The Innovation Imperative

Global Best Practices

Building the Arkansas Innovation Economy
March 8-9, 2010

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Today's Presentation

- **The Global Innovation Imperative**
- **The New U.S. Focus on Innovation**
  - **New Energy Initiatives**
  - **New Focus on Innovation Clusters**
- **Myths About Innovation are an Obstacle**
- **The Valley of Death**
  - **What about Venture Capital?**
- **Programs to Cross the Valley of Death**
- **Our Common Innovation Challenge**

The New Locational Competition

Intense and growing competition among nations and regions for well paid jobs and improving living standards

Innovation is Increasingly Mobile

- **In today's globalized markets, businesses have a much wider range of options**
- **Modern communications technology and transport systems mean that Businesses can switch suppliers and locations much more rapidly**
- **Financial incentives abound**
- **Quality of Workforce and infrastructure increasingly matter more than wages**

Global Mega-Challenges

- **Fostering Economic Growth**
  - Driving domestic Growth and Employment through Innovation
- **Developing New Sources of Energy**
  - Commercializing renewable alternatives to oil
  - Increasing the capacity to fuel growing global demand for electricity
- **Addressing Global Warming**
  - 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 Growing and Maintaining a Country's Competitive Position in the Global Economy and to address Global Challenges**
  - **Collaboration among Small and Large Businesses, Universities, and Research Institutes is Essential for Innovation**
  - **New Institutions and New Incentives, are increasingly important to support collaboration and foster innovation**

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**

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

Singapore's Innovation Strategy

- **Total Focus, Commitment, and Long-Term Spending by the Government**
  - Goal is to establish Singapore (population: 4.5 million) as Southeast 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
    - New S&T Parks—Biopolis & Fusionopolis
  - Develop new programs to address the early-stage funding challenge for innovative firms
- **Generating local entrepreneurs and firm growth remain challenges**

Spain's Powerful Innovation Strategy

- **New Plan: Priority to leveraging R&D and innovation in 6th National Plan for Research, Development and Innovation (2008-11)**
- **Pro-Innovation Policies: Ingenio 2010 policy package includes public-private partnerships for innovation, venture funds, and programs to increase research capacity**
- **More R&D: Boost in R&D budget (€8.1B in 2007)**
- **Stronger Workforce: Strong growth in R&D personnel (7.8% a year on average between 2000 and 2006).**
  - **Population of Spain = 45.5 million**
- **University Reform: 2007 Act increases administrative, academic and financial autonomy**

Canada's Innovation Strategy

- **Improving the business environment**
  - Reducing corporate, personal and capital taxes
  - Steadily improving the regulatory environment
  - Support for SMEs through the Industry Research Assistance Program: IRAP
- **New investments in R&D in the university, business and government sectors**
  - New programs to support university research
  - Research and experimentation tax incentives for businesses

Improving Canada's Innovation System

- **Getting the Best and Brightest**
  - Canada Chairs: Drawing star faculty and their networks
  - Immigration Policies: attract and integrate scientists, entrepreneurs, and high skill workers from around the world. Money Matters
- **A Focus on Commercialization**
  - Networks of Centers of Excellence Program
  - Funding: Sustainable Development Technology Fund and Additional seed-stage funding
  - Clusters: Programs to develop innovation clusters around Federal Laboratories

Regions Push Innovation Strategies

- **Flanders (pop. 6 million) in Belgium provides :**
  - **Support for IMEC—one of the top two semiconductor research centers in the world**
  - **Support for universities and advanced research centers, including Leuven University**
  - **Incentives for patenting and commercializing research**
  - **Partnership programs for Early-stage financing for Small Innovative Firms**
  - **Outreach to the public to explain the advantages of being a leading knowledge economy**

Source: NRC, Innovative Flanders, 2008

In a few years, we will wonder…

How did these countries and regions do so well?

Innovation in the United States

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

A Renewed Focus 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

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."**

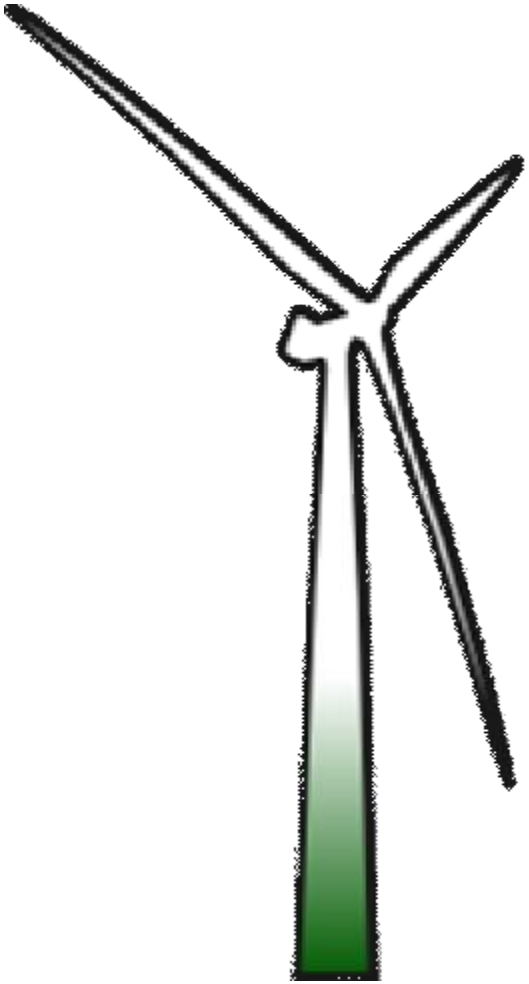
Address to the National Academy of Sciences, April 27, 2009

