



EUROPEAN UNION

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Inspire Policy Making with Territorial Evidence

The role of urban areas in the actual technological transformation

Main messages from T⁴

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// The consortium

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→ Lead partner; responsible for Task 1, 2 and 4
2. Technopolis Group
→ Partner; responsible for Task 3; contributor to Task 1 and 4
3. Prof. Slavo Radosevic
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4. MCRIT
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5. EUROREG – University of Warsaw
→ Partner; contributor to Task 3 and 4
6. University of Economics in Bratislava
→ Partner; contributor to Task 3 and 4

// Aim of the presentation

Through the results of the ESPON T4 project, the presentation aims to highlight the role of **cities in the present 4.0 technological transformation.**

n.b. The project is not yet finished.

// The present technological transformation: what is it about?

The new 4.0 technologies create technological transformations in the economy and in the society. By technological transformation the project depicts different structural socio-economic changes in:

- 1. the reconfiguration of the technology market, through the opening of market opportunities to newcomers and to user innovators, due to the recombinatorial nature of 4.0 technologies;**
- 2. the automation of industrial production processes (Industry 4.0)**
- 3. the creation of new digital services (servitisation and “gig economy”);**
- 4. new service delivery and new traditional industry activities (digitalisation of traditional activities).**

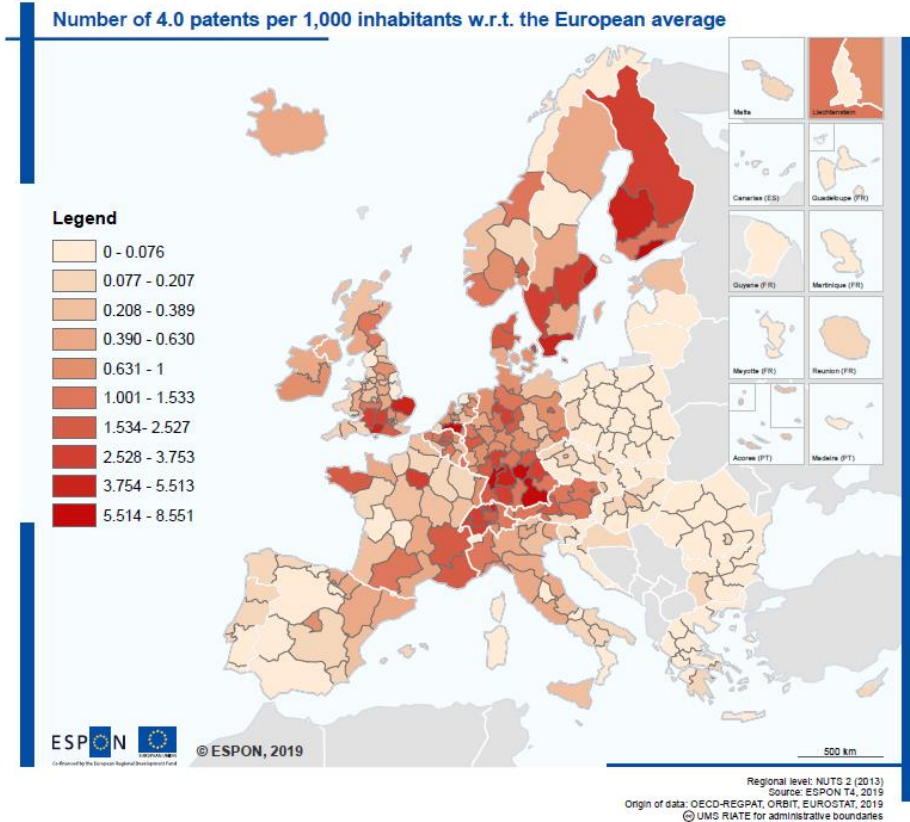
In this presentation we highlight **the role of cities in these technological transformations.**

Where does technological transformation take place?

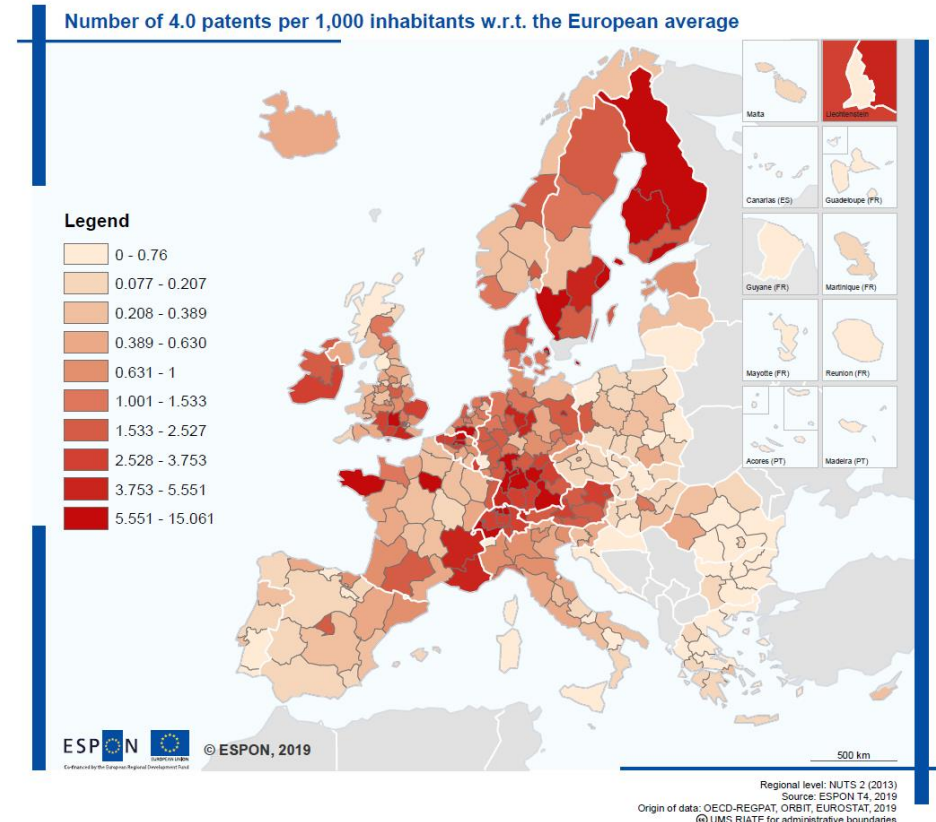
**The opening of market opportunities to newcomers in the
technology market, and to user innovators**

