Territories, Technologies, Actors: three dimensions to explore the production of innovative activities

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RISIS RESEARCH INFRASTRUCTURE FOR SCIENCE AND INNOVATION POLICY STUDIES

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Geography: Sereval scales to frame the analysis of innovation

- Three fundamental spatial scales can be considered to shape the geographic platform in which economic activity and innovation is organized: the global, the national, and the local scale
- The geography of knowledge production should take into account close distance interaction (local scale) but also long distance interaction.
- Local scale: knowledge exchange facilitated by local infrastructures of related and supporting industries, specialized skilled labor pools, and the proximity to a strong knowledge base - Local knowledge flows are associated with tacit forms of knowledge
- Regions, and in particular cities, have moved to the centre of attention over the past decades - based on the finding that inventors still heavily rely on local information or knowledge as input factor for novel products or processes
- Global knowledge corresponds to more formalized or codified knowledge (‘knowledge stickiness’ ; ‘absorptive capacity’)

Geography: Concentration of knowledge production

- Innovation is spatially concentrated
- The spatial and temporal distribution of knowledge is highly uneven and only a handful of regions are actively engaged
- Cities are key places of knowledge exchange; they are primary places of creativity and dense locations of knowledge generation and spillovers.
- Large metropolitan areas are among the most productive places
- Large diversified cities embody a functioning urban network ecology, well-developed political and institutional systems, research facilities and global knowledge linkages, all of which are conducive to knowledge creation
- Large metropolitan areas have disproportionately more inventors than smaller ones - Increasing returns to patenting exist as a scaling function of city size.

Concentration of patents in Functional Urban Area (FUA) in OECD countries (Paulov, 2019)

Average share of patent applications of the top 10%, 5% and 1% cities for 2010-14

	Top 10%	Top 5%	Top 1%
Japan	87.9	84.0	51.3
United States	67.0	53.4	25.2
Total*	63.8	54.1	31.1
France	60.6	53.9	34.2
Europe	48.7	37.7	17.1
United Kingdom	42.9	30.8	12.9
Germany	37.7	24.7	7.1

The concentration of patenting in a few leading cities is high at global and national level.

Top 10% of the 1 022 FUA account for (64%) of patent applications (and 31.4% of the population)
Top 5% of these FUA account for 54% of patent applications (24.6% of the population)
Top 1% of these FUA account for 31% of patent applications (12.7% of the population)
Top 5 cities (Tokyo, Seoul, San Francisco, Higashiosaka and Paris) : 22% of the patent applications ; 8% of the po

Concentration of patent production in Metropolitan Areas (MA) worldwide (Risis Patent Database)

Top 26 Metropolitan Areas (23 Large MA)

- 60% of patent production
- High growth of patent number: 137% (avg growth:32%)
- Half have stable production over time (patent share or ranking)
  - Fast growth in North America top MA (San Jose, Detroit, San Diego, SF, Seattle)
  - Negative or low growth in EU top MA (except Stockholm)

- 4 MA outperform (in Top 10 in 2010-14)
  - Guangzhou (China): + 109 Rk ; patent nber growth: >2800%
  - Beijing (China): + 100 Rk ; patent nber growth: >1600%
  - Taipei (Taiwan): + 35 Rk ; patent nber growth: 500 %
  - Shanghai (China): + 114 Rk ; patent nber growth: >1200%

MA	Type	Country	Share RPD 10_14	Rk 10_14	Rk 00_04
Tokyo	LMA	JP	18%	1	1
Osaka	LMA	JP	7%	2	2
Seoul	LMA	KR	6%	3	3
Guangzhou	LMA	CN	3%	4	113
San Jose	LMA	US	2%	5	5
Beijing	LMA	CN	2%	6	106
Taipei	LMA	TW	2%	7	42
Nagoya	LMA	JP	2%	8	7
Paris	LMA	FR	2%	9	4
Detroit	LMA	US	1%	10	29
Boston	LMA	US	1%	11	10
San Diego	LMA	US	1%	12	14
Anjo	MMA	JP	1%	13	12
San Francisco	LMA	US	1%	14	13
Shanghai	LMA	CN	1%	15	129
New York City	LMA	US	1%	16	6
Stuttgart	LMA	DE	1%	17	8
Seattle	LMA	US	1%	18	18
Munich	LMA	DE	1%	19	11
Daejeon	MMA	KR	1%	20	37
Los Angeles	LMA	US	1%	21	14
Minneapolis	LMA	US	1%	22	15
Eindhoven	MMA	NL	1%	23	9
Chicago	LMA	US	1%	24	16
Houston	LMA	US	1%	25	25
Stockholm	LMA	SE	1%	26	31

