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

Roberta Capello

Politecnico di Milano

Past-President of RSAI

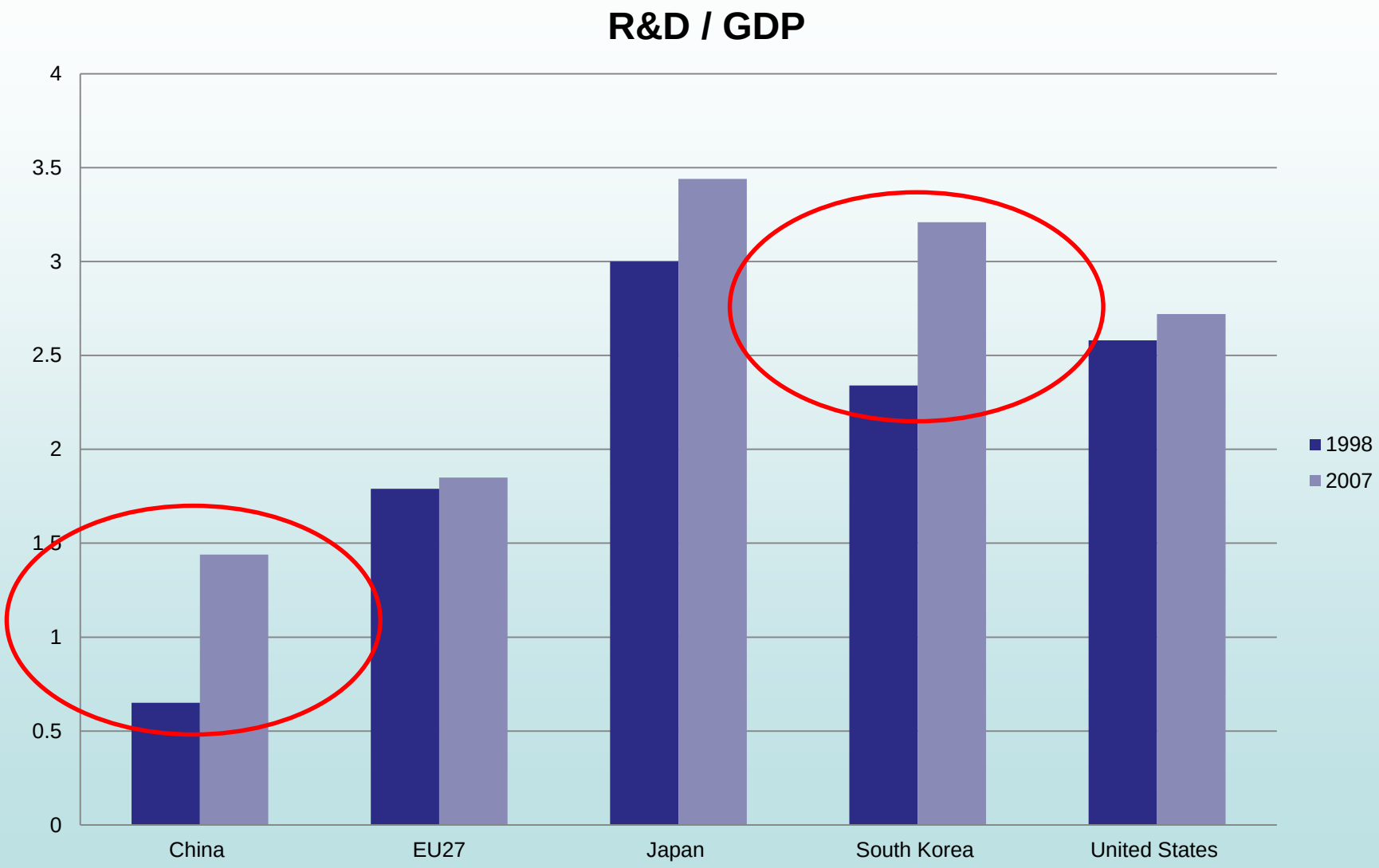
RSA Annual Conference, Piacenza, 25-27 May 2015

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

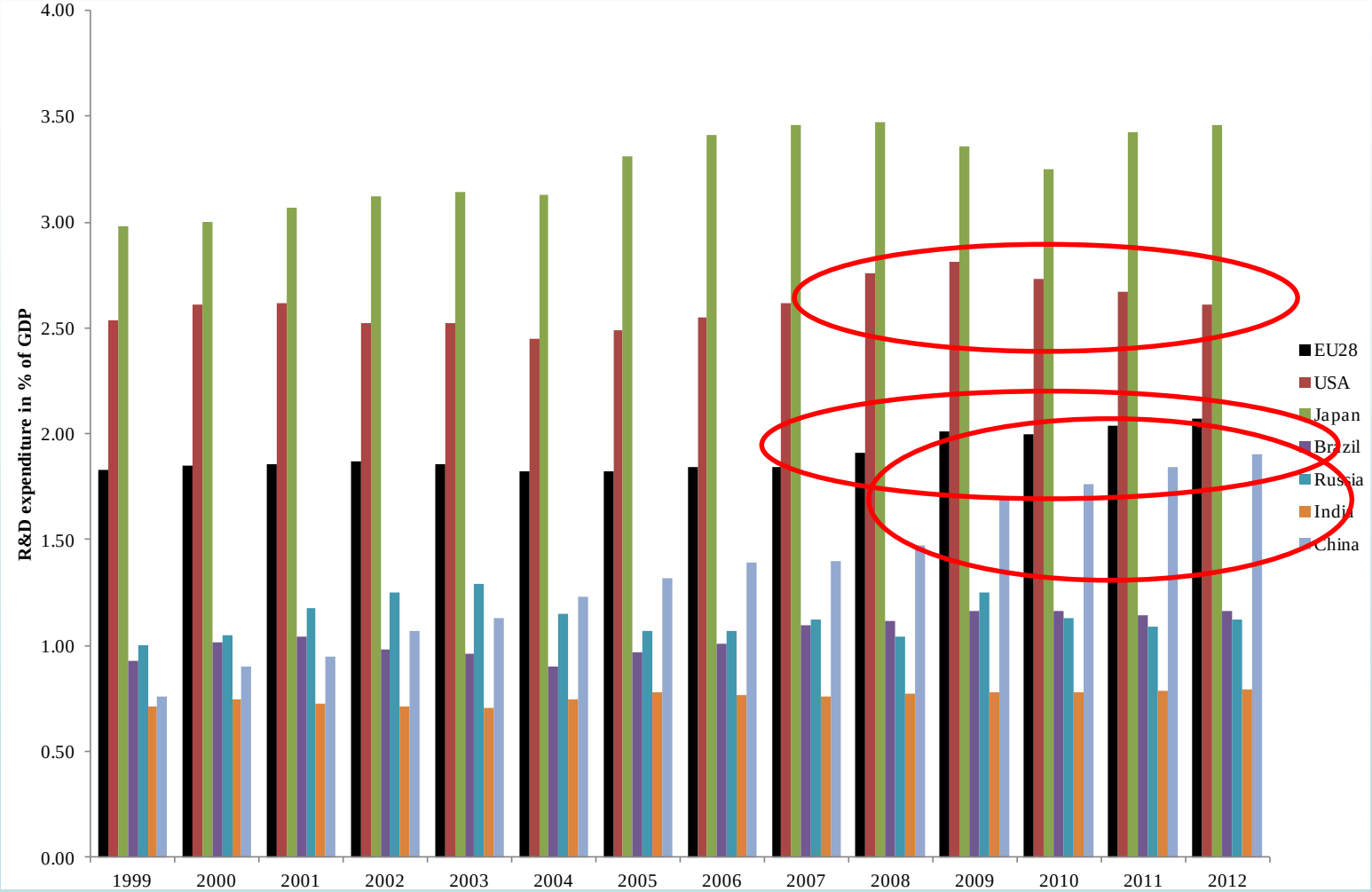


Source: World Bank and Eurostat

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

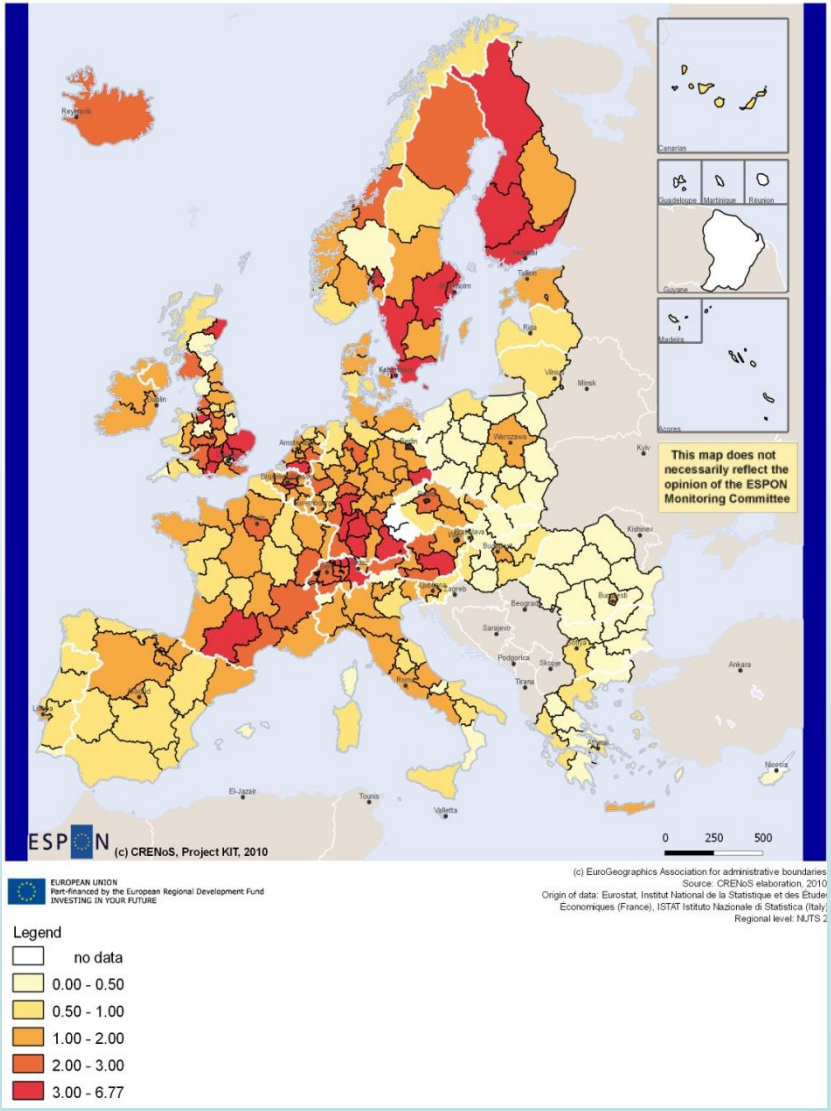
Pre-crisis policy recommendations

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%.