// Opening of market opportunities to newcomers in the technology market

Intensity of 4.0 patents - 2000-2009



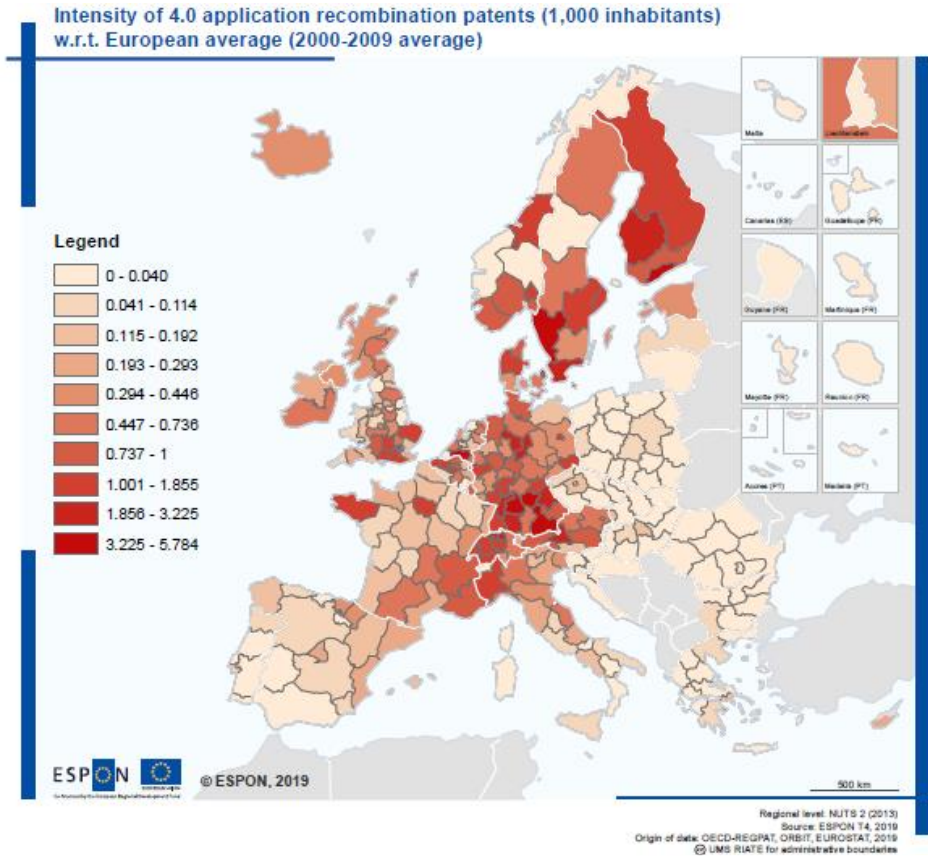
Intensity of 4.0 patents – 2010-2015



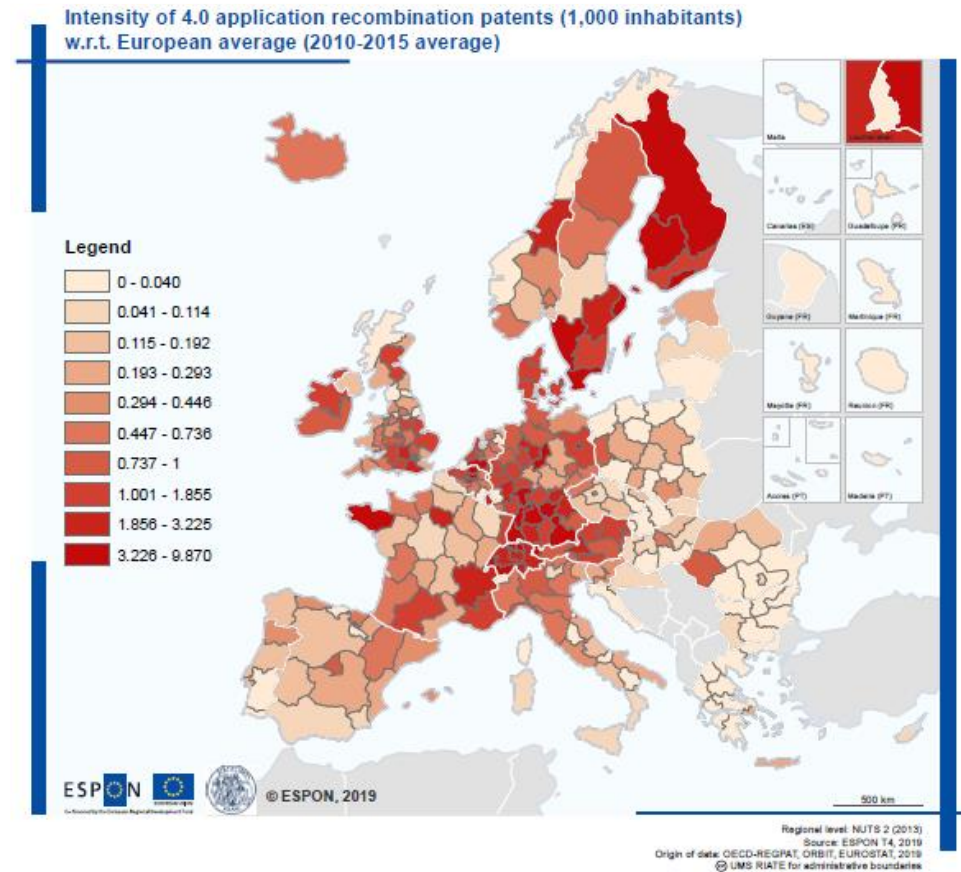
Urban areas register the highest intensity in 4.0 patents, and this is a trend that reinforces over time. Urban population is on average 66% of total population in the regions with the greatest intensity of creation and 22% in the least 4.0 patents creative regions.

