ESPON

EUROPEAN UNION

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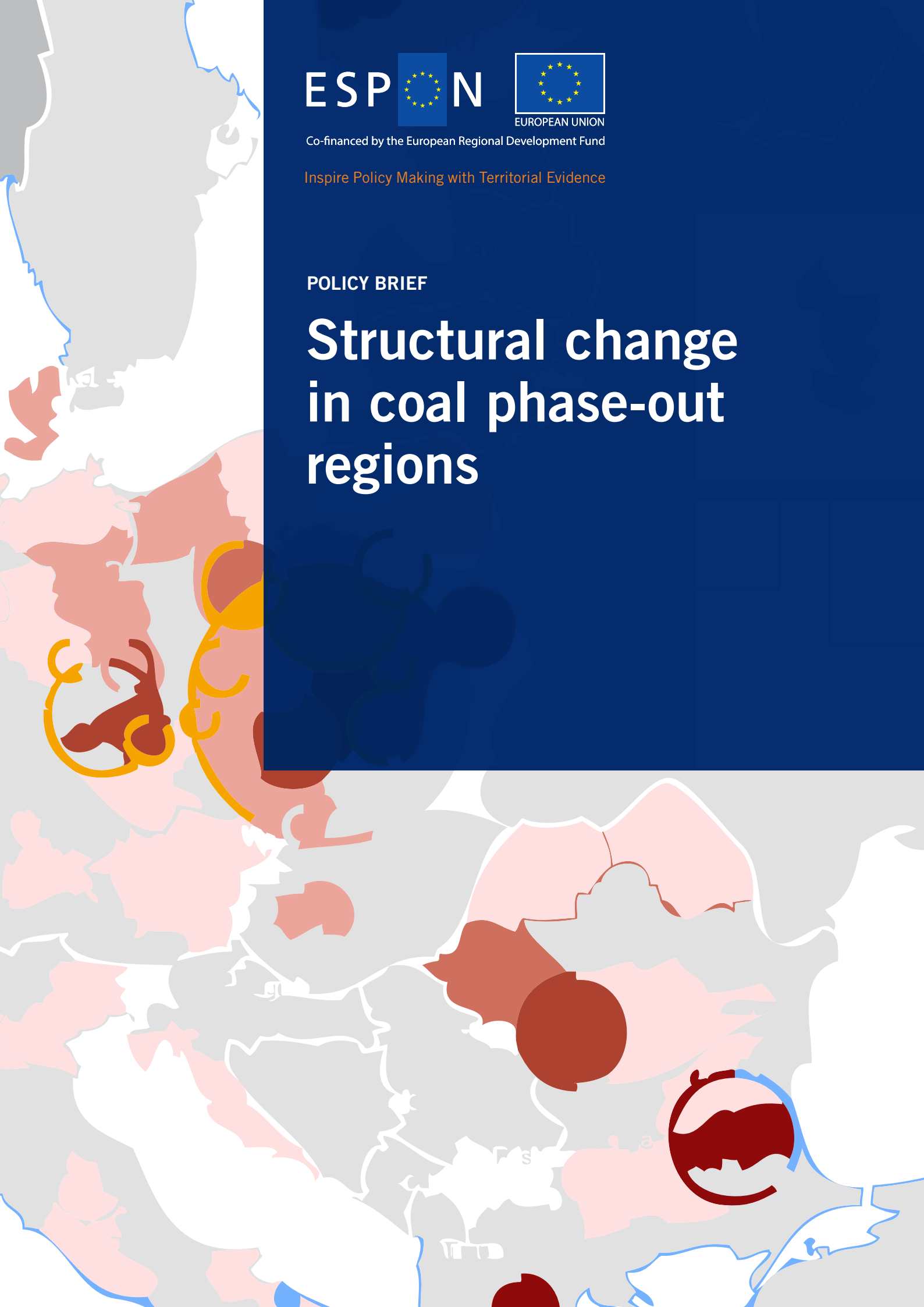
Inspire Policy Making with Territorial Evidence

