Cooperative Research Schemes: Perspectives on Best Practices

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ATWARM Conference, Dublin May 2013

Overview

- Where we've been: Old Science
- 21st Century Innovation Drivers
- Organizational Best Practice: Cooperative Research Centers
  - Best Practices
- Closing Thoughts

Science: Where we've been

Individual Principal Investigator

Linear Model of Innovation Process

Times they are a changing

- Bigger and more complex problems
  - Quality and quantity of water
- Cost of specialized scientific equipment and labs
- Pace of innovation and technology development
- National pressures to win the innovation contest
- Economic and societal consequences of innovation

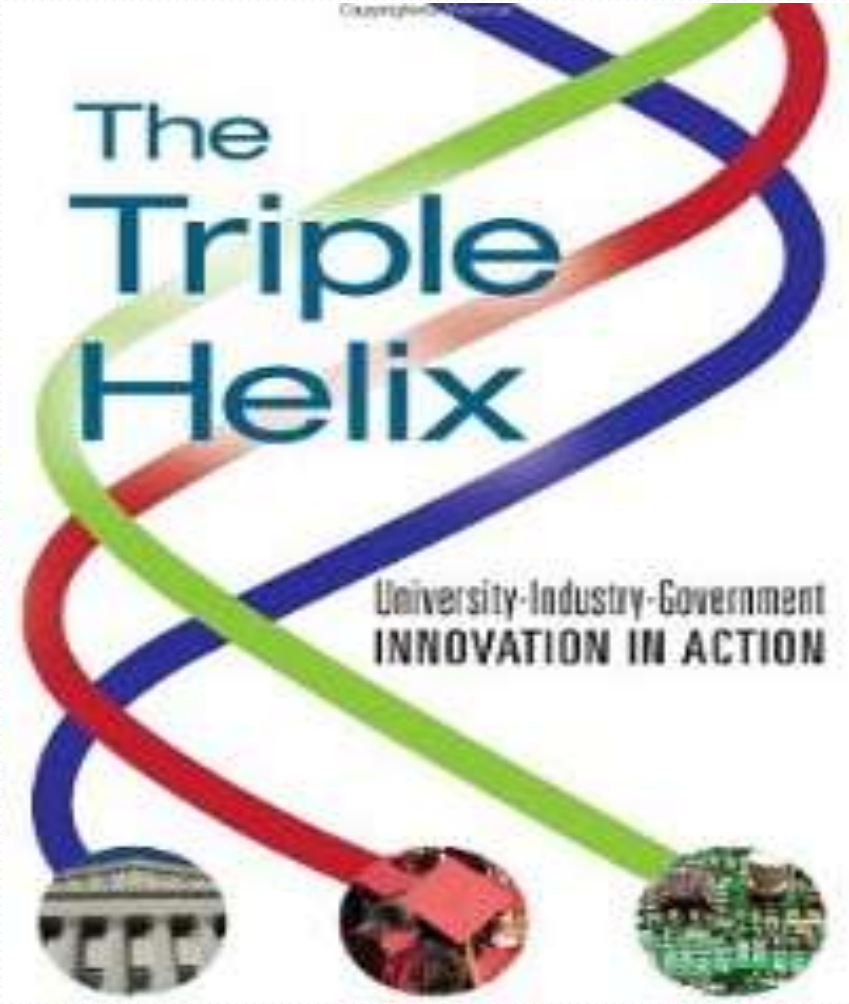
21st Century Innovation Drivers

Collectivization of Research

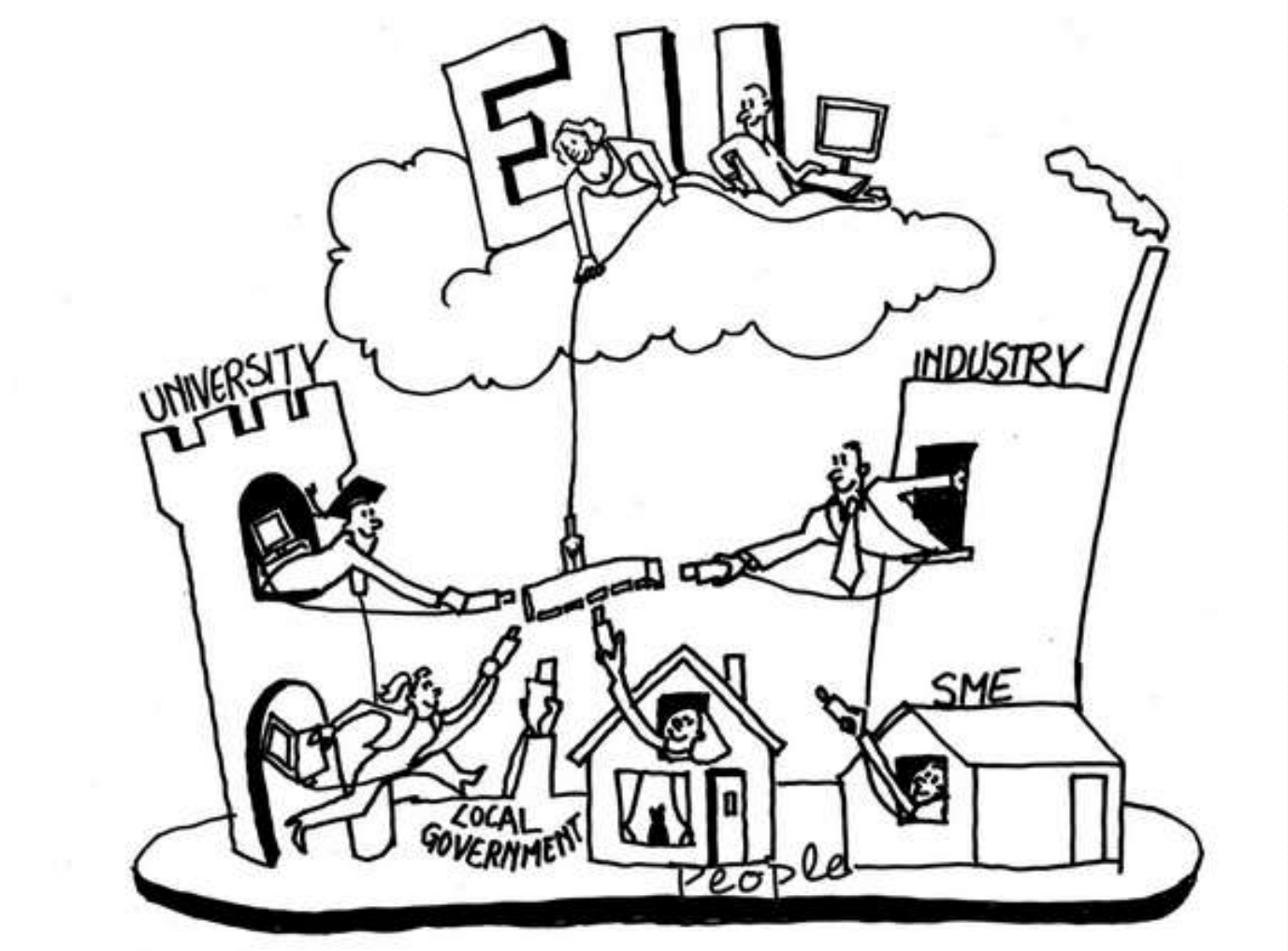
- Challenge:
  - Single heroic PIs are not enough to tackle big problems
- Collectivization, “Team Science”
  - Large multidisciplinary (multi-institutionally based) teams of investigators

Triple Helix Research

- Challenge
  - Innovation process is too complex and too multifaceted – funding basic research not enough
- Science Technology Innovation Policy ->Triple Helix
  - Support national innovation systems (NIS) (Industry + University+ Government)
  - Partnerships



Triple Helix EU-style



Open Innovation

- Challenge
  - Even the largest firms and N.I.S. can only capture a fraction of scientific talent available
- Open Innovation
  - Increasing use of external sources of R&D
    - VP for Open Innovation; National Meetings on Open Innovation
    - Absorptive capacity; networks; partner scanning

How to exploit Innovation Drivers?

