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Smart Specialisation and Regional Productivity New evidence

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Introduction

- In the last decades **economic development** and specially **place-based innovation** and **entrepreneurship policy** have had a special boom.
- In the current Cohesion Policy context, **Smart Specialisation** places an important role to ensure the exploitation of **local capabilities.**
- A new generation of **innovation-driven growth strategies** following the logic of **smart specialisation** are being developed and implemented around the world (Mexico, Colombia, Brazil, Chile, Peru, Argentina, Hong Kong, Singapore, South Korea, Australia, USA).
- **Rationale:** long-term approach to boost technological change, value added and skill upgrading which are considered the *basic factors for economic growth, social development and environmental adaptation*.
- However, it also signals a movement away **from old regional development policies** emphasising flagship high-technology initiatives or the advocacy of large-scale infrastructure building**.**

Introduction

Preliminary insights on S3 implementation in some countries show a significant share of ERDF resources devoted to strengthening research, technological development and innovation under the 2014-2020 programming period (Gianelli et al., 2017)

Table 8. ERDF - Thematic Objective 1 (Research and Innovation): funding allocated through S3-related calls (31 December 2016)

Member State	ERDF resources			Overall ERDF funding for TO1 in each MS (2014-2020)	S3 related calls: % of TO1 resources
	Total published calls (EUR)	S3-related calls (EUR)	% of S3-related calls		
Italy	774,080,874	747,453,316	96.6	3,512,735,843	21.3
Poland	3,860,052,103	3,846,348,571	99.6	8,351,428,665	46.1
Portugal	1,253,320,000	1,253,320,000	100.0	2,328,812,052	53.8
Czech Republic	873,251,940	659,267,479	79.5	2,421,050,979	27.2
Hungary	1,194,255,484	1,073,610,323	89.9	2,148,860,450	50.0
Lithuania	244,536,487	244,536,487	100.0	678,878,835	36.0
Slovenia	75,232,627	75,232,627	100.0	461,739,158	16.3
TOTAL	**8,230,334,399**	**7,899,768,803**	**96.0**	**19,903,505,982**	**39.7**

46 OPs in Italy, Poland, Portugal, Czech Republic, Hungary, Lithuania and Slovenia by 31 December 2016

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Introduction

Smart Specialisation:

"policy **prioritisation framework** aimed at finding ways to enhance the **scale and effectiveness** of entrepreneurial processes trying to develop **regions' indigenous potential**"

Smart Specialisation to promote *innovation* and *entrepreneurship* via: technological diversification, embeddedness and connectivity

Smart Specialisation: The Foundations

- **ERA *European Research Area*** and ***Innovation Union*** **Flagship Programme**
- ***Knowledge For Growth*** **Expert Group for EU commissioner of Research Janek Potocnik** – nine policy briefs 2006-2009
- **Smart specialisation concept** – Bart van Ark and Dominique Foray – subsequently developed by Paul David, Bronwyn Hall, etc.?
  - Context matters for technological evolution – *knowledge ecology* – in terms of pathways for innovation
  - Depends on existing institutional structures and innovation systems
  - Actors and players are entrepreneurs, universities, research institutes, multinational firms, etc …
  - Shift from a sectoral discourse to a regional discourse (Mccann and Ortega-Argiles)

European Policy Contextualisation

- Europe 2020 Economic Growth Strategy *A European Strategy for Smart, Sustainable and Inclusive Growth* [COM (2010) 2020] 3.3.2010
- The EU Budget Review [COM(2010)700]
- Regional Policy Contributing to Smart Growth in Europe [COM(2010)553]
- Investing in Europe's Future: Fifth Report on Economic, Social and Territorial Cohesion, 2010
- Legislative package for cohesion policy for the period from 2014-2020
- Flagship initiatives – under Europe 2020:
  - *Innovation Union; An integrated industrial policy for the Globalisation Era; Digital Agenda; Youth on the Move; Agenda for New Skills and Jobs; A European strategy for Key Enabling Technologies - A bridge to growth and jobs*
- *EU ex*-ante conditionalities (R&D conditionality, Digital agenda- ICT, SME conditionality and the statistical system and results indicators)

Europe 2020 Growth Strategy

- *Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth* [COM (2010) 2020] 3.3.2010
- *Smart Growth*: Improving the conditions for innovation, research and development; Improving education levels
- *Sustainable Growth*: Meeting climate change and energy objectives
- Inclusive Growth: promoting employment; Promoting social inclusion (in particular through the reduction of poverty)

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Europe 2020 Growth Strategy

EUROPE 2020 THEMATIC OBJECTIVES

- **Research and innovation**
- **Information and Communication Technologies**
- **Competitiveness of Small and Medium-Sized Enterprises (SME)**

- Shift to a low-carbon economy
- Climate change adaptation and risk management and prevention
- Environmental protection and resource efficiency
- Sustainable transport and disposal of congestion on major network infrastructure

- Employment and support for labour mobility
- Social inclusion and poverty reduction
- Education, skills and lifelong learning
- Increased institutional capacity and effectiveness of public administration

EU ex-ante conditionalities

for ERDF investment priority 1 and EAFRD innovation priority:

Thematic objectives	Ex ante conditionality	Criteria for fulfilment
Strengthening research, technological development and innovation (R&D target) (referred to in Article 9(1))	**1.1. Research and innovation:** The **existence** of a **national or regional research and innovation (strategy)** ***(strategic policy framework(s))*** **for smart specialisation** in line with the **National Reform Programme,** to **leverage private research and innovation expenditure, [** *which complies with the* ***features of well-performing national or regional research and innovation systems.***] **For research infrastructures only:** 1.2 The existence of a multi-annual plan for budgeting and prioritization of investments.	– is **based on a SWOT analysis** to concentrate resources on a **limited set of research and innovation priorities**; – outlines measures to **stimulate private RTD investment;** – contains a **monitoring [** ***and review*** **] system.** A **framework outlining available budgetary resources** for research and innovation; A [indicative] **multi-annual plan for budgeting and prioritization of investments** linked to EU priorities [and, where appropriate, the] European Strategy Forum on Research Infrastructures -ESFRI).

EU ex-ante conditionalities

for ERDF investment priority 1 and EAFRD innovation priority:

Thematic objectives	Ex ante conditionality	Criteria for fulfilment
2. Enhancing access to and use and quality of ICT	**2.1. Digital growth**: [The existence **within the national or regional innovation strategy for smart specialisation** of an explicit **chapter for]** A strategic policy framework for **digital growth** to stimulate demand for affordable, good quality and interoperable **ICT-enabled private and public services** and increase **uptake by citizens, including vulnerable groups, businesses and public administrations** including cross-border initiatives.	[A strategic policy framework for digital growth, for instance, within the national or regional innovation strategic policy framework for smart specialisation is in place that contains]: - budgeting and prioritisation of actions through a **SWOT analysis [** carried out in Alignment **]** consistent with the **Scoreboard of the Digital Agenda** for Europe; – an analyses of balancing **support for demand and supply** of information and communication technologies (ICT) should have been conducted; – **indicators** to measure progress [***measurable targets*** *for outcomes*] of interventions in the field of digital literacy, skills, e-inclusion, e-accessibility, and e-health [within the limits of Article 168 TFEU] which are aligned with existing relevant sectoral national or regional strategies. – **assessment of needs** to reinforce ICT capacity-building.