POLICY BRIEF

Structural change in coal phase-out regions



Recent debates on the just transition to a decarbonised economy have tasked policy-makers and academics alike with reconciling the different angles of the 'just' epithet. We turn attention to the place-invariant challenge that can be expected across all regional economies, albeit to different extents. The decarbonised economy commitments will bring about a paradigm shift in coal-dependent and arguably coal-independent regions alike. However, regions have different levels of potential to embark on this paradigm. In other words, regions have different levels of potential to induce structural change because of the different levels of dependency on incumbent industries, which may exacerbate the socioeconomic implications of such a paradigm shift. We plug in ESPON territorial evidence that will be useful for informed decisions on actions under the Just Transition Fund (JTF) related to research and development (R&D) investments and productive investments, as well as business incubation and consultancy for firm creation and development. We argue that these three types of JTF actions are crucial, as they are likely to influence parameters that best explain the variance in the structural change potential of coal-dependent regions. All other actions are likely to be pursued all across Europe within or beyond the JTF, with a comparable positive moderating effect on economic diversification. We suggest that the increasingly practised Entrepreneurial Discovery Process (EDP) should be established as a JTF governance and implementation mechanism in coal phase-out regions. The principles of this process, which is associated with regional smart specialisation, are equally applicable in a process of collaborative navigation towards the most favourable corridor out of an economic path dependency.

KEY POLICY QUESTIONS AND ANSWERS

What is the most meaningful application field of the JTF, given that EU industrial decarbonisation is estimated to require an annual investment of up to EUR 300 billion per year?

All proposed JTF actions dedicated to economic revitalisation, social support and land restoration are expected to have a positive marginal effect on structural change potential. However, the JTF can serve as a purposive instrument for designing, governing and implementing Territorial Just Transition Plans, and applying a strategic mission-oriented acquisition of funds.

Which types of JTF actions are likely to influence parameters that best explain the variance in structural change potential?

These would be the actions related to R&D investments, productive investments, as well as business incubation and consultancy for firm creation and development. The trajectory of these type of actions can be delineated and governed by a continuous EDP.

What is the social-benefit-maximising intensity and mix of these actions?

Take into account territorial parameters approximating the regional entrepreneurial and knowledge stocks to derive an adequate balance of related actions, respecting the entrepreneurial and knowledge stock maturity. The need for a balance is two-dimensional: (1) the magnitude of R&D capital investments and inbound open innovation versus the regional Innovation Commons; and (2) measures reducing entrepreneurial risk versus measures reducing entrepreneurial uncertainty.

1. Policy context

The prospective Just Transition Fund (JTF) is to be the first of three pillars that constitute the Just Transition Mechanism (JTM), the others being a dedicated scheme under InvestEU and a public sector loan facility managed by the EIB Group. In Article 1 of the proposal for a JTF regulation, the European Commission (2020, p. 13) defines the JTF as an instrument 'to provide support to territories facing serious socio-economic challenges deriving from the transition process towards a climate-neutral economy of the Union by 2050'.

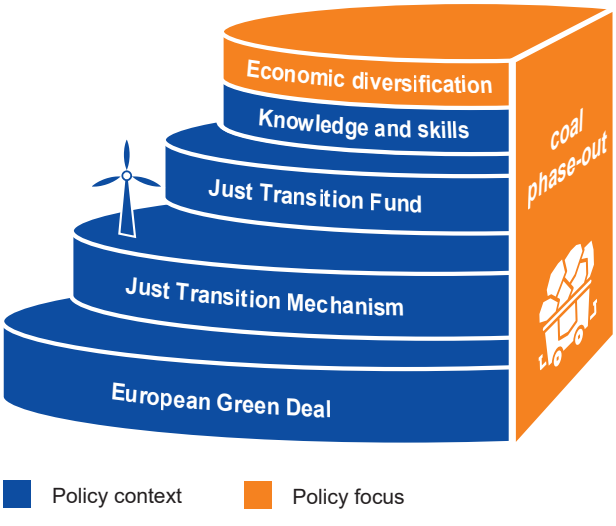
In a briefing requested by the European Parliament's Committee on Regional Development, Cameron et al. (2020, p. 3) regroup the proposed types of actions eligible under the JTF as follows[1]:

- economic revitalisation: (a) productive investments in small and medium-sized enterprises (SMEs), including start-ups, leading to economic diversification and reconversion; (b) investments in the creation of new firms, including through business incubators and consulting services; (c) investments in research and innovation activities and fostering the transfer of advanced technologies; (d) investments in the deployment of technology and infrastructures for affordable clean energy, and in greenhouse gas emission reduction, energy efficiency and renewable energy; (e) investments in digitalisation and digital connectivity; (g) investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling;
- social support: (h) upskilling and reskilling of workers; (i) job-search assistance to jobseekers; (j) active inclusion of jobseekers;
- land restoration: (f) investments in regeneration and decontamination of sites, land restoration and repurposing projects.

