Building Innovation Ecosystem - Accelerating Technology Commercialization and Cultivating Entrepreneurship

Grace Wang
Deputy Assistant Director for Engineering
National Science Foundation

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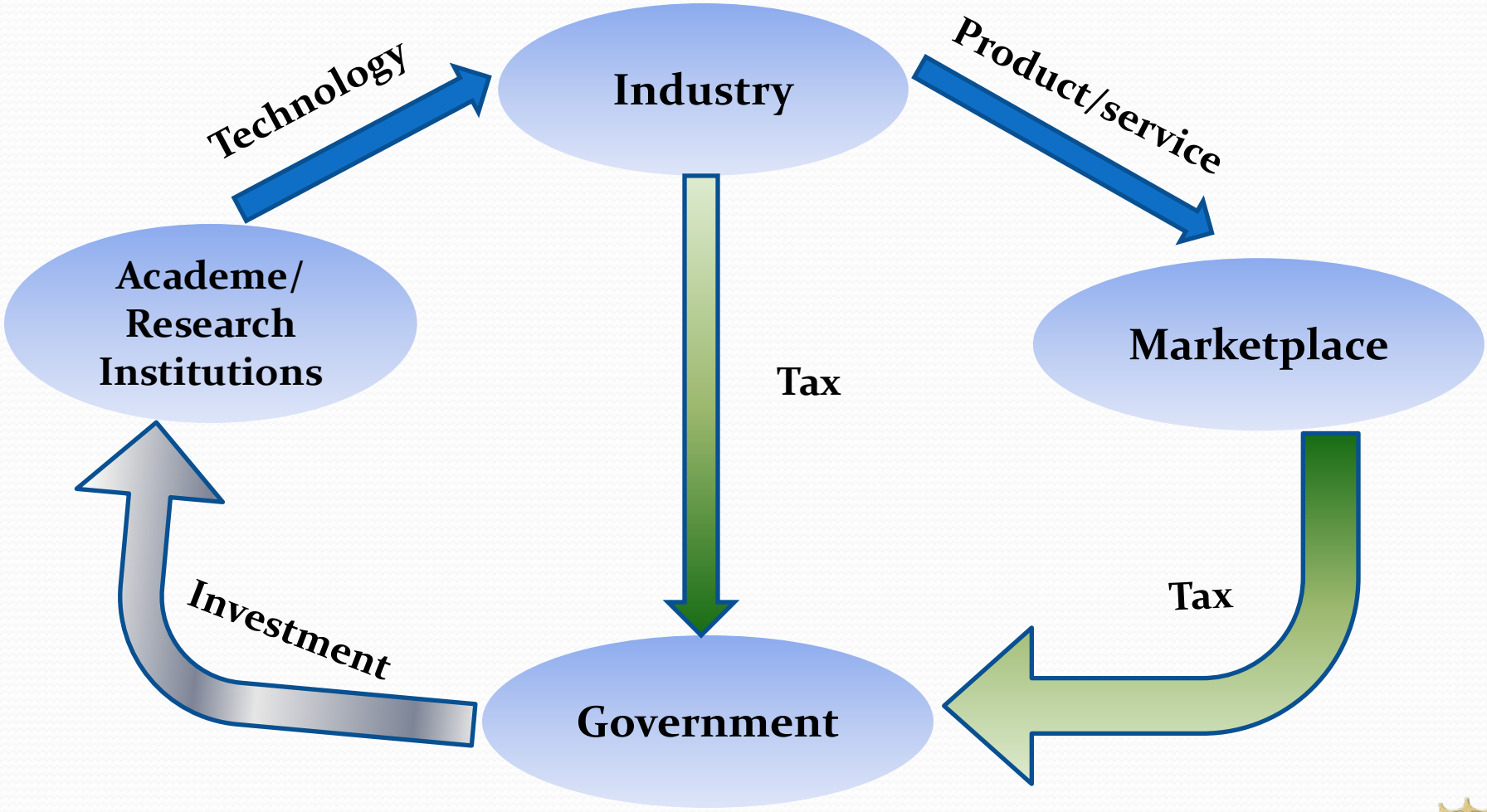
Definition of Innovation

"Innovation is the creation and delivery of surprising new knowledge, (*products and services)* that have sustainable value for society."