New Commitments to Support Innovation

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

New Initiatives to Advance Innovation in Renewable Energy

Stimulus Boost for Wind Energy



- **Extends the tax credit for producing electricity from wind for three years through 2012**
- **Provides $6 billion in loan guarantees for renewable energy projects and electricity transmission projects**
- **Provides grants of up to 30 percent of the cost of building a renewable energy facility.**
- **Provides $11 billion in spending and loan guarantees to build a "smart grid"**

Stimulus Funding for Solar and Batteries

- **$117 million to expand the development, deployment and use of solar energy throughout the U.S.**
- **$2.4 billion in new grants for Advanced Battery Makers**

Is this Government Support for Industry New?

"Government has played an important role in the technology development and transfer in almost every U.S. industry that has become competitive on a global scale"

Dr. Vernon Ruttan
University of Minnesota

Precedents for Public Role in Commercialization of Science in the U.S.

- **1798 - Grant to Eli Whitney to produce muskets with interchangeable parts, founds first machine tool industry**
- **1842 - Samuel Morse receives award to demonstrate feasibility of telegraph**
- **1903 – Wright Brothers fly, fulfilling the terms of an Army contract!**
- **1915 – National Advisory Committee for Aeronautics instrumental in rapid advance in commercial and military aircraft technology**

Precedents for Public Role in Commercialization of Science in the U.S.

- **1919 – Radio manufacturing (RCA) founded on initiative (equity and Board Membership) of U.S. Navy with commercial and military rationale.**
- **1940s, '50s, '60s – Jet Aircraft, Semiconductors, Computers, Satellites, Nuclear Energy**
- **1969-1990s - Government investment in forerunners of the Internet (Arpanet) and establishment of the Global Positioning System**
- **Today: Current investments in genomic and biomedical research, advanced computing and new materials**