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%.

At the beginning of the crisis

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

In 2012, it reached 1.9%.

What can be done? Whici 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.*

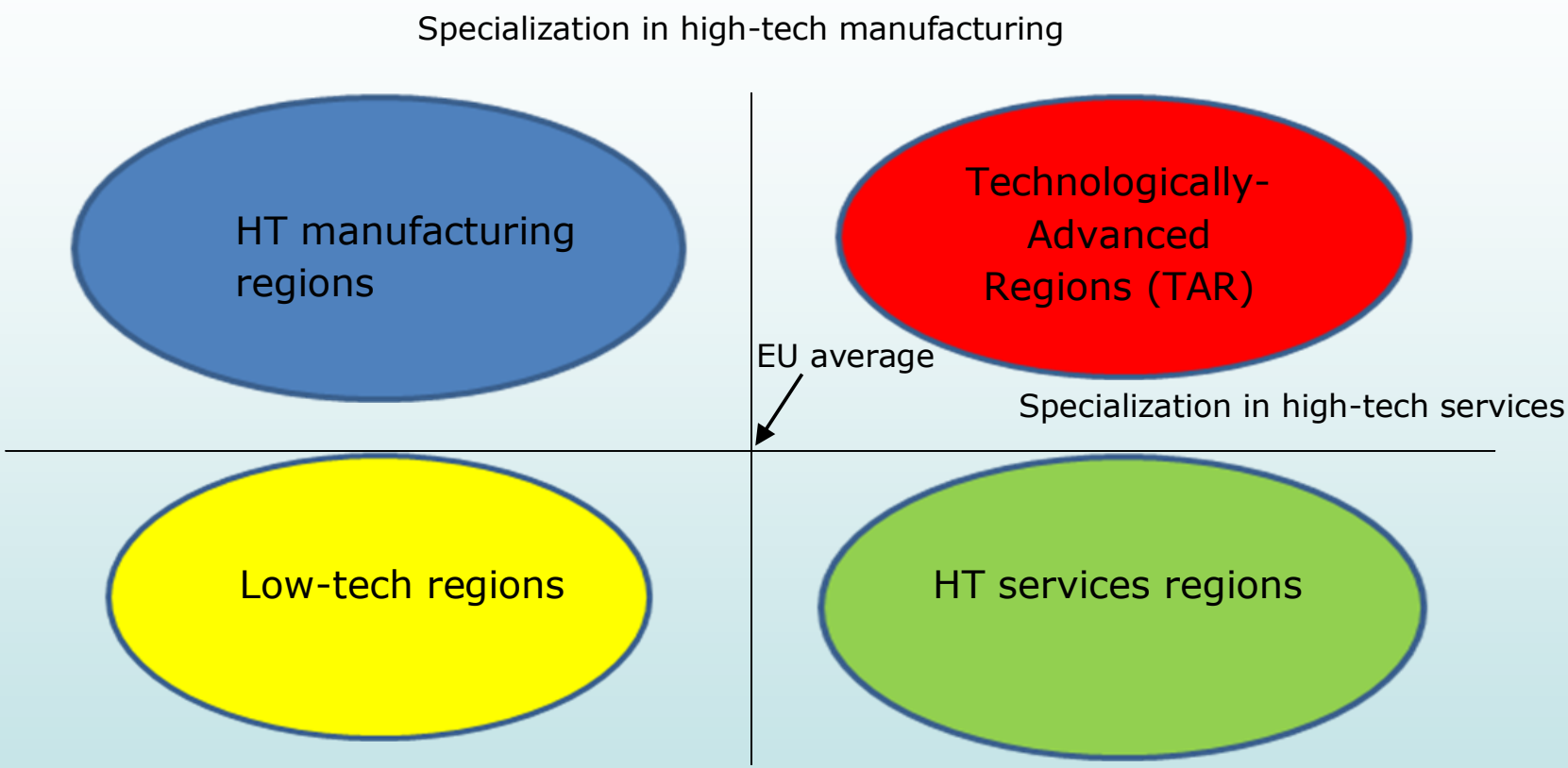
Different approaches are necessary:

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

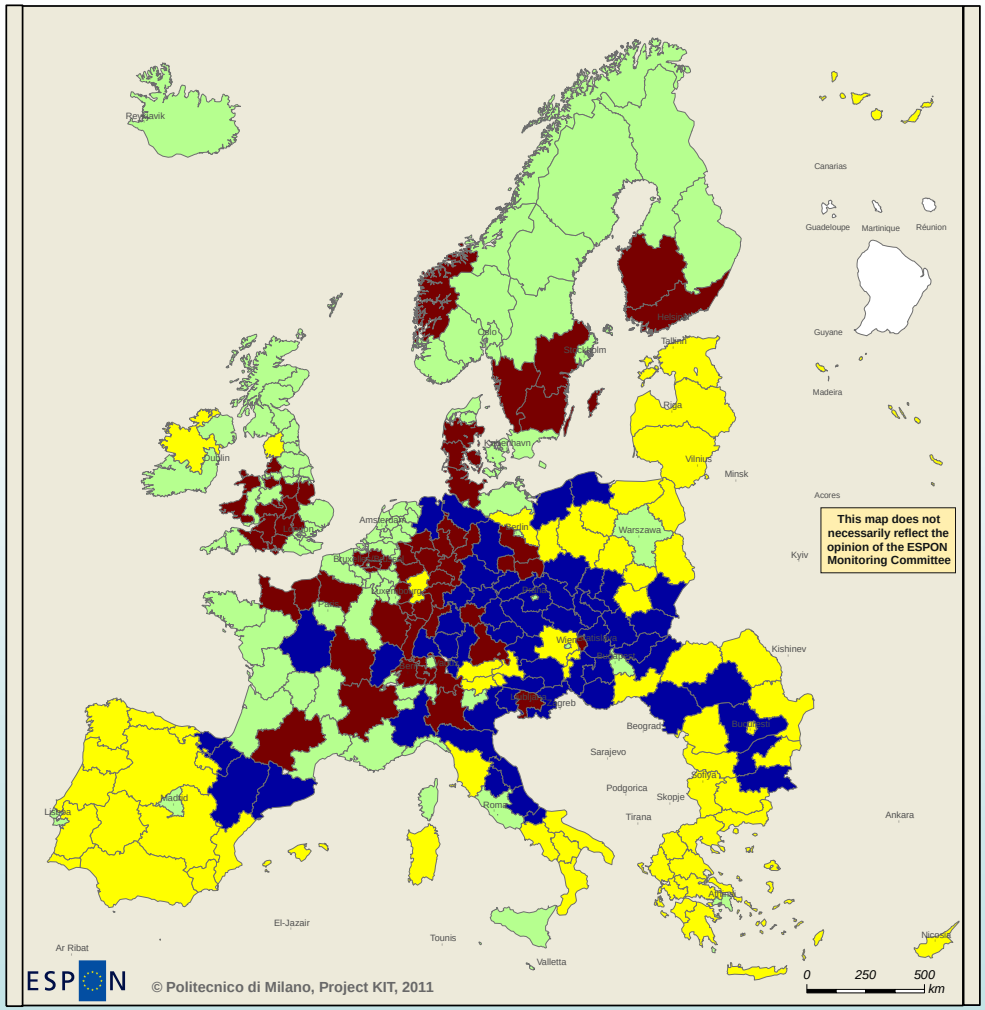
A2. Functional approach (presence in the region of functions like R&D, patents, human capital).

A3. Relation-based approach (presence in the region of interactive and collective learning processes).

