The Regional Dimension of the Knowledge Economy in Europe
Which Innovation Policies for Europe?

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Stylized facts

Europe entered the crisis with a gap in innovation activities with respect to advanced and even emerging countries. The crisis did not allow Europe to regain competitiveness over the past years.

The debate in Europe moves around a major question: which innovation policies should be developed in Europe in a period of economic downturn?
European pre-crisis R&D Gap

R&D / GDP

Source: World Bank and Eurostat
Average increase in R&D/GDP 1996-2007

Source: Knowledge, Network and Nations. The Royal Society
Increase in R&D/GDP 1999-2012

Source: Eurostat and World Bank
Pre-crisis policy recommendations

Recommandations from the EU in the Lisbon agenda in 2000.

Notwithstanding the recommandations and efforts made, in 2009 in Europe R&D/GDP was equal to 1.8%.

Moreover, the ratio has strong national disparities: only Finland and Sweden have a R&D/GDP ratio higher than 3%. 
In 2009 regions having reached 3% of R&D expenditures on GDP are 33 (11 per cent of the European NUTS2 regions) and concentrated in a few countries in the North of Europe. Moreover, a very high number of regions belongs to the lowest class, the one where R&D /GDP is lower than 0.5%. 

R&D expenditures / GDP
At the beginning of the crisis

In 2010, the EUROPE 2020 Agenda re-launched the same recommendations: 3% R&D/GDP

In 2012, it reached 1.9%.

What can be done? Which innovation policies can be foreseen for Europe?
To reply to the question, we need to

1. present the geography of the knowledge economy in Europe,

2. analyse the theoretical achievements and new reflections in knowledge, innovation and regional growth,

3. so to suggest an innovation policy design.
The geography of the knowledge economy in Europe
The Knowledge Economy in European regions (1)

Basic idea: *knowledge-based economy does not have a unique interpretative paradigm.*

Different approaches are necessary:

**A1. Sectoral approach** (presence in the region of science-based, high-technology sectors).

**A2. Functional approach** (presence in the region of functions like R&D, patents, human capital).

Technologically Advanced Regions

- HT manufacturing regions
- Technologically Advanced Regions (TAR)
- Low-tech regions
- HT services regions

Specialization in high-tech manufacturing

Specialization in high-tech services

EU average
Technologically Advanced Regions in EU

This map does not necessarily reflect the opinion of the ESPON Monitoring Committees.

Technologically-advanced regions

2007

- Low tech regions
- Advanced manufacturing regions
- Advanced services regions
- Technologically-advanced regions

Regional level: NUTS2

Source: Politecnico di Milano, 2011

Origin of data: EUROSTAT employment in high-tech sectors

© EuroGeographics Association for administrative boundaries
Scientific regions

- Research intensive regions
- Scientific regions
- Regions with other specialisations than R&D
- Human capital intensive regions

Research activities

EU average

Human capital
Scientific regions
Knowledge networking regions

Spatial linkages

Clustering regions

Networking Regions

EU average

Non interactive regions

Globalizing regions

A-spatial linkages
Knowledge networking regions

<table>
<thead>
<tr>
<th>Category</th>
<th>Meaning</th>
<th>Specialization in spatial linkages</th>
<th>Specialization in a-spatial linkages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-interactive regions</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Clustering regions</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Globalizing regions</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Networking regions</td>
<td>Yes</td>
<td>Yes</td>
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This map does not necessarily reflect the opinion of the ESPON Monitoring Committee.
The Knowledge Economy in Europe is a very fragmented picture.

What is striking from this map is the high number of regions in which the knowledge economy is still in its infancy.
Spatial trends of innovation in Europe

Product innovation only

Process innovation only
Open issues

Knowledge and innovation do not always match at spatial level.

What is the state of the art in the theoretical explanation for this?

Which are sound innovation policies that can be developed based on an advanced theoretical interpretation of regional growth through knowledge and innovation?
Theoretical achievements and new reflections in knowledge, innovation and regional growth
### Theoretical achievements