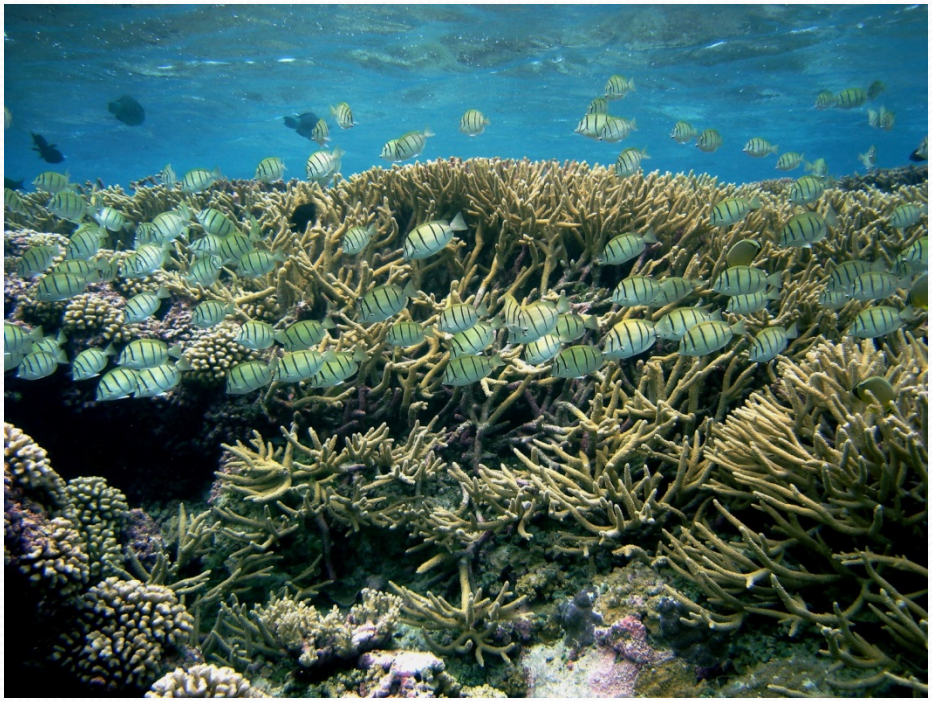
- Curtis Carlson

Myth: A Linear Innovation Model?



Innovation Ecosystem

- Stakeholders
- Innovation infrastructure and culture
- Partnerships and technology/talent flow