EU ex-ante conditionalities

for ERDF investment priority 1 and EAFRD innovation priority:

Thematic objective	Ex-ante conditionality	Criteria of fulfilment
3. Enhancing the competitiveness of Small and Medium Enterprises (SMEs)	3.1. Specific actions have been carried out for the effective implementation of the Small Business Act and its Review of 23 February 2011 including the "Think Small First" principle.	The specific actions include: - a monitoring mechanism to ensure the implementation of the SBA including a body in charge of coordinating SME issues across different administrative levels ("SME Envoy"); – measures to reduce the time to set-up business to 3 working days and the cost to €100; – measures to reduce the time needed to get licenses and permits to take up and perform the specific activity of an enterprise to 3 months; – a mechanism for systematic assessment of the impact of legislation on SMEs using an "SME test" while taking into account differences in the size of enterprises, where relevant.

EU ex-ante conditionalities

Thematic objective	Ex-ante conditionality	Criteria of fulfilment
7. Statistical systems and result indicators	The existence of a statistical system necessary to undertake evaluations to assess the effectiveness and impact of the programmes. The existence of an effective system of result indicators necessary to monitor progress towards results and to undertake impact evaluation.	A multi-annual plan for timely collection and aggregation of data is in place that includes: – the identification of sources and mechanisms to ensure statistical validation; – arrangements for publication and public availability. – an effective system of results indicators including: – the selection of result indicators for each programme providing information on those aspects of the well-being and progress of people that motivate policy actions financed by the programme; – the establishment of targets for these indicators; – the respect for each indicator of the following requisites: robustness and statistical validation, clarity of normative interpretation, responsiveness to policy, timely collection and public availability of data; – adequate procedures in place to ensure that all operations financed by the programme adopt an effective system of indicators.

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What to be achieved?

- Deliver the Europe 2020 strategy objectives of smart, sustainable and inclusive growth
- Strengthen partnership and cooperation
- Simplification and structuring
- Looking *beyond the short term*
- Focus on *results*, not spending
- Maximise the impact of EU funding ("do more with less")

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Basic argument

- "policy resources must be **prioritised on those activities, technologies or sectors where a region has the most realistic chances to develop wide-ranging and large-scale impacts** which also develop and build on many different *local* and *interregional* linkages and connections" (Foray et al. 2012).
- "smart specialization policy is about **diversifying from regional capabilities in general**, *not only* from knowledge captured by patents" (Balland et al. 2018)
- A common feature here must be that the entrepreneurial actions contain a sufficient degree of **experimentalism and self-discovery** (Hausmann and Rodrik 2003) as is essential in all forms of innovation.

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Key goals

- Many of these processes are fundamentally based on the **upgrading in the value chain** of an activity (product, process or service) and **strengthen** the regional capabilities while boosting **innovation-led growth**.
- Foray (2012) classifies these **pathways for regional innovation** into: *transition, modernisation, diversification* and *radical foundation.*

a) **rejuvenating traditional sectors** through higher value-added activities and new market niches (mining *Silesia*; shipbuilding *Skåne;* automotive *West Midlands);*
b) **modernising** by adopting and disseminating new technologies (logistics *Flanders)*;
c) **diversifying technologically** from existing specialisations into related fields (Aeronautics in *Toulouse* to GPS technologies);
d) **developing** new economic activities through **radical technological change** and **breakthrough innovations** (Tourism in *Balearic Islands*); and
e) **exploiting new forms of innovation** such as open and user-led innovation, social innovation and service innovation (Historical heritage in *Italy).*

- It is a **check-and-update**, **test-and-recast** exercise, cognizant of limitations, and emphasising **monitoring** and **evaluation** (Kyriakou, 2017)

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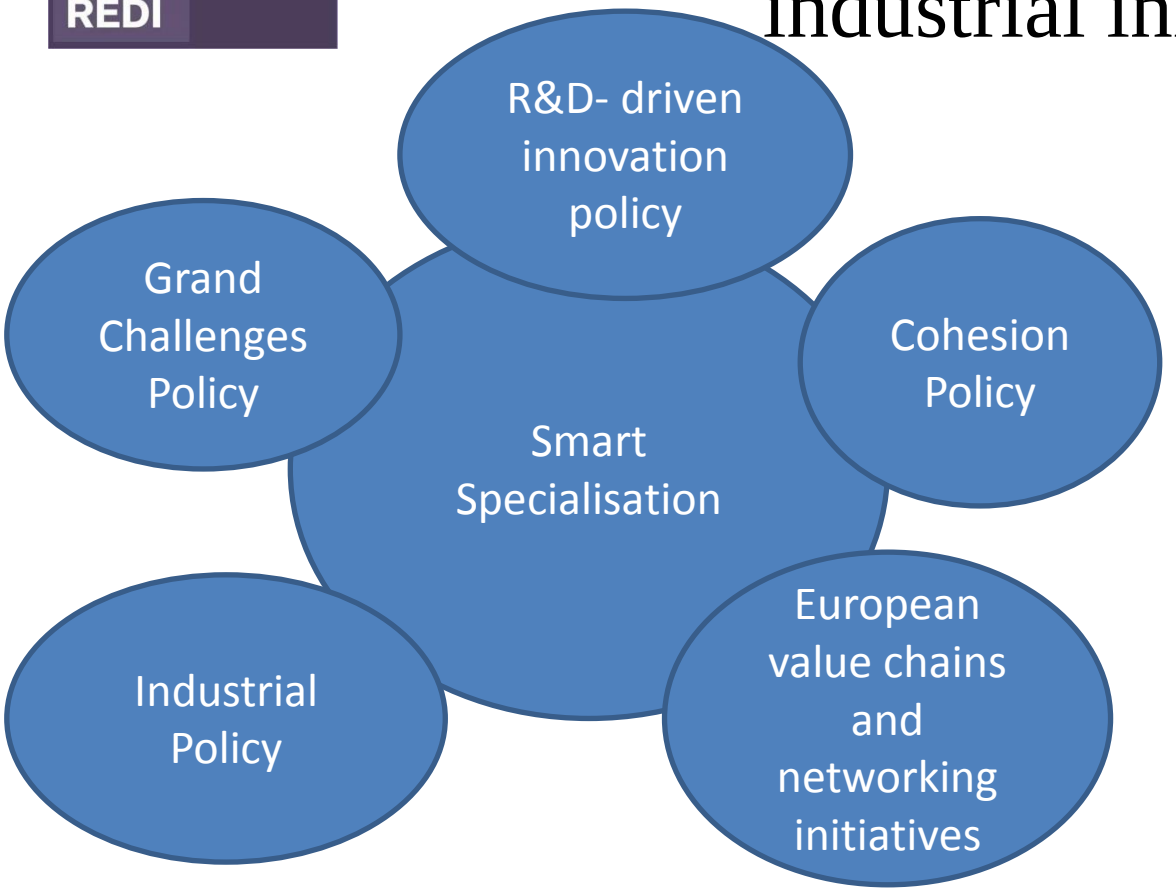
Definition

Smart specialisation is therefore a policy framework aimed at **transforming policy thinking** from top-down vertical sectoral approaches and horizontal innovation policy programmes focused on improving human capital, accelerating transfer and adaptation of technologies, creating incubators, cluster policy implementation to a **holistic, inclusive, place-based bottom up and smart policy mix approach**

(Nauwelaers et al., 2014; Kyriakou, 2017; S3 platform).