<table>
<thead>
<tr>
<th>Aim of the theory</th>
<th>Knowledge-innovation linkage</th>
<th>From innovation to performance</th>
<th>Location regions</th>
<th>Role of space</th>
<th>Period</th>
<th>Key references</th>
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</thead>
<tbody>
<tr>
<td>Identification of the spatial channels supporting innovation diffusion</td>
<td>Information-adoption short circuit</td>
<td>Adoption-performance linkage</td>
<td>Regions along the urban hierarchy</td>
<td>Barrier to information diffusion</td>
<td>End of the 1960s and 1970s</td>
<td>Hägerstrand, 1952; Griliches, 1957; Mansfield, 1961; Metcalfe, 1981; Camagni, 1985; Capello, 1988</td>
</tr>
<tr>
<td>Identification of the reasons for local innovation creation</td>
<td>Invention-innovation short circuit</td>
<td>Radical innovation, Schumpeterian profits</td>
<td>Advanced regions</td>
<td>Proximity economies, specialisation advantages</td>
<td>Middle of the 1980s</td>
<td>Malecki, 1980; Saxenian, 1996</td>
</tr>
<tr>
<td>Identification of the reasons for local knowledge creation</td>
<td>Spin-offs, spatial spillovers</td>
<td>Technological breakthrough, royalties on patents</td>
<td>Scientific regions</td>
<td>Agglomeration economies</td>
<td>End of the 1980s and 1990s</td>
<td>MacDonald, 1987; Massey et al. 1992; Monk et al., 1988; Storey and Tether, 1998</td>
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<td>Spin-offs, spatial spillovers</td>
<td>Knowledge-performance linkage</td>
<td>Networking regions</td>
<td>Proximity economies</td>
<td>Middle of the 1990s onward</td>
<td>Acs et al., 1994; Audretsch and Feldman, 1996; Anselin et al., 2000</td>
</tr>
<tr>
<td>Identification of the reasons for local knowledge diffusion</td>
<td>Common cognitive codes</td>
<td>Knowledge-performance linkage</td>
<td></td>
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</table>

**Key references**

- Hägerstrand, 1952
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- Mansfield, 1961
- Metcalfe, 1981
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- Malecki, 1980
- Saxenian, 1996
- MacDonald, 1987
- Massey et al. 1992
- Monk et al., 1988
- Storey and Tether, 1998
- Camagni, 1991
- Perrin, 1995
- Keeble and Wilkinson, 1999
- Capello 1999
- Cappellin, 2003a
- Lundvall and Johnson, 1994
- Acs et al., 1994
- Audretsch and Feldman, 1996
- Anselin et al., 2000
- Boschma, 2005
- Rallet and Torre, 1995
- Capello, 2009
Common features of existing approaches (1)

All these theories base their reflections on one particular phase of the innovation process, being either knowledge creation, innovation creation, innovation diffusion or knowledge diffusion.

Some theories even interpret knowledge and innovation as overlapping processes, taking for granted that if knowledge is locally created, this inevitably leads to innovation, and growth.
However, factors that enhance the implementation of new knowledge can be quite different from factors which stimulate innovation.

The fax machine, first developed in Germany (first working machine) and the US (first commercially viable product), was turned into a worldwide successful product by Japanese companies.

Anti-lock braking system (ABS) was invented by US car makers but became prominent primarily due to German automotive suppliers.
A new approach (1)

A leap in interpreting regional innovation processes lies in the capacity to build a conceptual framework:

- interpreting *different modes of performing the different phases of the innovation process*, and
- highlighting the *context conditions* (internal and external to the region) that accompany each phase.
A new approach (2)

Two new elements with respect to previous theoretical paradigms:

- conceptual distinction between knowledge and innovation, treating them as two separate (and sub-sequent) phases;

- identification of the context conditions, both internal and external to the region, that support the different innovation phases.
Territorial patterns of innovation

The concept of ‘Territorial Patterns of Innovation’ represents

• a spatial breakdown of variants of the knowledge→invention→innovation→development logical path,
• built on the presence/absence of territorial preconditions for knowledge creation, knowledge attraction and innovation.
Innovative region taxonomy and a territorial approach (1)

<table>
<thead>
<tr>
<th>Phases</th>
<th>Territorial preconditions for knowledge creation</th>
<th>Knowledge output</th>
<th>Territorial preconditions for innovation</th>
<th>Innovation</th>
<th>Economic efficiency</th>
</tr>
</thead>
</table>

**Region j**
- Education, human capital, accessibility, urban externalities
- Basic knowledge (General Purpose Technologies, GPTs)
- Specific, applied knowledge

**Region i**
- Education, human capital, accessibility, urban externalities
- Basic knowledge (General Purpose Technologies, GPTs)
- Specific, applied knowledge

**Territorial receptivity**
- Collective learning
- Entrepreneurship

1) **A European science-based area**: basic general purpose technologies
2) **An applied science area**: high patent activities in diversified applied technology fields

**Economic efficiency**
Innovative region taxonomy and a territorial approach (2)

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3) A smart technological application area
External specific technologies enhancing the upgrading of local innovation

4) Smart and creative diversification area
External tacit knowledge enhancing local innovation
Innovative region taxonomy and a territorial approach (3)

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<tr>
<td>Region j</td>
<td>Education, human capital, accessibility, urban externalities</td>
<td>Basic knowledge (General Purpose Technologies, GPTs)</td>
<td>Specific and applied knowledge</td>
<td>Collective learning</td>
<td>Product and process innovation</td>
</tr>
</tbody>
</table>