The proposal for a JTF regulation identifies 108 European regions with coal infrastructure and nearly 237,000 related jobs. Coal regions are among those particularly vulnerable as their regional economic ecosystems are historically linked with coal extraction and power generation. This brief synthesizes extant literature, recent research and policy advice in relation to structural change in coal phase-out regions and plugs in ESPON territorial evidence for policy questions that have not been addressed as yet. These relate to the efficient use of JTF resources, potential links with other funding streams and the design of interventions based on territorial parameters relating to the knowledge and entrepreneurial stock in coal-dependent localities.

The brief seeks to reconcile the different angles of the 'just' epithet. Coal phase-out resonates differently in different territorial realities. Coal-dependent regions perceive a redistribution of social benefits while marginal economic damage is inflicted upon a few regions. Colli (2020) warns of the opposite view. Particularly regions that have long embraced industrial decarbonisation are concerned about the increasing marginal damage through coal-related activities, where environmental costs are externalized from the incumbent industries. Financial allocations to remedy the market failure may be misperceived as a reward for regions that delay decarbonisation efforts (Colli, 2020). It is, therefore, important to prevent a positive feedback loop and turn the attention to a place-invariant challenge that can be expected across all regional economies, albeit to different extents. The decarbonised economy commitments will bring about a paradigm shift in coal-dependent and arguably coal-independent regions alike. Regions have different potentials to embark on the new paradigm, however. In other words, regions have different potentials to induce structural change, caused by the different levels of dependency on incumbent industries (Neffke et al. 2018), which may exacerbate the socio-economic implications of such paradigm shift.