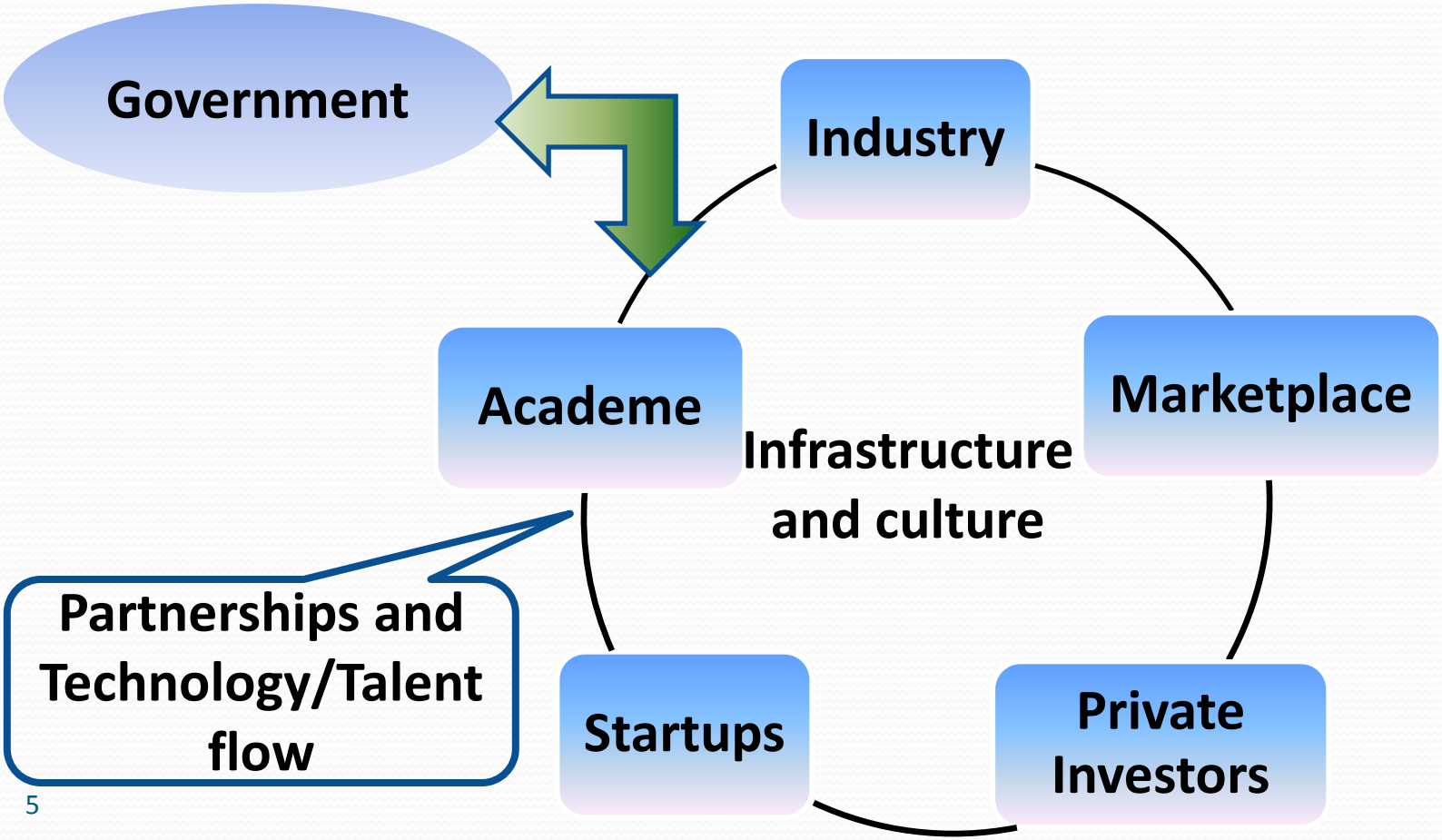


- Living organisms
- Environment
- Links

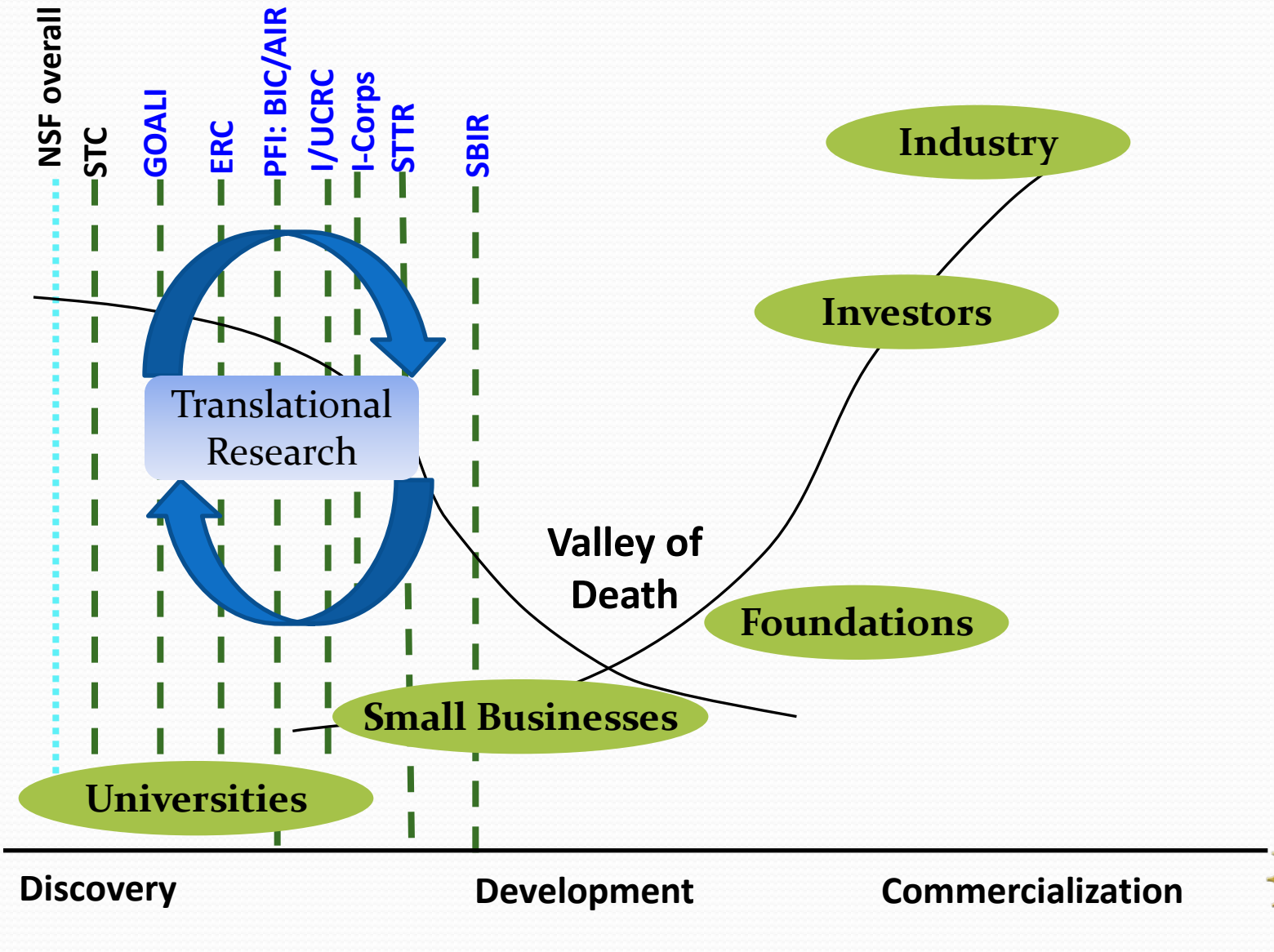
Building Innovation Ecosystem

Enabling innovation infrastructure and culture for value-added partnerships and technology/talent flow