// Opening of market opportunities to newcomers in the technology market

Intensity of 4.0 recombination patents with applications - 2000-2009



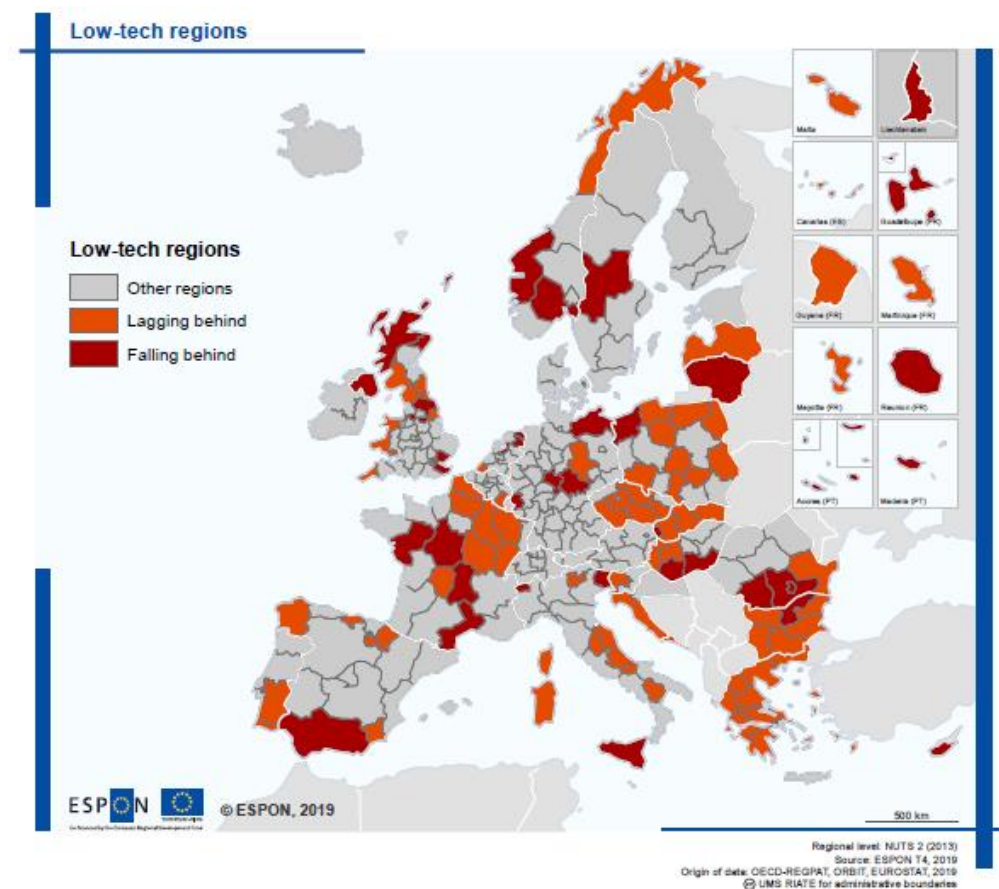
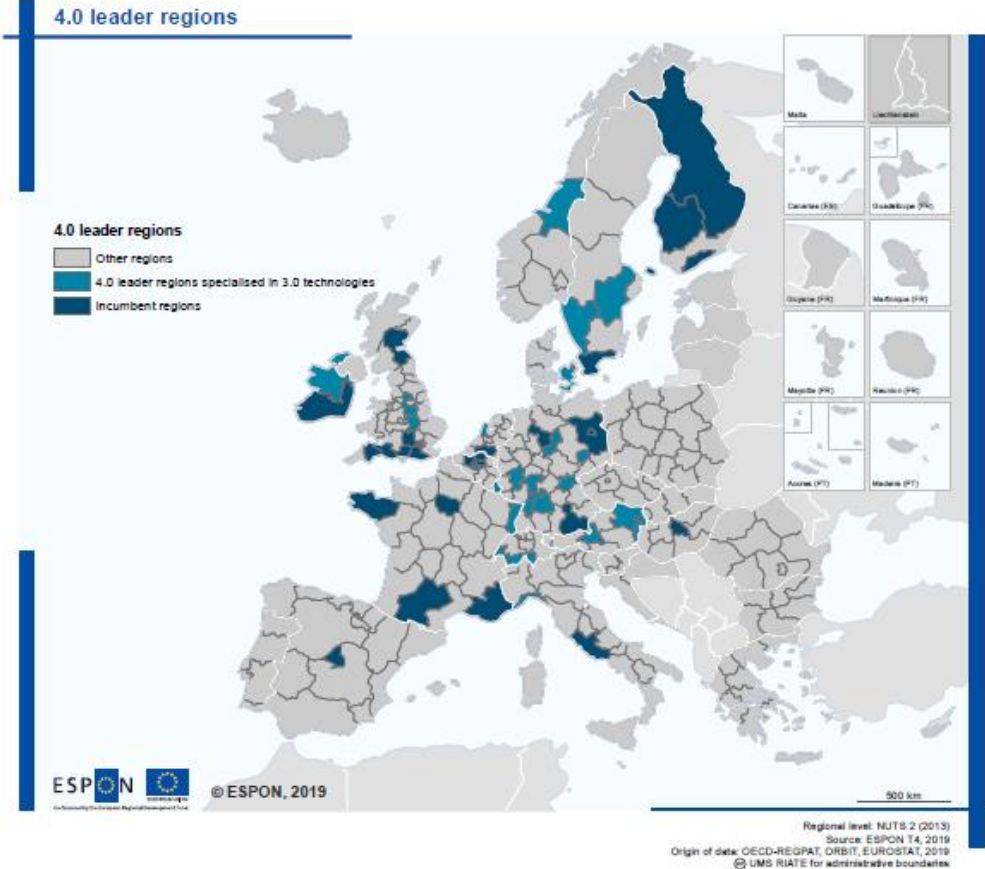
Intensity of 4.0 recombination patents with applications - 2010-2015



4.0 recombinatorial inventions are highly concentrated in space, as expected. In relative terms, however, **the spatial patterns of recombinatorial inventions targeting specific applications are more dispersed.**

Urban areas play an important role. Urban population is on average 66% of total population in the regions with the greatest intensity of creation of 4.0 patents, against **22%** in the least 4.0 patent creative regions.

// Leading regions and low-tech regions



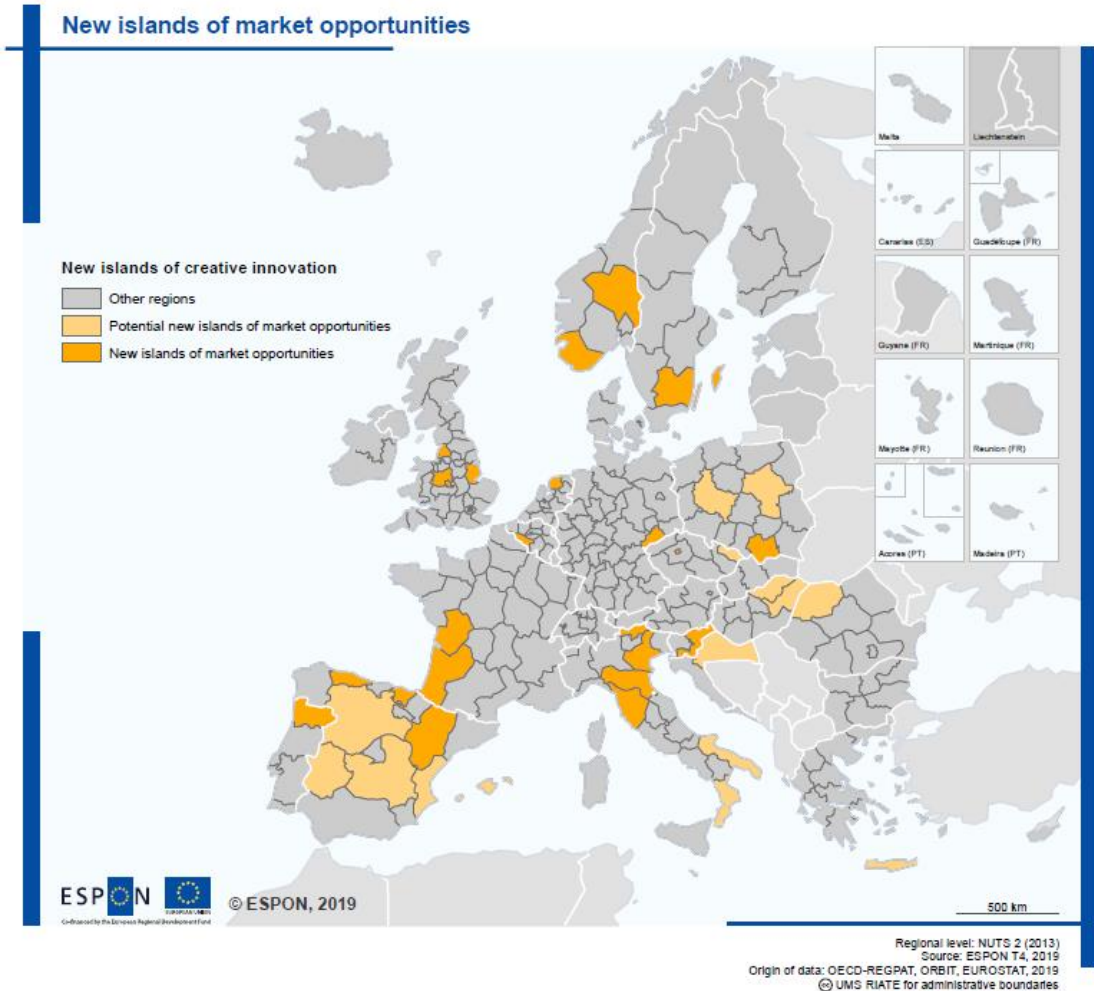
Technological cumulativeness is in general high, (i.e. 146 regions out of 292 present a varying combination of leader and niche statuses in the two groups of technologies).