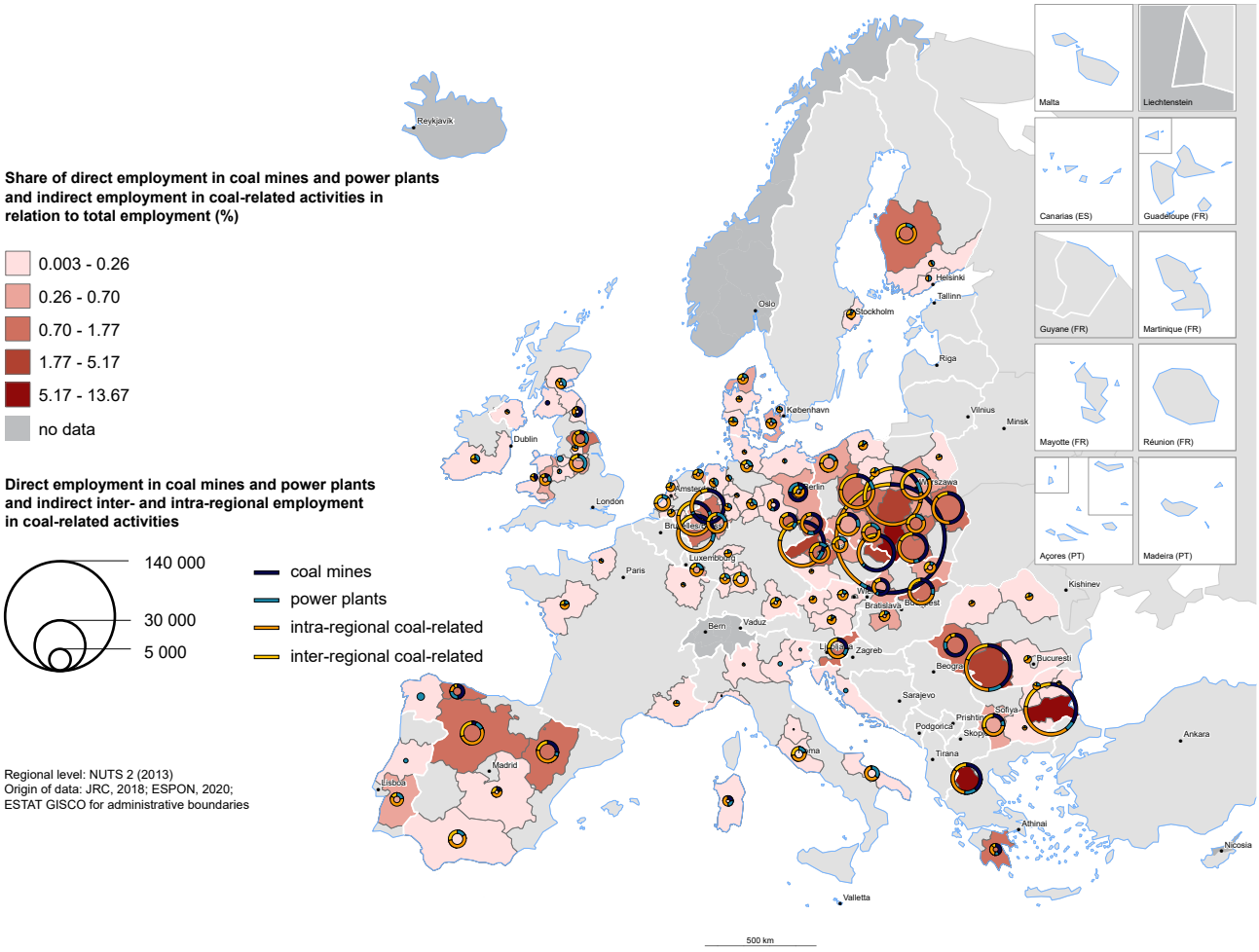
Figure 1
Policy context and focus



1 The proposed types of actions were amended by the European Parliament as communicated in the report of the Committee on Regional Development (European Parliament, 2020).