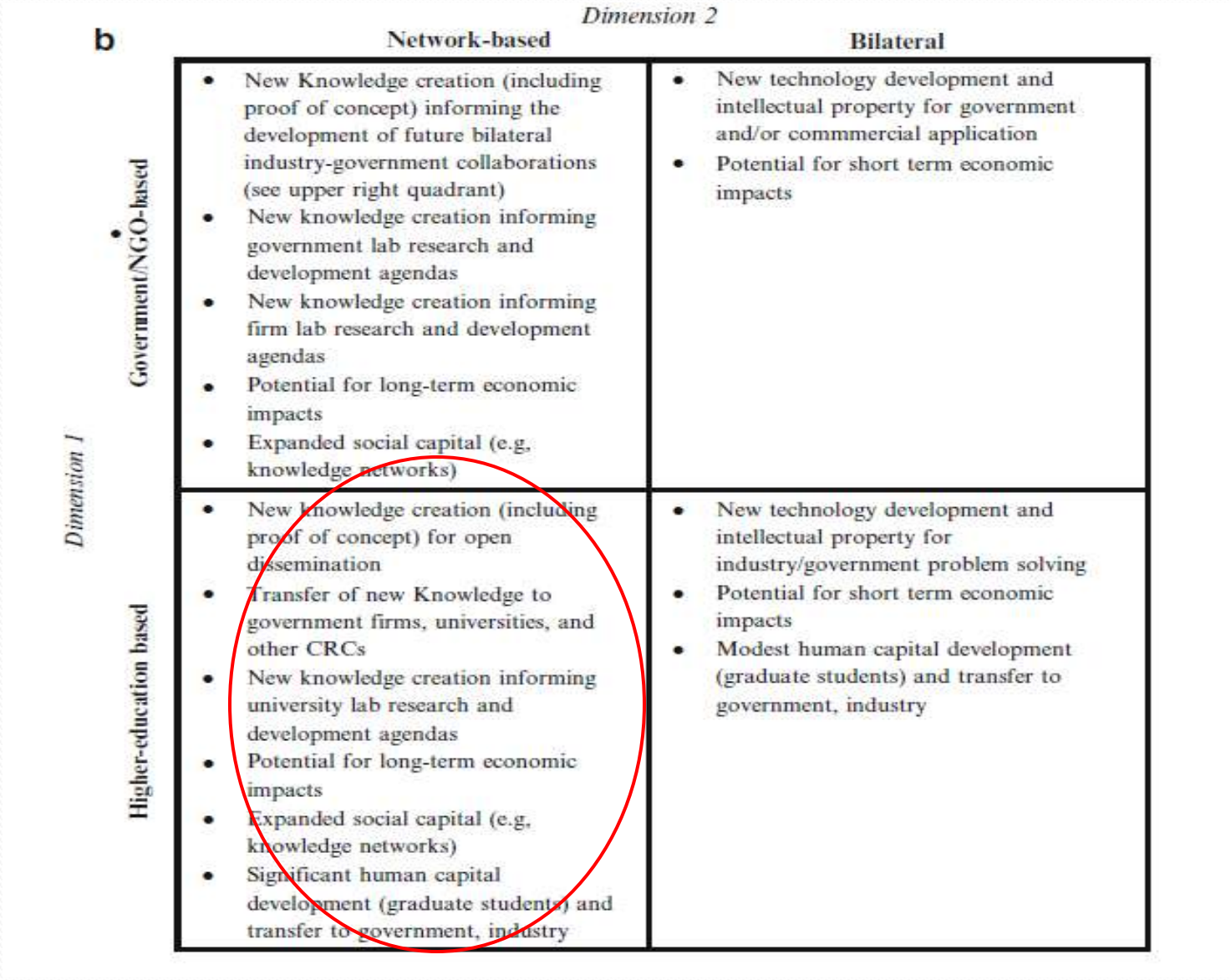
Cooperative Research Centers

- A cooperative research center (CRC) is an organization or unit within a larger organization that performs research and also has an explicit mission (and related activities) to promote, directly or indirectly, cross-sector collaboration, knowledge and technology transfer, and ultimately innovation. (Gray, Boardman & Rivers, 2013)
  - It's an organizational innovation
    - Team science
    - Triple helix
    - Open innovation

