Hard measures and soft issues: 
a potential model for incorporating metrics 
into cluster based analysis 

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Tara Procyshyn and Cami Ryan
Narrative——Metrics

- Primarily *soft* data -- qualitative
- Data used mostly to support narrative stories
- Some qualitative data used to:
  - correlate firm performance
  - estimate national economic performance
Mainly institutional aspects have been analyzed in cluster analysis but...

Functional aspects are also implicit integral parts of the cluster dynamic

Interaction creates the regional picture, with each component a separate piece in the “cluster jig-saw” (Martin & Sunley 2002).
The Metrics “Puzzle”

“Pieces”:

- Theodorakopoulous & Kalaitzandonakes (2001)
  - Density and Centrality
  - Activity Based Analysis (ABA) approach
A comparison of EU & US public-private knowledge networks in plant biotechnology

Utilize measurements of density and centrality

Benefit: strong basis for comparison!
Ryan & Phillips
Activity Based Analysis

Hybrid Activities

Science

Technology

Collective
Methodology

Density and centrality measures allowed to quantify and analyze relations at the cluster level.

We expand measures to include functional parameters:


N = 95

Eight core actors were analyzed.
## Organizational Breakdown within Region

<table>
<thead>
<tr>
<th></th>
<th>Whole Network (N=95)</th>
<th>Core Network (n=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public (39%)</td>
<td>Private (40%)</td>
</tr>
<tr>
<td><strong>Whole Network</strong></td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td><strong>Core Network</strong></td>
<td>5 (63%)</td>
<td>---</td>
</tr>
<tr>
<td><strong>Collective</strong></td>
<td>10 (10.5%)</td>
<td>1 (12%)</td>
</tr>
<tr>
<td><strong>Quasi</strong></td>
<td>10 (10.5%)</td>
<td>2 (25%)</td>
</tr>
</tbody>
</table>
Network Density

Density - “characteristic of the entire network, is a proportion that is calculated as the number of all ties occurring the matrix divided by the number of all possible ties.” (Knoke and Kuklinski 1982)

\[ \text{Density}_{\text{Local}} = \frac{2L}{N(N-1)} \]
Density Results

Across all functions, core actors (8) have an average of 85 connections.

Overall network density is 7.59% (678 of a possible 8,930).

Compare with Theo & K (2001) results:

<table>
<thead>
<tr>
<th></th>
<th># Links</th>
<th>Core Network Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>9</td>
<td>9%</td>
</tr>
<tr>
<td>EU</td>
<td>37</td>
<td>59%</td>
</tr>
</tbody>
</table>

Procysyn & Ryan
# Aggregate* Network Density by Function

<table>
<thead>
<tr>
<th>R&amp;D</th>
<th>Services</th>
<th>Financial</th>
<th>HQP</th>
<th>Networking</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3%</td>
<td>1.9%</td>
<td>1.4%</td>
<td>1.8%</td>
<td>8%</td>
</tr>
</tbody>
</table>

* limited to core actors

Procysyn & Ryan
Centrality

☞ Refers to the importance of a particular actor and the degree of centralization of an entire network

☞ Measures are used to “describe and measure properties of actor location in a social network” (Wasserman and Faust 1994)

\[
\text{Centrality} \approx \frac{x_{ij}}{N - 1}
\]
## Centrality by Functional Linkage

<table>
<thead>
<tr>
<th></th>
<th><strong>Ranges</strong></th>
<th><strong>Actors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R&amp;D</strong></td>
<td>0 – 39%</td>
<td>U of S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NRC-PBI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NRC-IRAP</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td>0 – 43%</td>
<td>NRC-IRAP</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td>0 – 34%</td>
<td>NRC-IRAP</td>
</tr>
<tr>
<td><strong>HQP</strong></td>
<td>0 – 27%</td>
<td>SRC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NRC-IRAP</td>
</tr>
<tr>
<td><strong>Networking</strong></td>
<td>0 – 97%</td>
<td>AgWest</td>
</tr>
</tbody>
</table>
### Dilution Factors

**“Noise”**

<table>
<thead>
<tr>
<th>PEOPLE</th>
<th>FIRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilution</td>
<td>$? \frac{N}{CommFirmPop^*} \neq \frac{95}{12,000}$</td>
</tr>
<tr>
<td>Dilution</td>
<td>$? \frac{N}{CommInstPop^*} \neq \frac{3000}{213,000}$</td>
</tr>
</tbody>
</table>

**Boffins' Factor**

$\frac{\# of Employees In Cluster}{Working Population} = \frac{3000^*}{80,000}$

*Beggs 2003 and authors*
Clusters & the Industry Life Cycle

☞ R&D – Commercialization – Adaptation – Adoption

Graph showing the life cycle of clusters with stages R&D, Commercialization, Adaptation, Adoption.
Applications

- Dependent variable against which we can evaluate answers to the survey
- Apply across multiple clusters or innovation systems