Be catalysts



Research to Commercialization

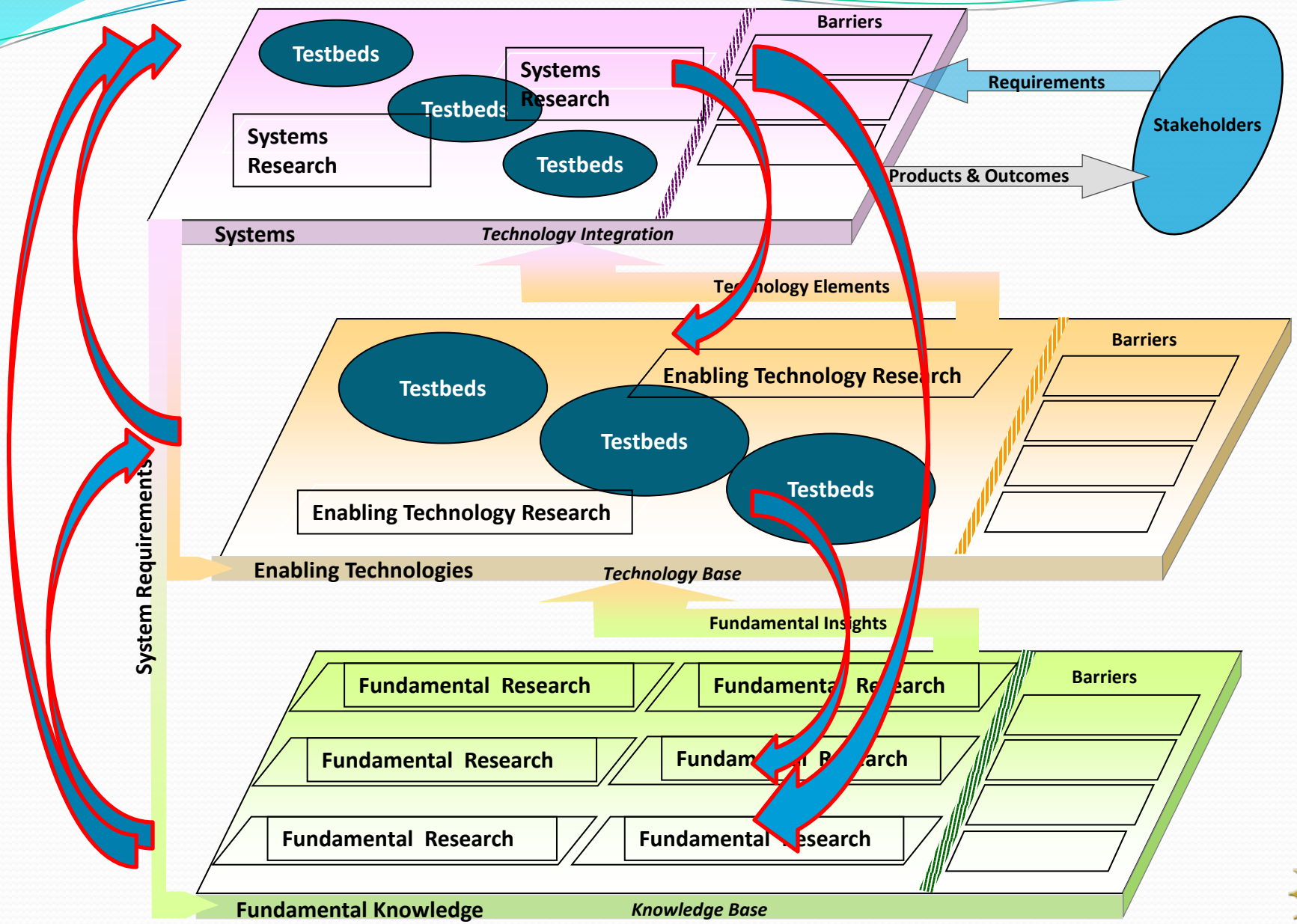


Building Innovation Infrastructure

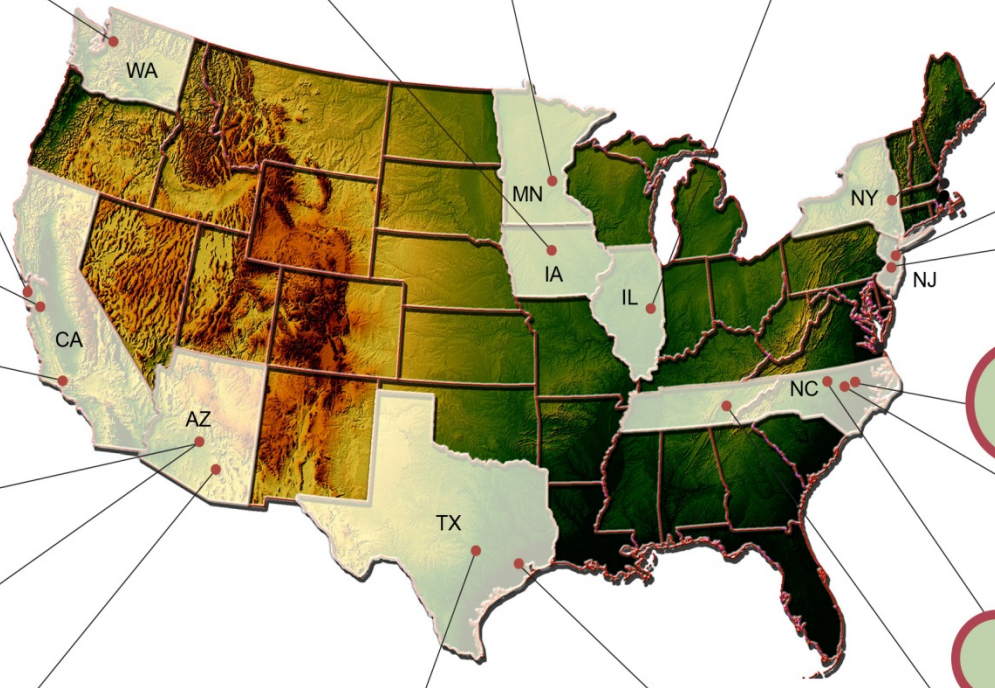
- Engineering Research Centers (ERC)
  - **System-level** engineering research
  - Transformative engineering research to enable new industries

- Industry/University Cooperative research Centers (I/UCRC)
  - Pre-competitive **industry-inspired** research consortia

ERC (Research) Strategic Framework



NSF's FY 2015 Engineering Research Centers (Lead institutions)



ERC for Sensorimotor Neural Engineering
University of Washington

ERC for Biorenewable Chemicals
Iowa State University

Center for Compact and Efficient Fluid Power
University of Minnesota

ERC for Power Optimization for Electro-Thermal Systems
University of Illinois at Urbana-Champaign

Smart Lighting ERC
Rensselaer Polytechnic Institute

Synthetic Biology ERC
University of California at Berkeley

ERC for Structured Organic Particulate Systems
Rutgers University

ERC for Re-inventing America's Urban Water Infrastructure
Stanford University

ERC on Mid-Infrared Technologies for Health and the Environment
Princeton University

Nanosystems ERC for Translational Applications of Nanoscale Multiferroic Systems
University of California, Los Angeles

Nanosystems ERC for Advanced Self-Powered Systems of Integrated Sensors and Technologies
North Carolina State University

ERC for Bio-mediated and Bio-inspired Geotechnics
Arizona State University

ERC for Future Renewable Electric Energy Delivery and Management
North Carolina State University

ERC for Quantum Energy and Sustainable Solar Technologies
Arizona State University

ERC for Revolutionizing Metallic Biomaterials
North Carolina A&T University

ERC for Integrated Access Networks
University of Arizona

Nanosystems ERC for Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies
The University of Texas at Austin

Nanosystems ERC for Nanotechnology Enabled Water Treatment Systems
Rice University

ERC for Ultra-wide Area Resilient Electric Energy Transmission Networks
University of Tennessee-Knoxville

Biotechnology and Health Care

Energy, Sustainability, and Infrastructure

Manufacturing

Microelectronics, Sensing, and IT

Note: All centers are multi-university partnerships; university shown is lead institution.

