Leadership: A Network-based View for Competitive Advantage

Dr. Dale L. Moore
Founder and President
The Moore Group LLC
• Today, the complexity and pace of the strategic environment is growing rapidly and requires new ways to view the world.
• Leaders need new models and lenses to help them make sense and give meaning to these dynamics and their complexity.
• Network science has evolved as a powerful tool to help analyze and evaluate these complex dynamics to help leaders to see, learn, think and better understand what is really going on internal and external to their organization.
• The science of networks provides the foundations for systems thinking, big data analytics and complexity science – both of which are powerful tools in the leader’s toolbox.
• Viewing the world through the lens of networks can help provide valuable insights for competitive advantage.
Human Disease Network
The Millennium Project
15 Global Challenges

http://www.millennium-project.org/projects/challenges/
Good for: Exploring interactions and interdependencies across organizational silos
Complexity Process Swimlane Map

Notional Example: RFP Development

<table>
<thead>
<tr>
<th>Program Mgr</th>
<th>Request</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>SOW</td>
<td>Technical Approval</td>
</tr>
<tr>
<td>Logistics</td>
<td>SOW</td>
<td>Review</td>
</tr>
<tr>
<td>Contracts</td>
<td>Type ID</td>
<td>RFP Format</td>
</tr>
<tr>
<td>Legal</td>
<td>Review</td>
<td>Final Review</td>
</tr>
</tbody>
</table>

Good for Identifying How Different Organizations Do the Same Things – Best Practices ID & Standardization

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Value Stream Map (notional example)

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John Boyd’s OODA-Loop
A Review of the Ecosystem Concept

Toward Coherent Ecosystem Design

M. Tsujimoto et al.

Technological Forecasting & Social Change 136 (2018) 49–58
Leveraging Complexity for Ecosystem Innovation

Fig. 1. The growing complexity of interactions and integration of activities from networking to collaboration. Source: adapted from (Camarinha-Matos and Afsarmanesh, 2008b, p. 312).
Leveraging Complexity for Ecosystem Innovation

M.G. Russell, N.V. Smorodinskaya

**Fig. 2.** Differentiating innovation capacity of business networks by their internal interaction complexity. Source: authors’ elaboration based on literature on networks, clusters and innovation.

**Triple Helix = Business Sector + Knowledge Generating Sector + Public Sector**
Leveraging Complexity for Ecosystem Innovation

Innovation Ecosystems are Complex Adaptive Systems

- Externally Sensing/Open
- Network ‘Non-Linear’ Effects
- Non-Deterministic
- Iterative Feedback Loops
- Real-Time Adaptable
- Self-organizing
- Self-Regulating
- Self-Governing
- Scales-Up/Scales-Down Easily
- Interaction Dependent
- Aggregated Behaviors
- Emergence Enabled
- Holistic & Synergistic

Tribe Helix = Business Sector + Knowledge Generating Sector + Public Sector

Fig. 3. The complexity of an ecosystem in a regional innovation cluster.
Source: authors' design, based on: (Napier and Kethelz, 2014).
AMFG White paper – The 3D AM Landscape

BREAKING DOWN THE ADDITIVE MANUFACTURING LANDSCAPE

Of the 171 organisations featured in the AM landscape, there are:

- 92 Hardware manufacturers
- 32 Software vendors
- 29 Material developers and suppliers
- 11 Research institutions
- 5 Post-processing system manufacturers
- 3 QA and process inspection companies

Exploring Innovation Ecosystems Across Science, Technology, and Business: A Case of 3D printing in China
Xu, Wu, Minshall, Zhou (2018)
Exploring Innovation Ecosystems Across Science, Technology, and Business: A Case of 3D printing in China
Xu, Wu, Minshall, Zhou (2018)

Fig. 6. Cross-layer analysis of integrated value chain of 3D printing in China.
Exploring Innovation Ecosystems Across Science, Technology, and Business: A Case of 3D printing in China
Xu, Wu, Minshall, Zhou (2018)

Fig. 10. Cross-layer analysis of collaborative network of 3D printing in China.
Strategic Organizational Networks

Closed Network

• Low Performance
• Few independent sources of info
• “Effective size” is smaller
• Little Diversity (more homogeneous)
• Dense Internal Flows

Entrepreneurial/Open Network

• High Performance
• Many independent sources of info
• Increased opportunities
• “Effective size” is greater
• Greater Diversity
• External plus Internal Flows

Krebs, Knetmap.com
Inflow SNA Software
Metcalfes Law

The value from the network is proportionate to the number of nodes (n) squared.