Technologically Advanced Regions



Technologically Advanced Regions in EU



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

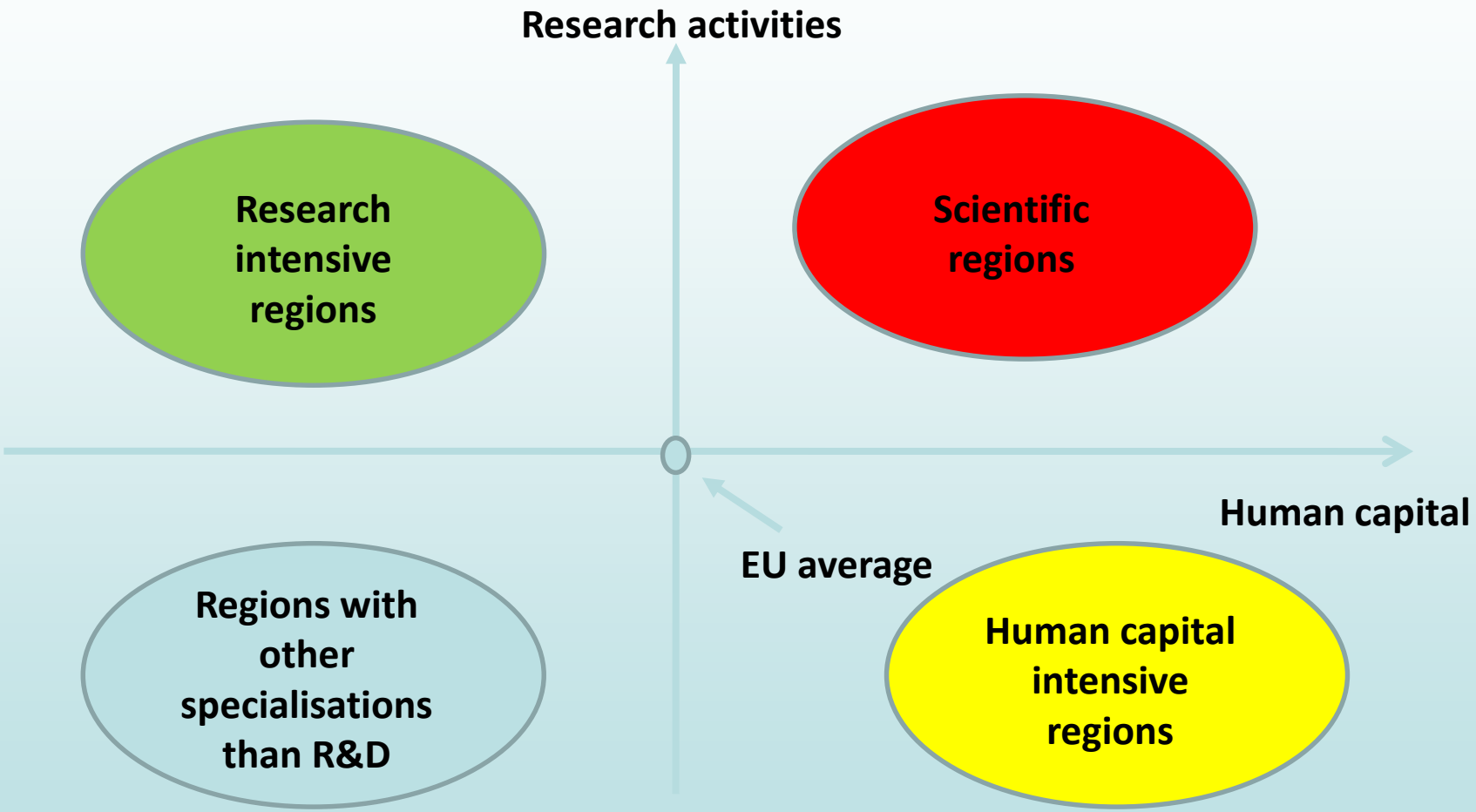
Regional level: NUTS2
Source: Politecnico di Milano, 2011
Origin of data: EUROSTAT employment in high-tech sectors
© EuroGeographics Association for administrative boundaries