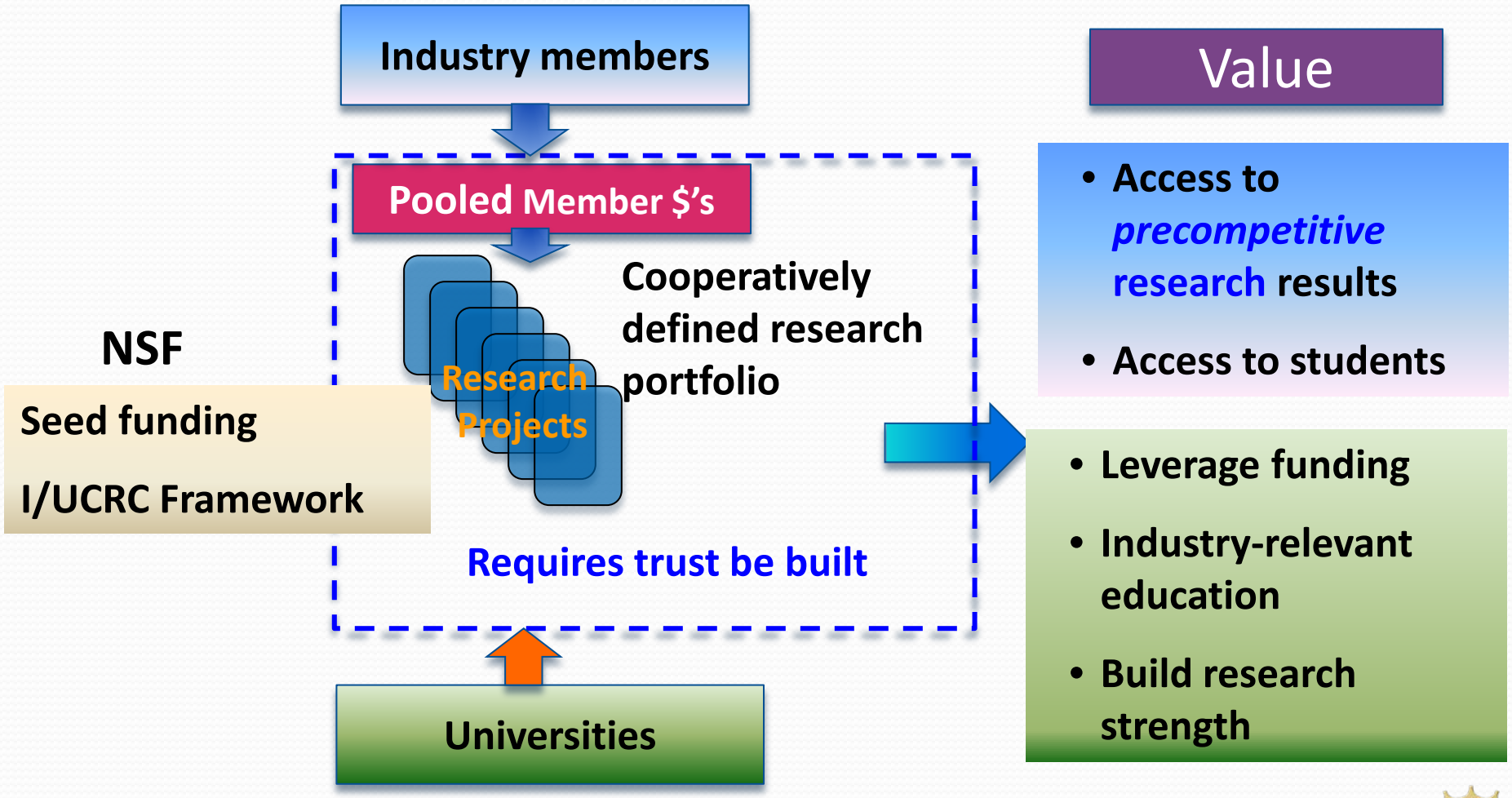
New ERC Solicitation (NSF 15-589)

- ***What is the compelling new idea and how does it relate to national needs?***

- ***Why is a center necessary to tackle the idea?***

- ***How will the ERC's infrastructure integrate and implement research, workforce development and innovation ecosystem development efforts to achieve its vision?***

Industry/University Cooperative Research Centers (I/UCRC)

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Moldova
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I/UCRC Impact vs. Investment: Examples

Each dollar invested by NSF-I/UCRC generated an estimated $64 in impacts.