Technology: Specialisation versus diversity

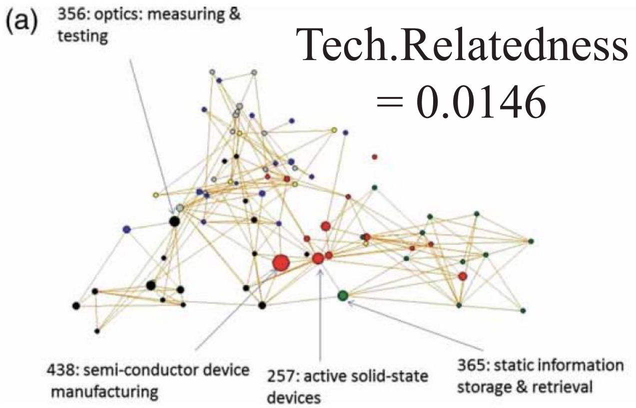
- The creation of new knowledge is both highly stylized and path dependent
- Specialisation versus diversity: both specialization and cross-fertilization of ideas between sectors (technologies) are important shaping the regional development
- Diversity and specialisation might play different roles
  - ✓Incremental innovation should demand specialized knowledge to improve existing technologies
  - ✓ The generation of radical, disruptive innovation should be boosted when diverse sectoral knowledge bases are combined,

Technology: Technology relatedness

- Technology specific capabilities of a territory are a key source of its industrial diversification (evolutionary process)
- Diversification occurs into new activities that are related to existing activities. New activities build on and combine related local activities
- Knowledge spillovers within the region occur primarily among related sectors (technologies) and only to a limited extent among unrelated sectors"
- 'Related variety': optimal cognitive distance for effective knowledge spillovers to increase innovative output in a particular place (Frenken,2007)
- Co-occurrence of technology classes listed on patent documents measures the technological relatedness (proximity)

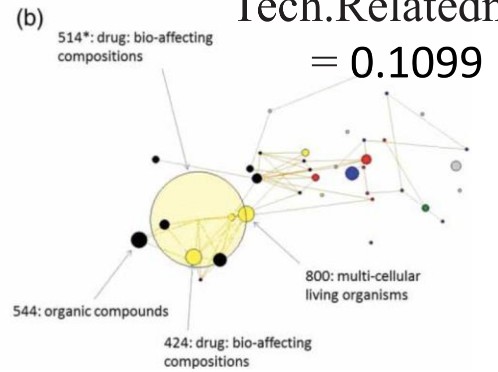
Technology: network and relatedness (Kogler, 2013)

Bradenton-Sarasota, FL



Tech.Relatedness = 0.0146

Diffuse pattern of invention

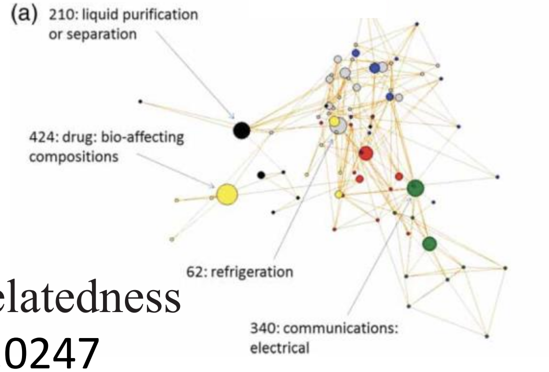


Tech.Relatedness = 0.1099

Specialised pattern of invention

Norwich-New London, CT

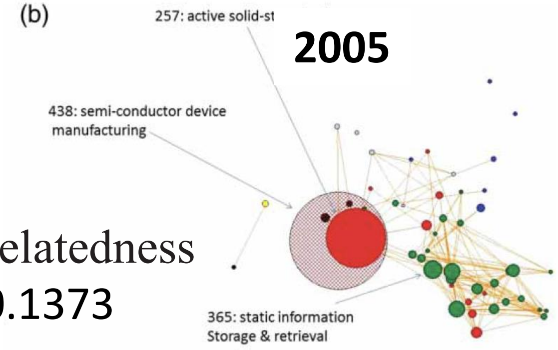
1975



Tech.Relatedness = 0.0247

Poughkeepsie, NY.