Region i

6) A potential innovation area

5) An imitative innovation area
Innovation imitation through territorial attractiveness
a European science-based area (ESBA);

an applied science area (ASA);

a smart technological application area (STAA);

a smart and creative diversification area (SCDA);

a imitative innovation area (IIA);

a potential innovation area (PIA).
Economic efficiency of the different territorial patterns

Policy lesson: each pattern of innovation has its economic efficiency.
Legend:
1 = European science-based area; 2 = Applied science area; 3 = Smart technological application area;
4 = Smart and creative diversification area; 5 = Imitative innovation area

Policy lesson: knowledge suffers from decreasing returns, as all economic resources.
Elasticity of GDP to R&D

Legend:
1 = European science-based area; 2 = Applied science area; 3 = Smart technological application area;
4 = Smart and creative diversification area; 5 = Imitative innovation area

Policy lesson: R&D requires a critical mass to have an effect on GDP.
Elasticity of innovation to R&D

Policy lesson: R&D has not always a positive effect on innovation.
Regional Innovation Policy Implications
Where do we stand with regional innovation policy debate?

There is general consensus about the need to avoid one unique innovation policy for all regions.

This view is fully coherent with the ‘smart specialization’ strategy (S3), which advocates differentiated policies:

- in the first phase: between ‘core’ and ‘periphery’ regions (Foray et al., 2009);
- in the second phase: for each region according to single specificities (McCann and Ortega-Argiles, 2014; Coffano and Foray, 2014; Boschma, 2014).

Our idea is that innovation policies have to be developed for regions with similar innovation patterns.
‘Smart innovation’ policies may be defined as those policies able to increase the innovation capability of an area by

- boosting the effectiveness of accumulated knowledge and
- fostering territorial applications and diversification, on the basis of local specificities and the characteristics of already established innovation patterns in each region.
<table>
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<tr>
<th>Policy aspects</th>
<th>European science-based area (Pattern 1)</th>
<th>Applied science area (Pattern 2)</th>
<th>Smart technological application area (Pattern 3)</th>
<th>Smart and creative diversification area (Pattern 4)</th>
<th>Imitative innovation area (Pattern 5)</th>
</tr>
</thead>
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<tr>
<td><strong>Policy goals</strong></td>
<td>Maximum return to R&amp;D investments</td>
<td>Maximum return to applications</td>
<td>Support to creative application, shifting capacity from old to new uses, improving productivity in existing uses, through:</td>
<td>Enhancing receptivity of existing innovation</td>
<td>Fast diffusion of existing innovation</td>
</tr>
<tr>
<td><strong>Policy actions</strong></td>
<td>Support to R&amp;D in:</td>
<td></td>
<td>Incentives to technological development and upgrading</td>
<td>Identification of international best practices</td>
<td>Support to local firms for complementary projects with MNCs</td>
</tr>
<tr>
<td>for local knowledge generation (Embeddedness)</td>
<td>New basic fields</td>
<td>Specialized technological fields</td>
<td>Variety in applications</td>
<td>Support to search in product/market diversification</td>
<td>Support to local firms for specialized subcontracting</td>
</tr>
<tr>
<td></td>
<td>General Purpose Technologies</td>
<td></td>
<td>Variety creation</td>
<td>Support to entrepreneurial creativity</td>
<td></td>
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<tr>
<td>Policy actions for exploitation of knowledge spillovers (Connectedness)</td>
<td>Incentives to inventors attraction and mobility</td>
<td>Incentives for creative applications through:</td>
<td>Co-operative research activities among related sectors</td>
<td>Participation of local actors to specialized international fairs</td>
<td>Incentives for MNCs attraction</td>
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<td></td>
<td>Support of research cooperation in:</td>
<td></td>
<td>Co-operative search for new technological solutions</td>
<td>Attraction of &quot;star&quot; researchers even for short periods</td>
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<td></td>
<td>GPT and trans-territorial projects (ERA)</td>
<td>specific technologies and trans-territorial projects (ERA), in related sectors/domains</td>
<td>Encouraging of labour mobility among related sectors/domains</td>
<td>Work experience in best practice</td>
<td>Bargaining on innovative ‘local content’ procurement by MNCs</td>
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<tr>
<td></td>
<td></td>
<td>Encouraging of labour mobility among related sectors/domains</td>
<td></td>
<td>Knowledge creation firms of the same domains</td>
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</table>
Evolutionary smart innovation policies

- Some regions could be able to ‘jump’ over different and more complex innovation patterns (empirical evidence collected);

- ‘evolutionary’ policies could support these paths, with extreme attention and careful assessments, provided that context conditions and reliability of actors and strategies/projects could reduce risks of failure.
Potential evolutionary trajectories (for the leading regions in each pattern)

Legend:
1 = European science-based area
2 = Applied science area
3 = Smart technological application area
4 = Smart and creative diversification area
5 = Imitative innovation area
All this and much more can be found in


THANK YOU VERY MUCH FOR YOUR ATTENTION!