk and Return of Venture Capital,” *Journal of Financial Economics*, 75(1):3-52, 2005.
- The issue is not “Where is the Venture Funding,” but “Where is the Deal Flow?”

Reality: The Early-Stage Funding Valley of Death



How can Innovative Small Firms Cross the Valley of Death?

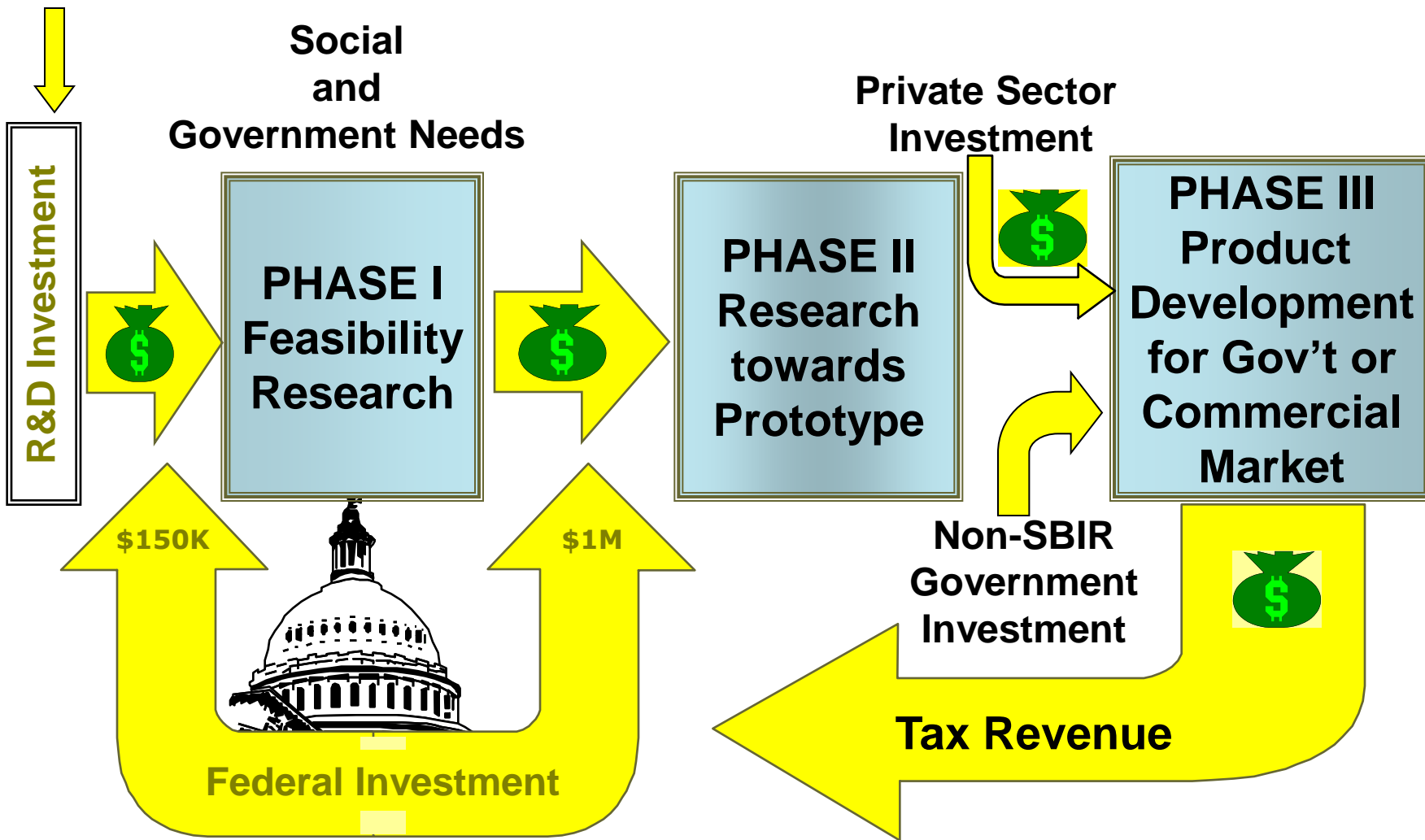
The Role of the Small Business Innovation
Research (SBIR) Program

