Academic inventors and patenting activities: a case study on University-owned and University-invented patents in two Italian universities

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OUTLINE

- AIM OF THE STUDY
- BACKGROUND LITERATURE
- THE CASE STUDY and DATA
- METHODOLOGY
  - Blockmodeling and and Brokerage Roles (key actors)
  - Qualitative analysis on key actors via in-depth interviews
- RESULTS
- CONCLUDING REMARKS
AIM OF THE STUDY

- Understand the **patenting activity** of the two universities looking at both **University owned** and **University invented patents** in terms of the network of collaboration and pattern of knowledge diffusion.

- Focus on University-Industry interactions jointly considering **inventors** and **assignees** (i.e., Academic Inventors and external organisations)

- To describe different strategies of interaction identifying different **sub-networks typologies** generated by academics patenting with their own university or with other subjects
ON ACADEMIC PATENTS AND SOCIAL NETWORK ANALYSIS

- **Academic patenting in Italy** and Europe: the importance (or the role) of University invented patents
  - Meyer, 2002; Balconi et al. 2004; Balconi and Laboranti 2006; Crespi et al. 2006; Lissoni et al. 2008; Thursby et al. 2009; Geuna and Rossi, 2011; Lissoni 2012

- **University-Industry relationships** (Leydersdorff and Meyer 2003, 2007 and the recent survey Perkman (2012)

- **Social network analysis** and SNA applied to Knowledge diffusion networks and innovation
  - Balconi et al. 2004, 2006; Breschi and Lissoni 2009; Breschi and Catalini 2010; Lissoni et al. 2011
THE CASE STUDY

The two Universities under analysis

- TRIESTE UNIVERSITY
  Located in an area with a very high concentration of PROs
- UDINE UNIVERSITY
  Surrounded by many SMEs, important manufacturing clusters

Patent Data collected from EPO, USPTO, WIPO matched with MIUR data on academics employed in the two universities (2000-2010)

<table>
<thead>
<tr>
<th>THE DATA</th>
<th>University</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trieste</td>
<td>Udine</td>
</tr>
<tr>
<td>Academic Patents (Total) owned by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only Universities</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Only Firms and/or Research bodies</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Only group of inventors</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Co-patented bet. Universities and Firms/PROs</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Academic inventors</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>Assignee (Firms, Research bodies, Public)</td>
<td>26</td>
<td>17</td>
</tr>
</tbody>
</table>
## THE OVERALL NETWORKS

<table>
<thead>
<tr>
<th>Some statistics</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trieste</td>
</tr>
<tr>
<td>Number of nodes</td>
<td>171</td>
</tr>
<tr>
<td>% of assignees (red triangles)</td>
<td>15.0</td>
</tr>
<tr>
<td>Density</td>
<td>0.036</td>
</tr>
<tr>
<td>Number of links</td>
<td>1024</td>
</tr>
<tr>
<td>% of multiple links (both owned and invented) (thick lines)</td>
<td>7.3</td>
</tr>
<tr>
<td>Number of components</td>
<td>12</td>
</tr>
<tr>
<td># of nodes in the giant component (% nodes)</td>
<td>124 (73.4%)</td>
</tr>
<tr>
<td>Number of cliques of Min. size 3</td>
<td>41</td>
</tr>
<tr>
<td>Average degree</td>
<td>12.1</td>
</tr>
<tr>
<td>Network Centralization</td>
<td>40.7%</td>
</tr>
</tbody>
</table>

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Sub-network analysis /1

Methodology: BLOCKMODELING and BROKERAGE ROLE

- From the networks to the sub-networks: blockmodeling approach (Doreian et al., 2004)
  - **Aim**: identification of blocks of regularly equivalent inventors/assignees
  - We want to disentangle the structure of knowledge diffusion between academia to the external world

- Individual actor positions: Brokerage roles (Gould and Ferrnandez, 2004)
  - We detect academic inventors in central positions within blocks
  - Used for sampling for direct in-depth interviews

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Methodology: Qualitative analysis

In-depth interviews focused on...

- The quality of the network ties based on patent data
  - real collaboration, direction of links;
  - preferential link with assignees;
  - hierarchical structure of collaboration with industrial inventors (when present).

- Other general issues
  - The role of industrial partners (if any);
  - Conditions that make it more reasonable to patent with their own university or with external organisations;
  - Complementarity or substitutability between patents and other different channels of cooperation an (e.g., different possible kinds of research contracts).
RESULTS

We detect three sub-network typologies of patterns of University-Industry relationships:

- **Type A.** Cooperation with external open science actors
- **Type B.** Multiple interactions and Co-patenting
- **Type C.** Disconnected sub-networks
Results: Sub-network structures / 1
Type A. Cooperation with external open science actors

- Horizontal relations
- Homogeneous actors composition (open science actors)
- Ties mediated by individual researchers
- Knowledge flows through inventors (rather than organisations)
Results: Sub-network structures / 2

Type B. Multiple interactions and Co-patenting

- Mixed relations
- Non-Homogeneous actors (academics and industrial researchers)
- Ties mediated by individual inventors (when academics) and by management (when industrial res.): Cross-levels links
- Knowledge flows from academia towards private organisations through (prominent) academic inventors: gatekeepers
Results: Sub-network structures / 3

Type C. Disconnected sub-networks

- Homogeneous actor composition (industrial researchers)

- Academic inventors act as broker connecting many industrial researchers and he’s disconnected from his own University group

- Ties mostly mediated by management (industrial res.): Cross-levels links

- Knowledge flows from academic inventors (broker) towards the private organization (as management) and then to the industrial researchers

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Concluding remarks

1. sub-networks seem to catch general typologies of University-Industry interactions (in patenting)

2. The difference between the (two) universities can be accounted by the frequency of the identified typologies

3. The area of conflict between the two forms of patenting seems to be limited and Complementarity with other channels of cooperation very high

4. Ties as evidence of real collaboration and great importance of cross-level links (academic inventors-assignees links) for the Type B and C

5. "Side-result": network sub-structures and brokerage roles are very efficient base for field studies
Open questions and further research

Some open questions...

1. Which typology of sub-network is better for knowledge exchange with the private sector? **type B vs. type C** or «spillovers vs. efficiency»

2. Is the frequency of different typologies related to the individual Universities cooperation strategies? **Implication for the governance of the Universities**

Further Research

1. To test the «results» on larger datasets

2. Go beyond «descriptives» and use of stochastic blockmodels and time-varying network models
THANK YOU
FOR YOUR ATTENTION
• Mixed actors composition (industrial researchers and open science org.) Academic inventors act as broker connecting diverse industrial researchers
• Ties mediated by management
• Knowledge flows towards private organizations through (prominent) academic inventor acting as a gatekeeper
• These brokers do not patent with other academic of the same organisation