Leader regions are more urbanised than the others: the shares of urban population are respectively **66%** and **42%**.

More than 40% of regions are excluded from any creative effort in the creation of 4.0 technologies (122 regions out of 292)

Low-tech regions are less urbanised than the others: the shares of urban population are respectively **36%** and **54%**.

// New islands of market opportunities



Technological leapfrogging is possible leading to the rise of **new islands of market opportunities** (23 out of 292) in regions located both in relatively less innovative areas of leading countries (e.g. FR, UK, SE, NL, DE) but also in follower countries (e.g. IT, PT, ES) and, even more importantly, in eastern countries and not only in capital regions (e.g. PL, CZ, SI, RO).

Cities are places where the most technological transformation takes place, but opportunities are given also to new and less developed regions.

These regions are relatively less urbanised than the others (the shares of urban population are respectively 42% and 47%).

How are industries adopting new emerging technologies and solutions?

The automation of industrial production processes (Industry 4.0)

The creation of new digital services (Servitisation and gig economy)

The digitalisation of traditional activities

// Additional types of technological transformation

- **The automation of industrial production processes (Industry 4.0)**
- **the creation of new digital services (servitisation and “gig economy”);**
- **digitalisation of traditional activities.**

In order to identify such transformations, we identified the sectors expected to lead such transformation, the degree of specialization of regions in such sectors and the intensity of adoption of new technologies in such sectors.

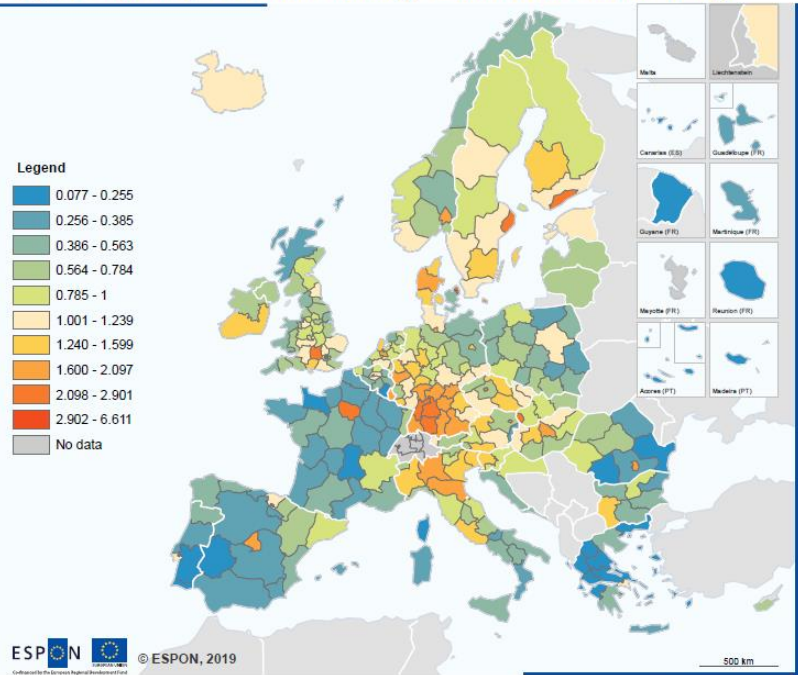
- **Technology sectors:** sectors that **actively produce such technologies.**
- **Carrier sectors:** sectors that **account both for the highest intensity of use of digital solutions and automation, and for their potential capacity to produce new technologies for their own purposes and for commercial activities.**
- **Induced sectors:** traditional industries and services which are not central to the current technological transformation

Regional sectoral specialisation

// Regional specialisation in the different sectors

Technology regions

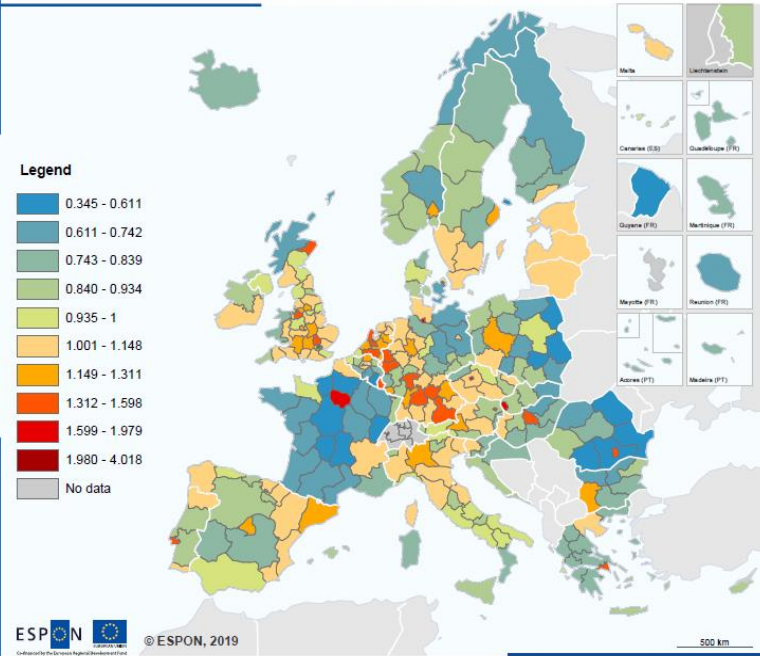
Degree of regional specialisation in technology sectors w.r.t. the European average



