Government as Network Catalyst

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Research Questions

• What role can governments play in emerging patterns of cross-sector cooperation?
• How does government intervention influence network formation over time?

• Health - Policy Networks (Provan and Kenis 2008)
• Environment - Collaborative Governance (Ansell & Gash 2008)
• Energy - Network Governance (Klijn and Koppenjan 2015)
• Science & Technology – Research Collaboration (Katz, & Martin 2007; Wagner & Leydesdorff 2009)
Specific Case

• High-Tech Sector 1990-2000
  • Semi-Conductor Industry
    • Highly cooperative, pre-competitive R&D
    • Rapid increase in cooperation at end of 20th century
    • Global network structure
  • Government Intervention
    • Sematech Consortium, DOD/DARPA
      • ~10 years funding (87’-96’)
      • Provided Subsidy to 14 firms, Exclusion of foreign firms
        • Funding and Exclusion removed 96’
Literature

• Governance Networks
  • Public & Private Sector Theory

• Complexity Theory
  • Generic Properties of Networks

• Network Intervention
  • Modes of intervention
Governance Networks

• “stable patterns of social relations between mutually dependent actors, which cluster around policy problems, a policy programme, and/or a set of resources and which emerge, are sustained, and are changed through a series of interactions” - Klijn and Koppenjan (2015:11)
Private Sector Theory

• **Resource-Based View** (Eisenhardt & Schoonhoven 1996)
  • Firms enter alliances to access partner resources
    • Economic, Social, Human Capital; Knowledge, information, etc.

• **Transaction Cost Economics** (Oxley 1997)
  • Firms enter alliances to economize hazards of cooperation
    • Uncertainty, Opportunism
      • E.g. Frequency, asset specificity, hold up
Complexity Theory

“Complex systems are co-evolving multilayer networks”

-- Thurner, Klimek, and Hanel (2018)

• Numerosity & Interaction (Ladyman, Lambert, Wiesner 2013)

• Self-organization & Emergence (Miller & Page 2009)

• Fitness Landscapes & Catalytic Task Spaces (Kauffman 1993)
Complexity & Networks

“A substance which when present in small amounts increases the rate of a chemical reaction or process but which is chemically unchanged by the reaction; a catalytic agent. “ Catalyst -- (OED)

• Preferential Attachment (Newman 2001; Robins, Lewis, Wang 2010)
  • Mathew Effect – “rich get richer”
  • New nodes prefer to attach to nodes that are already well connected
  • Scale free pattern, Non-linear increase in link formation
Network Intervention

“the process of using social network data to accelerate behavior change or improve organizational performance”

— Valente (2012)

• Types of Intervention
  • Adding/Deleting Nodes
  • Adding/Deleting Links
  • Rewiring Existing Links
Hypothesis

• H1: The Semiconductor industry network exhibits preferential attachment, generically
• H2: Government intervention stimulated preferential attachment around a set of public policy relevant target firms, i.e. Sematech members
  • H2a: Strongest PrefAtt effect for Sematech expected during DOD-sponsorship period
Data, Variables, Methods

• IC Insights- Longitudinal data 1991-1998
  • Contractual R&D alliances: co-dev, cross-license, IP exchanges, joint-venture
  • Sematech: 8-16 members depending on year

• SIENA model (longitudinal network analysis)
  • Primary variables
    • H1:Popularity – Well-connected firms form more ties over time (preferential attachment).
    • Sematech – Sematech members compared to non-members form more new ties.
    • H2:Popularity*Sematech – Sematech stimulates preferential attachment?
  • Control variables
    • Transitivity, country main effects & homophily, firm size main effects & homophily, & Sematech homophily

• Time Period Sub-samples
  • Early 91-93, Maturity 93-95, Post-DOD phases 95-98
Results

- **H1: Popularity**
  - consistent preferential attachment effect
- **H2: Sematech Interaction**
  - stimulates preferential attachment in the early years
  - but has a second effect from 1993-1995
- **Controls**
  - Transitivity in 2nd and 3rd period
  - No country difference
  - larger firms tend to form more ties
  - Differences in firm size leads to higher likelihood of a tie

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<td>1.31***</td>
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***p < 0.001, **p < 0.01, *p < 0.05
Discussion

• H1: Support for general PrefAtt effect
• H2: Mixed support for targeted (Sematech) PrefAtt effect
  • Time dependent PrefAtt effect
    • Detected initial PrefAtt affect
    • Reversed during maturity period
    • Post-DOD/period – No PrefAtt affect
• Target Firms benefit from initial intervention
  • But then focus on their established alliances, reduce new alliance formation
  • Consolidate local clusters into established alliance cliques
Future Research

Developing a *theory*: government-based network intervention

• As a catalyst for cooperative activity
  • For resource & knowledge recombination, for public ends

• What are the limits of intervention?
  • Are (PrefAtt-based) interventions more likely to succeed in incipient networks?
    • Less likely to succeed in established networks
  • Are there differential effects of focusing on small versus large firms?
    • Or combinations of small-large firms
  • Are there diminishing returns to cooperation?
    • Upper limit on cooperative behavior, cooperative capacity.
Thank You!