SBIR: Key Features

- **Long-Term and Large Scale:** Largest U.S. Innovation Partnership Program:
 - In place since 1982
 - Currently a \$2.5 billion per year
- **Modest Award Amounts**
 - Small initial contract or grant: \$150K
 - \$1 million Phase II award for successful companies
 - Follow-on acquisition in Phase III or Private Investment
 - Speculation permitted
- **Needs driven:** Participants vary
 - Government missions addressed by start-up firms, contract researchers, and high-growth gazelles

The SBIR Model

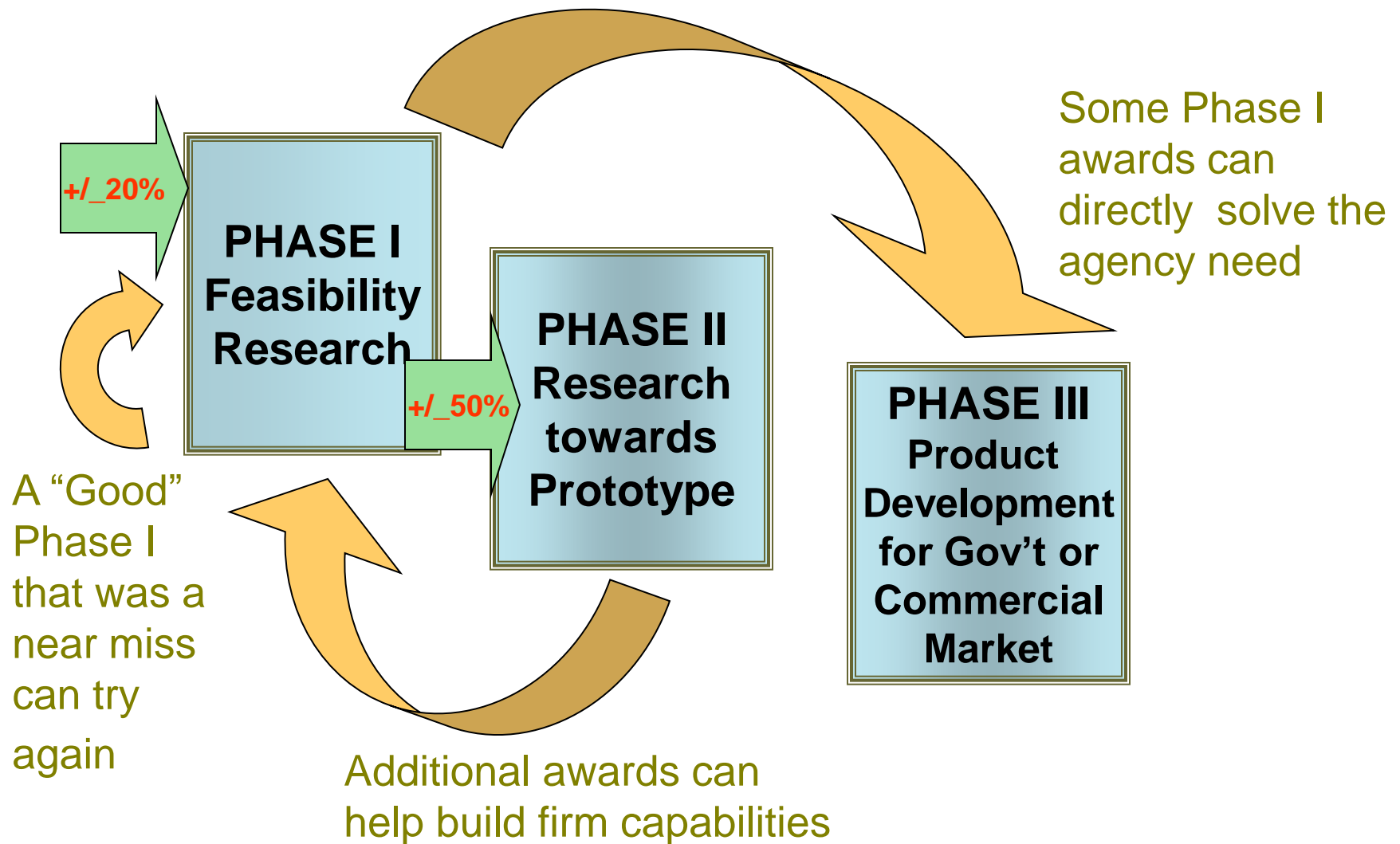
\$148 billion



SBIR Concept Advantages

- The Government identifies Societal needs in health, security, environment, & energy
 - Needs can be simple or complex
- But the actual proposals are Industry-Initiated, screened by a 2-Phase Filter
 - Phase I: Proof of Concept
 - Phase II: Prototype
- Screening is based on Technological and Commercial Feasibility
 - 20 percent of applicants get a Phase I award
 - Of these 40 percent get a Phase II award
 - Companies can get several awards
- SBIR is Flexible—it is not necessarily linear