IUCRC investments & Impacts	IMS	BSAC	CPaSS
Estimated impacts (present value)	$846 M	$410 M	$9 M
Total investments (present value)	$3 M	$13 M	$3 M
Benefit: Cost Ratio	270:1	31:1	3:1
Net Present Value	$843M	$397M	$6M

IMS: Intelligent Maintenance Systems (2001)
CPaSS: Center for Particulates & Surfactants (1998)
BSAC: Berkeley Sensors and Actuators Center (1986)

Cultivating Innovation Culture and Entrepreneurship

Grant Opportunities for Academic Liaison with Industry (GOALI)

Co-funding opportunity

Industrial scientists and engineers to universities

Faculty, postdoctoral fellows, and students to industry

University-industry teams to conduct joint research projects

Accelerating Innovation Research (AIR)

Require lineage to previously NSF-funded basic research awards

- ✓ **Proofs-of-concept and/or pre-commercial prototypes**
- ✓ **Promote entrepreneurial thinking among faculty and students**

➢ **TECHNOLOGY TRANSLATION (TT) (NSF 15-570)**

- ✓ **Single investigators**
- ✓ **$200k/1.5 years**

Building Innovation Capacity (BIC)

- ***Platform technologies*** **to enable human-centered and market-driven "smart" service systems**
- **Academe-industry partnerships required**
  - Industry contribution of market knowledge to ensure relevance
- **Social behavioral and/or cognitive science component required** to understand the potential interaction of the technology with users
- Up to $1 M for 3 years (NSF 15-610)

Innovation Corps (I-Corps)

- **Why I-Corps?**
  - ✓ **Capitalize on previously NSF-funded basic research**
  - ✓ **Cultivate entrepreneurial culture**
- **I-Corps approach**
  - ✓ **"Lean Launchpad" curriculum**
  - ✓ **Team: PI + Entrepreneurial Lead + Business Mentor**
  - ✓ **Experiential entrepreneurial education**