Value $\sim n^2$

Other factors such as connection quality, speed, trust, topology, processing time, subgroups etc. all play strong roles.
Single Node w/5 Links
Egocentric, Degree = 5

Undirected Dyad

Directed Triad

Weighted Undirected Triad

Centralized Hub
Sociogram
“Star” Topology

Clustered
Strong Ties
Frequent Interaction

Clustered
Weak Ties
Infrequent Interaction

Boundary Spanner

Structural Hole

Small Worlds Network

Scale-Free Network

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## Key Network Graphing Terms and Concepts

<table>
<thead>
<tr>
<th>Term/Variable</th>
<th>Description</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node or Actor</td>
<td>Entity, Object or Person</td>
<td>Number of Nodes Determines the Complexity</td>
</tr>
<tr>
<td>Link or Edge</td>
<td>Connection</td>
<td>Determines Relationship</td>
</tr>
<tr>
<td>Dyad</td>
<td>Two Nodes of Actors that are Linked</td>
<td>Simple Relationship</td>
</tr>
<tr>
<td>Triad</td>
<td>Three Nodes or Actors with Possible Links</td>
<td>Six Possible Combinations</td>
</tr>
<tr>
<td>Degree</td>
<td>Number of links to a Node</td>
<td>Extent of Connectivity</td>
</tr>
<tr>
<td>Centrality</td>
<td>Closeness to the Center</td>
<td>Extent of Network Access</td>
</tr>
<tr>
<td>Path Length</td>
<td># of Links Between Two or More Nodes or Actors</td>
<td>Measure of Centrality and Connectivity</td>
</tr>
<tr>
<td>Egocentric Graph</td>
<td>Network around single node or actor</td>
<td>Single Entity-level View</td>
</tr>
<tr>
<td>Sociometric Graph</td>
<td>Multi-node network w/o central node</td>
<td>Network-level view that illuminates topology</td>
</tr>
<tr>
<td>Directed Graph</td>
<td>Link or relationship with a directional flow</td>
<td>Indicates pathways and directionality</td>
</tr>
<tr>
<td>Undirected Graph</td>
<td>Link w/o a direction or flow</td>
<td>Indicates Links Only</td>
</tr>
<tr>
<td>Weighted Graph</td>
<td>Link with an attribute strength depicted</td>
<td>Indicates Extent of Relationship or Flow</td>
</tr>
<tr>
<td>Centralized Graph</td>
<td>Network with discernable hub</td>
<td>Depicts Area of Network Focus</td>
</tr>
<tr>
<td>Decentralized Graph</td>
<td>Network with no discernable hub</td>
<td>Network Topology w/o Centralized Focus</td>
</tr>
<tr>
<td>Distributed Graph</td>
<td>Network with distributed architecture</td>
<td>Balanced Node and Link Distribution</td>
</tr>
<tr>
<td>Hub</td>
<td>Center of the Network</td>
<td>Central Focus of Network</td>
</tr>
<tr>
<td>Clustering</td>
<td>Groupings of Nodes</td>
<td>Areas Where Grouped Activities are Occurring</td>
</tr>
<tr>
<td>Density</td>
<td>Degree of existing linkages compared to maximum potential linkages</td>
<td>Extent of Linkages among Nodes or Actors</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Top-Down/Bottom-Up Information Flow Architecture</td>
<td>Command and Control Architecture</td>
</tr>
<tr>
<td>Heterarchy</td>
<td>Multi-level/Inter-level Information Flow Architecture</td>
<td>Lateral and Ubiquitous Flows across the Network</td>
</tr>
<tr>
<td>Structural Holes</td>
<td>Gaps in the network</td>
<td>Locations where New and Novel Information, Value or Latent Potential Exists</td>
</tr>
<tr>
<td>Small Worlds</td>
<td>Networks with short path lengths and high clustering</td>
<td>Network Groupings in Clusters often Connected to Larger Networks</td>
</tr>
<tr>
<td>Scale Free</td>
<td>Network with power law distribution of node degrees</td>
<td>Resilient Network Topology</td>
</tr>
</tbody>
</table>

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A SOCIAL NETWORK ANALYSIS OF THE NATIONAL MATERIALS COMPETENCY AT NAVAL AIR SYSTEMS COMMAND

by

Dale L. Moore

September 2002

Thesis Advisor: Gail Fann Thomas
Thesis Associate Advisor: Mark E. Nissen

Approved for public release; distribution is unlimited.
Baseline Lay-Out

Baseline Structural Layout

Figure 6. Baseline Structural Layout for InFlow 3.0 Visualizations
Figure 8. National Level 3 All Question/All Responses with Frequency Weighting and Symmetric Ties Only
Converged/Diverged Emergent Structure