Integration of EU research and industrial innovation policies



Foray, Morgan and Radosevic (2017)

"RIS3 is a policy process focused on **technology and innovation deployment** in EU regions which is <u>being realised through other policies</u>"

"RIS3 includes elements of R&I policy, but these are **implemented, harmonised and integrated** into **national/regional R&I policies**"

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Implementation Challenges

- In designing a RIS3 regions have to **address a dual problem**: differentiation and specialisation of their innovation capacities (Foray, Morgan and Radosevic, 2017)
- ***Differentiation*: each region should find **new combinations** between **regional-specific capacities** and **regional-specific opportunities** that should be explored and developed further.**
- ***Specialisation*: concentrate **resources,** agglomerate **actors,** encourage **related projects** and provide the new specific **public goods** in order to advance knowledge and innovation in the selected domains.**

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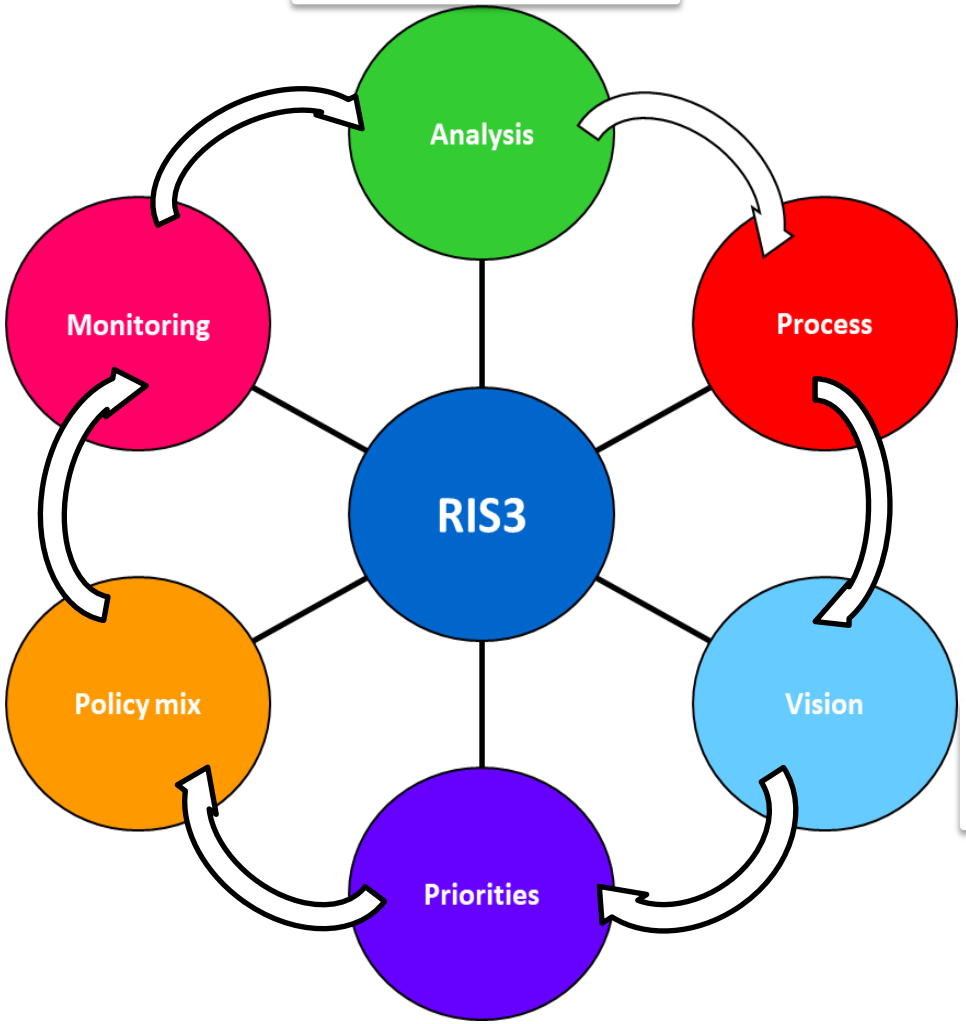
RIS3 steps