Technologically-advanced regions

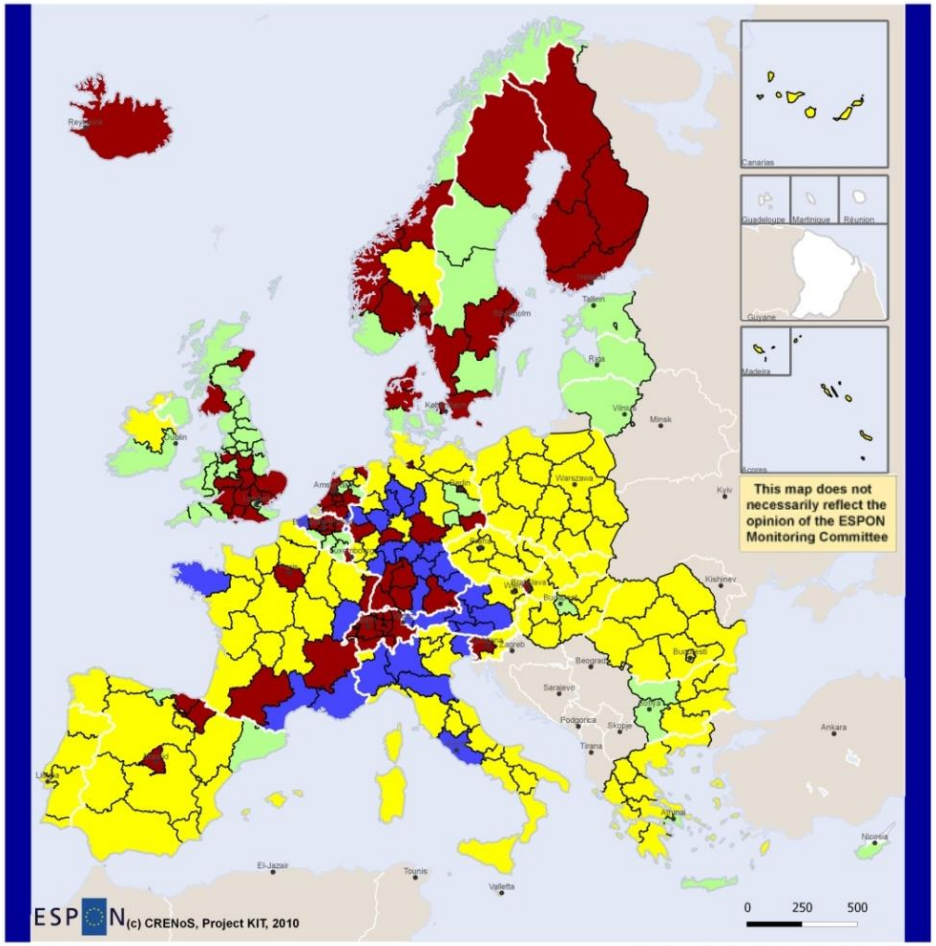
2007

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

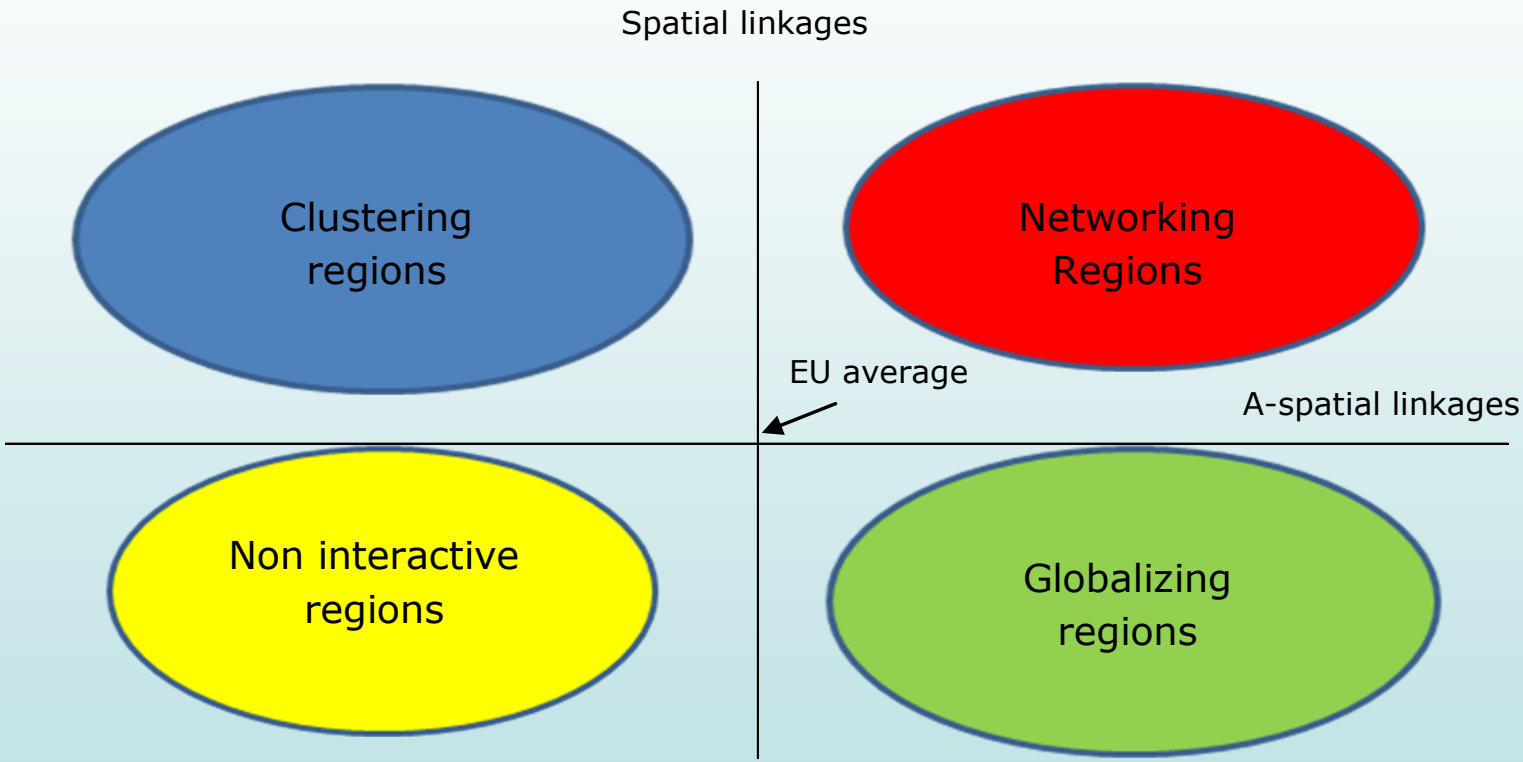
Scientific regions



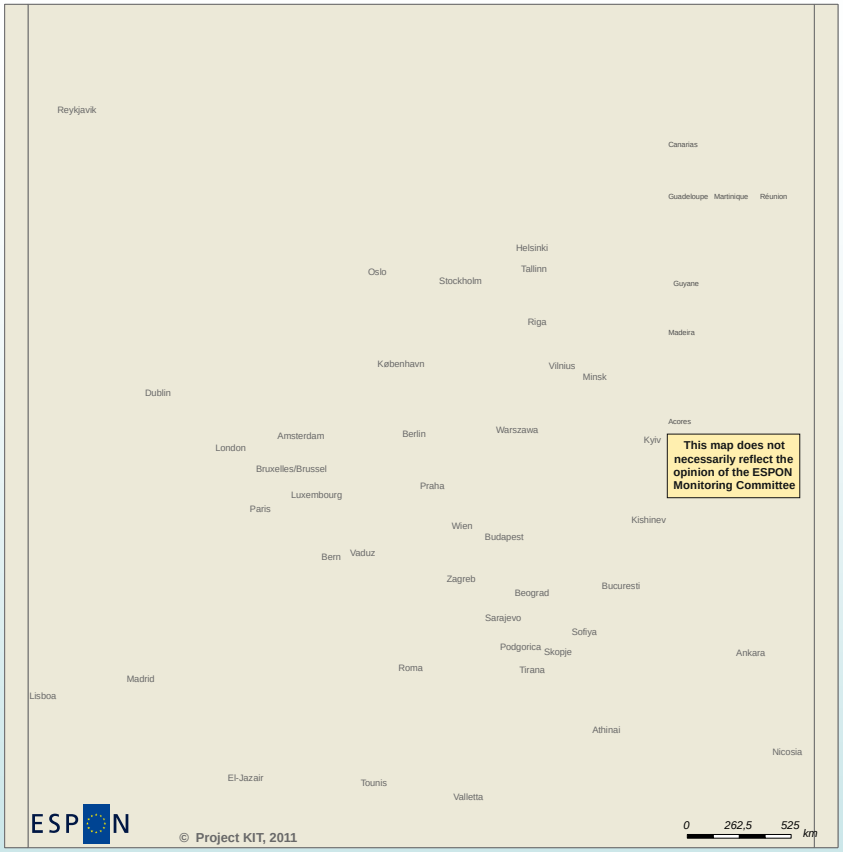
Scientific regions



Knowledge networking regions



Knowledge networking regions



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

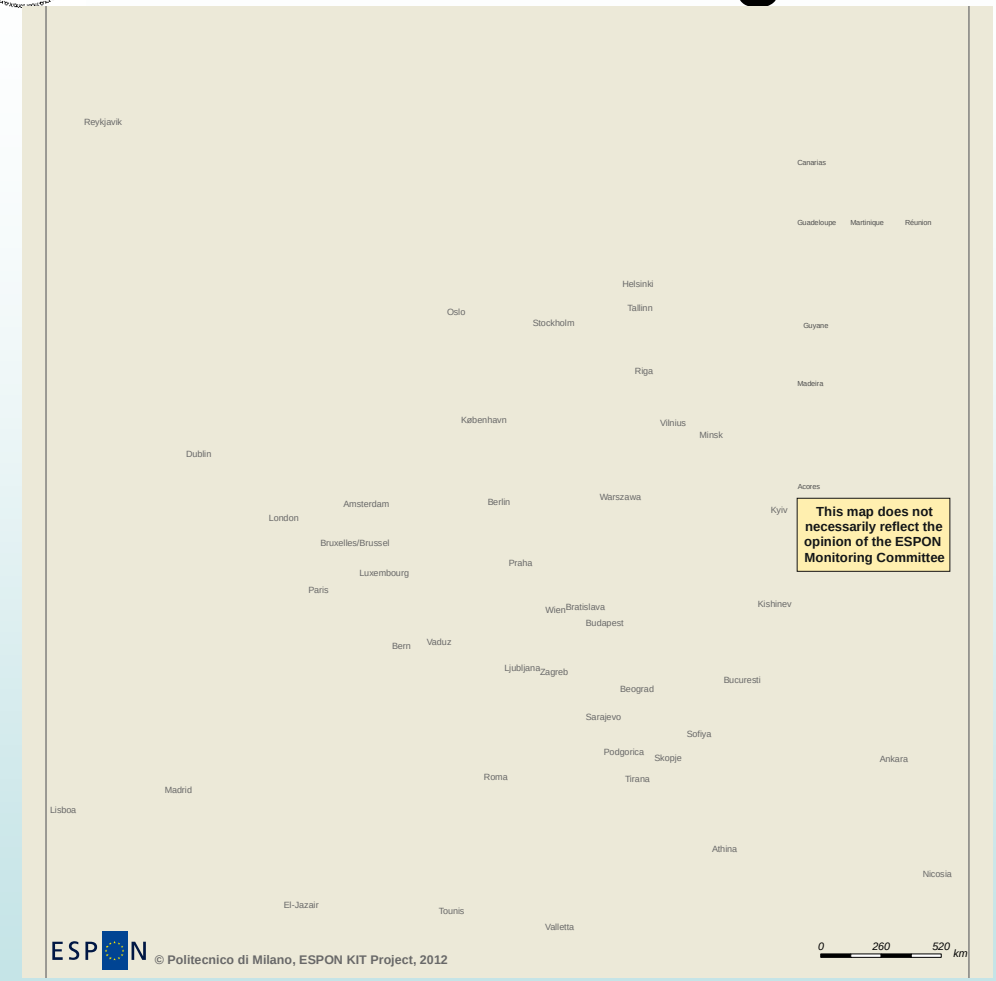
Regional level: NUTS 2
Source: AQR elaboration, 2011
Origin of data: OECD REGPAT Database, Cordis, EUROSTAT, ISTAT and Institute National de la Statistique et des Études Économiques data
© EuroGeographics Association for administrative boundaries

Category	Meaning	Specialization in spatial linkages	Specialization in a-spatial linkages
1	Non-interactive regions	No	No
2	Clustering regions	Yes	No
3	Globalizing regions	No	Yes
4	Networking regions	Yes	Yes

Knowledge networking regions

- Non-interactive regions
- Clustering regions
- Globalizing regions
- Networking regions

The Knowledge Economy in Europe



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS2
Source: Own elaboration, 2011
Origin of data: EUROSTAT and REGPAT, 2007
© EuroGeographics Association for administrative boundaries

Legend

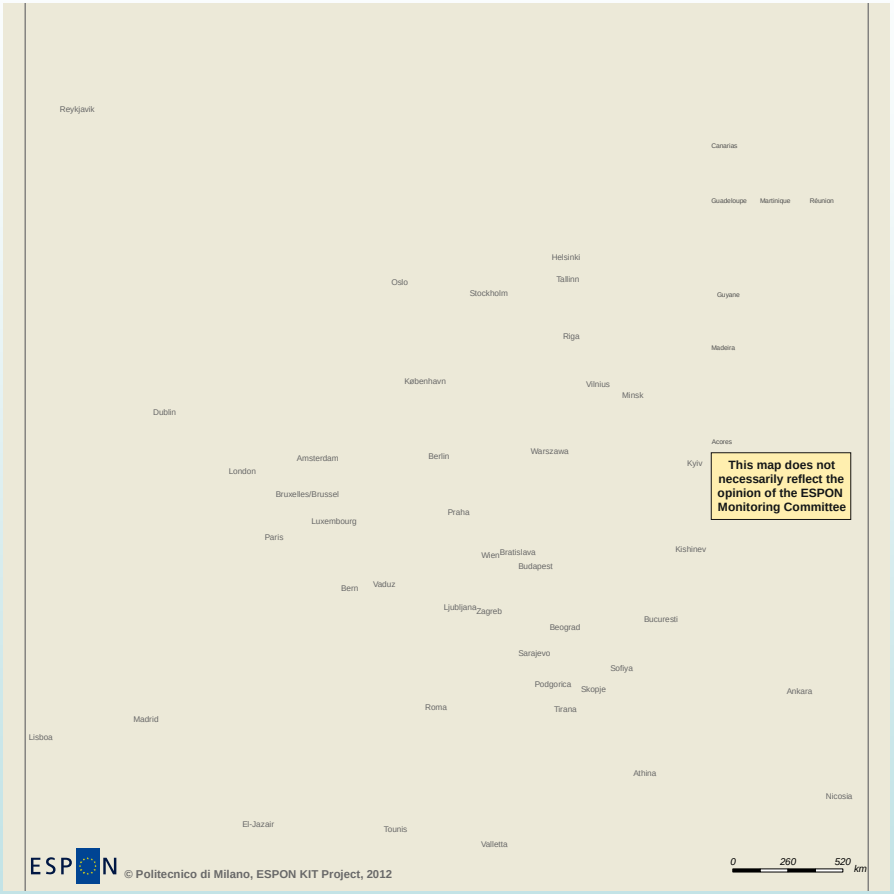
- No data
- None (137 regions)
- TAR only (8 regions)
- Scientific regions only (11 regions)
- Networking regions only (43 regions)
- TAR and scientific regions (3 regions)
- TAR and networking regions (20 regions)
- Scientific and networking regions (29 regions)
- TAR, scientific and networking regions (31 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