Regional level: NUTS 2 (2013)
Source: ESPON T4, 2019
Origin of data: EUROSTAT, 2019
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Carrier regions

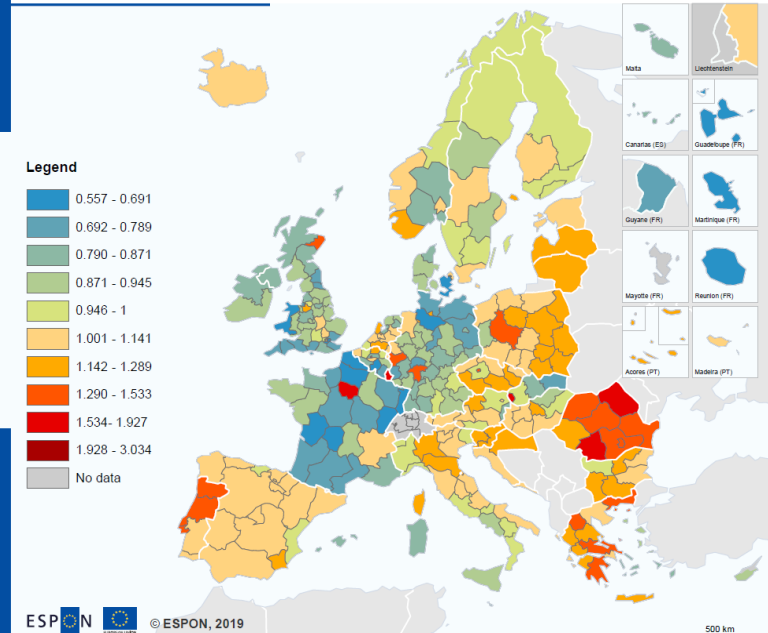
Degree of regional specialisation in carrier sectors w.r.t. the European average



Regional level: NUTS 2 (2013)
Source: ESPON T4, 2019
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Induced regions

Degree of regional specialisation in induced sectors w.r.t. the European average



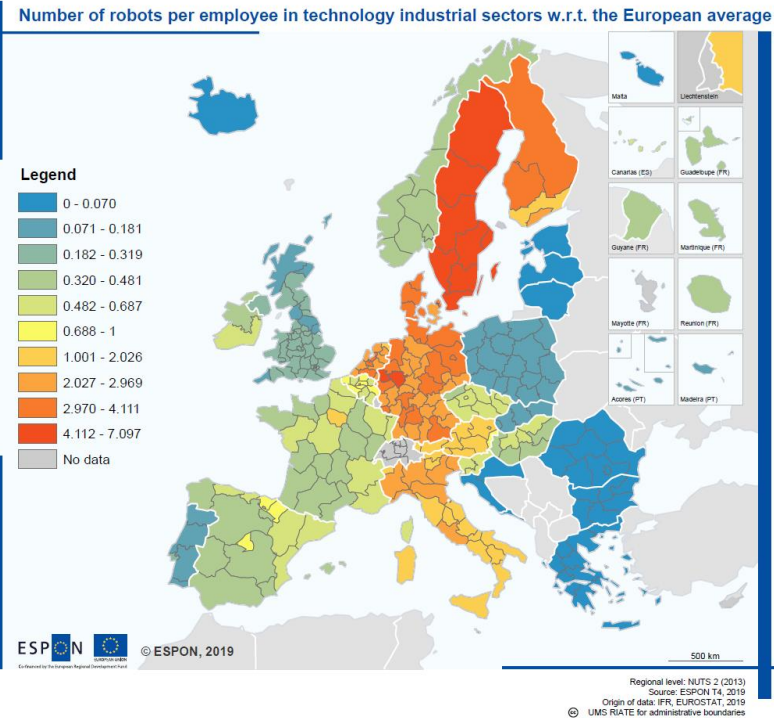
Regional level: NUTS 2 (2013)
Source: ESPON T4, 2019
Origin of data: EUROSTAT, 2019
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Urban areas are specialised in all types of sectors, i.e. all type of technological transformations can potentially take place.

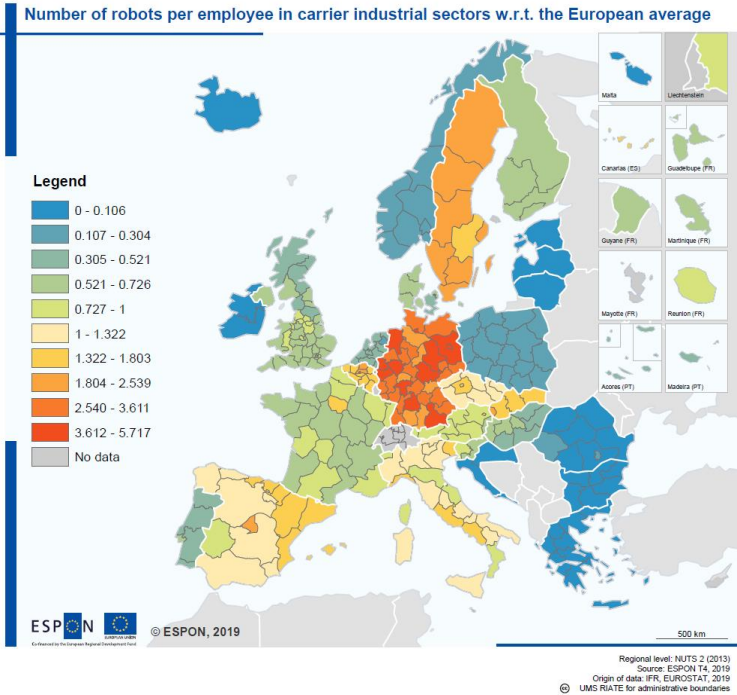
Intensity of adoption

// Intensity of adoption in manufacturing activities belonging to the different types of sectors – adoption of Industry 4.0

