Leveraging Territorial Knowledge Dynamics for a more effective Smart Specialisation implementation in EU Lagging regions.

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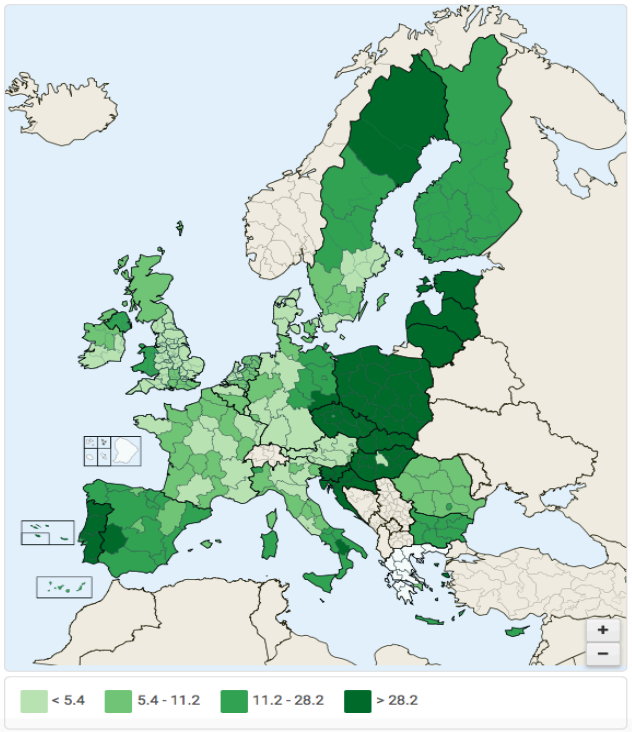
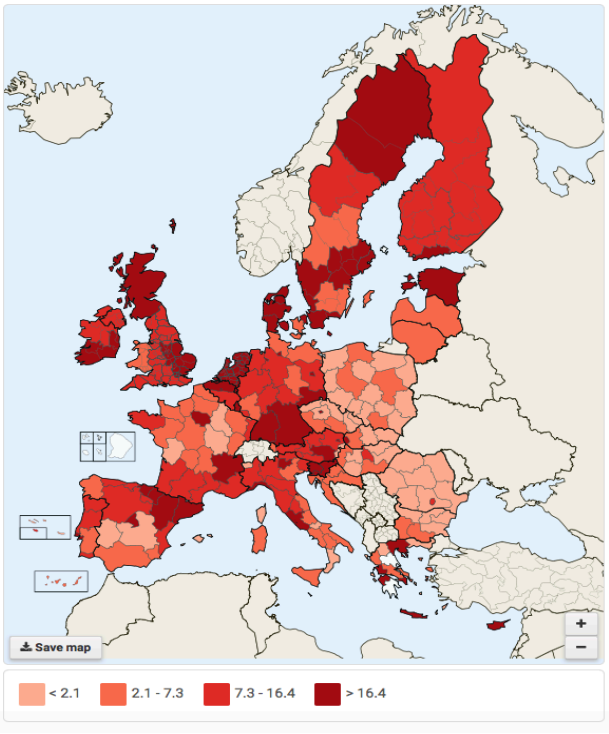
Structural Funds