Analysis of Context

Governance

Strategy Formulation

Priority Setting

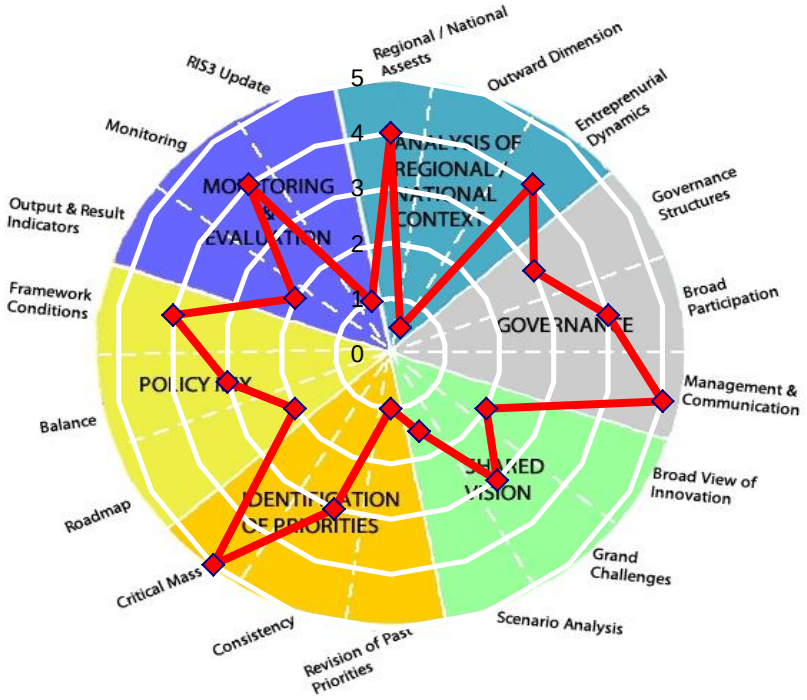
Policy Mix

Monitoring and Evaluation

Tools

From Priority Selection to Monitoring and Evaluation

RIS3 assessment wheel



Smart Specialisation Platform, JRC

Table 1 The 29 methods proposed by Online S3

PHASE	DESCRIPTION	METHOD
1. Governance	The term "governance" refers to government and stakeholder engagement. Governance implies also a quadruple helix approach as the key process of innovation production. This step should be placed at the start of RIS3, setting the framework of the entire process.	1.1. RIS3 vision sharing 1.2. Stakeholder engagement 1.3. RIS3 debate at a glance 1.4. RIS3 legal and administrative framework related to ESIF
?. Analysis of ontext	"Analysis" is an established and standard term of background information necessary for any strategic planning process. "Context" refers to regional/national specific conditions and existing institutional setting to be taken into account.	2.1. Regional asset mapping 2.2. Research infrastructure mapping 2.3. Clusters, incubators, and innovation ecosystem mapping 2.4. Benchmarking 2.5. Regional scientific production profile 2.6. Specialisation indexes 2.7. SWOT analysis
. Strategy ormulation	"Strategy" formulation (instead of policy formulation) denotes the character of RIS3 as strategy and as a project-oriented intervention. "Shared vision" makes clear the participatory approach in defining the vision and setting objectives.	3.1. Collaborative vision building 3.2. Scenario building 3.3. Delphi - Foresight
. Priority etting	Definition of activity, focus and priorities of smart specialisation.	4.1. EDP workshops 4.2. Extroversion analysis 4.3. Related variety analysis
. Policy mix	"Policy mix and action plan implementation" denote the sequence of actions for implementing the strategy. "Action plan" stresses the need for a structured project-driven approach to RIS3 implementation.	5.1. RIS3 intervention logic 5.2. RIS3 action plan co-design 5.3. RIS3 budgeting 5.4. RIS3 administrative framework conditions 5.5. RIS3 calls consultation 5.6. RIS3 innovation maps 5.7. RIS3 open data tool
. Monitoring nd evaluation	"Monitoring and evaluation" (instead of evaluation) refers to the data collection process: the need to create a repository of data to monitor the key processes of smartness.	6.1. RIS3 monitoring 6.2. Definition of RIS3 output and result indicators 6.3. Balanced scorecard 6.4. RIS3 beneficiaries and end users' satisfaction online survey 6.5. RIS3 social media analysis

Benchmarking and Profiling tools

- Eye@RIS3 (S3 Platform)
- Benchmarking regional structure (Orkestra)
- S3 Inter-regional Trade and Competition Tool
- Regional Innovation Monitor Plus
- European Innovation Scoreboard
- Regional Competitiveness Index
- KETs Observatory
- KETs Technology Infrastructure
- Digital Entrepreneurship Monitor
- Eurostat “Regional Statistics Illustrated” per NUTS2 regions
- Regional Entrepreneurship and Development Index
- Horizon2020 Policy Support Facility
- EU Trade Tool
- ICT Monitoring Tool
- Research and Innovation Observatory (RIO)
- European Service Innovation Scoreboard
- European Localised Innovation Observatory
- International Benchmarking Database BAKBasel
- The Online Education and Training Monitor
- CityBench-ESPON for benchmarking European Urban Zones
- EUROLIO
- European Cluster Observatory
- Database of Good Practices – Small Business Act
- Industrial information such as: Aeronautics and Space
- Country fiches (S3 Platform)

Table 4. Categories for 'Research and Innovation Capabilities' and 'Business Areas and Target Markets'.[4]

Research and Innovation Capabilities Business Areas and Target Markets	Examples of sub-categories	Examples of regions
Agriculture, forestry and fishing	Agricultural services Forestry and logging	Notio Aigaio (EL42) Kainuu (FI1D4)
Construction	Civil engineering Building construction	Picardie (FR22) Molise (ITF2)
Creative and cultural arts and entertainment	Amusement and recreation Sports activities	Illes Balears (ES53) Jämtlands län (SE322)
Energy production and distribution	Energy distribution Power generation/renewable sources	Flemish Region (BE2) Schleswig-Holstein (DEF)
Human health and social work activities	Residential care activities Social work activities without accomm.	Slaskie (PL22) No example found
ICT	Computer programming, consultancy Telecommunications	Bratislavský kraj (SK01) Galicia (ES11)
Manufacturing and Industry	Chemicals and chemical products Nanotechnology	Nord-Pas-de-Calais (FR30) Sachsen (DED)
Mining and quarrying	Mining support service activities Mining of metal ores	Lubelskie (PL31) Sweden (SE)
Public administration, security and defence	Defence Public administration justice, judicial,	No example found Romania (RO)
Services	Education Security and investigation activities	Luxembourg (LU) Midi-Pyrénées (FR62)
Tourism, restaurants and recreation	Accommodation (hotels, camping) Restaurants and catering industry	Basilicata (ITF5) Provincia Autonoma di Trento (ITH2)
Transporting and storage	Rail transport and related services Road transport and related services	Kymenlaakso (FI1C4) Aquitaine (FR61)
Water supply, sewerage, waste management and remediation activities	Sewerage Water collection, treatment and supply	Etelä-Karjala (FI1C5) Poland (PL)
Wholesale and retail trade	Retail trade Wholesale trade	Nord-Pas-de-Calais (FR30) Nord-Pas-de-Calais (FR30)

Source: 'Eye@RIS3' database.

McCann and Ortega-Argiles (*European Planning Studies,* 2016)

National Specialisation Areas:
Smart specialisation strategies programming period 2014-2020, EU13.

	Bulgaria	Croatia	Cyprus	Czech Republic	Estonia	Hungary	Lithuania	Malta	Romania	Slovakia	Slovenia
Food, agriculture and fisheries	X	X	P	X	P	X		X			
Biotechnology	X	P		X	P		P			x	x
Health		P	P		P	X	P	X			
ICT	X		P		P		P	X			x
Nanosciences & nanotechnologies				X					x		x
Materials					P		P		x	x	x
New production technologies		P	P	X	P	X	P	X	x	x	x
Integration of nanotechnologies for individual app				X			P	X	x	x	x
Energy		P	P				P			x	
Environment		P		X			P		x	x	X
Aeronautics	X			X				X	x		X
Space				X				X			
Automotive			P								
Rail				X			P				
Waterborne		P	P					X	x		
Urban transport and intermodalities	X	P	p	X		X	P	X	x	x	X
Socio-economic sciences and humanities				X		X		X	x	x	X
Security		X			P				x	x	

Source: **Stairway to Excellence project**

Notes: X(covered), P (partially covered). Latvia is NA. Poland analysis is at regional level.

Covered: research area fully included into S3 priority definition. Partially covered: Research area only partially included into S3 priority definition (S3 priority definition do not cover the full scope the research area).

Good practices

Multi-level governance and Territorial Reforms

New cross-border governance mechanisms
Norte (PT)/Galicia (ES)
TTR-ELAT: Top Technology Region (Eindhoven/Leuven/Aachen Triangle)
EC: Vanguard Initiative
Thematic Partnerships

Evidence-based

For Priority Selection, Monitoring and Evaluation
Developing policy tools with measurable goals.

Prioritization

"Choosing races and placing bets"
Eye@RIS3
Emilia-Romagna (IT): Biomedicine
Extremadura (ES): High-tech Farming
Lapland (FI): Arctic natural resources
Podkarpackie (PL): skill improvements in aerospace

Result-oriented and Performance-based

Galicia (ES): S3 monitoring system – 74 indicators performance/output, results and impact/context
Navarra (ES): SODENA plan
Lower-Austria (AU): Scorecard methodology
North of Netherlands: Innovator Monitor

Good Practices

Experimentation, co-creation and cooperation

University-Industry (Region Norte, PT)
Pilot programmes
Knowledge vouchers
Industrial Relatedness
Catalonia (ES): "Campus Sectorials"
business–led knowledge brokers
EC: Smart Specialisation Platforms

Key role of regional and in particular local authorities

They are essential for tackling the voice of **inclusive growth**
Ensuring political commitment
Synergic approach from different fields of policies (industrial, innovation, education, etc.)