Cooperative Research Centers

- Cooperative Research Centers (I-U-G) are immensely important to the global "innovation system"
  - Thousands globally
  - Increasing percentage of industry support for universities
- Social science Research Conclusion
  - "*broad set of benefits for these centers, including patents and licenses, but extending well beyond these markers of technology transfer" (Feller,1994)*

CRC Typology and Outcomes



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Dimension 2

Dimension 1	Network-based	Bilateral
Government/NGO-based	• New Knowledge creation (including proof of concept) informing the development of future bilateral industry-government collaborations (see upper right quadrant) • New knowledge creation informing government lab research and development agendas • New knowledge creation informing firm lab research and development agendas • Potential for long-term economic impacts • Expanded social capital (e.g, knowledge networks)	• New technology development and intellectual property for government and/or commmercial application • Potential for short term economic impacts
Higher-education based	• New knowledge creation (including proof of concept) for open dissemination • Transfer of new Knowledge to government firms, universities, and other CRCs • New knowledge creation informing university lab research and development agendas • Potential for long-term economic impacts • Expanded social capital (e.g, knowledge networks) • Significant human capital development (graduate students) and transfer to government, industry	• New technology development and intellectual property for industry/government problem solving • Potential for short term economic impacts • Modest human capital development (graduate students) and transfer to government, industry

NSF IUCRC Program

The Industry/University Cooperative Research Centers (I/UCRC) Program

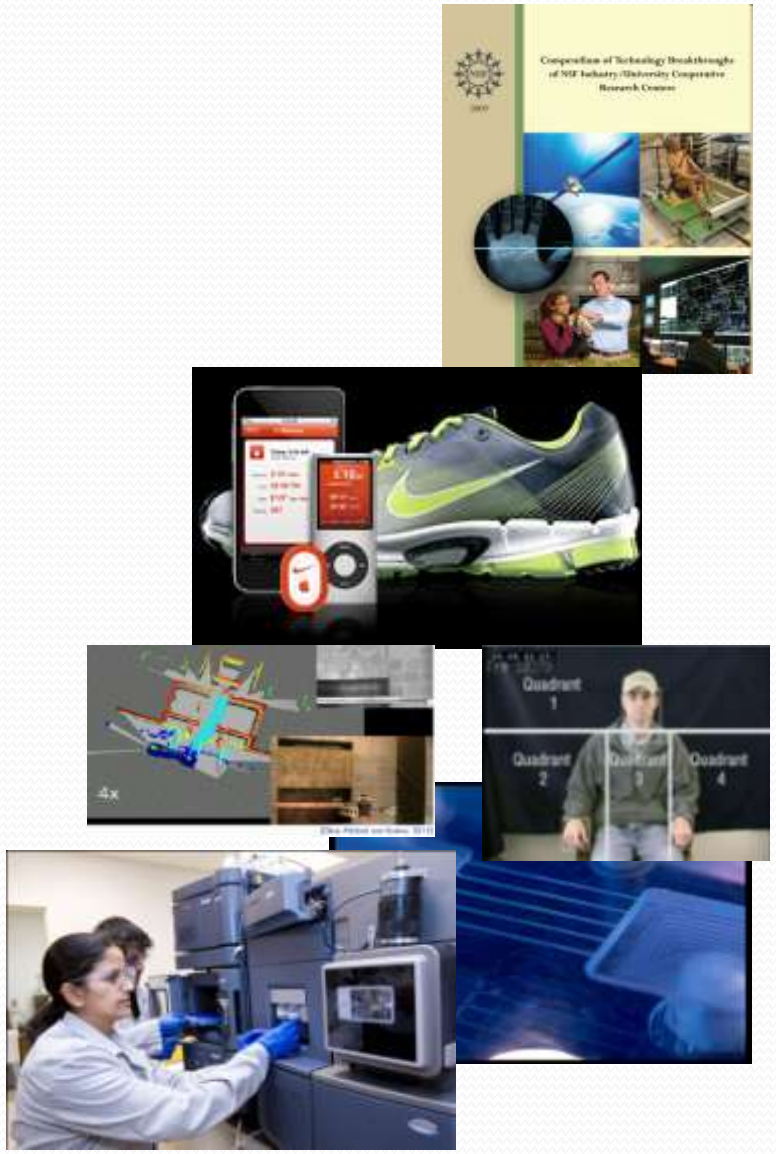
Mission:

- To contribute to the nation's research infrastructure base by **developing long-term partnerships among industry, academe and government**
- To leverage NSF funds with industry to **support graduate students performing industrially relevant research**

Vision:

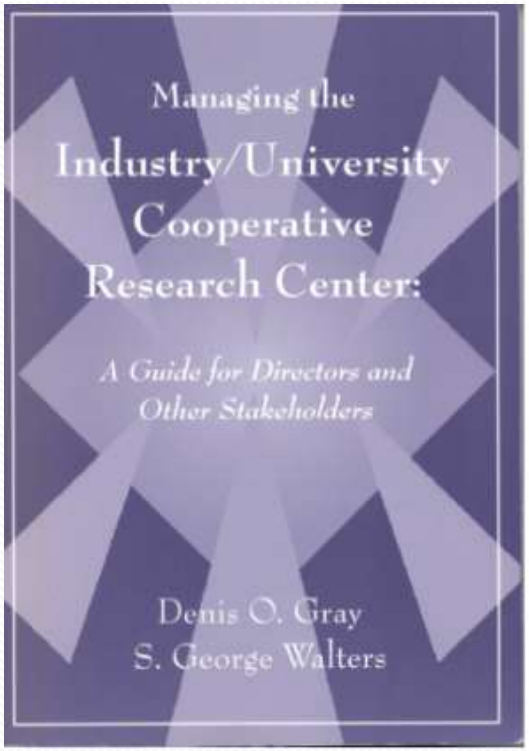
- To **expand the innovation capacity of our nation's competitive workforce** through partnerships between industries and universities

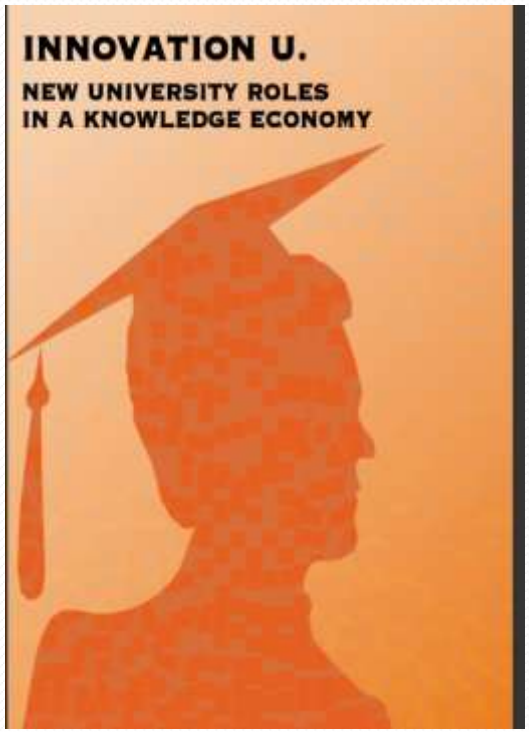
Over 30 years of fostering and growing long-term trusted relationships between Industry and academe based on shared value



CRC Program of Research

- 30 year program of research
- Mixed-methods
- "Insider's view" based on embedded participant observer evaluator