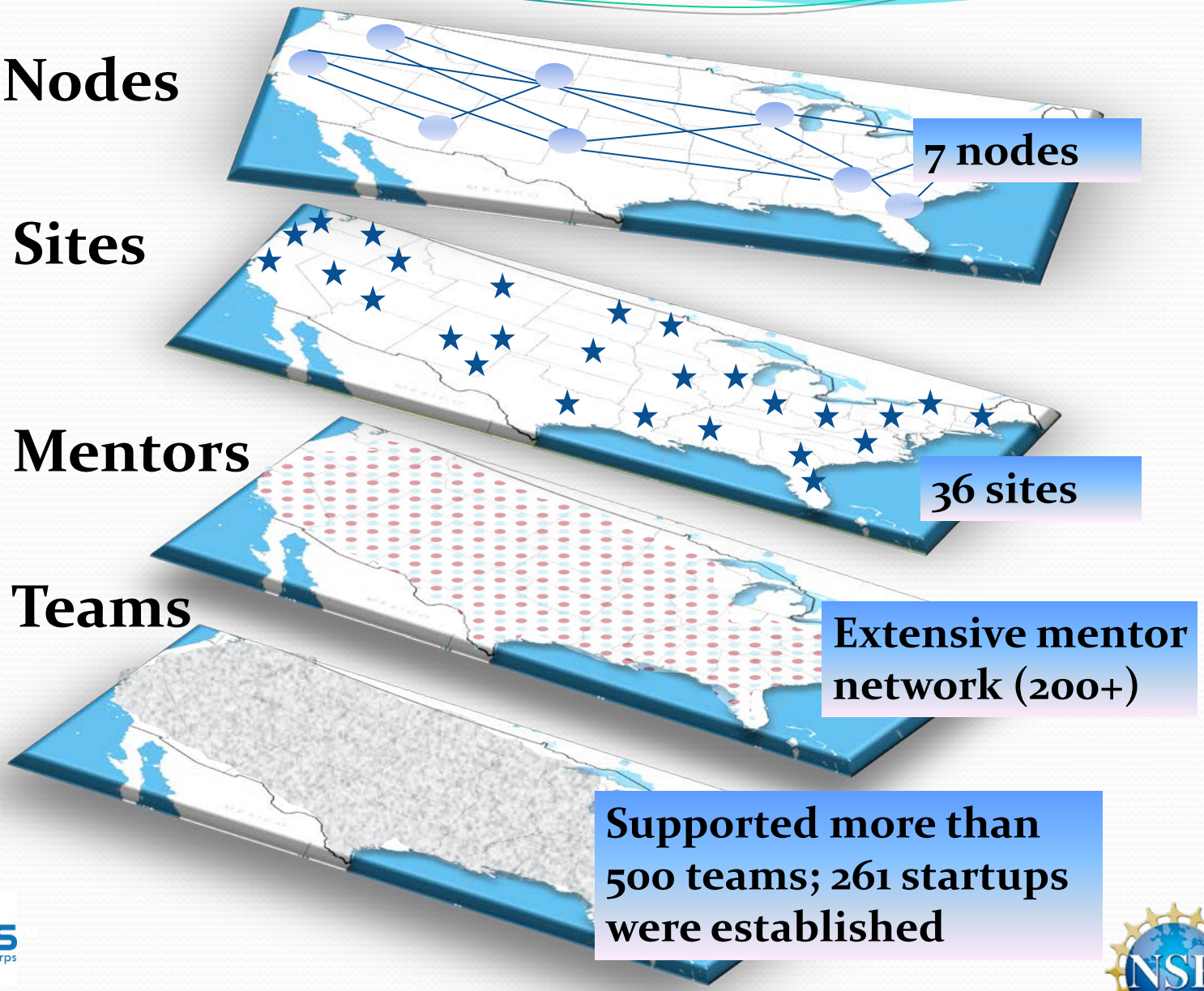
Building a National Innovation Network

I-Corps™ Nodes

I-Corps™ Sites

I-Corps™ Mentors

I-Corps™ Teams



NSF | I-CORPS NSF Innovation Corps

NSF

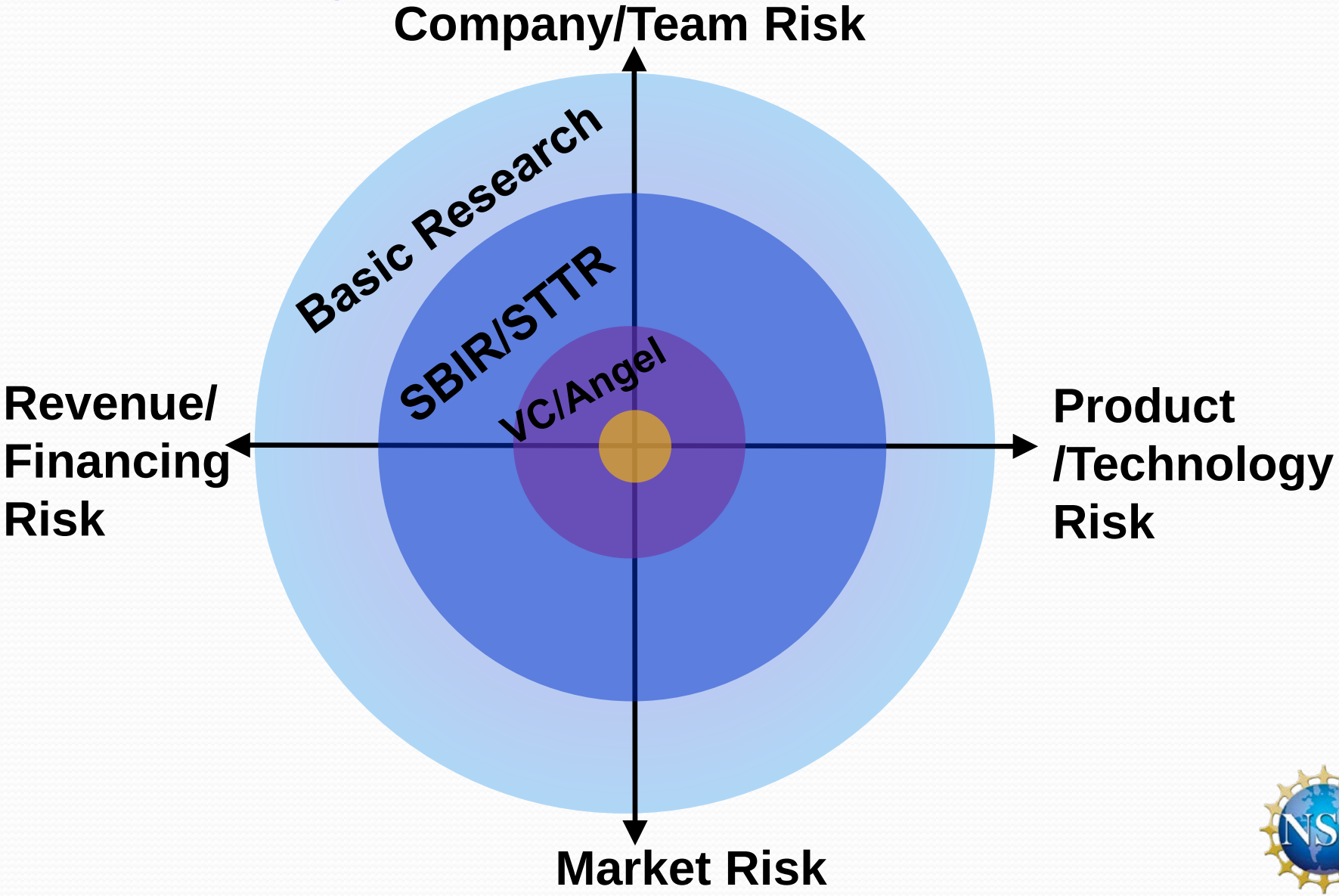
Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR)

Seeking high-risk, high-payback innovations with high commercialization potential

Invest in for-profit small businesses



Positioning of NSF SBIR/STTR Program – *Help Mitigate Risks*



Strong Ties to Universities

- **STTR**
  - ✓ **Subcontract to universities is mandatory**
  - ✓ **Strongly encourages NSF funding lineage**

- **Phase I:**
  - ✓ **STTR $225K, 12 months**
  - ✓ **SBIR: $225K, 6-12 months**

- **Phase II**
  - ✓ **SBIR/STTR: $750K, 2 years**

Inclusive Topic Areas

- Educational Technologies and Applications (EA)
- Information and Communication Technologies (IC)
- Semiconductors (S) and Photonic (PH) Devices and Materials
- Electronic Hardware, Robotics and Wireless Technologies (EW)
- Advanced Manufacturing and Nanotechnology (MN)
- Advanced Materials and Instrumentation (MI)
- Chemical and Environmental Technologies (CT)
- Biological Technologies (BT)
- Smart Health (SH) and Biomedical (BM) Technologies

Encourage Fundraising from Private Sectors - *Help mitigate financing risk*

- Phase IIB supplement
  - ✓ Match 50% of third-party investment up to $500k
- Third-party investment that SBIR/STTR Phase II grantees collectively raised
  - ✓ **$78 million in FY2012**
  - ✓ **$83 million in FY2013**
- 19 acquisitions in last 2 years for an estimated over $600 million acquisition value

Cultivating Entrepreneurship

- Launched SBIR "Beat The Odds" Boot-Camp
  - Focusing on customer discovery and understanding market needs
  - Overwhelmingly positive feedback
- SBIR/STTR Grantees Conferences
  - Focus on entrepreneurial education

Looking Back and Looking into the Future…

Of $65 billion total in U.S. university R&D expenditures in FY2011*

- **4.9%, or $3.2 billion, was funded by businesses**

U.S. large R&D Companies**

- **Funding to universities represents less than 1% of company R&D spending in 2010**

Need to integrate industry-inspired basic research into universities' mission

*Source: National Science Foundation's Higher Education Research and Development (HERD) Survey

**SOURCE: National Science Foundation, National Center for Science and Engineering Statistics and U.S. Census Bureau, Business R&D and Innovation Survey, 2010.