2.
Which regions are most affected?

Map 1
Coal-related employment

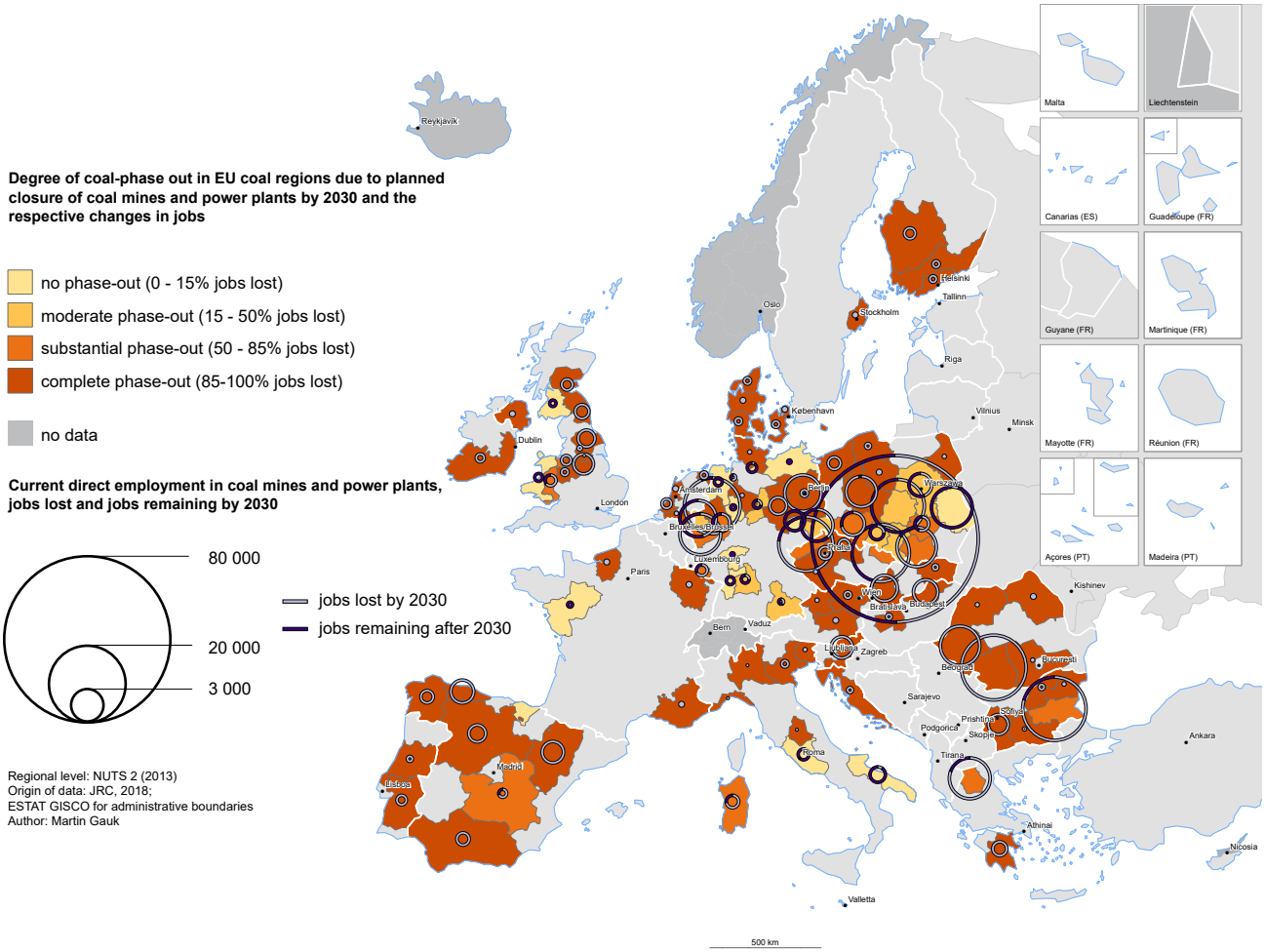


Alves Dias et al. (2018) estimate that the regions that will be most affected by 2030 are located in Poland, Germany, the Czech Republic and Bulgaria. By 2025, the Polish voivodeships of Śląskie (Silesia) and Małopolskie (Lesser Poland), the Czech regions of Karlovy Vary, Ústí nad Labem and Moravskoslezský and the German states of Brandenburg and Nordrhein-Westfalen are projected to register more than 2,000 job losses each. Direct job losses boil down to mining communities and employment in power plants. Affected communities include the Silesian subregions of Katowicki, Bytomski, Gliwicki, Rybnicki, Sosnowiecki and Tyski and Lesser Poland's subregion of Oświęcimski; the district of Sokolov in Karlovy Vary and districts in Lausitz and the governmental district of Köln.

By 2030, Śląskie and the Bulgarian provinces of Stara Zagora and Sliven are estimated to lose 39,000 jobs in total. The Bulgarian power plant and mining communities to be most affected are the municipalities of Galabovo, Radnevo and Nova Zagora.

Alves Dias et al. (2018) estimate losses in other regions as well, including the Polish voivodships of Dolnośląskie (Lower Silesia) and Eastern Wielkopolskie (Greater Poland); the Bulgarian municipalities of Pernik and Bobov Dol; Upper Nitra in Slovakia; the Romanian development regions of Sud-Vest Oltenia and Vest; the Greek region of Western Macedonia; Eastern Slovenia; the governmental district of Düsseldorf and the Saxonian Lausitz districts.