Partnerships
Cooperation with social partners

Slovenia: Open Partnerships for private and public actors
Wielkopolska (PL): Stakeholders Engagement Platforms
Eastern Macedonia and Thrace (GR): Project Development Labs

Early findings

- Identifying smarter goals for a given region is **only a beginning**. RIS3 is not a one-off process, necessary simply to respond to ex-ante conditionalities, but rather an **ongoing process of governance and policy-making upgrading**.
- The early stage experience of RIS3 implementation across many EU regions suggests that **the benefits of RIS3 tend to be multi-dimensional** rather than purely technological and research, also involving institutional and governance dimensions.
- Earlier understandings of innovation and entrepreneurship policy tended to focus purely on narrow scientific and R&D and firm creation related aspects, whereas today they:
    - focus on **local and societal aspects**
    - involve **public and private** sector actors
    - engage **society via participatory actions**
- Relevant domains are now activities, tasks or specific technological functions in firms and production processes rather than sectors or industries

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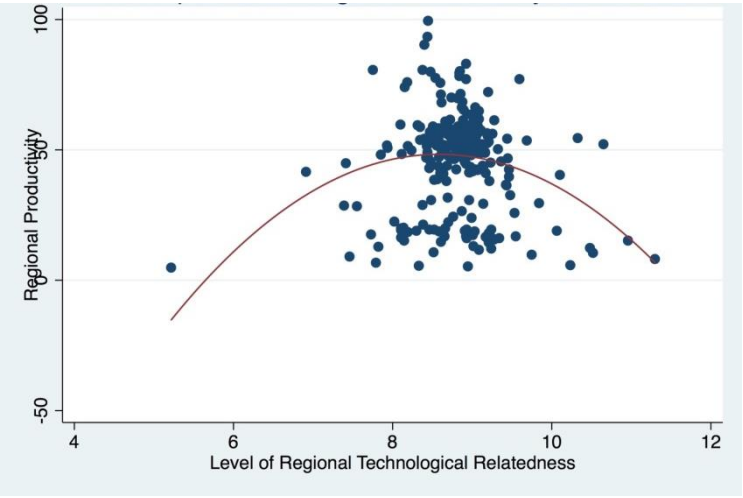
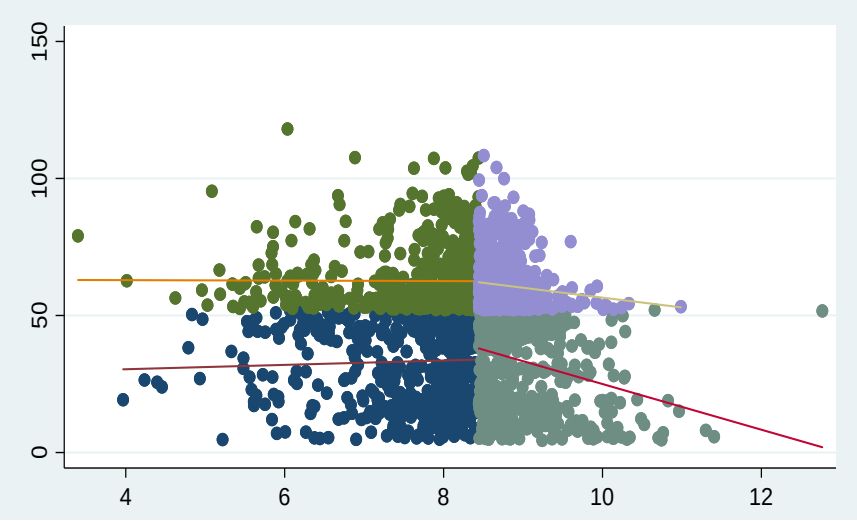
Early findings

- In economically strong regions with more *robust institutional and governance systems*, RIS3 often leads to a refining and sharpening of existing practices, while in many Southern European regions in particular, RIS3 activities appear to have **led to real progress** (McCann and Ortega-Argilés, 2016).
- On the other hand, in the economically weakest regions with *less robust governance arrangements*, and in particular in Eastern Europe, RIS3 has often proved to be **very challenging**. RIS3 poses challenging demands on fragile or limited institutional frameworks, but at the same time this also offers real opportunities for institutional learning and the upgrading of governance capabilities (McCann and Ortega-Argilés, 2016, Stairway to Excellence Pilot Project).

Lagging regions' RIS3 Challenges

- Technological diversification drives regional performance due to the potential **benefits of knowledge recombination processes** (Frenken et al., 2007; Frenken and Boschma, 2007; Foray, 2014)
- The **productivity of EU peripheral regions** is driven much more by a variety of **non-R&D activities** (engineering, production capability and management practices)





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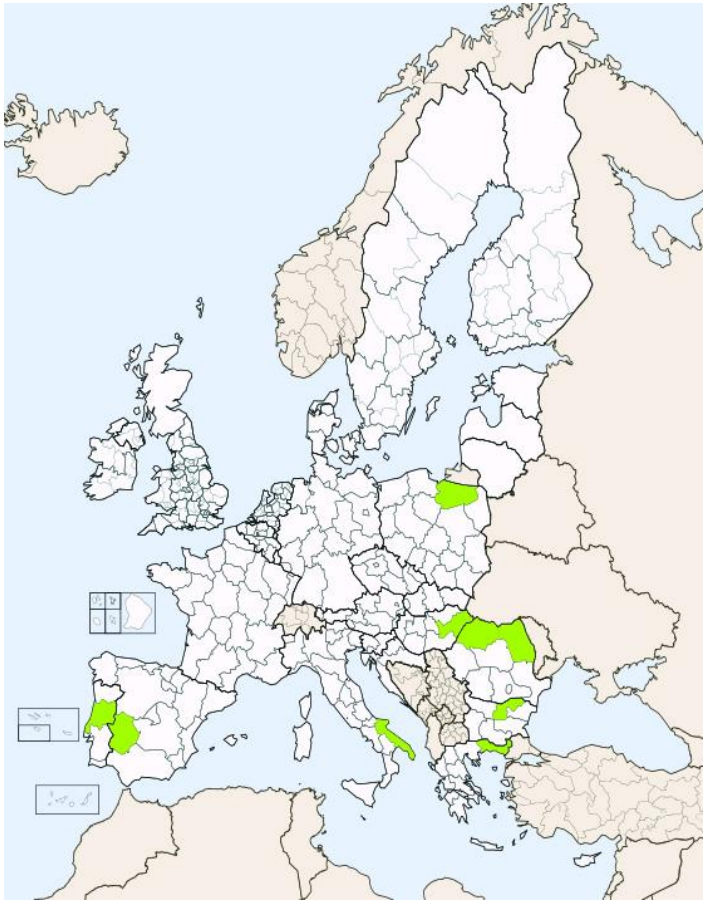
Action: JRC RIS3 support to lagging regions



Objectives:

- Improve **understanding of slow and limited growth** in EU regions and **links to macro-economic framework conditions**, taking RIS3 as an entry point.
- **Develop and disseminate lessons** and a **tool box** for other EU regions.
- Contribute to **advancing relevant theory** on (implementation of) smart specialisation by codifying **hands-on experiences.**

Low Growth	Low Income
Greece – all regions	Bulgaria - Severen Tsentralen
Italy – Puglia	Hungary - Észak-Alföld (city focus
Portugal – Centro	- Debrecen)
Spain - Extremadura	Poland - Warminsko Masurskie
	Romania - Nord-Est and Nord-Vest

