An Evidence-Based Assessment of Research Collaboration and Team Science: Patterns in Industry and University-Industry Partnerships

Barry Bozeman
Craig Boardman

Presented by
Susan Winter, UMD
Organization of Scientific Work

- **Old Science**
  - Brilliant Solitary Researcher

- **Modern Science**
  - 90% of research in STEM fields
    - Collaboration
    - Teams
    - Networks
    - Co-authorship
  - Specialized Training
  - Complex problems
  - Collaborative Technologies
  - Shared Resources
  - Public Policies
Collaboration

Definition
- Social processes
- Pool human beings’ experience, knowledge and social skills
- Objective is to produce new knowledge

Collaborators may never meet or interact with one another
Collaboration

- Levels of Analysis
  - Individuals
  - Groups and Teams
  - Organizations

- Study Approaches/Methods Are Diverse

- Sector Differences

- Setting
  - Industry
    - Most Research Collaboration is Here
  - Academia
    - Most Studies of Research Collaboration are Here
Study Focus

✓ Boundary-Spanning Research Collaborations
  ➢ University-Based
  ➢ University-Industry Partnerships
  ➢ Industry Interdisciplinary Research Collaborations

✓ Forms
  ➢ Multi-Discipline, Multi-Purpose University Research Centers
  ➢ R&D Alliances
  ➢ Consortia
  ➢ Joint Ventures
Study Questions

- Influences on research organization productivity and effectiveness
  - Needed organizational structures, policies, practices and resources
    - Human resource management
    - Cyberinfrastructure
  - Effective research management approaches, partnership models and leadership styles
  - Incentives for academics
  - Intellectual property and conflict of interest issues

- Reasons for failure

- Implications for practice
Sampling Frame

- **Empirical Evidence**
  - Quantitative
  - Qualitative

- **Not**
  - Conceptual Models
  - Unverifiable Personal Insights
  - Unsupported Anecdotes or Opinions
Theoretical Frame

- Scientific and Technical Human Capital (STHC)
  - Social Knowledge, Skills and Resources
  - Formal Education, Training, Social Relations
  - Network Ties
    • Other Scientists, Funding Agents, Vendors, Entrepreneurs, Equipment Developers, Technicians, Public Officials, etc

- Collaboration
  - Is Driven By the Need to Pool STHC to Address Challenges
  - Develops STHC
Organizing the Literature

- Inputs and Resources
  - People and Groups
  - Materiel
  - Organizational Capital

- Processes and Activities
  - Project Level Management and Leadership
  - Organization Level Management
Organizing the Literature

- Outputs, Outcomes, Impacts
  - Enhanced Outputs and Impacts
    - Knowledge-Focused, Property-Focused
  - Enhanced Scientific and Technical Human Capital
  - Negative Impacts of Collaboration

- Contextual Factors
  - Sector
  - Function
  - External Resources Environment
Findings

- Engineering Disciplines Most Likely to Collaborate with Industry

- Disciplinary Heterogeneity
  - Increased Productivity
  - Heterogeneity of Incentives and Motivations
  - Hierarchical and More Formalized Organizationally

- Little Research Has Considered Past Productivity as an Antecedent to Collaboration
  - Measurement Issues with Pubs and Patents
Findings

- Heterogeneous Research Experiences
  - Findings are Mixed

- Prior Acquaintance and Trust
  - Very Important
  - Easiest with High Similarity
  - Can Compensate with Formal Structures and Authorities
Findings

- **Tangible Capital**
  - Collaborate to Gain Access to Resources and Capabilities

- **Intangible Organizational Capital**
  - Ability to Coordinate and Manage Diverse Resources
  - Induces Coordinated Problem Solving

- **Most Important Resource and Input to Collaboration**
Management and Leadership

- Project Level Teams Well Studied
  - Best Local Practices May Not Be Robust Across Situations
  - Equifinality (Multiple Possible Practices) So Successful Collaborations Can Differ
Management and Leadership

- Organizational Level
  - Levers for Coordinating Inputs and Resources
    - Goal Congruence, Resource Interdependence, Formal Authorities

- Center Management Underdeveloped
  - Little Research on Effective Responses
Collaboration Assessment

- Products
  - Knowledge Focused
    - Publications, Citations
  - Property Focused
    - Patents, Patent Citations, Commercial Products
  - Capacity Building

- Measurement Weaknesses Abound

- Baseline Data N/A
  - Productivity When Not Collaborating
Who Benefits?

- Increased Science and Technology Human Capital

  - Additive so Improved Individual, Group, Lab, Firm and Research Center STHC
  
  - Mediated by Ability to Deploy the STHC (Intangible Organizational Capital)
Study Questions

- Effective research management approaches, partnership models and leadership styles
  - **Evidence Base Is Minimal**
  - Importance of
    - Monitoring of Terms of Contracts
    - Trust
    - Alliance Management
    - Proximity

- **Management Practices of Collaboration Organizations Often Poorly Thought Out**
Reasons for Failure

- **Poorly Understood**
  - Threshold Effects
  - Interactions Among Variables

- Inherent Instability?

- Intellectual property and conflict of interest issues
  - Alliance Management Skills
Recommendations

- Much Is Well-studied Already
  - Dyads, Triads, Small Groups
  - Co-authorship and Patenting Patterns
More Research Needed

- How Choose Among Available Collaborative Institutions and Modalities
- Institutional Failures and the “Dark Side”
- Science and Technology Human Capital Aspects
More Research Needed

- Management of University-Based Centers
  - Scientists Expected to Become Managers
  - Inadequate Professional Managerial Training

- Field Experiments/Find Patterns Across Instances

- Impact-Focused Research
  - Multiple Informants, Longitudinal
Thank You