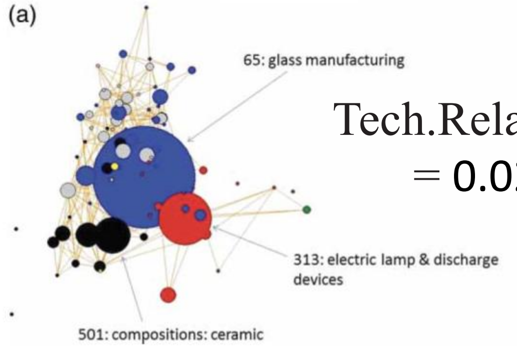
2005



Tech.Relatedness = 0.1373

Specialisation
Patent number increase

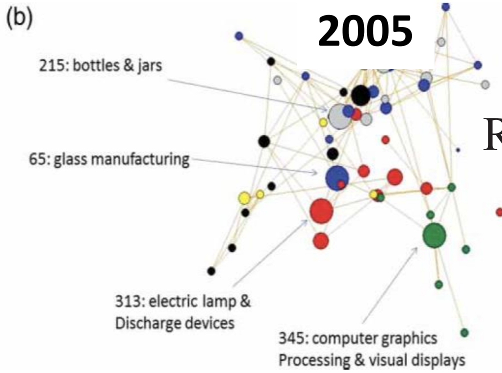
1975



Tech.Relatedness = 0.0290

Toledo, Ohio

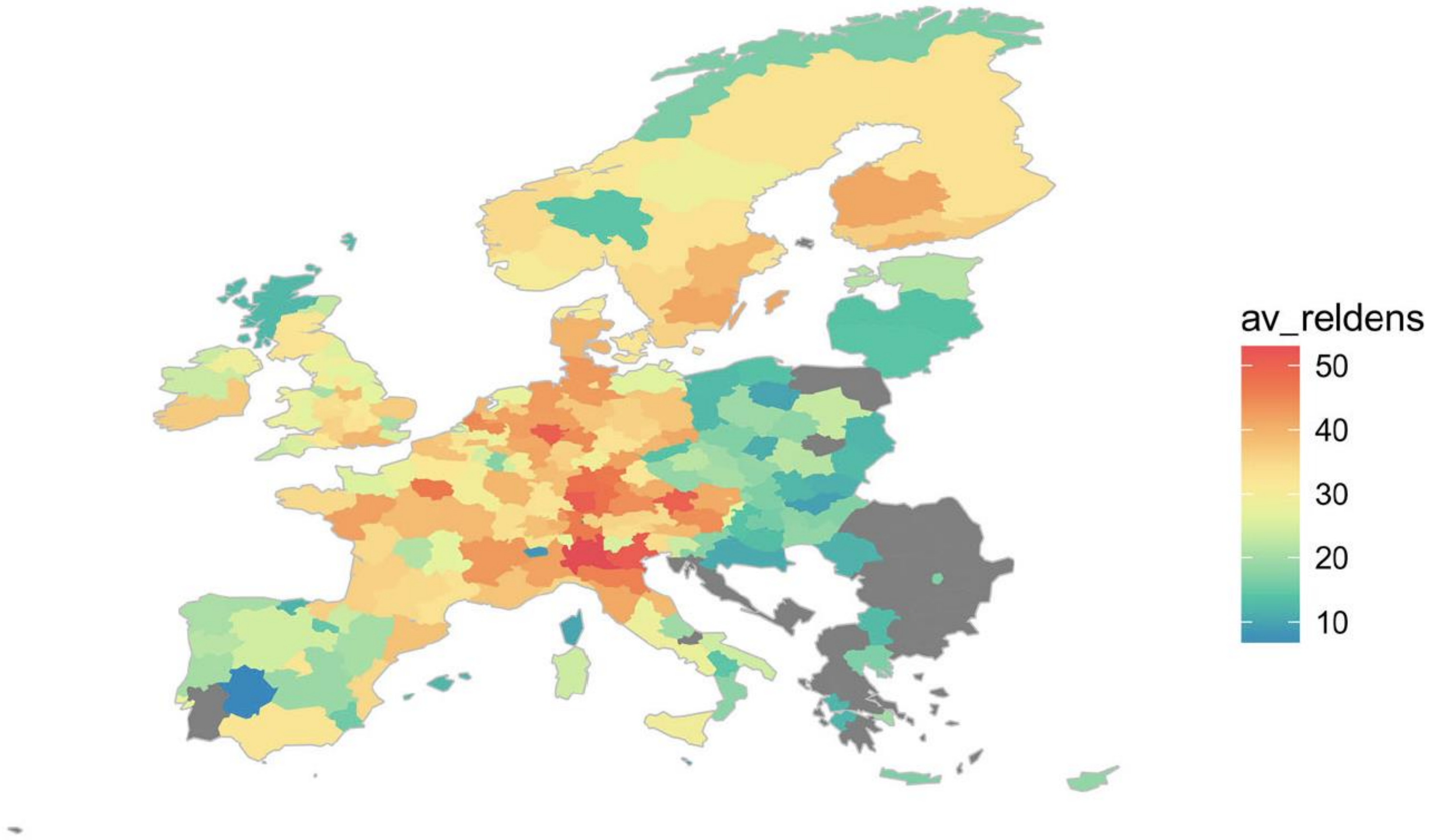
2005



Tech. Relatedness = 0.0156

Loss of specialization
Patent number decrease

Average relatedness density between existing technologies in European regions (Balland, 2019)



Technology relatedness drives regional knowledge development

- Technology relatedness enhances rates of patenting per worker (Kogler,2013)
- Technologies related to the regions pre-existing knowledge space have a high probability to enter that region that technologies that did not (Ridby, 2015)