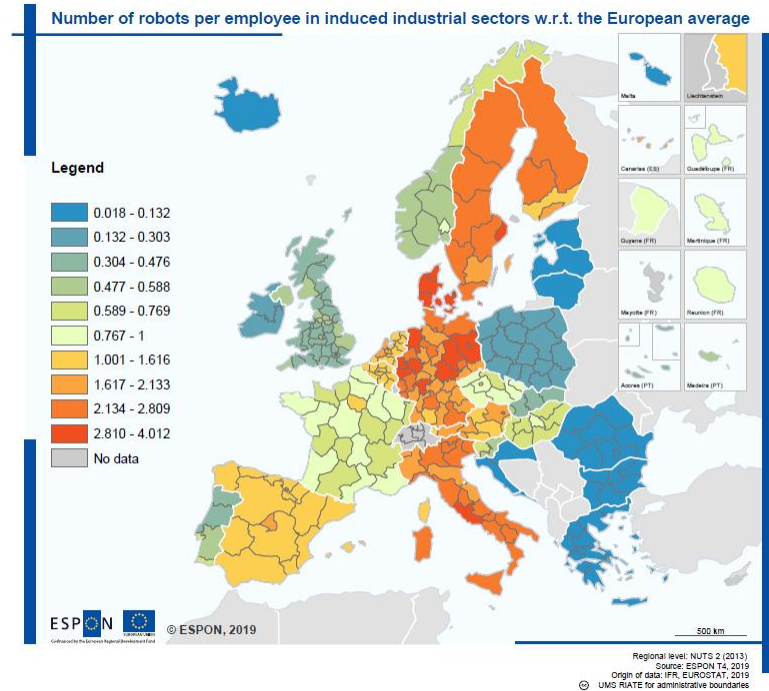
Robots in technology industrial sectors



Robots in carrier industrial sectors



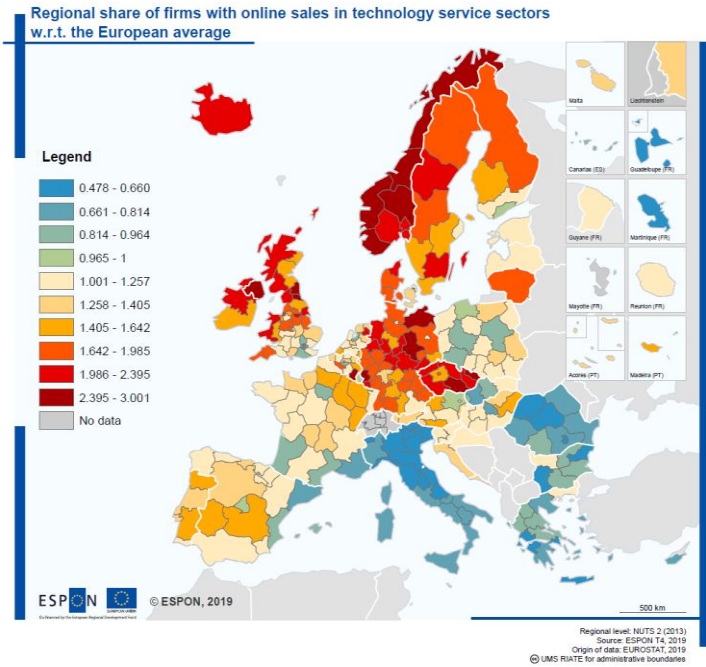
Robots in induced industrial sectors



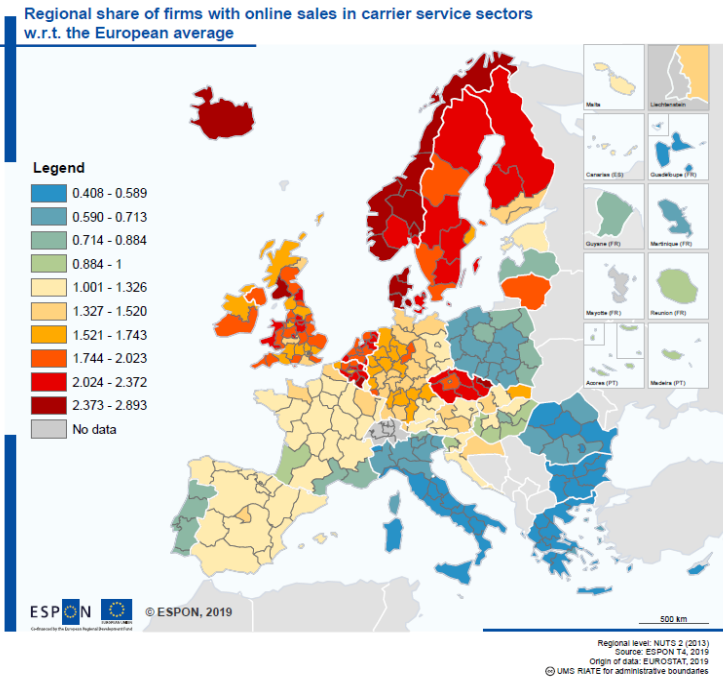
- **Urban areas have a relatively high intensity of robot adoption.**
- The share of urban population in the regions with the highest intensity of robot adoption (top 25%) is respectively **55%, 62% and 52%** for technology robots, carrier robots and induced robots;
- instead, the share of urban population in the regions with the lowest intensity of robot adoption (bottom 25%) is respectively **32%, 28% and 35%** for technology robots, carrier robots and induced robots.

// Intensity of adoption in the service sectors belonging to the different types of sectors – Towards servitisation

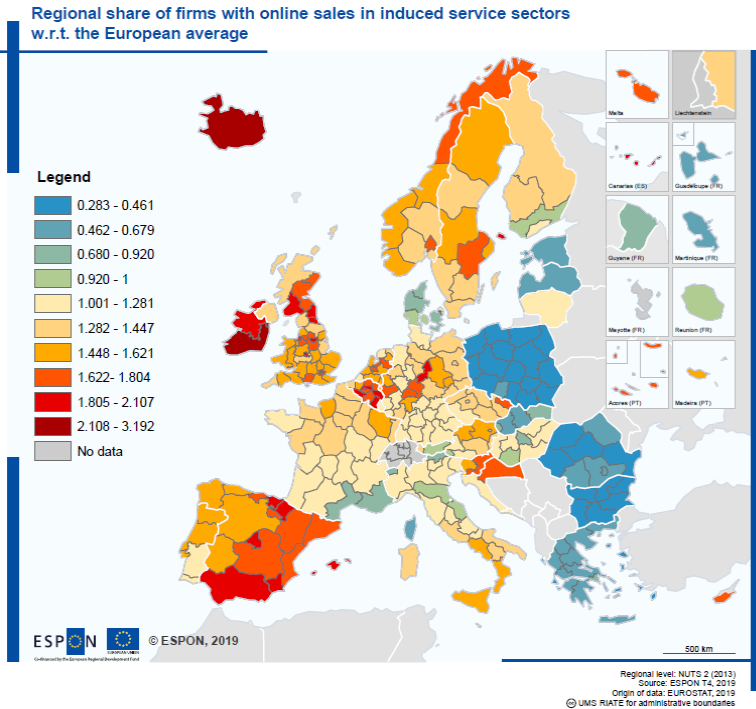
On line sales in technology service sectors