Planned investments 2014-2020



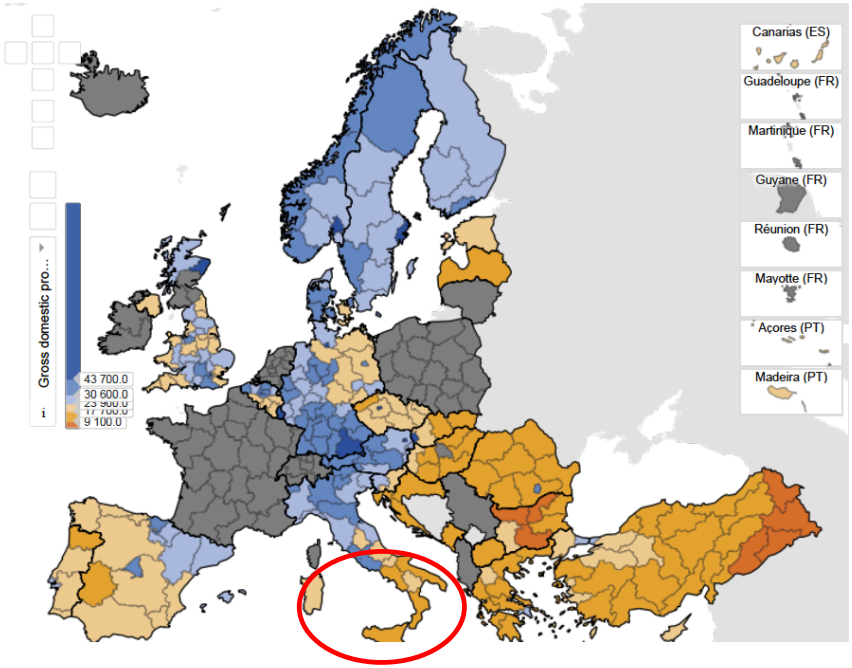
Horizon 2020

Allocated funding Until May 2017

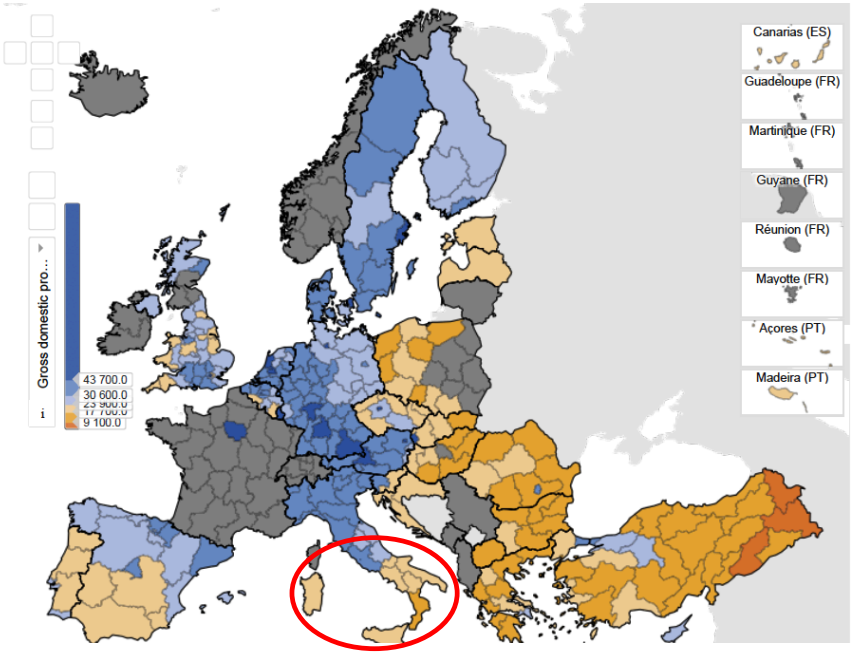


Source: S3 platfrom
https://s3platform.jrc.ec.europa.eu/synergies-tool?p_p_id=synergiestool_WAR_synergiestoolportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=3&_synergiestool_WAR_synergiestoolportlet_formDate=1565946236871&_synergiestool_WAR_synergiestoolportlet_economicData=2&_synergiestool_WAR_synergiestoolportlet_structuralFund=216&_synergiestool_WAR_synergiestoolportlet_frameworkProgramme=118 (Accessed August 2019))

EU Regions GDP per capita



2013



2017

Source: https://ec.europa.eu/eurostat/cache/RCI/#?vis=nuts2.scitech&lang=en (Accessed August 2019))

Research Questions

- Internal-regional disparities: Do they influence the achievement of regional structural innovation change?
- If yes, How to capture and exploit knowledge and innovation flows at the internal-regional level (i.e. urban scale)?

Hyphothesis

1. Persistent regional disparities are linked with internal regional differences: dynamic economic areas vs less dynamic

2. The less dynamic part are not able to catch knowledge flows making ineffective the investments in research and development, hampering the transition towards the knowledge economy and increasing the gap with the advanced regions

3. The integration (connection) among them through a targeted and specific policy action (diversification, modernisation etc.) within the S3 framework will reduce the gap making effective S3 implementation

We argue that empowering Territorial Knowledge Dynamics in lagging regions could reverse the current trend

- traditional approaches to investigate the relationship between innovation and space focused on Territorial Innovation Models (TIMs) (Butzin and Widmaier, 2016).
- Popular concepts on TIMs include Regional Innovation Systems (RISs), Clusters, Learning Regions, and more recently Territorial Knowledge Dynamics (TKDs) (Table 1).

Table 1. Concepts on Territorial Knowledge Dynamics (TKDs).
See Crevoisier and Jeannerat (2009).