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

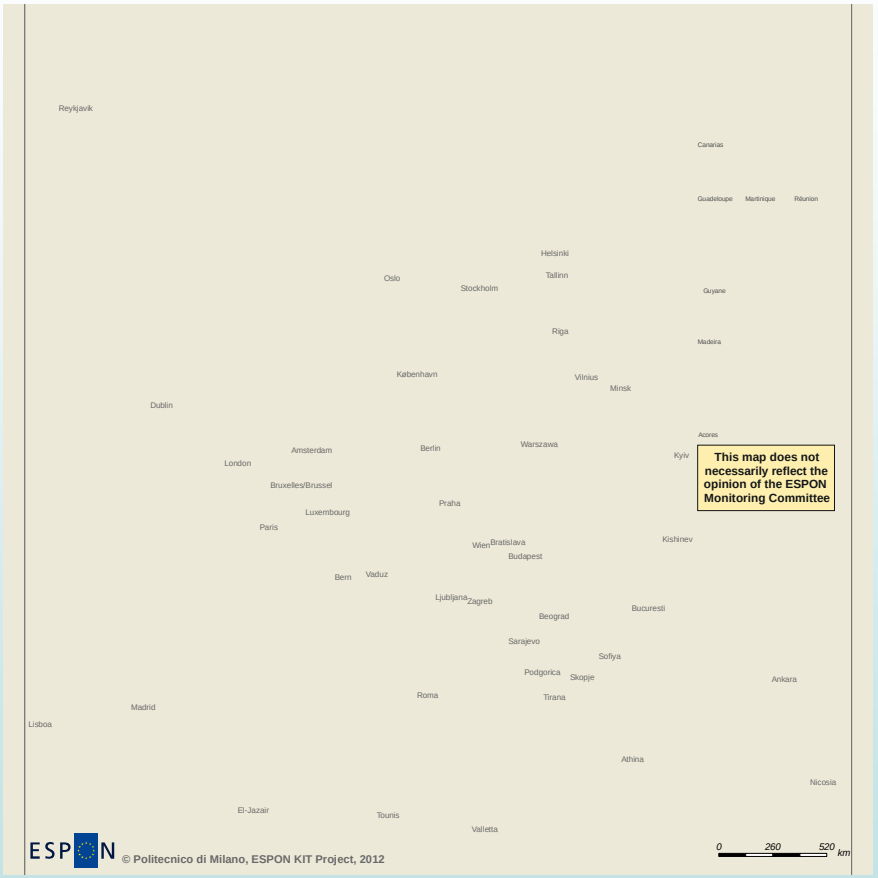
Regional level: NUTS2
Source: Own elaboration, 2011
Origin of data: EUROSTAT - Community Innovation Survey, 2002-2004
© EuroGeographics Association for administrative boundaries

Legend

- No data
- < 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 product innovation
Iceland: CIS3 data
Latvia and Slovenija: CIS2006 data

Process innovation only



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS2
Source: Own elaboration, 2011
Origin of data: EUROSTAT - Community Innovation Survey, 2002-2004
© EuroGeographics Association for administrative boundaries

Legend

- No data
- < 5.40
- 5.41 - 8.09
- 8.10 - 10.09
- 10.10 - 12.32
- 12.33 - 14.71
- 14.72 - 18.01
- 18.02 - 25.92
- 25.93 - 55.08

Switzerland: share of firms introducing process innovation
Iceland: CIS3 data
Latvia and Slovenija: CIS2006 data

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

	Innovation diffusion	Innovation creation	Knowledge creation		Knowledge diffusion	
			Functional approach	Cognitive approach	Spatial approach	Evolutionary approach
Aim of the theory	Identification of the spatial channels supporting innovation diffusion	Identification of the reasons for local innovation creation	Identification of the reasons for local knowledge creation		Identification of the reasons for local knowledge diffusion	
Knowledge-innovation linkage	Information-adoption short circuit	Invention-innovation short circuit	Spin-offs, spatial spillovers	Collective learning, local synergies Entrepreneur-ship	Spin-offs, spatial spillovers	Common cognitive codes
From innovation to performance	Adoption-performance linkage	Radical innovation, Schumpeteria n profits	Technological breakthrough, royalties on patents	Continuing innovation, productivity increases	Knowledge-performance linkage	
Location regions	Regions along the urban hierarchy	Advanced regions	Scientific regions	Milieux Learning regions	Networking regions	
Role of space	Barrier to information diffusion	Proximity economies, specialisatio n advantages	Agglomeratio n economies	Uncertainty reduction, relational capital	Proximity economies	
Period	End of the 1960s and 1970s	Middle of the 1980s	End of the 1980s and 1990s	End of the 1980s and 1990s	Middle of the 1990s onward	Middle of the 2000s
Key references	Hägerstrand, 1952; Griliches, 1957; Mansfield, 1961; Metcalfe, 1981; Camagni, 1985; Capello, 1988	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.

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;

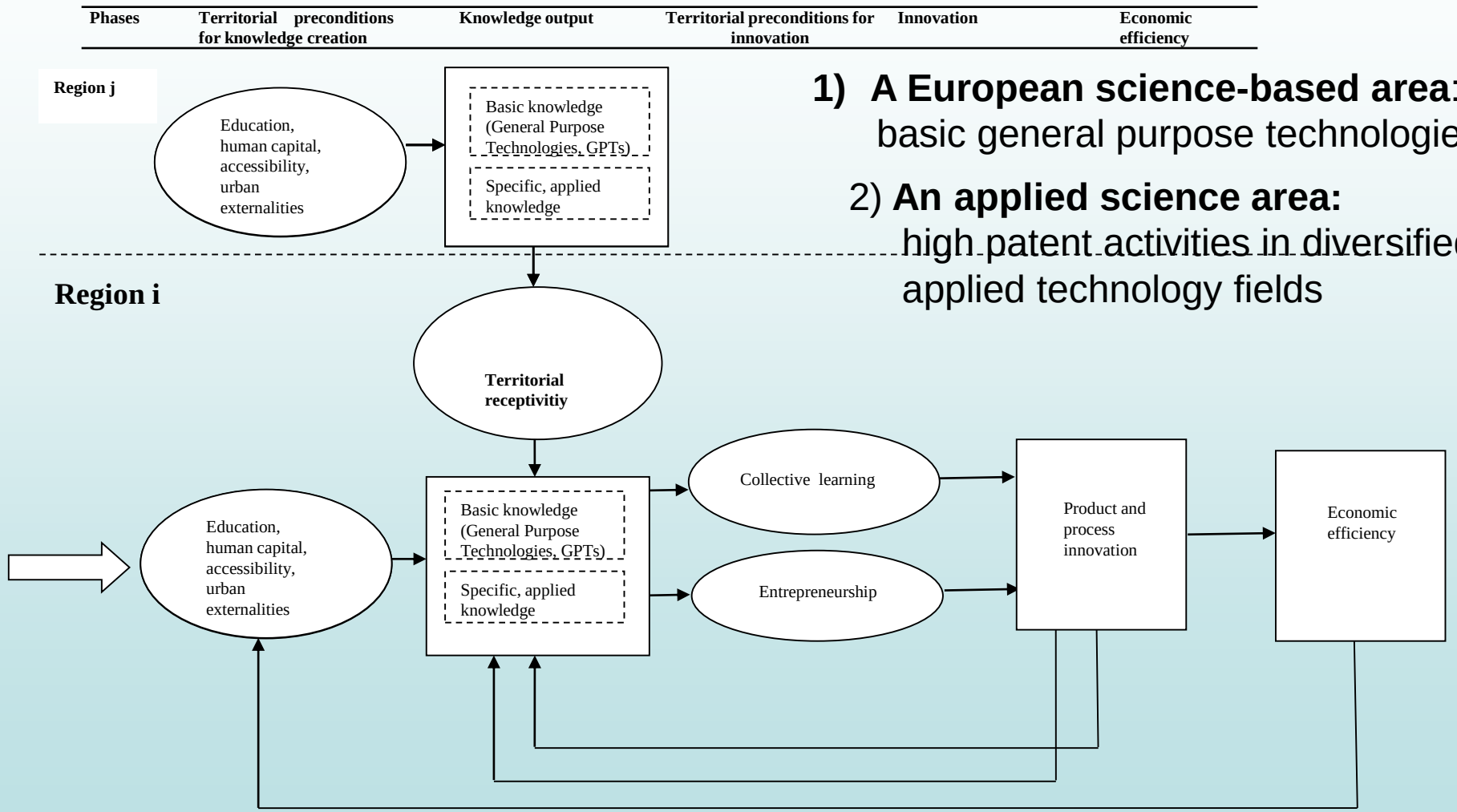
- identification of the **context conditions**, both internal and external to the region, that support the different innovation phases.

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)