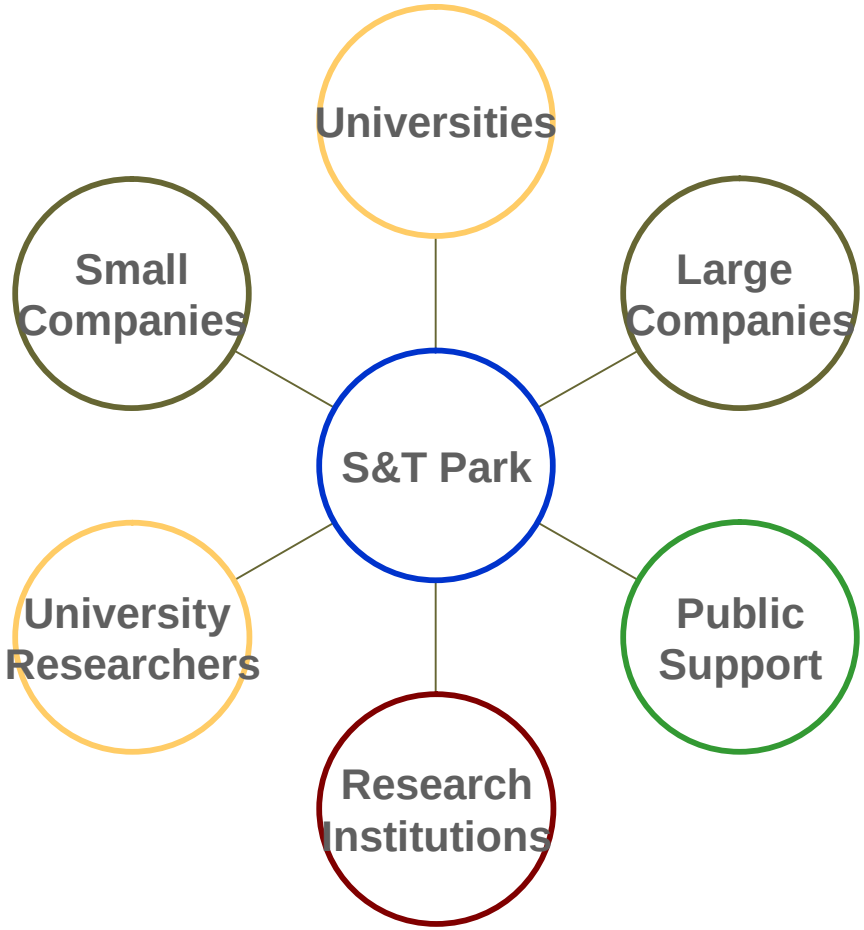
New Focus on Innovation Clusters

Greater Federal Role Seen for Fostering Regional Innovation Clusters

- **"Regional industry clusters represent a potent source of productivity at a moment of national vulnerability to global economic competition."**
  - **Karen Mills, Clusters and Competitiveness, Brookings 2008**
- **President Obama has called for a new federal effort to support regional innovation clusters**
  - **The U.S. Economic Development Administration supports regional innovation clusters and business incubators—more funds are needed**

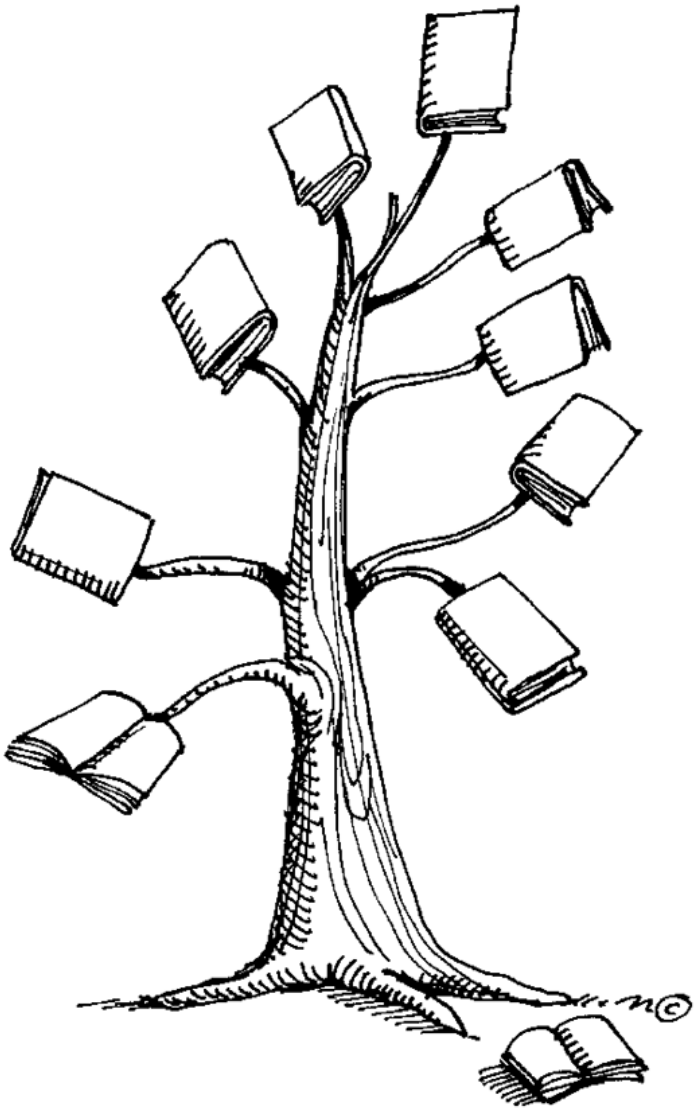
S&T Parks can Jump Start Cluster Development

- **Well-conceived and well-funded S&T Parks and Clusters can:**
  - **Build partnerships among researchers, small companies, and large companies**
  - **Help create companies**
  - **Advance university missions in education, research, and commercialization**



Universities play a Growing Role in Commercializing Knowledge

Universities that are able to connect with Industry Drive Regional Development and are Assets for National Competitiveness



Why Faculty need to do Research?

- **To advance the frontiers of knowledge**
  - **Researchers hone their skills and knowledge**
- **Professors who conduct Research and Teach enrich the classroom with up-to-date information and insights**
  - **Able to help industry**
- **Cooperation with Industry is Mutually Beneficial**
  - **Generates Research Papers and Market-Ready Students**