SBIR is Flexible: Alternative Flows



SBIR “Jump Starts” Entrepreneurs

- Provides ‘first money’
 - Helps get new projects started
 - Academics can apply even without a company
- No dilution of ownership; owners retain control
- No repayment is required
 - Government recoupment is through the tax system
- SBIR recipients retain intellectual property developed using the SBIR award
 - No royalties owed to the government, though government retains royalty-free use for a limited period
- Certification effect draws in additional investment
 - Signal to private investors of technological validity and commercial promise of the innovation

Academies Research Reveals SBIR Impact on Firm Formation and Growth

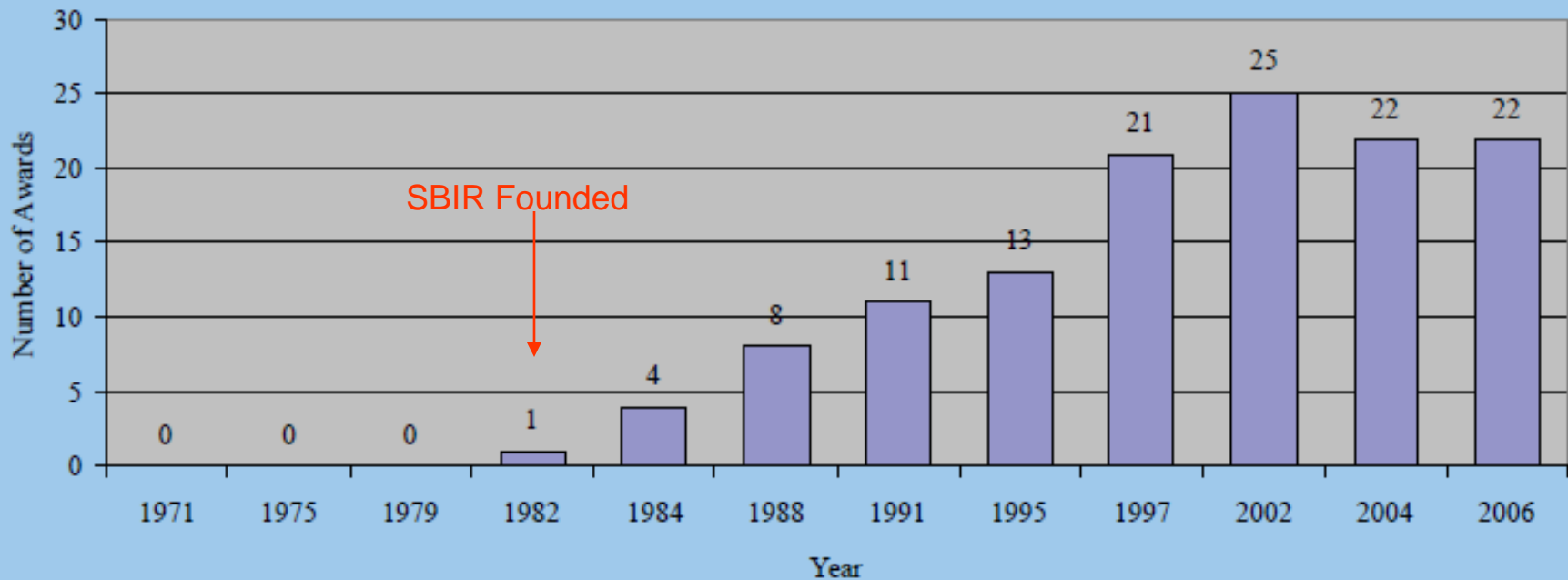
- **Company Creation:** 20% of responding companies said they were founded as a result of a prospective SBIR award (25% at Defense)
- **Research Initiation:** SBIR awards played a key role in the decision to pursue a research project (70% claimed as cause)
- **Company Growth:** Significant part of firm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