Models	Highlights
Regional Innovation Systems (RISs)	- local institutional dynamics play a significant role (organizational and institutional change (Edquist, 1997); - industrial districts (Brusco, 1990) and innovative milieus; - social relationships in economics for co-location - focus on the perspective and the initiative of the firms
Clusters	- links between innovation and proximity - a wider sectoral approach in terms of including non-technologically focused sectors
Learning Region	- interactive innovation and social capital - the role of knowledge in terms of education and skill development
Territorial Knowledge Dynamics (TKD)*	- a shift is taking place from cumulative to combinatorial knowledge dynamics; a combination of different types of knowledge in innovation processes, and multi-locational knowledge dynamics - establishment of external relations (relational–organizational proximity) - the complexity of producer and consumer relations (firms' responses to socio-cultural dynamics of consumer groups)

Territorial Knowledge Dynamics

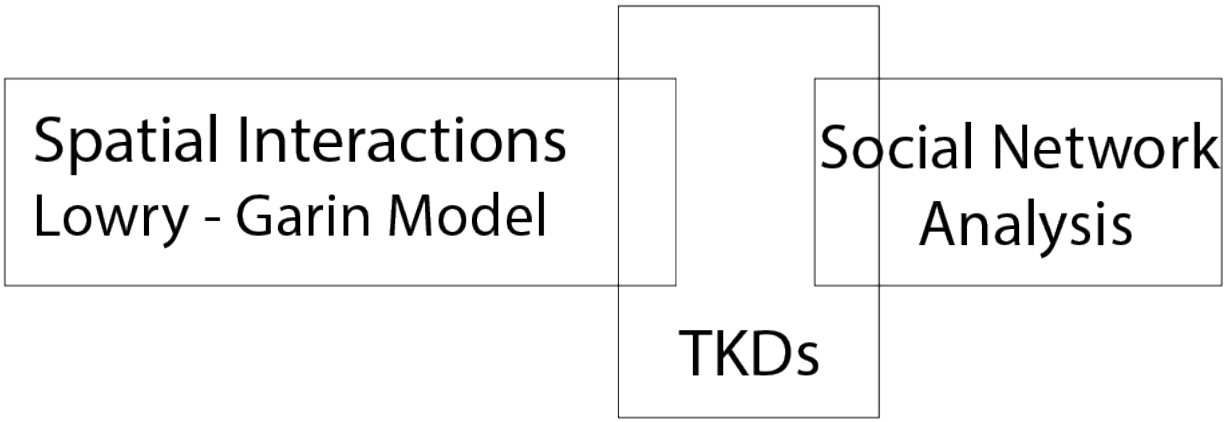
Crevoisier and Jeannerat (2009) identify three key elements that make TKD an update to TIMs.

- First, TKD is concerned with the role of ***combinatorial knowledge*** in learning and innovation processes.
- Second, the TKD concept stresses the significance of establishing "***external relations***" in order to ***capture the different types of knowledge*** and how to ***anchor this knowledge***.
- Finally, the TKD concept stresses the "***interrelatedness of production and consumption" processes,*** which is related to the increasing influence of ***non-technological innovation and socio-cultural dynamics in the knowledge economy***.

TKDs are influenced by:

- External relationship:
  - ability to capture the knowledge necessary for a territory
  - anchoring knowledge in that territory
- Knowledge economy Production/Consumptions Interactions, influenced by:
  - non-technological innovation
  - socio-cultural dynamics

- Starting from TKD we elaborated a model to characterize and localize the power zones in which knowledge and innovation are exchanged focusing on *Territorial Knowledge Networks (TKNs)* aiming at capturing the relationships between territorial assets and knowledge dynamics
- The TKNs model could characeterize places/nodes with respect their function and relevance in the network.


Spatial Interactions
Lowry - Garin Model
Social Network
Analysis
TKDs

Spatial Interaction

- The Lowry-Garin model defines the location factors of the activities according to the population of employees in the basic economic sectors and the movements induced by the demand for services.

Fd (demand of services) $N(1) = f E^B$ [1]

N(1): base population F: labor force participation rate E^B: number of employees in the basic sector

Fa *(interactions)* $I_{ij} = K A_J / T_{ij}$

I_{ij} = interaction between zones i and j A_J = attractiveness of j zone T_{ij} = index of short road trip between zones i and j K = scale constant

Social Network Analysis

- Recent contributions on ***complexity*** have been developed to understand why and how innovation occur (Fløysand, Jakobsen, 2011) with a focus on ***network of actors, knowledge flows and assets within these networks and interconnectivity of various networks*** (Fløysand, Jakobsen, 2011: 329)
- ***Social Network Analysis (SNA) resulted a frequent empirical approach in the understanding of "collective mechanisms of innovation generation***.. ..***within a territory*** (Butzin and Widmaier, 2016: 222).