From the "Ivory Tower" to the Marketplace

- **"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

Why 21st Century Universities Matter

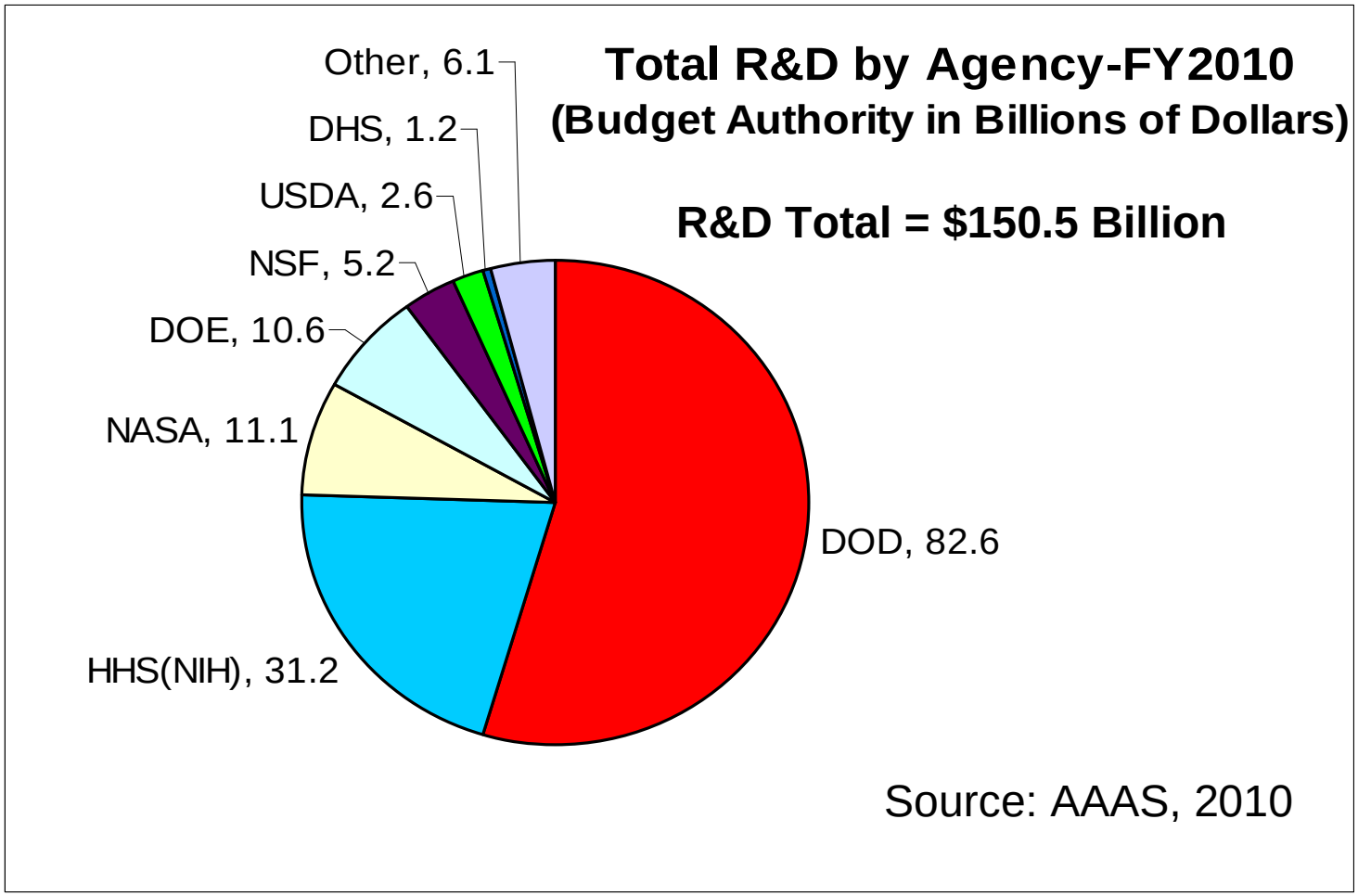
- Research Universities Are a Critical Element to our Cities and States
- With First Class Research Universities, Arkansas can:
  - Keep Top Talent
  - Attract Federal Research and Development Dollars
  - Bring in Venture Capital Investment Dollars from other States
  - Generate Businesses and Exports to other States and Countries

Key Challenge for the U.S

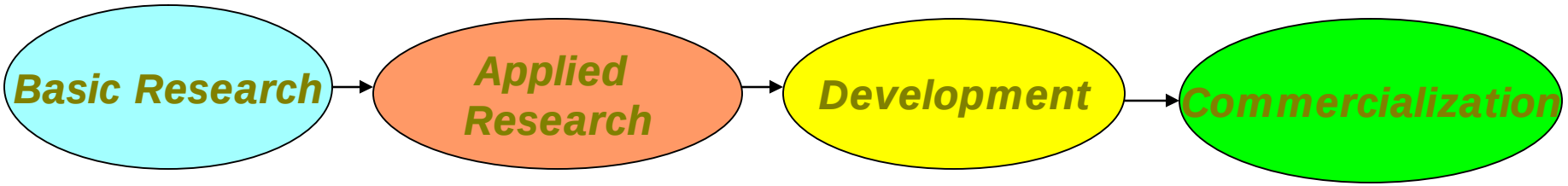
How do we Capitalize on Investments in Research?

