The territorial dimension of the knowledge economy in Europe: which innovation policies in an era of austerity?

Roberta Capello

Politecnico di Milano
2013 RSAI Fellow

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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 revolves around two major questions:
- which innovation policies should be developed in Europe?
- how can innovation policies be justified in a period of austerity, when short-term policies seem more appropriate?
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, reinforced by the Europe 2020 agenda: achievement of 3% of R&D/GDP in 2010.

Notwithstanding the recommandations and efforts made, in 2009 in Europe R&D/GDP was equal to 1.8%. In 2012, it reached 1.9%.

Moreover, the ratio has strong national disparities: only Finland and Sweden have a R&D/GDP ratio higher than 3%.
R&D expenditures / GDP

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%.
Aim of the presentation

• To enter the regional innovation policy debate that is developed at the EU level in order to present the rationale for a regionalised conception, design and delivery of innovation policies, by:
  – describing the situation of the Knowledge Economy in European regions;
  – highlighting how the theoretical toolbox of knowledge and innovation and regional growth can interpret the situation.

• To find justifications for innovation strategies in a period of austerity, when short-term demand policies seem more appropriate.
Structure of the presentation

1. The geography of the knowledge economy in Europe

2. Theoretical achievements and new reflections in knowledge, innovation and regional growth

3. Innovation policy implications

4. Justification for regional innovation policies in an era of austerity
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

EU average

Specialization in high-tech services
Technologically Advanced Regions in EU

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

Regional level: NUTS2
Source: Politecnico di Milano, 2011
Origin of data: EUROSTAT employment in high-tech sectors
©EuroGeographics Association for administrative boundaries

Technologically-advanced regions
2007
- NA
- Low tech regions
- Advanced manufacturing regions
- Advanced services regions
- Technologically-advanced regions

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Scientific regions

Research activities

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

Human capital

- Scientific regions
- Human capital intensive regions

EU average
Scientific regions
Knowledge networking regions

Spatial linkages

Clustering regions

Networking Regions

EU average

A-spatial linkages

Non interactive regions

Globalizing regions
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 Non-interactive regions</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2 Clustering regions</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3 Globalizing regions</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>4 Networking regions</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Knowledge networking regions:
- Non-interactive regions
- Clustering regions
- Globalizing regions
- Networking regions
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

Legend
- No data
- 0 - 2.86
- 2.87 - 5.82
- 9.13 - 12.80
- 12.81 - 17.30
- 17.31 - 23.43
- 23.44 - 33.45
- > 33.45

Switzerland: share of firms introducing product innovation
Iceland: CIS3 data
Latvia and Slovenia: CIS2006 data

Legend
- No data
- 0 - 3.26
- 3.27 - 5.92
- 5.93 - 9.12
- 9.13 - 12.80
- 12.81 - 17.30
- 17.31 - 23.43
- 23.44 - 33.45
- > 33.45

Switzerland: share of firms introducing process innovation
Iceland: CIS3 data
Latvia and Slovenia: CIS2006 data
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>Innovation diffusion</th>
<th>Innovation creation</th>
<th>Knowledge creation</th>
<th>Knowledge diffusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Identification of the spatial channels supporting innovation diffusion</td>
<td>Identification of the reasons for local innovation creation</td>
<td>Identification of the reasons for local knowledge creation</td>
<td>Identification of the reasons for local knowledge diffusion</td>
</tr>
<tr>
<td>Knowledge-innovation linkage</td>
<td>Information-adoption short circuit</td>
<td>Invention-innovation short circuit</td>
<td>Spin-offs, spatial spillovers</td>
<td>Spin-offs, spatial spillovers</td>
</tr>
<tr>
<td>From innovation to performance</td>
<td>Adoption-performance linkage</td>
<td>Radical innovation, Schumpeterian profits</td>
<td>Technological breakthrough, royalties on patents</td>
<td>Continuing innovation, productivity increases</td>
</tr>
<tr>
<td>Location regions</td>
<td>Regions along the urban hierarchy</td>
<td>Advanced regions</td>
<td>Scientific regions</td>
<td>Milieux Learning regions</td>
</tr>
<tr>
<td>Role of space</td>
<td>Barrier to information diffusion</td>
<td>Proximity economies, specialisation advantages</td>
<td>Agglomeratio n economies</td>
<td>Uncertainty reduction, relational capital</td>
</tr>
<tr>
<td>Period</td>
<td>End of the 1960s and 1970s</td>
<td>Middle of the 1980s</td>
<td>End of the 1980s and 1990s</td>
<td>End of the 1980s and 1990s</td>
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<td></td>
<td>Middle of the 1990s onward</td>
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<td>Middle of the 2000s</td>
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<td>Acs et al., 1994; Audretsch and Feldman, 1995; Capello, 1999; Anselin et al., 2000</td>
</tr>
</tbody>
</table>
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.
Common features of existing approaches (2)