Map 2
Estimated job losses in coal phase-out regions by 2030

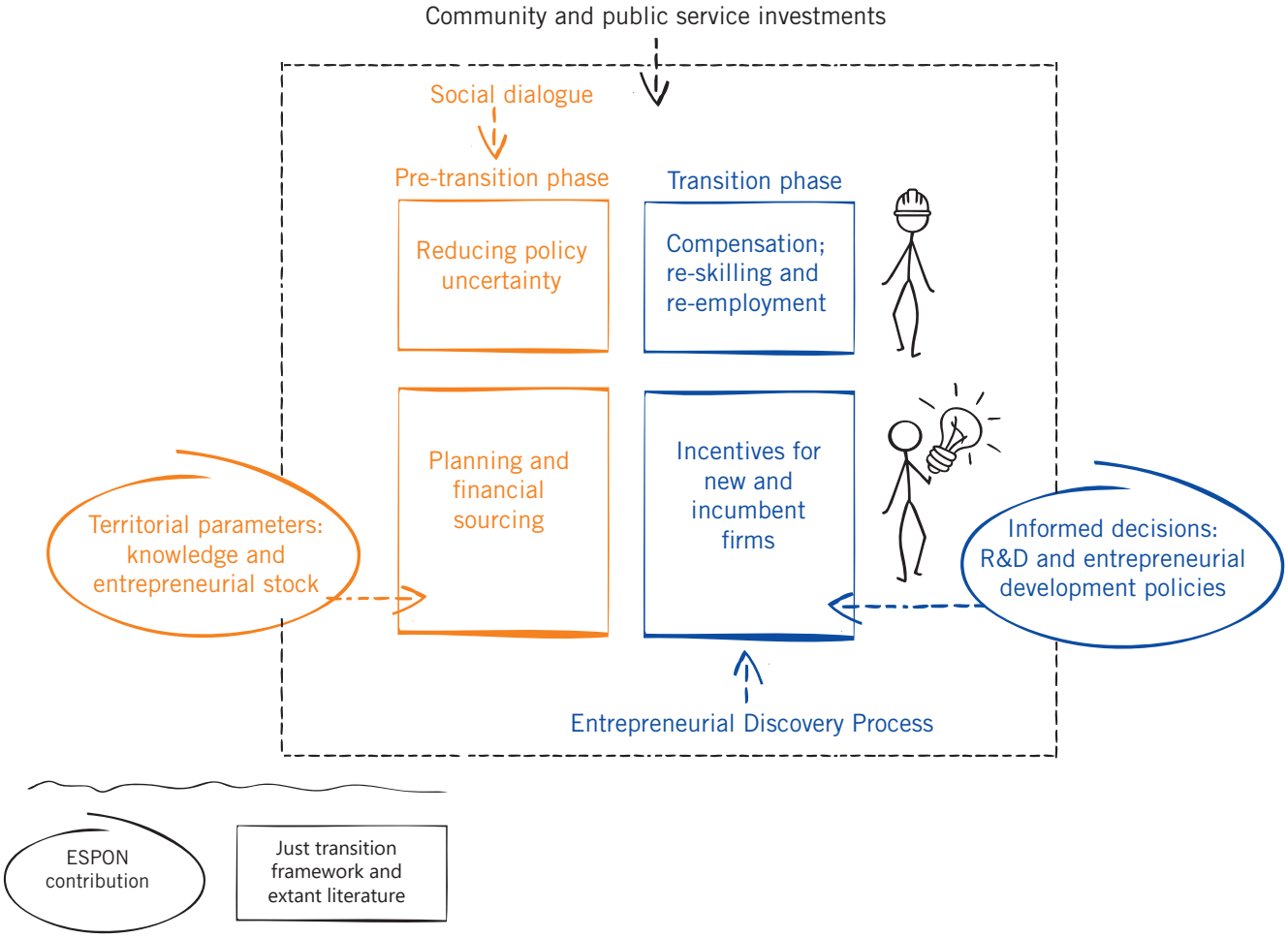


3. Extant literature and research-policy discourse

This brief capitalises on the conceptual framework for just transition in coal-producing jurisdictions by Harrahill and Douglas (2019); on policy recommendations from Colli (2020), who investigates challenges for the just transition and proposes how to overcome them; on evidence from Skoczkowski et al. (2020), who quantitatively assess risks and opportunities of the coal phase-out in Silesia; and on the report 'Just Transition to Climate Neutrality' released by WWF Germany (2020). Three particular postulates for bringing about a just transition appear to be consistent across the research-policy debates, namely, the need to reduce policy uncertainty, the fact that a just transition is not a matter of the JTF only and the need to compensate workers and invest in their reskilling and re-employment. These matters have been extensively debated and appear to be unchallenged by stakeholders. That is why this brief embraces these and focuses on two other postulates where we see missing links and the need to turn stakeholders' attention to territorial parameters. These are: (a) the just transition and neo-industrialisation

are not only about decarbonised energy supply and (b) there is a need for a multi-stakeholder approach. These two statements are entry points for ESPON territorial evidence that will be useful for informed decision-making on actions related to productive investments, firm creation and research and development (R&D) investments, i.e. the first three types of activities proposed by the JTF regulation. We connect the just transition, economic diversification and structural change debates to the practised concepts of Entrepreneurial Discovery Process (Foray, 2015), Open Innovation (Chesbrough, 2006) and Innovation Commons (Allen and Potts, 2016).

Figure 2
Extended framework for just transition based on Harrahill and Douglas (2019)



While we applaud the conceptual framework for just transition in coal-producing jurisdictions of Harrahill and Douglas (2019), we believe that it misses important elements that can inform decisions related to the first three proposed JTF actions based on territorial parameters. We argue that first three types of JTF actions are crucial, as they are likely to influence parameters that best explain the variance in the structural change potential of coal-dependent regions. All other actions are likely to be pursued all across Europe within or beyond the JTF with a comparable positive moderating effect on diversification. Taking into account consistent postulates in the extant literature and the research-policy discourse as well as the entry points for ESPON evidence, we propose an upgrade of the just transition framework of Harrahill and Douglas (2019), (Figure 2).