The U.S. R&D Budget for 2010

55% of U.S. Federal R&D is for Defense



The Myth of the Linear Model of Innovation

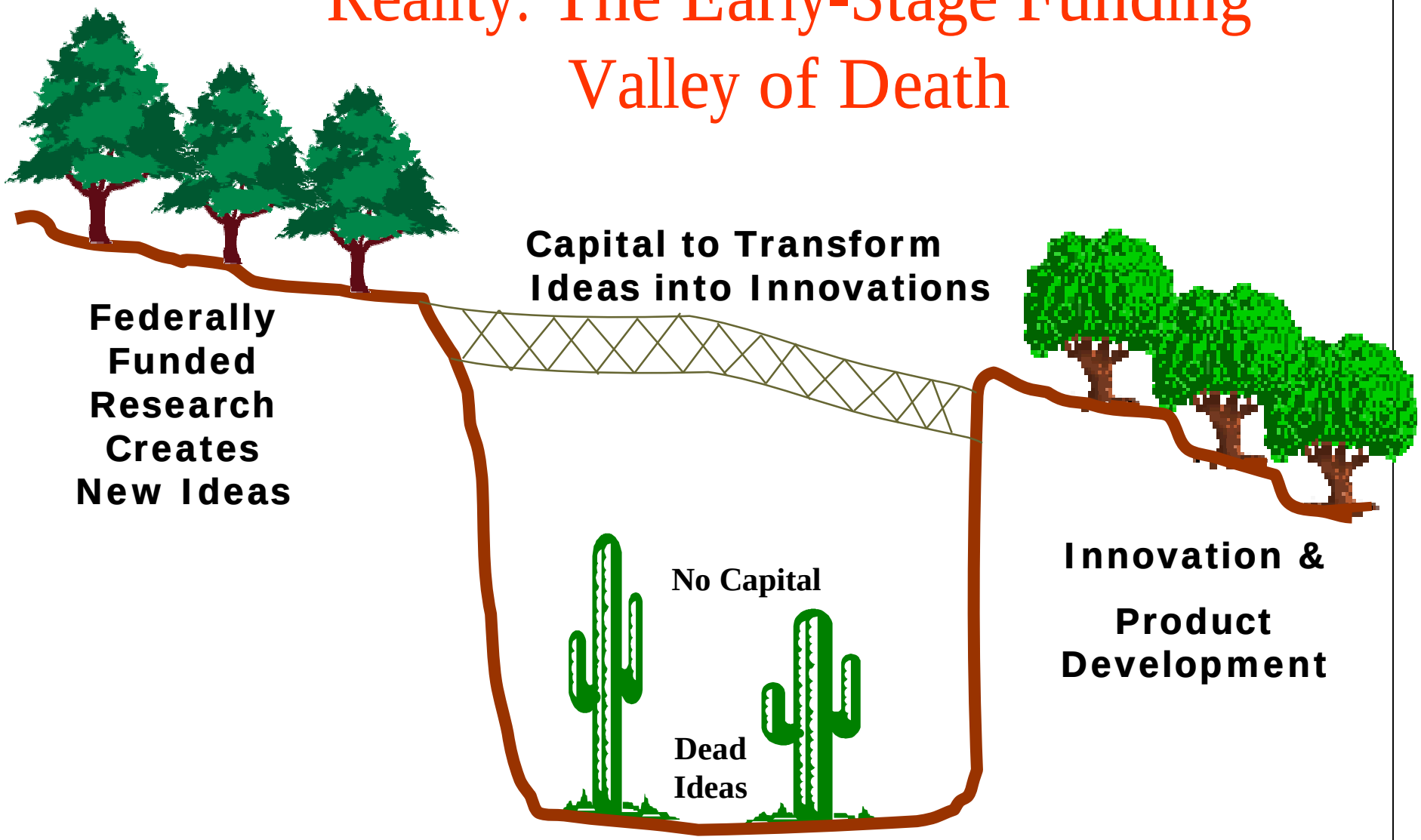


- **Reality: Innovation is a Complex Process**
  - **Major overlap between Basic and Applied Research, as well as between Development and Commercialization**
  - **Principal Investigators and/or Patents and Processes are Mobile, i.e., not firm-dependent**
  - **Many Unexpected Outcomes**
  - **Technological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