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

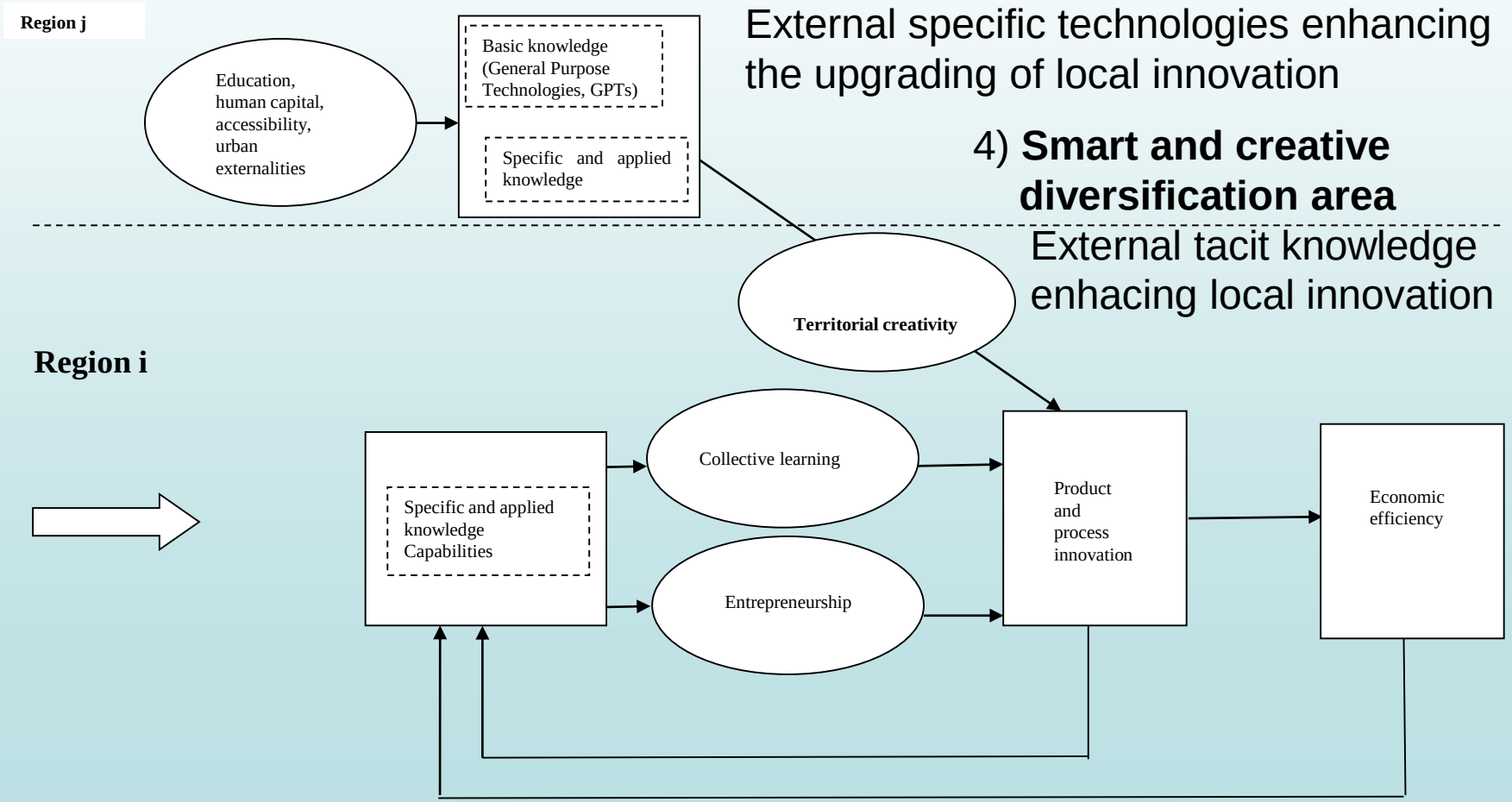
2) **An applied science area:** high patent activities in diversified applied technology fields

Innovative region taxonomy and a territorial approach (2)

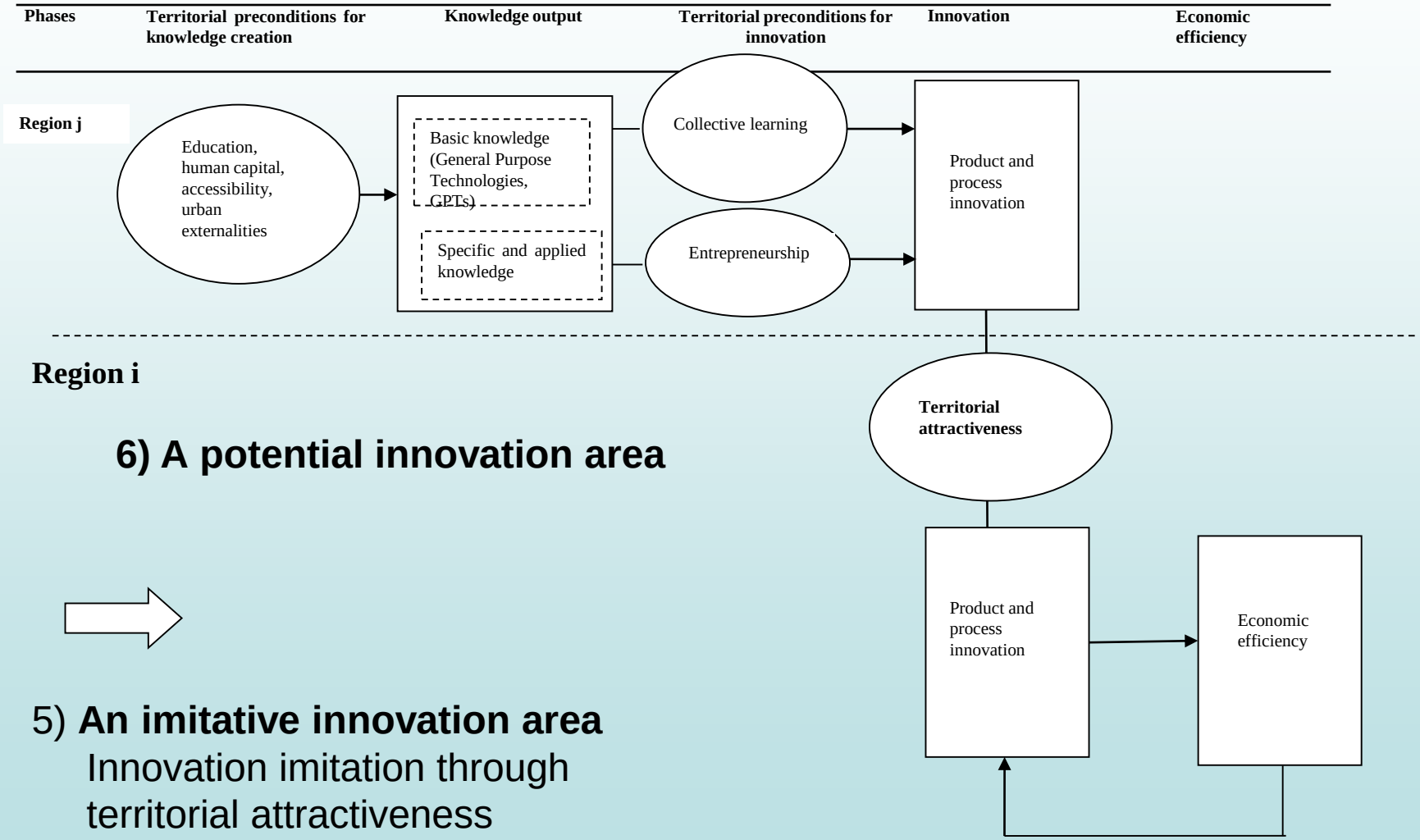
Phases	Territorial preconditions for knowledge creation	Knowledge output	Territorial preconditions for innovation	Innovation	Economic efficiency

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

4) **Smart and creative diversification area**
External tacit knowledge enhacing local innovation



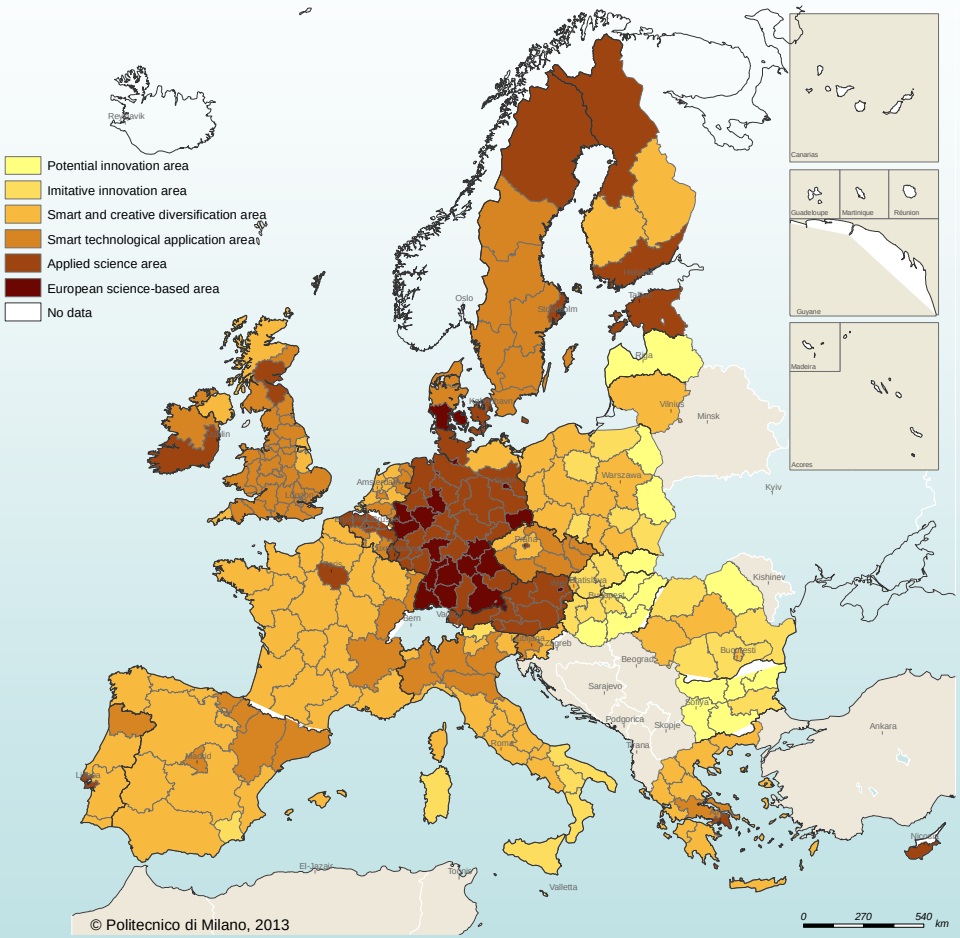
Innovative region taxonomy and a territorial approach (3)



6) A potential innovation area

5) **An imitative innovation area**
Innovation imitation through territorial attractiveness

Territorial patterns of innovation in Europe



a **European science-based area (ESBA)**;

an **applied science area (ASA)**;