Reducing policy uncertainty

The framework for just transition (Harrahill and Douglas, 2019) begins with the need for establishing a timeline for decarbonisation. Colli (2020) proposes industrial targets and clear timelines as a regulatory source of certainty for firms. Skoczkowski et al. (2020) find that all surveyed stakeholders in Silesia link the risks jeopardising a low-carbon transition with political uncertainties and the

lack of a regional strategy. The latter is echoed by the WWF Germany (2020) report on Western Macedonia and Silesia calling for such strategies to be introduced.

A just transition is not a matter of the JTF only

Colli (2020) argues that the European Structural and Investment Funds (ESIF) had already been tapped for actions contributing to a just transition and recommends mainstreaming the notion of just transition, promoting it under all Green Deal actions. WWF Germany (2020) reports on the establishment of a National Just Transition Fund in Greece. It is the first national counterpart of the JTF in the EU and is financed by 6 per cent of the revenue generated by CO2 allowance auctioning. Cameron et al. (2020) recommend focussing JTF interventions on social policy and land restoration, the latter to a lesser extent. Their argument is that industrial decarbonisation is a very cost-intensive endeavour, requiring an annual investment of up to EUR 300 billion per year. They suggest that economic revitalization efforts should source funding from ESIF, the InvestEU initiative, promotional banks and private investment induced by reformed fiscal rules. Another argument in favour of financial diversification is the overlap of JTF actions with specific objectives under the European Regional Development Fund (ERDF), the European Social Fund + (ESF+); the European Agricultural Fund for Rural Development (EAFRD) and thematic priorities of the LIFE programme. Cameron et al. (2020) conclude that JTF should seek to adopt the mission-oriented approach applied by Horizon Europe and the LIFE Programme, ensuring synchronization of measures that tap different funds. This could be attained by earmarking ERDF resources for structural change in coal phase-out regions combined with strong social support in these regions from the JTF.

Furthermore, two of the thematic partnerships of the Urban Agenda for the EU[2] are of particular importance for the transition process of regions towards a climate-neutral economy. The Thematic Partnership on Energy Transition addresses the challenge of energy transition in European cities and is implementing a number of actions in this field. This partnership is led by three cities, Gdańsk (PL), London (UK) and Roeselare (BE) and has members across the European Union. The partnership is committed to promoting energy transition at EU, national and local levels, and considers that this process requires a long-term structural change in the approach to energy systems, creating a more integrated and smarter energy system for all. The Thematic Partnership on Climate Adaptation led by the City of Genoa (IT) aims to find the best ways to translate the needs of cities into concrete action in the area of climate adaptation. Through the implementation of joint actions, the ambition is to achieve a higher awareness in view of the urgency of responding to climate change, and to develop the capacities of European cities to address and adapt to the impacts of climate change.

Compensation for workers and re-skilling

The framework for just transition (Harrahill and Douglas, 2019) explicitly lists compensation, re-training and re-employment as desired actions in the transition phase. One of the recommendations of WWF Germany (2020) aimed at Bulgarian national authorities is to embark on policies supporting re-training and social adaptation to new industrial sectors. These recommendations are echoed by Cameron et al. (2020), who call for quick re-training actions from authorities in regions likely to face plummeting demand for coal industry related skills.

A just transition and neo-industrialisation are not only about decarbonised energy supply

The neo-industrialisation path of Nordrhein-Westfalen lauded by Harrahill and Douglas (2019) that had arguably led that state to become a leader in new energy technologies, is not a model for other coal-dependent regions. Indeed, stakeholders tend to connect the void in energy production that the coal phase-out will bring about with emerging opportunities for renewable energy specialisation. Skoczkowski et al. (2020) report that Silesian stakeholders perceive renewable energy expansion as the most probable among the events investigated. The researchers declare, however, that this finding is inconsistent with observations by the Polish Energy Regulation Authority, which registered an unexpected decline in renewable energy production in Poland in 2017 compared with 2016.

The second of three challenges towards just transition in coal phase-out regions identified by Colli (2020) is to

2 The Urban Agenda for the EU (UAEU) was initiated within the framework of intergovernmental cooperation through the Pact of Amsterdam signed on 30 May 2016. The agenda intends to better involve cities in the design and implementation of policies at national and EU levels. The overall objective is to include the urban dimension in policies and its implementation should lead to better regulation, better funding and better knowledge for cities in Europe. More information on the Urban Agenda for the EU and on its thematic partnerships: https://ec.europa.eu/futurium/en/urban-agenda

move beyond energy production. The identification of industries likely to be affected other than energy, along with accompanying data collection, impact assessments and forecasting, is considered vital. Cameron et al. (2020) list collateral damage sectors, which include energy-intensive manufacturing and project that a growing demand for renewable energy installation could offset losses. At the same time, the authors admit that renewable energy is no guarantee of employment in coal-dependent regions.