The U.S. Myth of Perfect Markets

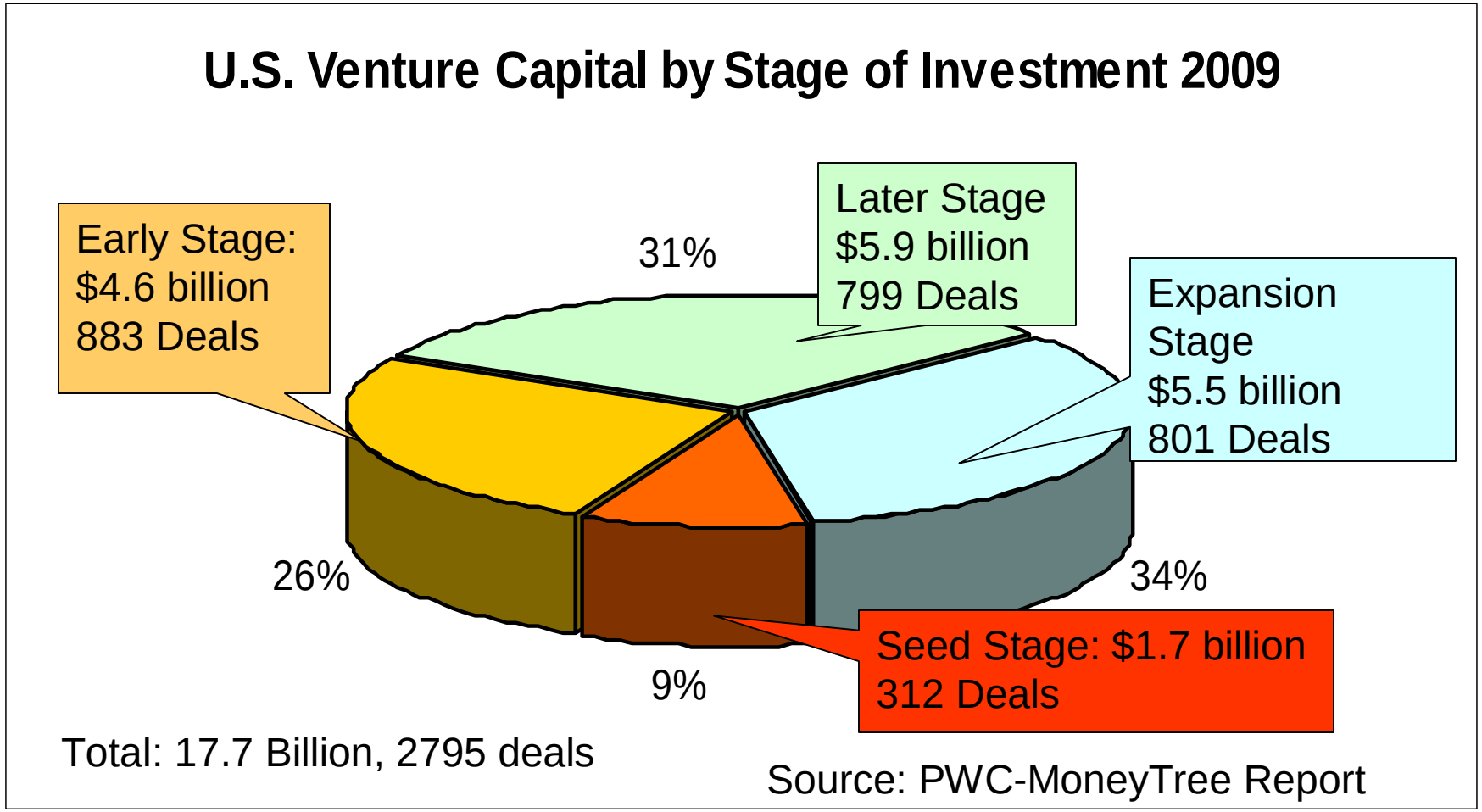
- **Strong U.S. Myth: "If it is a good idea, the market will fund it."**
- **Reality:**
  - **Potential Investors have less than perfect knowledge, especially about innovative new ideas**
  - **"Asymmetric Information" leads to suboptimal investments**
    - **George Akerlof, Michael Spence and Joseph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

Reality: The Early-Stage Funding Valley of Death



What about Venture Capital?

U.S. Venture Investments Down 37% in 2009



Crossing the Valley of Death is Hard: There is no "one-size-fits-all" solution

One Path Across the Valley involves Innovation Awards

The Technology Innovation Program
The Small Business Innovation Research (SBIR) Program