On line sales in carrier service sectors



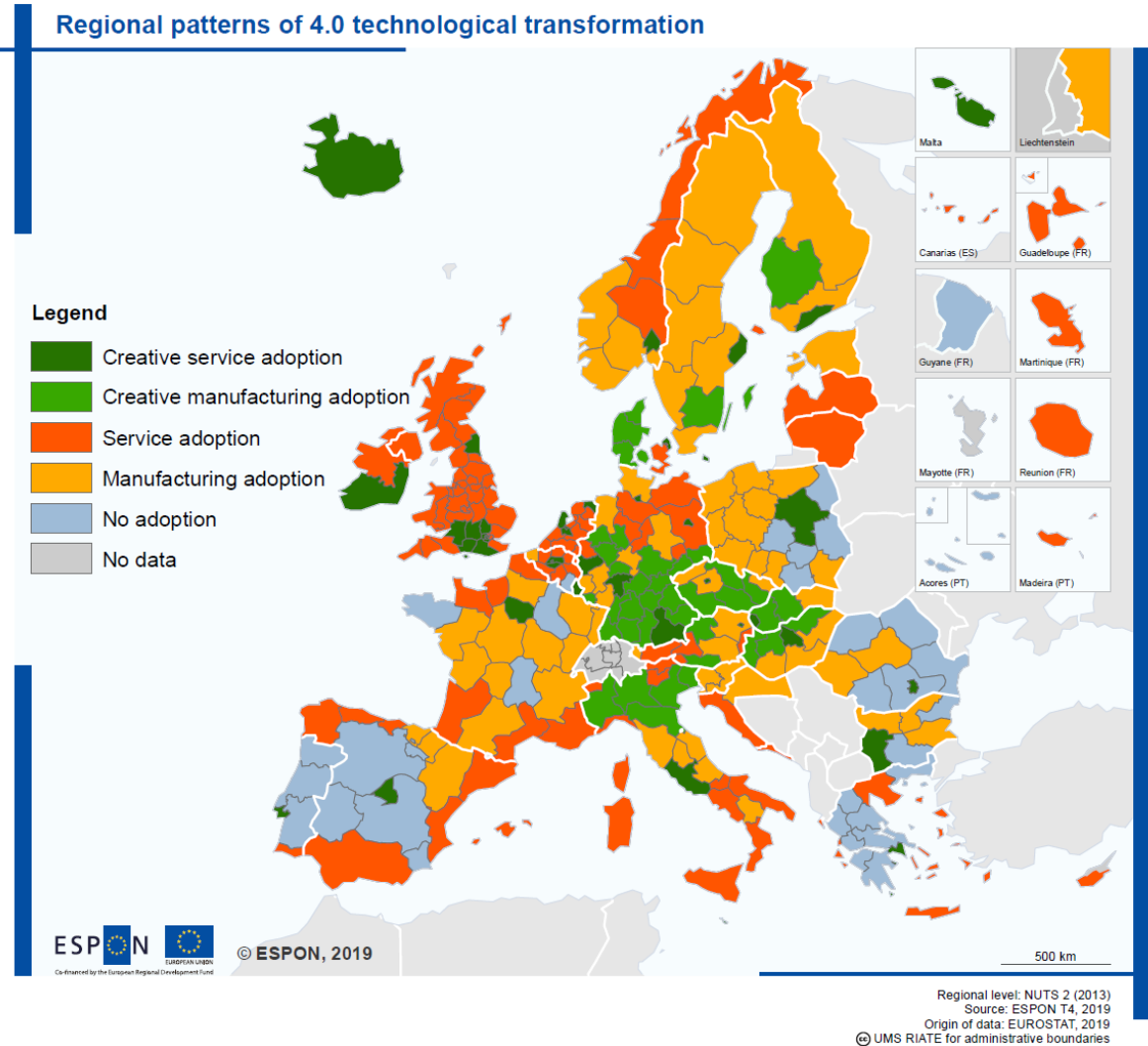
On line sales in induced service sectors



- Urban areas have a relatively high intensity of sales on line, especially in carriers and induced service sectors.
- The share of urban population in the regions with the highest intensity of online sales (top 25%) is respectively **42%, 47% and 59% for technology online sales, carrier online sales and induced online sales;**
- instead, the share of urban population in the regions with the lowest intensity of online sales (bottom 25%) is respectively **42%, 32% and 37% for technology online sales, carrier online sales and induced online sales.**

Types of transforming regions

// Regions according to their technological transformation



- **Creation of new digital services (servitisation and the gig economy) transformation** (dark green areas) takes place especially in large cities (e.g. London, Paris, Dublin, Warsaw, Rome ...)
- **The Industry 4.0 technology transformation** (light green areas) takes place especially in particular industrial city areas (e.g. Stuttgart, Milan, Turin ...)
- **The digitalisation of traditional manufacturing and service transformation** (red and yellow areas) takes place in cities in less developed and rural areas.

// Characteristics accompanying transforming urban areas

	Creative service adoption	Creative manufacturing adoption	Service adoption	Manufacturing adoption	No adoption
Robot adoption (number of robots per employee in industry) in industry w.r.t. the European average	1.3	1.93	1.07	1.11	0.41
Robot adoption in technology manufacturing sectors w.r.t. the European average	1.36	2.36	0.95	1.26	0.16
Robot adoption in carrier sectors w.r.t. the European average	1.35	2.02	0.96	1.04	0.36
Robot adoption in patenting carrier sectors w.r.t. the European average	1.39	2	0.92	0.98	0.33
Robot adoption in non-patenting carrier sectors w.r.t. the European average	1.43	2.02	1.05	1.51	0.43
Robot adoption in induced manufacturing sectors w.r.t. the European average	1.32				0.46
Digitalisation intensity (share of firms selling online, at least 1% of turnover) in service sectors w.r.t. the European average	1.49	1.44	1.57	1.29	0.94
Digitalisation intensity in technology service sectors w.r.t. the European average	1.18	1.62	1.42	1.37	1.13
Digitalisation intensity in carrier service sectors w.r.t. the European average	1.48	1.52	1.51	1.27	0.83
Digitalisation intensity in induced service sectors w.r.t. the European average	1.45				0.9
Patent intensity (number of patents per 1,000 inhabitants)	0.133	0.178	0.064	0.083	0.019
4.0 patent intensity (number of 4.0 patents per 1,000 inhabitants)	0.032				0.003
Trademark intensity (number of trademarks per 1,000 inhabitants)	0.348				0.054
Entrepreneurship (share of firms with average annual growth rate >= 20% over a three year period - emerging sectors)	2.15		1.7	1.35	1.61
Entrepreneurship (share of firms with average annual growth rate >= 20% over a three year period - traded sectors)	2.07	1.35	1.65	1.26	1.71
Personal wealth (GDP per capita, euro)	46258	29889	28064	23921	13730
Urbanisation (share of population living in metropolitan areas)	83.77	44.55	45.54	37.17	25.17
Average risk of automation	44.57	48.22	46.06	48.5	52.85
High risk of automation (% of jobs)	12.95	16.61	14.65	18.01	25.03