Territorial Knowledge Network (TKN)

Demand and Supply of innovation: TKN

- The TKNs model defines:

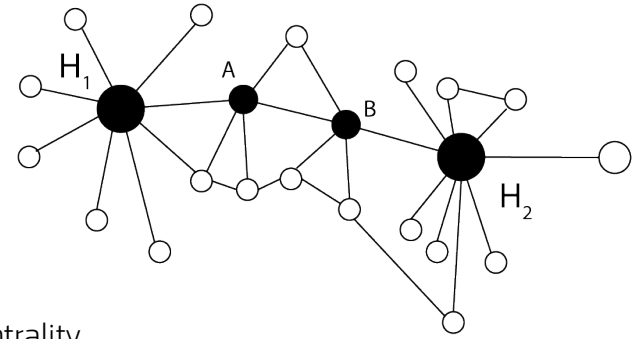
the location factors of the activities according to the population of employees in the knowledge-based economic sectors, and the movements induced by the demand for innovation.

the network elements (from SNA) are the following:

- *Nodes*: the places of production/consumption of knowledge defined and classified through their characteristics such as density and concentration of the knowledge and innovation production/consumptions key factors
- *Arcs*: the external relationships, information flows moving knowledge and innovation that need to be captured and systematized within the nodes

TKN

- SNA allows both to define the network in terms of nodes hierarchization and connections (arcs) and its efficiency level
- The definition of Terrritorial Knowledge Networks “carrying capacity” is a key step, because allows to understand if the TKN is:
  - able to support the current demand of innovation;
  - over-sized with respect the demand of innovation
- measured through:
  - density: define the cohesion level of the network
  - centrality: actor positioning in the network
- From centrality we use:
  - in-degree/out-degree measure: number of connections centrality
  - betweeness: node’s interposition centrality



$H_1 H_2$ Hubs

A, B Sub Nodes

$H_1 H_2$ (Indegree/outdegree)

A, B (Betweeness)

TKN

$$E^R(1) = a\,N(1) = a\,f\,E^B \quad [2]$$

$E^B(1)$: the amount of employment resulting and useful to the base population

a: the scale factor of service employment

The ***Fd*** calculate the increase of services and the relative employees population when the basic activities grow-up.

<u>Considering as basic activities those related to the knowledge economy we can elaborate a model connected to the key activities of knowledge production:</u>

N(k): population of the actors generating the demand for knowledge.

E^K: the amount of employment into the services related to knowledge production

Considering as basic activities for knowledge production:

- Education (e.g. universities and related institutions),
- Innovation centers,
- R&D Institutions (e.g. research centers powered by hi-tech firms),
- Spinoff , Start-up.

Adding the several activities related to the basic ones (i.e. services) and generalizing the equations [1] and [2] we obtain

[3] $E = E^B (1 - a\, f)^{-1}$ [4] $N = f\, E = f\, E^B (1 - a\, f)^{-1}$

Respectively describing:

- [3] the total amount of employees into the services related to the knowledge production
- [4] The total amount of employees operating within the knowledge production

- *(Fa)* by replacing the equation parameters with the ones related to knowledge and innovation, we can redefine the model to obtain the interactions in terms of production and consumption of knowledge.
- T_{ij} can be supposed as the index of ordinary trade of knowledge or innovation, in terms of:
  - Patents (P)
  - Licenses (L)
  - Innovative Funding criteria (F)
  - …..
- A_J Can be supposed as the ***attractiveness*** directly proportional to the concentration of innovation and knowledge production characterizing a specific area (power zone). In this perspective the j zone plays the role supply taker due to its capacity to produce innovation and knowledge.

$$[6]\ I_{ij}(P) = K\ \ Nj / d_{ij}^{a}$$

- $I_{ij}(P)$= Interaction between i and j for patents trade
- Nj = j zone population of the actors producing innovation and knowledge
- dij = difference of production concentration of innovation and knowledge between j and i
- a = a parameter that weighs the impedance (in term of costs) to the interactions determined by the difference between j and I. It represent the supplier position of j which can play a monopolistic role within the region in terms of innovation trade.
- K = scale constant

$$I_{ii} = \sum_{z=1}^{m} I_{ii}\ (z) \qquad E_{ij}^{R} = \sum_{z=1}^{m} E_{ij}^{R}\ (z)$$

- The output of the model will be the total number of “transactions” for each category of “product” exchanged and the total demand for services associated with the production category (patents, licenses, etc.)

Conclusions

- The model proposed provides a clear scheme of the allocation of knowledge and innovation production within a region, highlighting the areas where knowledge and innovation are exchanged.
- The transposition of the *Lowry-Garin model* allows to track and map out knowledge flows from the hubs – where knowledge and innovation is produced – to the nodes of the network where knowledge and innovation is captured and anchored.

Conclusions

- By overlapping the territorial knowledge network deriving from this model with the territorial systems it is possible to highlights the zones unable to catch and anchor knowledge flows detecting the internal regional differences
- Such overlapping activity results crucial in the policy design and implementation phase:
  - Firstly, it allows to target those areas where the policy intervention is needed.
  - Secondly, it suggest the intervention typology because it matches the territorial needs with the policy objectives.

Future Developments

- The development of this model in further empirical studies could provide solid basis to link spatial dimension and knowledge/innovation flows
- As a possible application, the TKN model could be integrated with the development of operational tools such as open-data platforms/GIS helping in measuring complex knowledge dynamics and supporting the S3 implementation process.

Thank you!

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