Need new ways of seeing IP value

- **16 universities took 70% of total licensing income of the university system in 2012**

- **Over the last 20 years, on average, 87% of technology transfer offices did not break even**

Source: University Start-Ups: Critical for Improving Technology Transfer (Brookings, Nov. 2013)

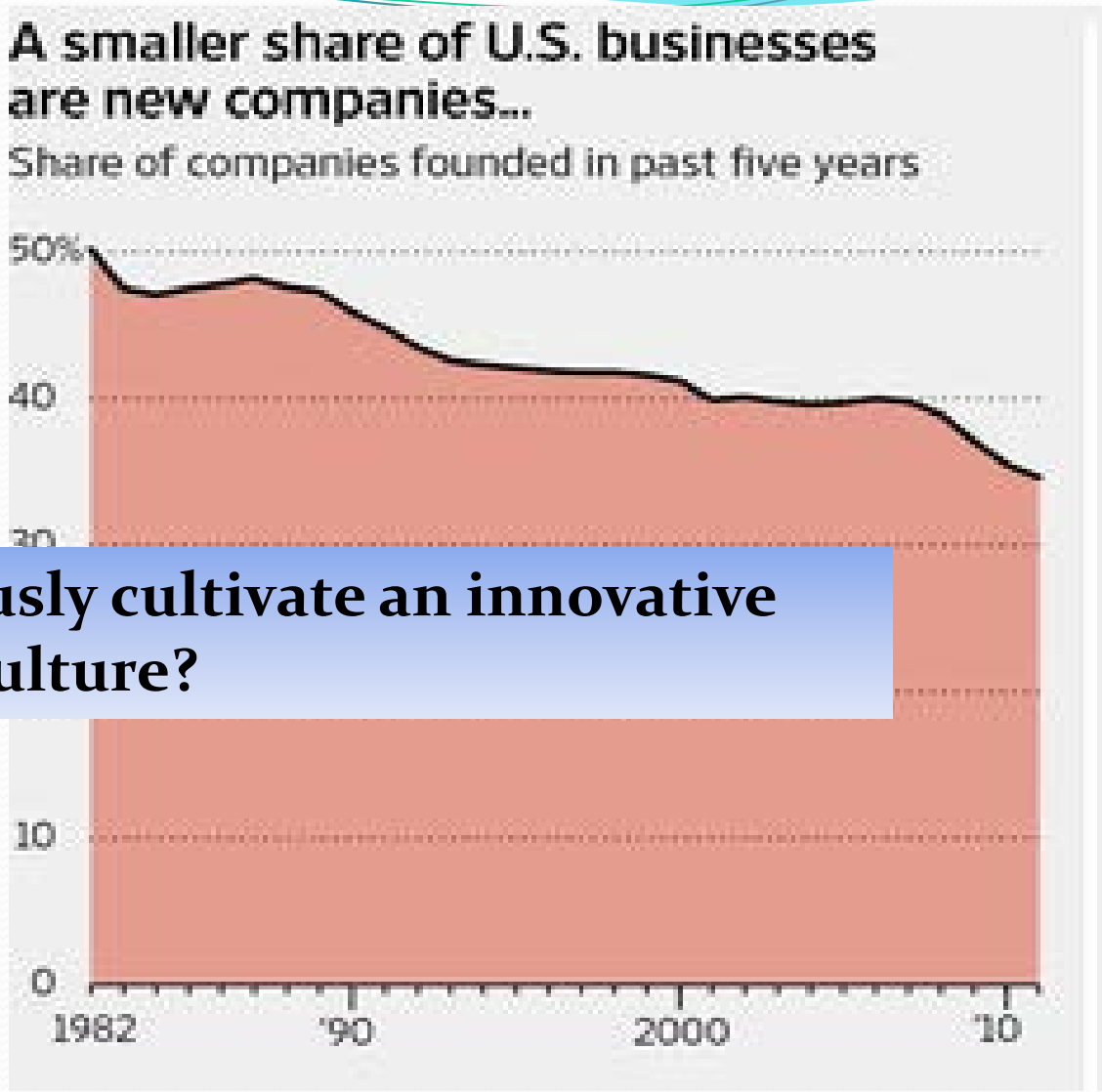
THE FUTURE OF EMPLOYMENT: HOW SUSCEPTIBLE ARE JOBS TO COMPUTERISATION?

Osborne and Frey, 2013, Oxford University

"… about 47 percent of total US employment is at risk."

How to prepare our students for such a future?

For Startups,



How to continuously cultivate an innovative and risk-taking culture?

Source: Commerce Department's Business Dynamics Statistics

- Encourage industry-inspired basic research
- Explore new IP practices
- Stimulate innovative education models
- Cultivate entrepreneurship

It is all about infrastructure and culture