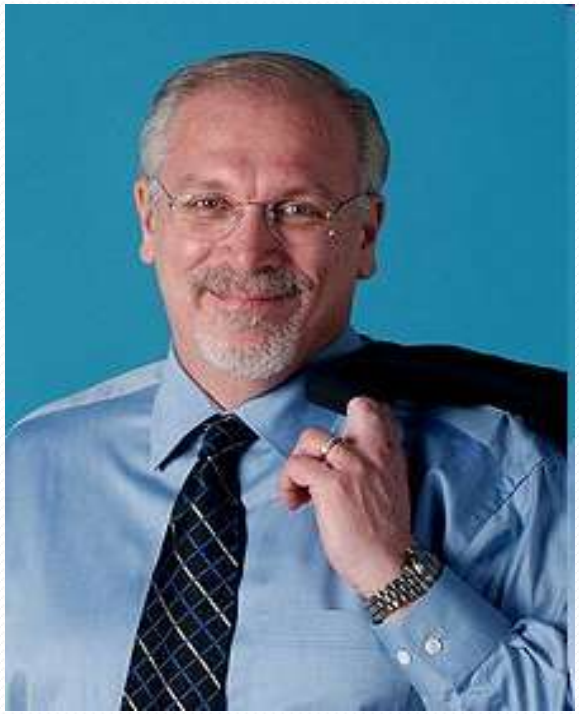


Perspectives on Best Practices for CRCs

Outstanding Leadership is Critical

- administratively challenging
- multi-faceted (research, education, outreach)
- boundary-spanning organizations
- start-up organization

Dr. John White



Dr. Richard DeMillo

Dr. Sarah Rajala

Anticipate and Manage Leadership Transitions

- If you choose or develop great leaders, many will move on
  - CRC director become target for promotions/leadership poaching
  - Directors serve ~ 4 years
    - Significant percentage decline bureaucratic promotions for "science-saturated" leadership positions in centers/institutes (Gray & Rivers, 2012)
- *When the Triple Helix Unravels (Gray et al. 2010)*
  - 6 CRCs that failed after years of successful operation
  - Cascading problems: Botched, negligent leadership transitions were the top factor
  - Good News: If you anticipate and manage these transitions well center can sustain themselves for long time…

Questor: Leadership Transition Done Right!

External stakeholders must have "skin in the game"

- "Skin in the game" = aphorism meaning "to have incurred a monetary/time risk by being invested in achieving a goal"
- Money:
  - Tight budgets it's necessary to show leveraging and plain get work done
  - Great indicator that "technology pull" innovation will happen
- Time (roles):
  - Virtual R&D manager
  - Technology gatekeeper
  - Technology champion

CRCs Must be Learning Organizations

- CRCs operate in highly dynamic environments and are often launched by entrepreneurial but novice faculty managers

- Training:
  - IUCRC program supports annual "Director's Meeting" – very best practice oriented
  - Supported handbook: *Managing the IUCRC*
- Improvement-oriented evaluation
  - Social scientist embedded in CRC who focuses on both process and outcome feedback

Smart funders recognize the administrative burden of running CRCs

- Multi-institutional CRCs can provide stakeholders more value but …
  - Require high levels of administration and coordination
- Cummings research on collaborative teams:
  - Mono-institutional collaborations out performed multi-institutional collaborations
  - Reason: Coordination costs
- Funding agencies need to provide adequate administrative resources
- Funding agencies need to step up funding when economy get tough

Benefits Matter: Investing in human capital (students) is a Key to CRC Longevity

- CRCs offer a portfolio of potential benefits including research, test beds, technology transfer, economic development

- All are valuable but stakeholders may vary in which benefit is most important to them
- McGowen's research on CRC sustainability:
  - Hiring of students by stakeholders was the single most important predictor CRC being sustained (after government funding ended)

Closing Thoughts

- Individual PIs are not on the way to extinction but…
- We need powerful research organizations that match the scope and complexity of the problems we are trying to solve
  - "… truly transformational technological innovation requires synchronous organizational innovation…"
- ATWARM/Questor

Thank you and questions

Acknowledgement: Findings reported in this presentation were supported under grant support provided by the National Science Foundation's Industrial Innovation and Partnership program