The visible hand of cluster policy makers: An analysis of Aerospace Valley (2006-2015) using a place-based network methodology

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Work in progress – preliminary results
A brief history of clusters

• From Marshall to Porter (in economics and business studies)

• Saxenian and the Silicon Valley (in sociology)

• Cooke, Asheim (and others, in complexity and evolutionary theories in geography)

→ Networks and geography matter for innovation

• Secrets do not flow in the air
  
  – Local Knowledge Spillovers (LKS) and the structure of knowledge flows (Breschi and Lissoni, 2001)

  – A first attempt of cluster analysis using network theories and empirics: Owen-Smith and Powell, 2004 (Boston biotech cluster)
The rise of cluster policies

- Institutional reports diffusion in the 2000s (OECD, EU, WB)
- European cluster policy group (funded by EU)
- Several national and regional initiatives
  - Basque country cluster policy
  - Bavaria cluster policy
  - Vinnova program of cluster development in Sweden
  - French cluster policy (Pôle de compétitivité)
  - ...
The aim of cluster policies and the design of collaborative incentives

Cluster policies aim at fostering local innovation systems. Repair network failures.

The idea: an additional source of R&D productivity at the meso level remains hidden behind the simple aggregation of the innovative capabilities of each organization considered in isolation.

Cluster policies are mainly based on public collaborative incentives in order to develop local knowledge networks (Uyarra & Ramlogan, 2012).

But subsidizing a set of “good collaborations” does not necessarily imply shaping “good networks”.

Two aims for policy makers:
• Filtering and selecting knowledge collaborations in clusters
• Monitoring connectivity and the structural properties of networks in clusters
Filtering and selecting collaborations in clusters
Network “failures”

Four main relational failures and selection criteria on clusters policies

• Public knowledge dissemination and absorption
  Tacit knowledge and cultural divide between public and private R&D communities (Hemmert et al., 2014)

• SMEs entry and connectivity
  Cluster long run performances depend on the renewing degree of firms’ demography

• Local cohesiveness and global accessibility
  Clusters aggregate performance depends both of their internal structuring and their degree of embeddedness in global networks (Owen-Smith and Powell, 2004)

• Technological relatedness, diversification and new growth paths
  Cluster dynamics are not never-ending stories of industrial specialization, nor pure random processes of jump from one industry to another
Monitoring connectivity and the structural properties of networks in clusters

Clusters policies: the “visible hand” taking the control of Local Knowledge Spillovers?

• Connectivity versus density
  Distribution of links matters more than the number of links (Efficiency) (Crespo et al., 2016)
  Cohesiveness and bridging have different roles in a innovation network, and both are necessary.

• Degree distribution and correlation
  – Hierarchy
    An increasing hierarchy in a cluster is a good indicator of its growing maturity.
    In terms of industrial organization, growing capabilities of central organizations to manage
    the systemic process of innovation with a dynamics of new entries (Klepper, 1996)
  – Assortativity
    Is an indicator of the knowledge pathways between big organizations and less central
    ones, such as spinoffs and SMEs
    Is an indicator of the overlap degree between emergent and mature markets
Monitoring connectivity and the structural properties of networks in clusters

Source: Crespo et al., 2014
The context of Aerospace Valley

Historical cluster
  Oligopolistic companies in aeronautic, space, and embedded systems industry.
  Universities and leading engineering school in aeronautics.
  Mature markets and the need for regional diversification and relatedness
  In 2005 becomes a “Pôle de compétitivité” (Institutionalization of the cluster)

National cluster funding policy: the two stages selection process
  Cluster certification. (First filtering process)
  National selection. Public funded research consortia (FUI and ANR programs)
  (Second filtering process)

The changing guideline of collaborative incentives over the period
  • First phase: fostering local public/private R&D networks
  • Second phase: providing incentives and support to SMEs
  • Third phase: Fostering pipelines
    • National coordination
    • Diversification
Data collection and methodology (1)

<table>
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<tr>
<th>Cohort#</th>
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<th>#projects</th>
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<td>Cohort#2</td>
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<tr>
<td>Cohort#4</td>
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<td>62</td>
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Data collection