Lagging regions' RIS3 Proposals

- Measures **promoting technology absorption** ("engineering excellence") rather than R&I excellence; **managerial capabilities** and **skills** are better suited for these regions (life long learning)
- **Stimulating R&D, ICT adoption, Technological Upgrading activities in firms** specially SMEs, supporting projects involving new graduates and including collaboration with research centres (knowledge vouchers, technical training)
- Increasing local business **competitiveness,** by supporting **business growth** (SMEs), **cluster formation,** promoting **internationalisation** and **export propensity**
- Skills and training, institutional and organisational changes not only focused on high-tech sectors but also **low-tech and traditional ones** (agri-food, forestry, tourism and textiles) that evolve through incremental innovation

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Lagging regions' RIS3 Proposals

- Develop a stronger **place-based regional innovation eco-system**:
  - Improving **internal connectivity** between industrial and knowledge provision (addressing mismatches through a triple-helix dialogue)
  - Opening it up and connecting to **macro-regional and European knowledge networks**
- Identify **local strengths and market opportunities** is **crucial**, as boosting only R&D may exacerbate the so-called *European paradox* by generating increased R&D outputs along side weak R&D demand that does not match local needs. **Public Consultation.**
- Development of **entrepreneurial culture** (entrepreneurship education), **learning** and **promotion**

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Lagging regions' RIS3 Proposals

- Move from process to product and **technology value chain upgrading** involving **manufacturing** as well as **services** (Radosevic and Stancova, 2016) (RIS3 thematic platforms)
- Supra-national, national and sub-national governance levels complemented with **bottom-up initiatives** (Vanguard) – challenges of globalisation and the need to generate synergies and complementarities among actors and regions (Transnational cooperation pilots, Interreg, **Thematic Smart Specialisation Platforms – Interregional partnerships** (Energy, Industrial Modernisation, Agri-food)

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S3 Thematic Platforms

EC promote new growth models at regional level, by targeting investments in innovative sectors with **significant growth potential and high added value.**

Smart Specialisation Thematic Platforms are **instruments** to support **bottom-up collaboration** between **businesses and researchers** along **value chains across the EU**.

S3 Thematic Platforms:

- promote **complementarity** of regional funding for innovation in specific smart specialisation areas (Key Enabling Technologies, service innovation or resource efficiency)
- target key political priorities in order to facilitate the **emergence of transnational projects** to modernise EU industry.
- boost Europe's competitiveness by moving into **commercialisation** and **scale-up phases**.

S3 Partnerships – Thematic S3

Energy	Agri-food	Industrial Modernisation
• Marine Renewable Energy • Sustainable Buildings • Bioenergy • Smart Grids • Solar • Advanced materials for batteries • Safe and sustainable mobility	• High Technology Farming • Traceability and Big Data • European agri-food and smart electronic systems • Bioeconomy	• Advanced manufacturing for energy applications • Efficient and sustainable manufacturing • High performance production – 3D printing • Industry 4.0 for SMEs • Innovative Textile • Medical technologies • New nano-enable products • Sport • Artificial Intelligence and Human Machine Interface • Social Economy • European Cyber Valleys • Personalised Medicine

A total of **28 existing thematic partnerships** supported by the three S3 platforms already in place **more than 100** regions are involved.

Illustration: Thematic Smart Specialisation Platform on Agri-Food

- European Commission services including DG AGRI, DG REGIO, DG RTD and JRC.
- Launched in 2016, with a total of five partnerships:
  - Consumer Involvement in Agri-Food Innovation (lead regions: Province of Gelderland, NL and Östergötland, SE)
  - High-tech Farming (lead region: Tuscany, IT)
  - Nutritional Ingredients (lead regions: Wallonia and Flanders, BE)
  - Smart sensors for agri-food (lead regions: Flanders and Wallonia, BE)
  - Traceability and Big Data (lead regions: Andalusia, ES and Emilia-Romagna, IT)
- 50 territorial administrative units involved. The majority of participating entities are located in Italy (8), Spain (8), France (5), Hungary (4) and the Netherlands (4).

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Step further

Linking and collaborating across the three thematic platforms, to:

- facilitate the **commercialisation** and **scale-up** of **inter-regional innovation projects** and to incentivise joint business.
- **combine complementary** strengths,
- **exploit other partnerships' competences** in R&I
- get **necessary research capacity**
- **overcome any lack of critical mass** or skills
- **reduce fragmentation**
- access to global value chains.

INTERREG Europe projects connected with RIS3 (Mariussen et al., 2016)

- HIGHER – **Better policy instruments** for higher innovation projects in the European regions
- BEYOND EDP – Improve the **RIS3 effectiveness** through the management of the EDP (Entrepreneurial Development Process)
- BRIDGES – Bridging competence **infrastructure gaps** and speeding up **growth and job delivery** in the regions
- Clust&RIS3 – Leveraging **Cluster Policies** for successful implementation of RIS3
- CLUSTERIX 2.0 – New models of Innovation **for Strategic Cluster Partnerships**
- SmartPilots – Improving policies in support of shared pilot facilities to increase their **impact on KET**s in Industrial **Biotech** and the **European Bioeconomy**
- S3Chem – Smart **chemistry** specialisation strategy
- S34Growth – Enhancing **policies through interregional cooperation;** New industrial value chains for growth

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Early findings

RIS3 has already proved to be an **important narrative** for beginning to **overcome various institutional blockages** and bringing about **changes to policy making** both within and beyond the sphere of technological and pure firm formation matters (Rodrik, 2014).

Despite differences in the reception of the S3 agenda across the EU, and the difficulties encountered in economically weak regions with limited institutional capabilities, there is **evidence of advancements in regional and national innovation policies' design** and a **high commitment to S3 ideas and process** (Gianelle et al., 2017)

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Regional Productivity: Measurement

Illustration:

The interplay between regional and industrial aspects in the R&D – productivity link: Evidence from Europe

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Motivation and aim

- The relationship between Research and Development (R&D) and firm performance has been receiving considerable attention in academic and political debates in the last decades.

- From Griliches (1979) many studies have provided solid evidence of the fact that firms investing in R&D gain access to productivity-enhancing innovations and improve their overall firm performance (Klette and Kortum, 2004; Janz et al., 2004; Rogers, 2010)

- Few studies have fully explored the role played by factors *mediating* this relationship.

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Motivation and aim

- Especially, at firm level, *heterogeneity* may imply that not all firms benefit equally from investments in R&D
- Firm specific (firm size, industry, age) and exogenous factors (geographical conditions, local competition, macro-economic conditions) influence both the intensity of R&D and the effectiveness of innovation in increasing productivity.
- The aim of this paper is to analyse the double *heterogeneity* in the R&D-productivity link.
- In order to do that we consider industry affiliation as a benchmark in terms of expected investments in innovation and the geographical dimension as a mediator in determining a firm's capacity to translate R&D investments into productivity and performance gains.