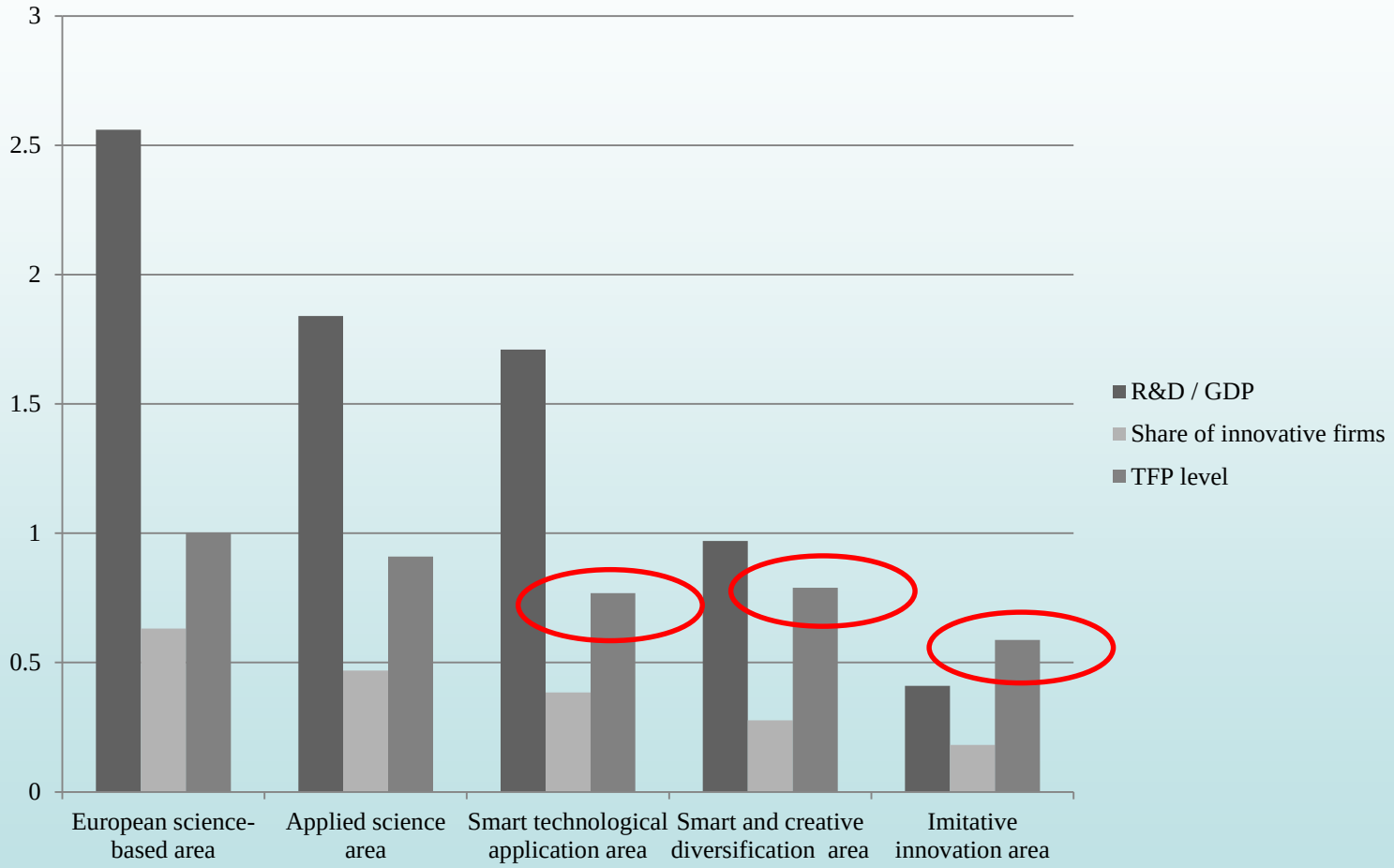
a **smart technological application area (STAA)**;

a **smart and creative diversification area (SCDA)**;

a **imitative innovation area (IIA);**

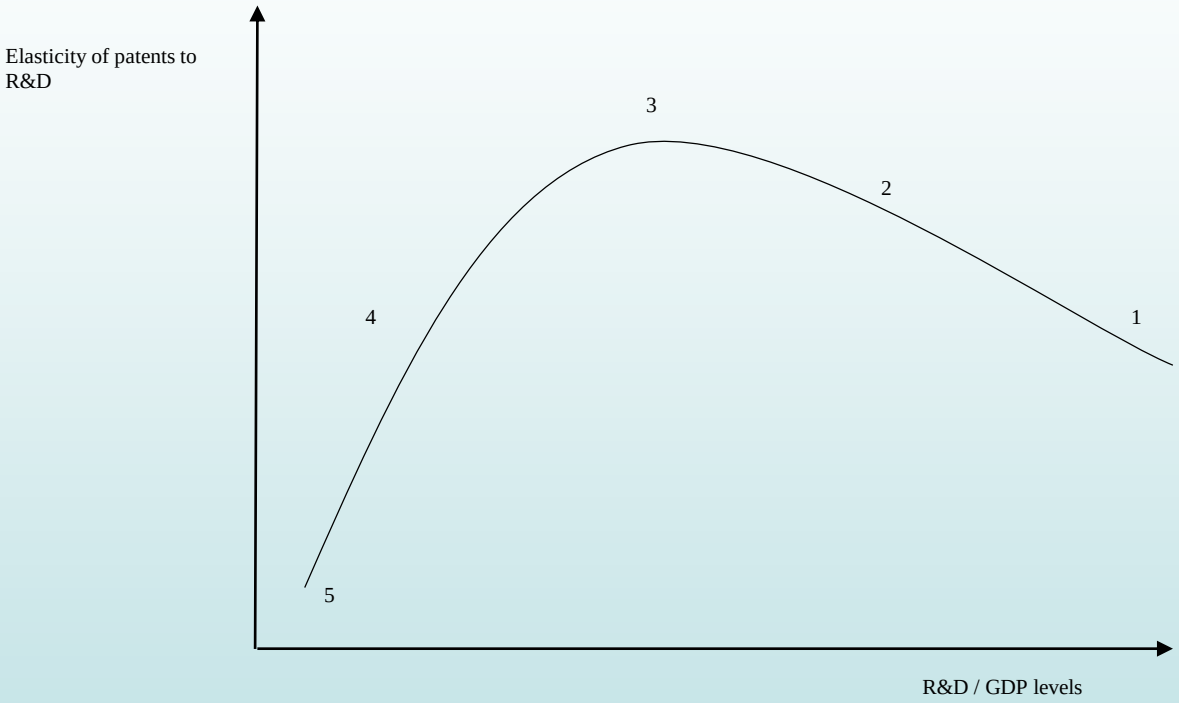
a **potential innovation area (PIA)**.

Economic efficiency of the different territorial patterns



Policy lesson: each pattern of innovation has its economic efficiency.

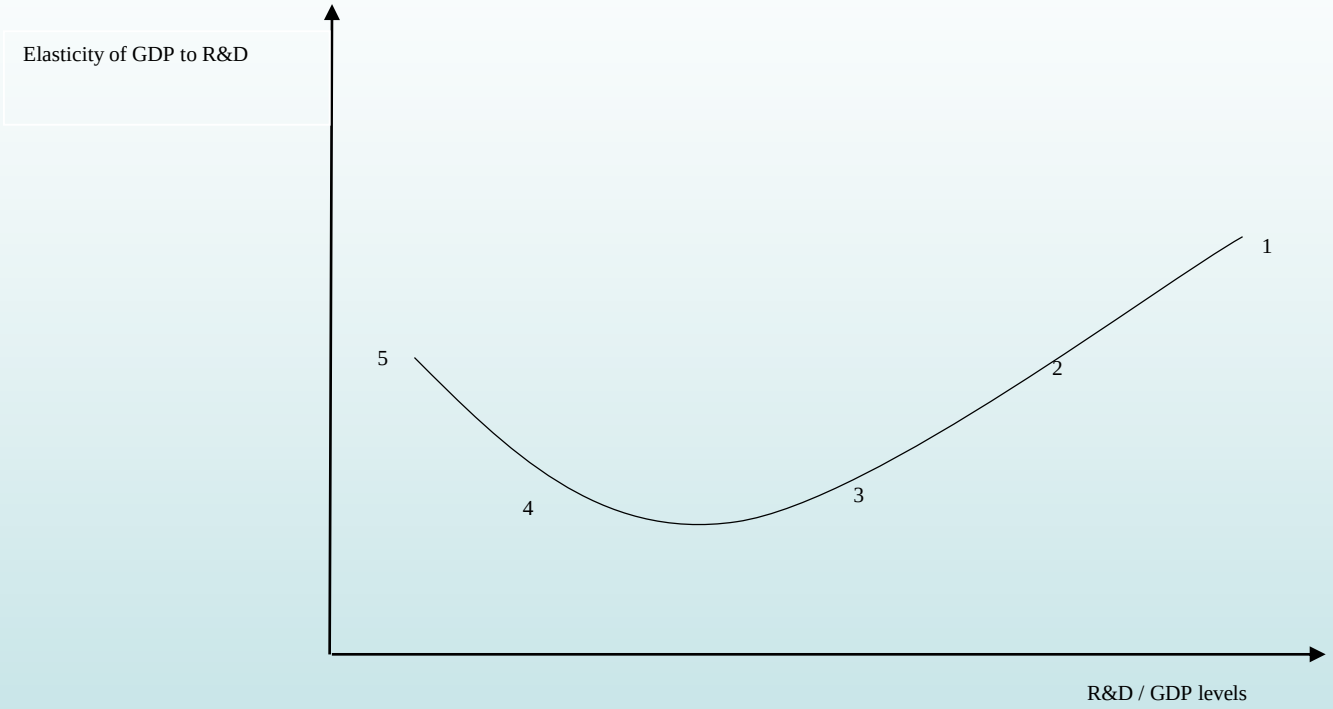
Elasticity of knowledge to R&D



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 lession: knowledge suffers from decreasing returns, as all economic resources.