- Collaborative R&D projects funded by FUI and ANR from 2006 to 2015, divided into 4 time windows (cohorts)
- Certified by Aerospace Valley cluster and selected by FUI of ANR
- Data disambiguation (identification of plants and departments)
- 248 projects
- 4 types of organizations (big companies, SMEs, PRO, others)
- Binary location (in or out)
- Multi-cluster certification
Data collection and methodology (2)

Methodology

Overpassing bias and capturing groups’ behavior when using consortium data in network analysis

Limitations of 2 and 1-modes networks analysis (big noise due to heterogeneity in consortia size) (Uzzi & Spiro, 2005) Risk of misinterpretation in degree-based indicators.

The opportunity of structural equivalence analysis [Lorraine & White, 1971; Burt, 1982]

• Structural equivalent organizations have similar patterns of relations to others, and thus share and face same relational resources and constraints (Pallotti & Lomi, 2011).
• They tend to disseminate knowledge in a same way not only because they influence each other by direct ties, but because they face similar dependencies and relational contexts.

Identifying groups-behavior based on structural equivalence: The place-based network methodology (Pizarro, 2007)
How to deal with groups’ behaviors: the place-based network approach?

Let us start by considering a finite set of organizations $I = \{i_1, i_2, i_3, ... i_p\}$, each affiliated to one or more projects belonging to the set of projects, noted $C$ (in order to consider each project as a fully interconnected clique), with $C = \{c_1, c_2, c_3, ... c_n\}$.

We can define a place $P_i$ of an organization $i \in I$ as a subset of $C$ such that at least one of the organizations of $I$ belongs to every one and only to the projects included in the subset $P_i$. Therefore, for $i \in I$, $P_i = \{c_j \in E : i_i \in c_j\}$.

If two organizations $i, j \in I$ have the same subsets of $C$, they belong to the same place. Places become the new nodes of the network, that are connected by a relation $R$ when $P_i \cap P_j \neq \emptyset$.

Therefore, the set $P$ of all the places defined in $C$ and the set $R$ of their relations constitute the network of places.

This set $P$ can be also defined as a set $P(k,l)$, where $k$ represents the number of projects in which organizations are involved together, and $l$ the number of organization belonging to the place.
Data collection and methodology (4)

<table>
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<th>Organizational network (COH4)</th>
<th>Network of places (COH4)</th>
</tr>
</thead>
</table>

1-mode network turned into network of places (Aerospace Valley cluster, cohort #4)
Preliminary results (1)

Degree Correlation & Distribution

Degree
- Correlation
- Distribution

Cohort
- COH1
- COH2
- COH3
- COH4
Preliminary results (2a)

Out to explain the changing structural properties?

Cohesive blocks analysis: Method of determining hierarchical subsets of graph vertices based on their structural cohesion (Moody & White, 2003; Powell et al., 2005)
Support the idea of a more distributed influence in the coordination of R&D activities over the period and a gradual shift in the balance between closure and bridging. Explain why in the last period hierarchy decreases at the same time than assortativity.
Core: Organizations in places with more than one project. Structure the R&D network

Elite: Highly connected organizations. Main R&D activities of the networks

Changes in the core and elite composition $\rightarrow$ higher implication of SMEs in the overall coordination over time
Preliminary results (4)

Organizations linking “Diversified projects”

The growing role of SMEs in pipelines
Conclusion

- The innovative capabilities of clusters do not depend only on the weight of big (and oligopolistic) companies, SMEs (nascent ones) and public research organizations, but also on how they interact and structure knowledge flows together.

- Here, by focusing - rightfully – on incentives related to the geographical openness (more pipelines) and to the institutional demography (more SMEs), policy makers provided public incentives for more open and creative networks, with a less centered control, and more connections between core and peripheral organizations.

- This strong support for SMEs has adversely affected the entry of public research organizations over the period → Risk of changing the balance between exploration and exploitation.

- Do cluster policies have to deal with both, or do they have to concentrate incentives on exploration?
Thank you!