- Relatedness between technologies is one of the driving factors behind regional diversification (Boschma, 2017)
- Growth of fuel cell technologies in Europe (Tanner, 2014); nanotechnologies in European regions (Colombelli, 2014) ; spatial diffusion of rDNA technology across US metropoles (Feldman, 2015).

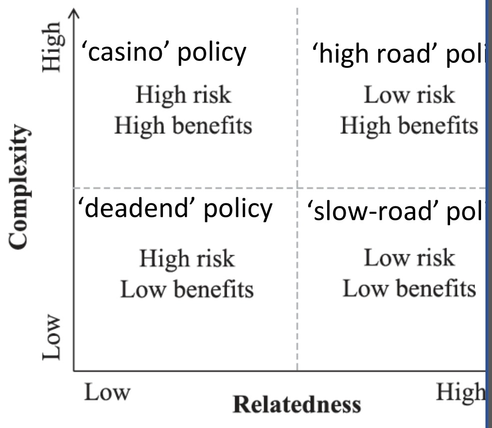
Technology relatedness and Technology complexity

A further step to study regional development combines:

- Technological relatedness of a region (technology specialisation)
- Complexity (unambiguousity) of the technologies mastered in the region - It allocates a «value» to the technology

- Use as a framework for smart specialisation (Balland, 2019)
- Identification of the most promising areas for the green transformation