High digitalisation in service

High creativity in 4.0 technologies

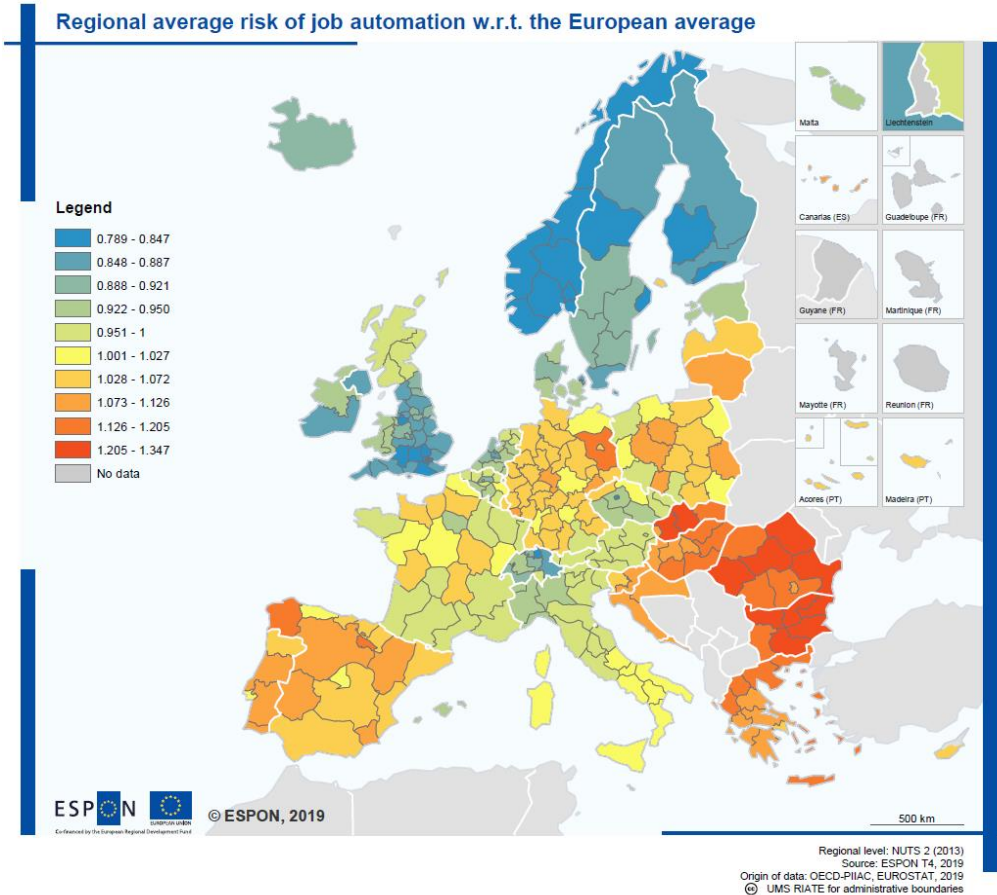
High entrepreneurship

Urban areas

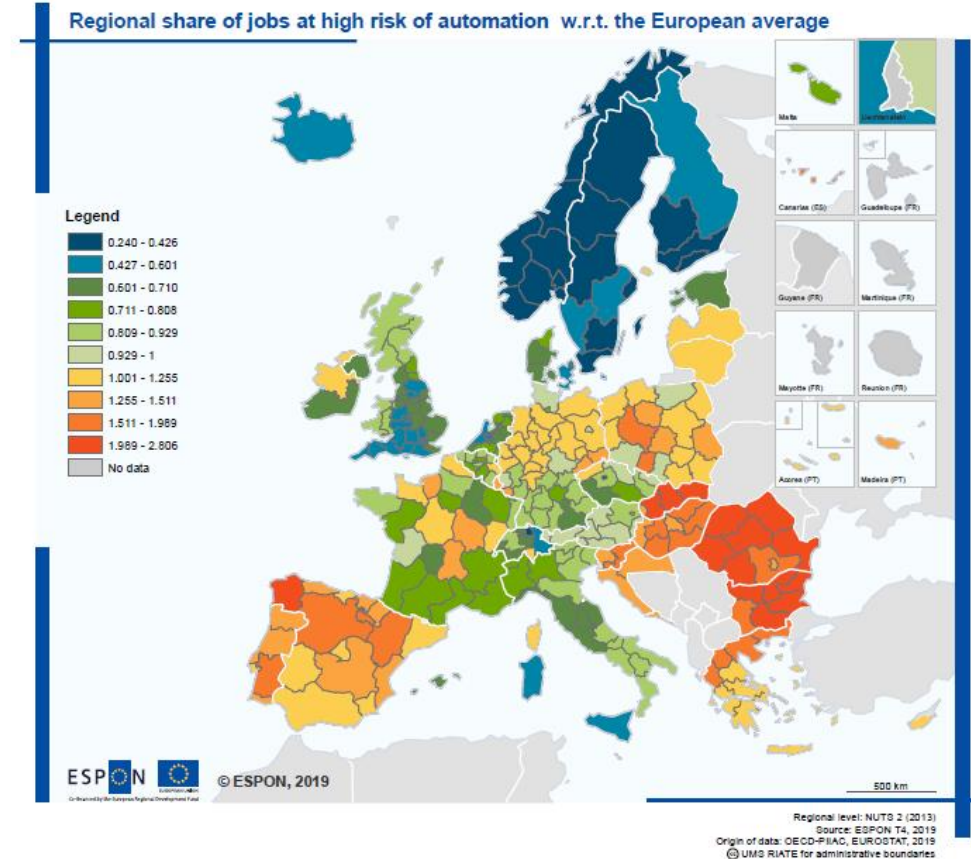
**Which are the territorial consequences of digital transformation
on regional labour market**

// Job risks associated to the present technological transformation

Share of jobs with regional average risk of automation - 2011



Regional share of jobs at high risk of automation - 2011



In most of the high-risk regions, adoption is negligible. Adoption rates are higher in region in which the risk of automation is low. This is true also for urban areas in non-adopting countries.

Which policies are needed to accelerate innovation dissemination and adoption?

// Tentative policy recommendations

- **Policies have to help adoption processes to occur.** These adoption processes happen in capital or large cities in both advanced and less advanced countries and urban areas in Europe.
- **Policies have to help urban systems to adjust to the changes** imposed by the “servitisation” and the “gig economy” that are a reality in many European cities, so to maximise advantages and minimise disadvantages.
- **Policy measures should concentrate on the possibility to help “islands of innovation” to emerge, creating and supporting the preconditions for such innovation to occur.**
- **Existing policy measures are rarely aimed at overcoming growth barriers in lagging regions. 4.0 technologies** should instead be interpreted as an effective way to solve underperformance of regions, and **policy measures should be developed in such direction.**
- Much of the 4.0 technological transformation and penetration depends on the sectoral specialisation of the region. However, our empirical results show that there are regions in Europe in which the degree of penetration of 4.0 technology is not explained by its sectoral specialisation; **territorial conditions, to be further identified in the next steps of the research, are behind such success and should inspire policy measures.**
- The countries and regions where 4.0 technologies are not yet penetrated are those where the risk of automation of routine jobs is higher. **This means that 4.0 policy measures have to be developed taking at the same time the risks of the adoption of such technologies, through containment measures.**