Academies Study finds that SBIR Encourages the Commercialization of University Research

- SBIR links the University with Industry and helps Spin-outs
 - **Lowers Risk:** Faculty do not have to give up University post to apply
 - **Lowers Overhead:** Don't need to have a company to apply
 - **Success Rates** (15 to 20%) comparable to other grants
- SBIR Innovation Awards Directly Cause Researchers to create New Firms
- New firms help grow the region and provide returns on R&D investments

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

Figure 6: Innovation Awards to SBIR Firms



- 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

✓ Places to Meet, Learn, and Grow:

University Research Parks as a
Catalyst for Innovation Clusters

What are Innovation Clusters?

- Clusters are a combination of geographically co-located...
 - Private sector R&D companies
 - Related manufacturing and service industries
 - Research universities and teaching institutions
 - Government sponsored laboratories and technology programs
- Successful clusters emerge from networks of trust and cooperation that reaches across multiple organizations
 - You cannot build a cluster alone

Source: National Academies Conference on “Growing Innovative Clusters”- June 3, 2009

S&T Parks are an Important Catalyst for University-Industry Cooperation

Successful S&T Parks:

- Help advance university missions
- Build partnerships among researchers, small companies, and large companies
- Provide tangible outcomes from university research. This helps justify university funding



Universities Gain from Research Parks

- Universities Successfully Associated with S&T parks stimulate:
 - Higher publication rates
 - More successful patents
 - Stronger Ability to hire star faculty
 - Larger extramural grants
 - “Market-ready” students
 - More robust regional growth

Source: Prof. Al Link, Understanding Research S&T Parks, National Academies Press (2009)