Kamada-Kawai spring embedder algorithm

Site Leadership

Figure 9. National Level 3 All Questions/All Responses with Frequency Weighting and Symmetric Ties Only Arranged Emergent Structure
Figure 10. National Level 3 All Questions/Responses 3 to 5 Frequency Weighting, One and Two-way Directionality
Notable Impediments to Knowledge Flow

Physical/Organizational Constraints

- Time Availability
- Resources Constraints
- Lack of Cross-site Video-teleconference Capability
- Competition for Resources
- Geographically Dispersion
- Structural Difference: Hiring, Awards, Promotions, Funding, Code Assignments, Performance Metrics
- Infrequency of Management-level Interactions
- Inadequate Opportunities for Formal or Informal Exchange
Notable Impediments to Knowledge Flow

Social Constraints

- Inadequate Knowledge and Awareness of Individual and Site Skills and Capabilities
- Competition for Resources
- Resistance to Change
- Lack of Trust and Respect
- Inadequate Awareness of Lessons Learned
- Not Knowing Others: Expertise, Capabilities, Programs
- Reluctance to Problem Solving by “Committee”
- Inadequate Cross-site Support, Endorsement and Acknowledgement
Recommendations to Improve Knowledge Flow

Formal and Informal Relationship Building

- Create Cross-site Enterprise Teams
- Develop More Cross-site Cooperative Programs
- Provide Cross-site Training
- Increase Rotational Assignments between Sites
- Reduce e-Mail, Emphasize Phone Conversations
- Increase One-to-One Interaction
- Educate Organization on Competency Charter, and Competency Operating Guide (COG)
- Increase Formal/Informal Interactions on Technical Issues and Policies
- Engage Working Level on National Projects
- Develop Friendships Throughout National Organization
- Improve National Competency Training
- Continue National Air Vehicle Conference Involvement
- Improve Sharing of National Competency Capabilities
Recommendations to Improve Knowledge Flow

Organizational Processes and Policies Development

- Establish Common Organizational Codes
- Highlight Best Examples of Teamwork
- Seek Level 2 Organizational Buy-in for Competency Operating Guide (COG)
- Establish National “Common” Goals
- Obtain National Level 2 Endorsements for COG
- Develop a Resume Directory
- Post National Competency Requirement, Needs, and Goals
- Improve Definition of Roles and Responsibilities
Recommendations to Improve Knowledge Flow

Technology Enabling Enhancements

- Provide Enhanced Collaborative Environments
- Schedule Regular, Planned and Coordinated Video-teleconferences
- Implement the Aerospace Materials Technology Consortium Tele-collaborative Web Portal
- Conduct National Level 4 Meetings (video teleconference enhanced)
- Create Common Databases
- Hold Regular MMB Meetings (site and video teleconference)
- Establish a National Web-site
SECI Model of Knowledge Dimensions
(Ikujiro Nonaka)

Legend
i - individual
g - group
o - organization
Complexity science sees leadership as an influence process that arises through interactions across the organization, leveraging diverse sets of knowledge, ideas, and perspectives to create new knowledge and innovation.

The process of innovation, associated with emergence and the unfolding of new and novel concepts and ideas across the organization, at every level, as has been described by the term “generative leadership.”

Complexity science focuses on the interactions within the system or organization to enable the emergence of the new and novel, ultimately to build an ecology for innovation through social networks.

Contemporary practices for knowledge creation and ideation include crowdsourcing and open innovation concepts which are rooted in complexity science and complexity leadership practice.

“the true catalyst of innovation are the web of relationships – in the nexus of interactions.”

Goldstein, Hazy and Lichenstein (2010)
Leadership is About Designing Systems for Emergence

In designing for emergence, an important step is distributing intelligence, which involves making information widely available to everyone.

Openness and accessibility becomes a value in organizations designed for emergence because information is the lifeblood of organizations, the energy that enables innovation and new ideas.

Thus managers who design for emergence do not censor information; rather they unleash it into the organization knowing that some of it will create disequilibrium, a necessary condition for organization growth and learning.

When organizations are designed for emergence rather than fit, or for specific outcomes, intelligence is widely distributed, conversations multiply, rich connections among people abound, tension drives innovations, and patterns embody meaning that help guide the organizations.

Complex Systems Leadership Theory
Hazy, Goldstein & Lichtenstein (2007)
The ability to “see” and analyze what is happening within organizations through a network-based lens can provide significant insights and foresights leading to more competitive postures and positions.

Taking a network-based view can enhance organizational agility, adaptation to the environment, and help organizations anticipate and better position themselves for the future.

Ultimately, a network-based view provides important insights and perspectives at all levels of leadership - supporting the cultural transformations and technological paradigm-shifts deemed essential for sustaining organizational competitiveness.
Questions?

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