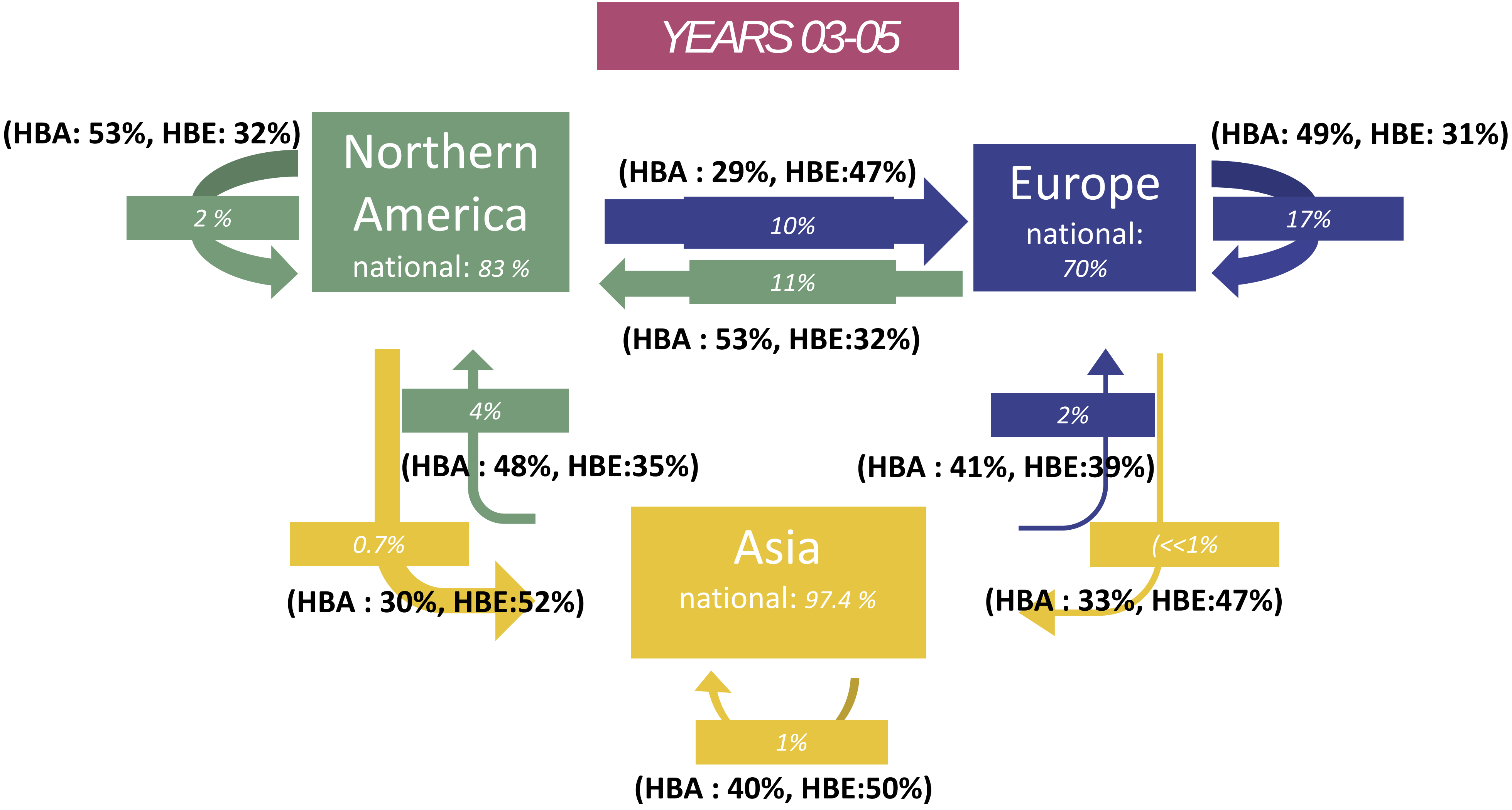
(https://iri.jrc.ec.europa.eu/complexity/main-outputs/green-complexity)



Actors: MNCs concentrate R&D activities

- Multinational corporations (MNCs): focal entities of innovation activities: 4000 top R&D performers applied for more than 75% of the priority patents (Asia > North America >Europe)
- Both intra- and extra-organizational networks at the global scale significantly contribute to product and process innovations in MNCs; firms outsource R&D activities and partner
- MNCs have the ability to re-locate their sites of production and R&D: decisions are strongly guided by the availability of local resources - R&D is still first home-based and the global R&D internationalisation (23%) is stable (Laurens, 2015)
- Innovation processes are still carried out predominantly in a few key regions:100 top Metropolitan Areas (i.e. 6,2% of Worldwide MA) produce 82,7% of MNC patetents (Top 9 Asian MA produce 82% of the Asian patents; Top 50 North American MA produce 82% of NA patents ; Top 105 EU MA produce 82% of EU patents)

Actors: pattern of MNCs internationalisation of R&D activities



(Laurens et al., 201

- Study of innovation dynamics in innovation system requires to set up:

  - A geographical frame where to study the organisation of knowledge activity and locate both the knowledge production and the actors involved in the knowledge production process
  - All places are not equal: urbanization, localization, and diversity
  - Innovation is quite concentrated (geography, technology, actors)

- Thanks to large patent databases, a lot of studies focus on invention, the first step of innovation

  - Large metropoles
  - Technology relatedness (and complexity)
  - Large Multinationals

- Limits

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