The Key Role of 21st Century Universities is being Recognized Around the World

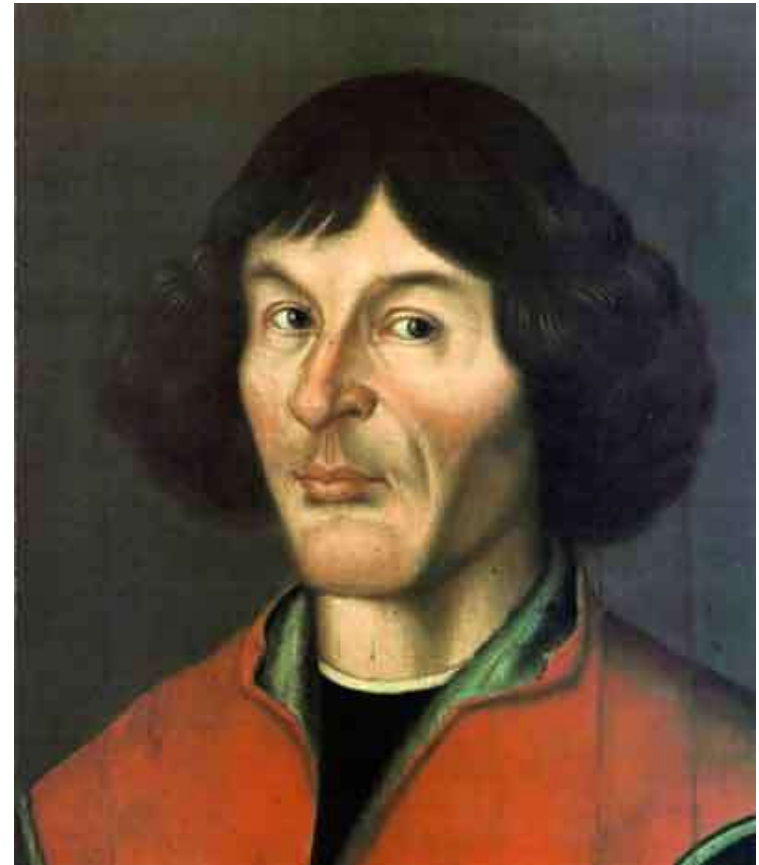
Universities are increasingly seen
as keys to economic growth, jobs,
and international competitiveness

Where are the 21st Century Universities?

- In California: Stanford and CalTech
- In Massachusetts: MIT
- In Flanders: KU Leuven
- In Sweden: Chalmers and Jönköping University
- In Finland: the new Aalto University
- **And in Poland?**

Growing Innovation Universities in Poland

- Poland has a very long tradition of scientific excellence
- The Challenge is to transform this scientific excellence into market ready innovations



Encouraging Universities to serve as a Nexus of Growth...

- ...Requires Real Changes in
 - **Culture and Values**: This requires new leadership and new incentives
 - **Status of Professors**: permissive environment to encourage innovations, collaboration with industry, and pursuit of innovation awards and wealth
 - **Institutional Practices**: Parallel research institutes with self-select mechanism
- **A key point: Strong local Leadership & Local Autonomy are required!**
- Incentive Programs like SBIR help shift the culture

To Conclude...

The Global Challenge is
Poland's Opportunity

Poland's Future Rests on Innovation

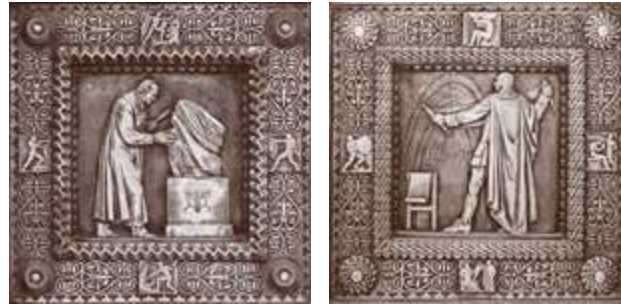
- Putting all the pieces together:
 - **Invest:** Make R&D investments part of a coordinated innovation strategy
 - **Build** on regional strengths, but add new options
 - **Innovate** for the real world: Globally and locally
 - **Collaborate:** Innovation needs partners from universities, industry, and government
 - **Focus:** Be focused, determined, and willing to spend, but also patient—results take time
 - **Evaluate:** It will take time to get long-term goals, but measuring short-term gains is critical to getting there

Source: Adapted from National Governor's Association, "Innovation America," 2007

Creating Innovation Clusters
can Help Poland Address
the 21st Century Innovation Imperative

- Innovation is needed to address 21st Century Challenges in Growth, Energy, Climate, Health, and Security
- You have the Ideas, the Traditions, and the Energy
- Now you need Policy Incentives

Thank You



Charles W. Wessner, Ph.D.

Director, Program on
Technology, Innovation and Entrepreneurship

The U.S. National Academies

500 Fifth Street NW

Washington, D.C. 20001

cwessner@nas.edu

Tel: 202 334 3801

<http://www.nationalacademies.org/step>