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Motivation and novelty

- High-tech industries outperform middle or low-tech industries in terms of productivity derived from R&D e.g pharmaceuticals vs. textiles (Ortega-Argiles et al., 2015)
- However, this industrial perspective neglects the fact that firms do not undertake R&D in a vacuum.
- Firms are *embedded in national and regional networks* and their performance crucially depends on the opportunities and challenges presented by their location and environment.
- Janz et al. (2004) pointed that studies on productivity focused on the national level ignoring the extent of diversity within countries.
- This paper moves beyond existing approaches by combining micro-level firm data with a detailed exogenous classification of European regions.

Industry & Geographical environments

Mairesse et al. (2005)

- R&D is seen as an input that creates new ideas that materialise in innovations which can be a product-type (demand creating) or a process-type (cost-reducing)
- Demand-creating innovations increase a firm's output
- Cost-reducing innovations decrease the use of inputs
- Both leading to an increase in productivity *ceteris paribus*

Sun et al. (2016)

- Applied research and experimental development have positive effects on the growth rates of productivity
- Basic research does not affect productivity in the immediate period and instead contribute to the frontier shift through its positive effect on technical change.

Industry & Geographical environments

- At firm level, firms face different **regional environments** and **specificities**
- Economic geography literature: **agglomeration economies** and **regional innovation systems**
- **Agglomeration economies**: advantages that accrue to firms locating close to other firms. E.g. firms that are located in an industrial cluster enjoy improved access to a skilled workforce, benefits from sharing suppliers, in particular if firms are operating in the same or related industries (Industrial relatedness, Frenken et al. 2007)
- Positive externalities, knowledge spillovers (Audretsch and Feldman, 96; Adams and Jaffe, 96; Cantwell and Iammarino, 2003)
- An endowed geographical area might enhance firms' ***absorptive capacity*** *(Cohen and Levinthal, 89)* and facilitate ***technology transfer*** and the super-additive effects of investments in technology over productivity (Griffith et al., 2004)

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Industry & Geographical environments

- **Regional Innovation systems**: innovation-related structure of the region understood as an integrated area including innovation clusters, networks and institutional frameworks (Asheim & Gertler, 2005)
- Asheim and Coenen (2005) – connects the regional dimension with the industrial dimension. Differentiating the traditional industrial cluster with synthetic knowledge based industries e.g. engineering based industries and regional innovation systems with analytical knowledge based industries such as science-based, IT or bio-tech.
- Zhang et al. (2012) Chinese case, high-tech industries at the sub-national level. Impact of R&D on output, 2000-2007, Eastern Chinese regions benefit more from R&D investment but least from technical progress, whereas western Chinese regions experience reverse patterns.

Data

Micro-data used in this study were provided by the JRC-IPTS, extracted from a variety of sources, including companies' annual reports with their global figures.

The construction of a longitudinal database was guided through a complex procedure made by six steps in order to have an adequate panel to run estimates.

First step: data extraction

only companies with R&D>0 in, at least, one year in the 1990-2008 time span;

only companies located EU-27 countries;

expressing all the value data in the current national currency.

Second step: deflation of current nominal values

- Nominal values were commuted into constant price values trough GDP deflators (source: IMF) centred in year 2000. For a tiny minority of firms reporting in currencies different from the national ones, we opted for deflating the nominal values through the national GDP deflator.

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Data

Third step: values in PPP dollars

- Once obtained constant 2000 prices values, all figures were converted into US dollars using the PPP exchange rate at year 2000 (source: OECD).

Fourth step: the format of the final data string

- The obtained unbalanced database comprises 690 European global players, 4 codes (country, region, sector and high vs. medium/low tech) and 5 variables (R&D expenses; Capital expenditures; Net turnover; Cost of goods sold; Employees + Value added obtained as net turnover-cost of goods sold) over a period of 18 years (1991-2008). Unbalanced panel of publicly traded companies and therefore relatively large in organisational terms.
- Data covers 16 EU countries.

Data

Fifth step: computation of the R&D and capital stocks

The methodology adopted in this study requires to compute the R&D and capital stocks, accordingly with the perpetual inventory method:

(1) $$K_{t0} = \frac{R\&D_{t0}}{(g+\delta)}$$ and $$K_t = K_{t-1} \cdot (1-\delta) + R\&D_t$$

where R&D = R&D expenditures; K=knowledge capital

(2) $$C_{t0} = \frac{I_{t0}}{(g+\delta)}$$ and $$C_t = C_{t-1} \cdot (1-\delta) + I_t$$

where I = gross investment; C=physical capital

Sixth step: outliers

In order to check for the presence of outliers, the Grubbs test was run on the key variables K and C.

We ended up with a final dataset comprising companies and 659 EU companies.

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OECD Categorisation

Category	Characteristics
Knowledge Hubs	Highest wealth levels and best performance in science and technology. Core and capital regions in Europe High proportion of high-tech and knowledge-intensive sectors.
Industrial Production Zones	Second-tier regions with large share of manufacturing
Non-science- and- technology- driven regions	Least innovative and often low population density, large share of primary sector

Based on Ajmone Marsan and Maguire (2011)

- Cluster analysis of innovation-related variables such as the number of patent applications per inhabitant, share of knowledge-intensive firms, % labour force in tertiary education
- Regional classification OECD TL2 regions

Econometric Specification

Consistently with the previous studies, we tested the following augmented production function, obtainable from a standard Cobb-Douglas function in three inputs: physical capital, labour and knowledge capital (see Hall and Mairesse, 1995):

$$\ln(VA)_{it} = \alpha + \beta \ln(R\&D)_{it} + \gamma \ln(K)_{it} + \lambda \ln(L)_{it} + \delta mediatingdummy_i * \ln(R\&D)_{it} + \mu_i + \eta_t + \xi_{it}$$

Our proxy for productivity is labour productivity (Value Added); our pivotal impact variables are the R&D stock (R&D) per employee and the physical capital stock (K) per employee, the mediating factor (industry).

Dealing with R&D stocks has two advantages:

- since stocks incorporate the cumulated R&D investments in the past, the risks of endogeneity is minimised;
- there is no need to deal with the complex and often arbitrary choice of the appropriate structure of lags for the R&D regressor.

All the variables were taken in natural logarithms.

Table 2. **Baseline Model**

VARIABLES	(1) All	(2) Knowledge Hubs	(3) Industrial Zones	(4) interaction	(5) interaction	(6) interaction	(7) interaction
ln(R&D)	0.060***	0.084***	0.030	0.084***	0.060***	0.060***	0.089***
	(0.020)	(0.024)	(0.028)	(0.023)	(0.020)	(0.020)	(0.024)
ln(K)	0.061***	0.042	0.101**	0.060***	0.062***	0.062***	0.050*
	(0.022)	(0.027)	(0.040)	(0.022)	(0.024)	(0.022)	(0.025)
ln(L)	0.693***	0.696***	0.658***	0.687***	0.693***	0.707***	0.692***
	(0.043)	(0.052)	(0.077)	(0.043)	(0.043)	(0.050)	(0.052)
ind. zone* lnR&D				-0.059*			-0.070*
				(0.035)			(0.037)
ind zone * lnK					-0.005		0.033
					(0.038)		(0.044)
ind zone * ln L						-0.051	-0.021
						(0.073)	(0.094)
Constant	3.996***	4.038***	3.828***	3.974***	3.995***	3.990***	3.970***
	(0.129)	(0.156)	(0.214)	(0.126)	(0.129)	(0.129)	(0.126)
Observations	3,680	2,493	1,187	3,680	3,680	3,680	3,680
R-squared	0.497	0.535	0.428	0.498	0.497	0.497	0.499
Number of id	659	441	218	659	659	659	659
Year FE	yes	yes	yes	yes	yes	yes	yes
Year FE Fstat	2.839	3.026	0.993	2.760	2.820	2.760	2.780
Year FE p-value	8.59e-05	2.96e-05	0.464	0.000136	9.60e-05	0.000137	0.000122
Hausman stat	107.3	71.44	36.81	113.8	106.6	109.3	115.8
Hausman p-value	0	1.06e-07	0.0123	0	0	0	0

Notes: Cluster robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Dependent variable: Labour Productivity. Estimation method: FE.