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**

- Territorial receptivity
- Education, human capital, accessibility, urban externalities
- Basic knowledge (General Purpose Technologies, GPTs)
- Specific, applied knowledge

1) **A European science-based area:**
   - basic general purpose technologies

2) **An applied science area:**
   - high patent activities in diversified applied technology fields
Innovative region taxonomy and a territorial approach (2)

<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>

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

Region j

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

Region i

- Specific and applied knowledge
- Capabilities
- Collective learning
- Entrepreneurship
- Product and process innovation
- Economic efficiency
Innovative region taxonomy and a territorial approach (3)

<table>
<thead>
<tr>
<th>Phases</th>
<th>Territorial preconditions for knowledge creation</th>
<th>Knowledge output</th>
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<tbody>
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<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.
Elasticity of knowledge 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: 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.
### Territorial patterns of innovation

<table>
<thead>
<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>
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<tbody>
<tr>
<td><strong>Policy goals</strong></td>
<td>Maximum return to R&amp;D investments</td>
<td>Maximum return to applications and co-operation in applications</td>
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<td>Maximum return to imitation</td>
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<td><strong>Policy actions for local knowledge generation</strong> (Embeddedness)</td>
<td>Support to R&amp;D in: New basic fields, General Purpose Technologies</td>
<td>Support to creative application, shifting capacity from old to new uses, improving productivity in existing uses, through: Specialized technological fields, Variety in applications</td>
<td>Incentives to technological development and upgrading Variety creation</td>
<td>Identification of international best practices Support to search in product/market diversification Support to entrepreneurial creativity</td>
<td>Fast diffusion of existing innovation Enhancing receptivity of existing innovation Support to local firms for complementary projects with MNCs Support to local firms for specialized subcontracting</td>
</tr>
<tr>
<td>Policy aspects</td>
<td>European science-based area (Pattern 1)</td>
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<tr>
<td><strong>Policy actions for exploitation of knowledge spillovers (Connectedness)</strong></td>
<td>Incentives to inventors attraction and mobility</td>
<td>Support of research cooperation in:</td>
<td>Incentives for creative applications through:</td>
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<td>Incentives for MNCs attraction</td>
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<td>GPT and trans-territorial projects (ERA)</td>
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</table>
Justification for Regional Innovation Policies in an Era of Austerity
Macroeconomic conditions and regional disparities (1)

Demand-side, macroeconomic elements – at first glance – are not expected to generate asymmetric effects at regional level.

And yet, they do, both at the inter-national and intra-national level.
Example of spatially differentiated impacts: the EU austerity measures and the increase in the spread with respect to the interest on German bonds following the international financial crisis implied:

- a strong control on national public expenditure, especially in countries with relevant public deficits and/or debts. The effects are expected to be stronger in regions more dependent on public demand or on internal demand, being generally the poorest and least competitive ones;

- an increase in interest rates, generating a reduction of private investments, particularly in industrial regions;

- a credit crunch as a consequence of the financial intermediaries’ decision to prefer financing public debts instead of the private sector, when guarantees existed on sovereign default; industrial regions, mainly hosting SMEs were once again penalized more than others.
A recent simulation exercise

Our MASST3 model allows a simulation exercise on the effects of macroeconomic changes on regional growth.

A Baseline scenario for 2030 was built (see ESPON ET2050 project), defined as a scenario with

- no change in policies and in cohesion budget,
- a general slow economic recovery starting in 2016.
Convergence trends interrupted

Overall Theil Index
Between countries Theil Index
Within countries Theil Index
Total disparities
Between countries disparities
Within countries disparities

Year
2010, 2015, 2020, 2025, 2030
Convergence trends interrupted
Consequences for Cohesion Policies

Regional cohesion policies have a reason to be launched even in an era of economic downturn, when demand policies would be more natural.

They even have to be reinforced: their present intensity is not sufficient to engender a decrease in regional disparities.

They are therefore necessary in order to correct for the regional imbalances caused by the restrictive macroeconomic policies imposed by the austerity measures.
All this and much more can be found in


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