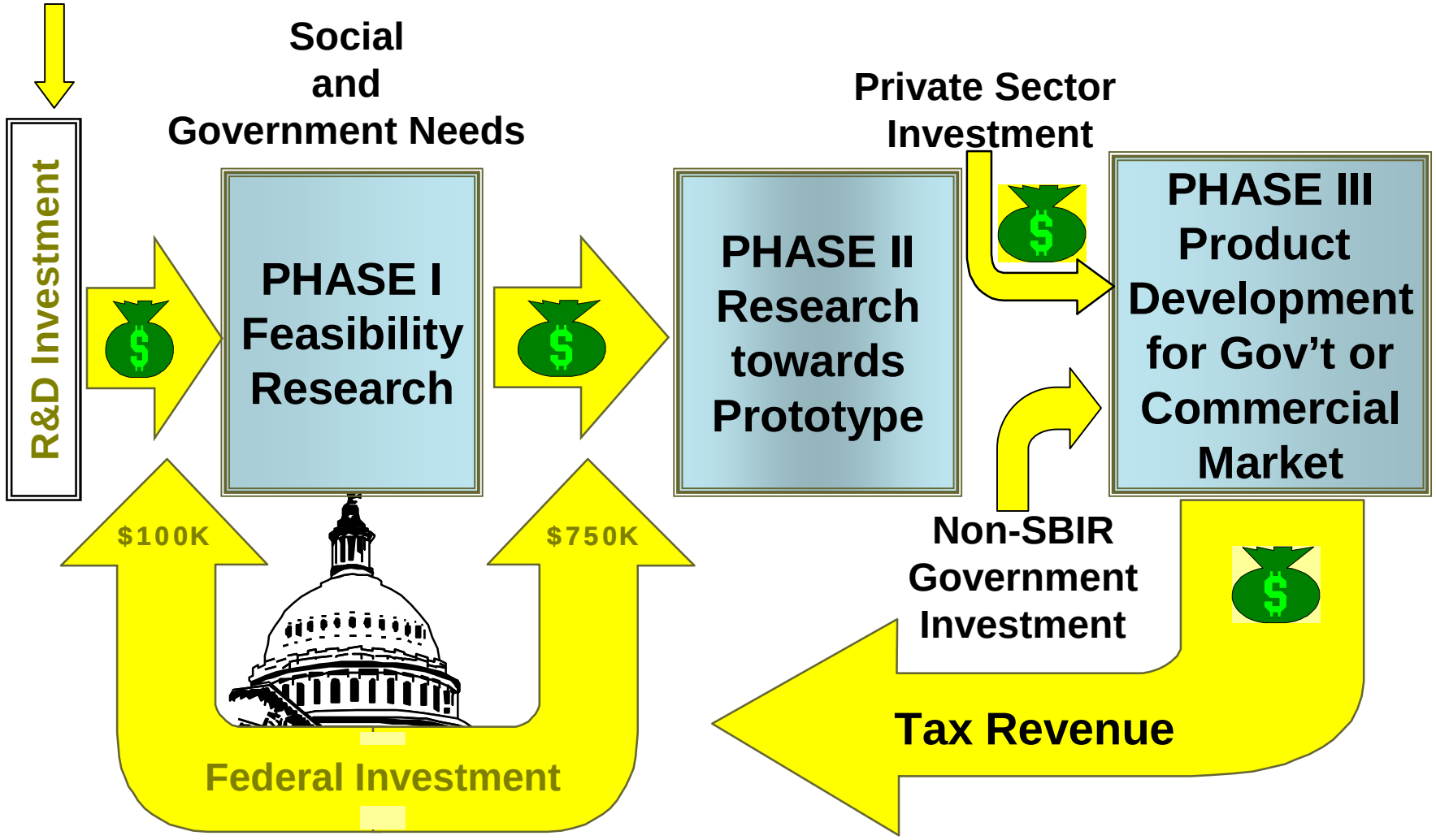
The Technology Innovation Program (TIP)

- **TIP accelerates innovation through high-risk, high-reward research in areas of "critical national need"**
  - **Aim is to speed the development of high-risk, transformative research**
  - **Targeted to address key societal challenges**
- **TIP provides funding to universities, small and medium-sized businesses, and consortia for research on promising technologies**
  - **Awards are Merit Based**
  - **Funding provided through cost-shared research grants, cooperative agreements, or contracts**
- **Sufficient Funds not Available**

