TOPIC: Network Models of Regional Innovation Clusters and their Influence on Economic Growth (information item)

COMMITTEE: Economic Development and Technology Commercialization

DATE OF COMMITTEE MEETING: June 18, 2013

SUMMARY: Universities play a critical role in the innovation ecosystem and the topic examines models for stimulating innovation and regional economic development. Network models can identify clusters where innovation and entrepreneurial efforts may be targeted and will help focus resources on high-yield economic activities, and measure the results of these activities more effectively.

ALTERNATIVE(S): This item is for information purposes.

FISCAL IMPACT: This item is for information purposes.

CHANCELLOR’S RECOMMENDATION: This item is for information purposes.

COMMITTEE RECOMMENDATION: DATE:

BOARD ACTION: DATE:

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Network Models of Regional Innovation Clusters and their Influence on Economic Growth

Using Big Data and Social Network Analysis in Planning and Economic Development

Regents’ Committee on Economic Development and Technology Commercialization
June 18, 2013

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Today’s Talk

1. Regional Innovation Clusters: Why current metrics don’t tell us what we need to know - and how to fix it

2. Innovation Networks & economic growth (dissertation)

3. Creating new tools and new metrics (current research)

4. Maryland - work in progress

5. Discussion: What’s possible and how DBED can help

http://www.terpconnect.umd.edu/~dempy/docs/md05162013.pptx
Innovation Driven Growth
a simple stylized model

Basic Research

Invention

Development

Production

Product Improvement

Production Employment

Research Parks
Incubators

Economic Development Response

Business Attraction
Business Expansion

Business Retention
Innovation Driven Growth

how do we measure it now?

Basic Research

Invention

Development

Production

Product Improvement

Production Employment

First Employment Data Available

Clusters defined by established Industries, not emerging technologies

Regional Cluster Analysis

Innovation based Production

years

~ 5 years +/-

Bottom Line

Industry clusters -by whatever name- reflect the state of innovation about five years ago
Innovation Driven Growth

gaining early actionable intelligence

Innovation Driven Growth

Innovation based Production

Basic Research

Invention

Development

Production

Product Improvement

Production Employment

First Employment Data Available

A New Approach

NIH Awards
NSF Awards
NASA Awards
State Investment Data
Available Data Sets

Innovation Network Analysis
Patents
SBIR Awards

~ 5 years +/-

~ 4 years +/-

This approach can shorten the lag between real-time innovation and actionable economic development intelligence by several years while also revealing rich talent pools, emerging technology trends, and specific E.D. targets.
Regional Innovation Clusters are Complex Systems

Complex Systems:

- involve many interconnected or interacting parts
- exhibit *emergence* - behaviors that cannot be understood or predicted by looking at the components of the system alone
- Emergence is based on a few simple rules of interaction
- Networks are ideal for modeling complex systems

Georgia Innovation Network 2008 – 2010
Locations of selected actors
Networks & Network Models

Networks made up of nodes and links (ties, edges)

Nodes are actors, agents or *objects*
- People
- Organizations
- Agencies
- Places *
- documents

Links are the relationships that connect the nodes
Analyzing Regional Innovation Clusters

Extract relationships from patent and research grant data - about 7M records

Use social network analysis (SNA) to analyze and visualize network structure

Theoretical grounding in sociology and science of complexity

Behavior of the core network guides behavior of whole network

Clustering based on intensity of relationships

This reveals emerging technologies - what people and firms are working on - and specialized talent pools
1. Innovation networks are (or could be) drivers of economic development in tier 2 manufacturing regions.

2. Innovation is more global and more interconnected than previously thought.

3. Network structure influences manufacturing employment growth within about 3 years of patent application (more for med & pharma).

4. Economic development strategies that enhance innovation networks may be a cost-effective alternative to current capital intensive strategies.

Dissertation Conclusions

Network graphics created with NodeXL
This example looks at US – Canada cross-border innovation around the great lakes. How do we quickly find, simplify and understand the driving innovation clusters in this region?
Great Lakes Regional Innovation & Manufacturing Clusters (core)
Weak tie sub-networks are identified; weak ties represent similarities in patent technologies. May also represent the "commonalities and complementarities" that contribute to industry clusters. (click to zoom)
Quickly Identifying Key Innovators

This looks like a local concentration of inventive talent - let's take a closer look.
Identifying Local Talent Pools

Looks like a high potential core talent cluster of about 30 inventors within Kent & Ottawa Counties - about a 15 mile radius - with connections to about 20 firms. (click to zoom)
What this means for economic development

This approach gives you a list of firms to go talk to and specific things to talk with them about. It also identifies specific talent clusters. These are things that traditional cluster analysis has never done.

These represent immediate and specific economic development opportunities that can have a positive, measurable influence on manufacturing employment.
Changes in the Maryland Network

**Why do we see changes?**

- Still work in progress
  - Data issue?
  - Specific to type of research?
  - Lagged influence of recession?
  - Could be…???
- May represent structural changes

**What does it mean?**

- If data issue or anomaly
  - Nothing
- If type of research or recession influence – understanding of those dynamics
- If structural
  - Diminished benefits of agglomeration
  - Limited leverage of R&D
  - Economic Development more difficult
What’s Next?

Current Research

• Database and web interface development
• Field testing & research
• Urban planning and economic dev. Apps
• Document and teach methods

• Funded by EDA and UMD Office of Research

Future Possibilities

• Workforce Development applications
• Integration of additional data sources
• Sensitivity analysis and predictive models
• Other applications?

• Pending proposal with DLLR / DBED
More Examples
New Jersey Core Innovation Network 2011 - 2013
Fruchterman-Reingold layout
In NodeXL

Grid layout in NodeXL
University of Maryland
Human Computer Interaction Lab
Influence on NSF Network 2000 - 2011