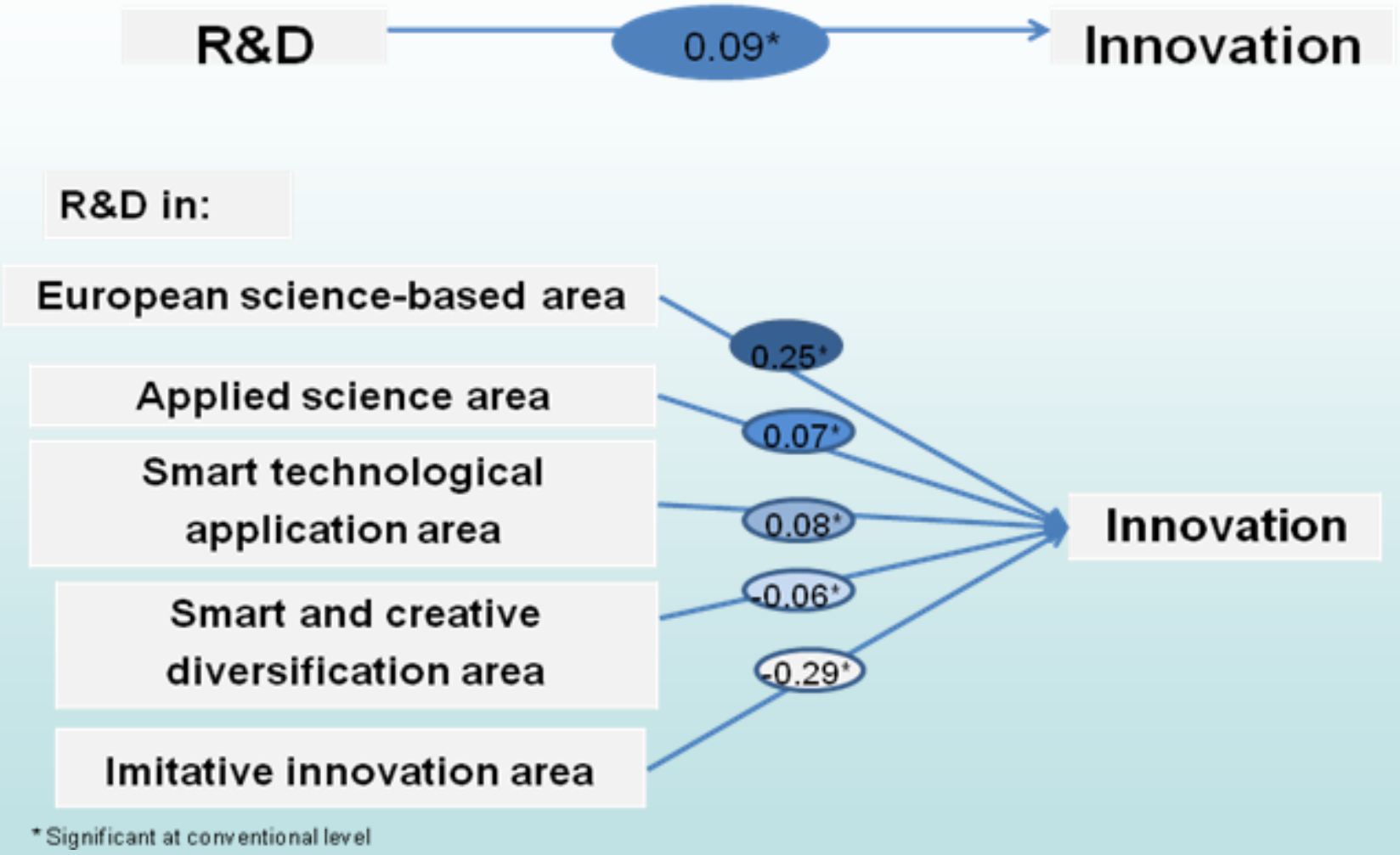
Elasticity of GDP to R&D



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-Argìles, 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

‘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				
Policy aspects	**European science-based area (Pattern 1)**	**Applied science area (Pattern 2)**	**Smart technological application area (Pattern 3)**	**Smart and creative diversification area (Pattern 4)**	**Imitative innovation area (Pattern 5)**
Policy goals	Maximum return to R&D investments		Maximum return to applications and co-operation in applications		Maximum return to imitation
Policy actions for local knowledge generation (Embeddedness)	Support to R&D in:		Support to creative application, shifting capacity from old to new uses, improving productivity in existing uses, through:		Fast diffusion of existing innovation Enhancing receptivity of existing innovation
	New basic fields General Purpose Technologies	Specialized technological fields Variety in applications	Incentives to technological development and upgrading Variety creation	Identification of international best practices Support to search in product/market diversification Support to entrepreneurial creativity	Support to local firms for complementary projects with MNCs Support to local firms for specialized subcontracting

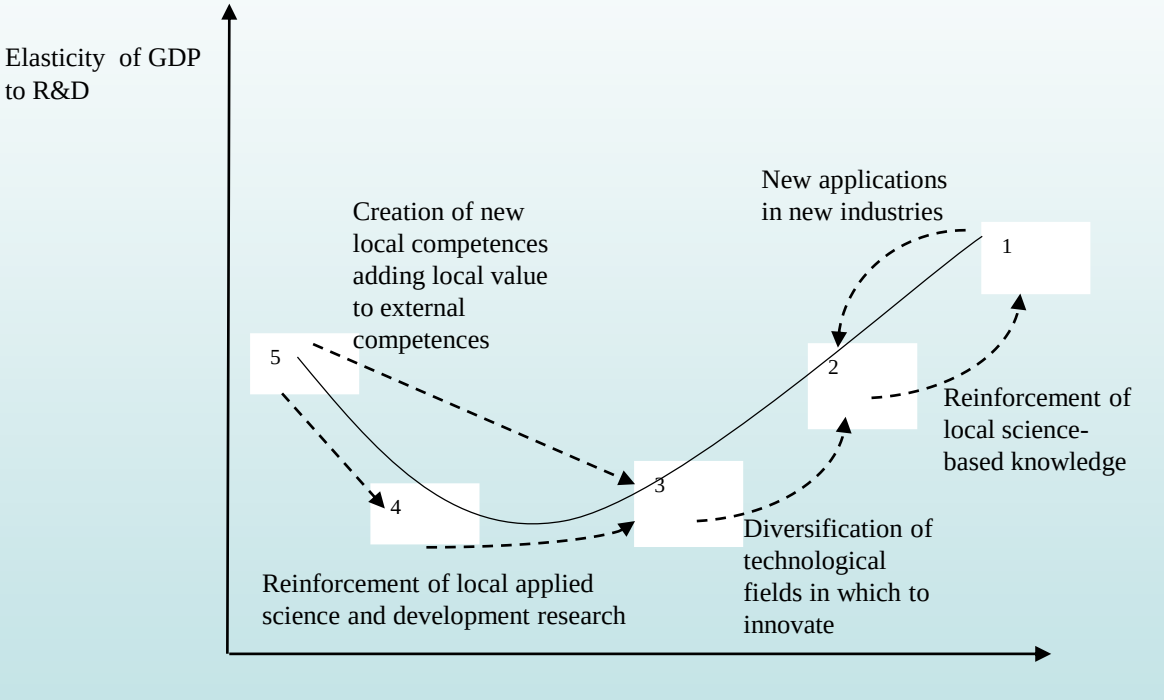
	Territorial patterns of innovation				
Policy aspects	**European science-based area (Pattern 1)**	**Applied science area (Pattern 2)**	**Smart technological application area (Pattern 3)**	**Smart and creative diversification area (Pattern 4)**	**Imitative innovation area (Pattern 5)**
Policy actions for exploitation of knowledge spillovers (Connectedness)	Incentives to inventors attraction and mobility Support of research cooperation in:		Incentives for creative applications through:		Incentives for MNCs attraction
	GPT and trans-territorial projects (ERA)	specific technologies and trans-territorial projects (ERA), in related sectors/domains Encouraging of labour mobility among related sectors/domains	Co-operative research activities among related sectors Co-operative search for new technological solutions	Participation of local actors to specialized international fairs Attraction of "star" researchers even for short periods Work experience in best practice Knowledge creation firms of the same domains	Bargaining on innovative 'local content' procurement by MNCs

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

Camagni R. and Capello R. (2013), «Regional Innovation Patterns and the EU Regional Policy Reform: Towards Smart Innovation Policies», *Growth and Change*, 44(2), 355-389

Capello R. and Lenzi C. (eds.) (2013), *Territorial patterns of innovation. An Inquiry on the Knowledge Economy in European Regions,* Routledge, London

Capello R. and Lenzi C. (2013), «Knowledge, Innovation and Regional Growth Nexus: Spatial Heterogeneity in European Regions», *Journal of Regional Science,* DOI: 10.1111/jors.12074

Camagni R. and Capello R. (2014), «Rationale and design of EU cohesion policies in a period of austerity», *Regional Science Policy and Practice,* doi: 10.1111/rsp3.12047

Capello R., Caragliu A. and Fratesi U. (2014), «Modelling Regional Growth between Competitiveness and Austerity Measures: the MASST3 Model», *International Regional Science Review*, DOI: 10.1177/0160017614543850

Capello R. and Lenzi C. (2014), «Knowledge, Innovation and Productivity Gains across European Regions», *Regional Studies*, DOI: 10.1080/00343404.2014.917167

Capello R., Caragliu A. and Fratesi U. (2014), «The Costs of the Economic Crisis: Which Scenario for the European Regions?», *Environment and Planning C*

THANK YOU VERY MUCH FOR YOUR ATTENTION!