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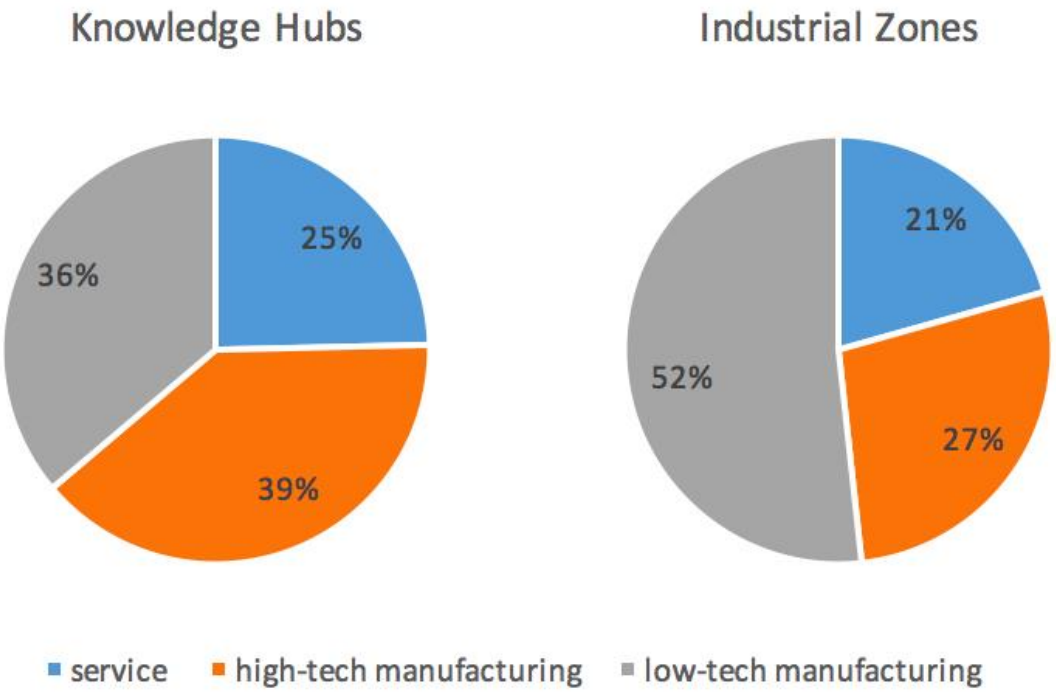
Results: Baseline

- **R&D effects** appear to be highly significant and positive for the whole sample but less so in industrial zones than in knowledge hubs.
- Firm located in regions with superior innovation characteristics may profit more strongly from conducting R&D.
- The effect of **physical capital** does not seem to be mediated by regional location as the interaction term with the industrial zone dummy is not significant.
- **Industrial zones** are likely to be less conducive for undertaking R&D, it seems reasonable that firms rely more strongly on technological change embodied in physical capital – the stock of physical capital is dominantly related to increases in productivity for firms located in industrial zones.
- However, industry aspects are neglected in these regressions.

Industrial composition of the sub-samples



VARIABLES	(1) Manufacturing Firms	(2) Manufacturing Firms	(3) Knowledge Hubs	(4) Industrial Zones	(5) Manufacturing Firms	(6) Manufacturing Firms
ln(R&D)	0.106**	0.062**	0.196***	0.023	0.185***	0.063**
	(0.048)	(0.027)	(0.054)	(0.039)	(0.048)	(0.027)
ln(K)	0.053**	0.058*	0.017	0.075	0.055**	0.073**
	(0.023)	(0.031)	(0.035)	(0.059)	(0.022)	(0.035)
ln(L)	0.697***	0.705***	0.694***	0.650***	0.681***	0.704***
	(0.057)	(0.056)	(0.063)	(0.104)	(0.054)	(0.056)
low-tech*ln(R&D)	-0.085*		-0.174***	-0.003		
	(0.049)		(0.059)	(0.059)		
low-tech*ln(K)		-0.009	0.067	-0.010		
		(0.035)	(0.042)	(0.069)		
(high-tech in inz)*ln(R&D)					-0.170***	
					(0.057)	
(low-tech in knh)*ln(R&D)					-0.141***	
					(0.051)	
(low-tech in inz)*ln(R&D)					-0.179***	
					(0.065)	
(high-tech in inz)*ln(K)						-0.042
						(0.057)
(low-tech in knh)*ln(K)						-0.004
						(0.040)
(low-tech in inz)*ln(K)						-0.072
						(0.056)
Constant	4.058***	4.037***	3.853***	4.081***	3.957***	4.045***
	(0.167)	(0.163)	(0.190)	(0.329)	(0.157)	(0.170)
Observations	2,821	2,821	1,879	942	2,821	2,821
R-squared	0.458	0.455	0.520	0.349	0.464	0.456
Number of id	485	485	316	169	485	485
Year FE	Yes	yes	yes	yes	yes	yes
Year FE Fstat	2.550	2.507	1.872	1.056	2.282	2.516
Year FE p-value	0.000465	0.000592	0.0166	0.394	0.00203	0.000565
Hausman stat	91.59	187.9	49.18	35.71	95.67	64.74
Hausman p-value	8.56e-11	0	0.000757	0.0326	7.80e-11	7.66e-06

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Results: manufacturing

- The main conclusion of the baseline model are reflected.
- **Low-tech firms** seem to derive less productivity from R&D than high-tech firms.
- The difference in the elasticity of value added with respect to R&D investment between low-tech and high-tech is more pronounced in knowledge-hubs.
- A **high-tech firm** in a knowledge hub with a 1% larger R&D investment exhibits, on average, a 0.174 percentage point larger increase in value added than a similar low-tech firm.
- Whereas high-tech firms may obtain a bonus on their R&D investment in knowledge hubs relatively to low-tech firms, no such difference exists in industrial zones.

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Conclusions

- The aim of the study was to empirically analyse **the joint effect of regional and industry characteristics** on the productivity derived from R&D expenditures.
- The **elasticity of labour productivity with respect to R&D** is found to be larger in regions characterised by a higher innovation performance (knowledge hubs).
- Physical capital plays a larger role in increasing productivity in **less innovative regions (industrial zones).**
- Industry affiliation and regional characteristics **mediate** the gains from R&D. While service sectors do not systematically differ from manufacturing in our analysis, we find that low-tech manufacturing firms profit less from R&D than high-tech ones. We further find that high-tech firms in innovation-prone regions experience larger gains from R&D than in less innovative regions.