The Small Business Innovation Research (SBIR) Program

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

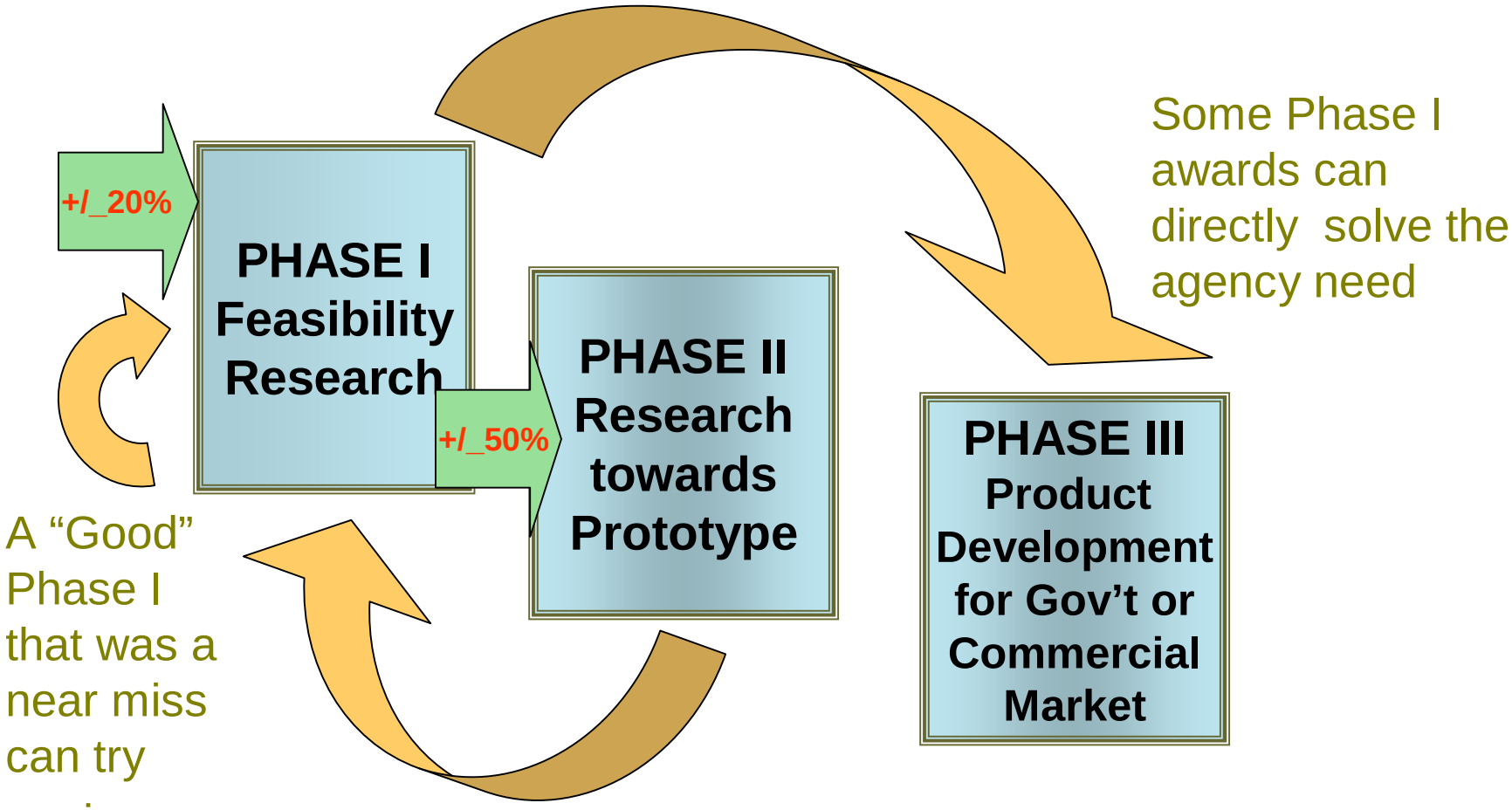
The SBIR "Open Innovation" Model



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

SBIR is a Flexible, 2nd Chance Program



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**

Factors Affecting Success in SBIR

- **Key Factor: States with more applicants get more SBIR awards**
- **Number of applicants is related to:**
  - **Number of high-tech companies**
  - **Number of Science and Engineers in the State**
  - **State expenditures on R&D**
  - **Private R&D expenditures in the state**
  - **Number of research universities**
- **SBIR is merit-based**
  - **If you have a quality proposal—you can win**
  - **If you are rejected, you can try again!**

Source: NRC, An Assessment of the SBIR Program, 2008, page 99

Boosting SBIR Participation:

Leveraging SBIR to Boost State Growth

- **Advertising the program helps!**
- **Incentives for Applicants may help:**
  - **North Carolina awards up to $100,000 in matching funds to each company that wins a SBIR grant from the federal government.**
  - **This approach reinforces support for high-potential small firms**
    - **Source: Robert McMahan, North Carolina Board of Science and Technology**

Arkansas can also Leverage the Federal Manufacturing Extension Partnership (MEP) Program

- **MEP is a national network with hundreds of specialists in business and manufacturing process improvements**
  - **Provides advice to small- and medium-sized manufacturers through over 400 centers located across the US**
- **A Public-Private Partnership**
  - **Teams with industry as well as state and local organizations**
  - **Leverages over $100 million dollars of federal investment into a nearly $300 million dollar program**

Conclusions

Innovation is Key to our Future

Arkansas needs Focus and Funds, and Help from the Federal Government, the Universities, and the Private Sector

Each Partner Counts

"Innovation" is the Key to how Regions and Nations Compete in the 21st Century

- **Innovation is key to growth, prosperity, and security**
- **Resource Inputs are Essential, but are not Sufficient**
- **Incentives are Required for Innovation and this involves Institutional Change**
- **Innovation Policy is not an Afterthought**
  - **It is a Central Mission of Government at Every Level**
  - **Our Children's future depends on it**

Thank You

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