The case study on Silesia released in the report of WWF Germany (2020) calls for diversification efforts, capitalising on the Silesian engineering, electrotechnical, chemical and pharmaceutical industrial base. The authors recommend industrial policy that promotes the service sector, in particular in the information technology, medical and engineering domains as well as embracing the potential of electric mobility through the emerging automotive knowledge base. The case study on Bulgaria concluded that there is a need for municipal investment analyses that spur the secondary and tertiary economic sectors.

An effective just transition is an open and multi-stakeholder process

Colli (2020) calls for the inclusion of the private sector and civil society in the development of territorial just transition plans as well as in the governance and implementation of projects. In their recommendations for Western Macedonia, WWF Germany (2020) refer to the establishment of a Just Transition Committee that brings together national and subnational authorities, local stakeholders, trade unions, non-governmental organisations and the Public Power Corporation.

While we fully subscribe to the above recommendations, we argue that these are particularly relevant to the pre-transition phase (Figure 2) and need considerable adjustments during the transition phase. The link between Entrepreneurial Discovery Process and structural change is not new and has already been studied (Pinto et al. 2019). We argue that in this case, the Entrepreneurial Discovery Process presents an advanced form of social dialogue that seeks to detect the most favourable trajectory during the transition phase (Figure 2).

ENTREPRENEURIAL DISCOVERY PROCESS

Foray, David and Hall (2009) argued that traditional multi-sector research and innovation policy would be allocatively inefficient in regions that do not exhibit any particular strengths in science and technology. Instead, public research and innovation investments should be aligned with other place-specific productive assets. They introduced the idea of Entrepreneurial Discovery Process as the operational backbone of smart specialisation. It is assumed that the traditional innovation, research and entrepreneurial policies alone may miss opportunities and create deadweight losses (Hausmann and Rodrik, 2003). Governments are seen as trapped in a 'principal-agent' problem, i.e. governments (the principal) do not possess ex-ante knowledge to determine which are the emerging sectors that can bring higher marginal benefits for society (Foray, 2015). The Entrepreneurial Discovery Process is based on the notion that knowledge is distributed among a variety of entrepreneurial actors (Rodríguez-Pose and Wilkie, 2015) including firms, universities, research facilities and public services.

We suggest that the increasingly practiced Entrepreneurial Discovery Process should be established as a JTF governance and implementation mechanism in coal phase-out regions. This proposal may be found paradoxical, given the fact that the desired outcome of such a governance model is economic diversification, whereas the Entrepreneurial Discovery Process is closely associated with regional smart specialization. The principles of this process, however, are equally applicable in a process of collaborative navigation towards the most favourable corridor out of an economic path dependency. While the Entrepreneurial Discovery Process can be practiced as an overall governance and implementation mechanism, we introduce the concepts of open innovation and the Innovation Commons as instruments to determine the social-benefit-maximising intensity and mix of JTF actions listed under (c), i.e. investments in research and innovation activities and fostering the transfer of advanced technologies[3].

3 Amended by the European Parliament to: 'investments in research and innovation activities, including in universities and public research institutions, and fostering the transfer of advanced and market-ready technologies'

OPEN INNOVATION

Chesbrough (2006) introduced the concept of open innovation to describe a process of knowledge inflows (inbound open innovation) and outflows (outbound open innovation) embraced by firms to improve their internal innovation policy and expand to other markets. The notion of open innovation has evolved to include both public and private knowledge sources and recipients.

The social-benefit-maximizing intensity and mix of the other two proposed JTF actions in the focus of this brief, i.e. (a) productive investments in SMEs, including start-ups[4] and (b) investments in the creation of new firms including business incubation and advice[5], can be approximated though the level of entrepreneurial maturity (Figure 3). This echoes the calls of the European Court of Auditors (2018) for vigilance in productive investments so as to prevent deadweight losses.

We plug in ESPON evidence on SME, the Knowledge Economy (KE), Foreign Direct Investment (FDI) and technological transformation and transitioning of regional economies to demonstrate how territorial evidence can inform decisions on the intensity and mix of the (a), (b) and (c) JTF actions.

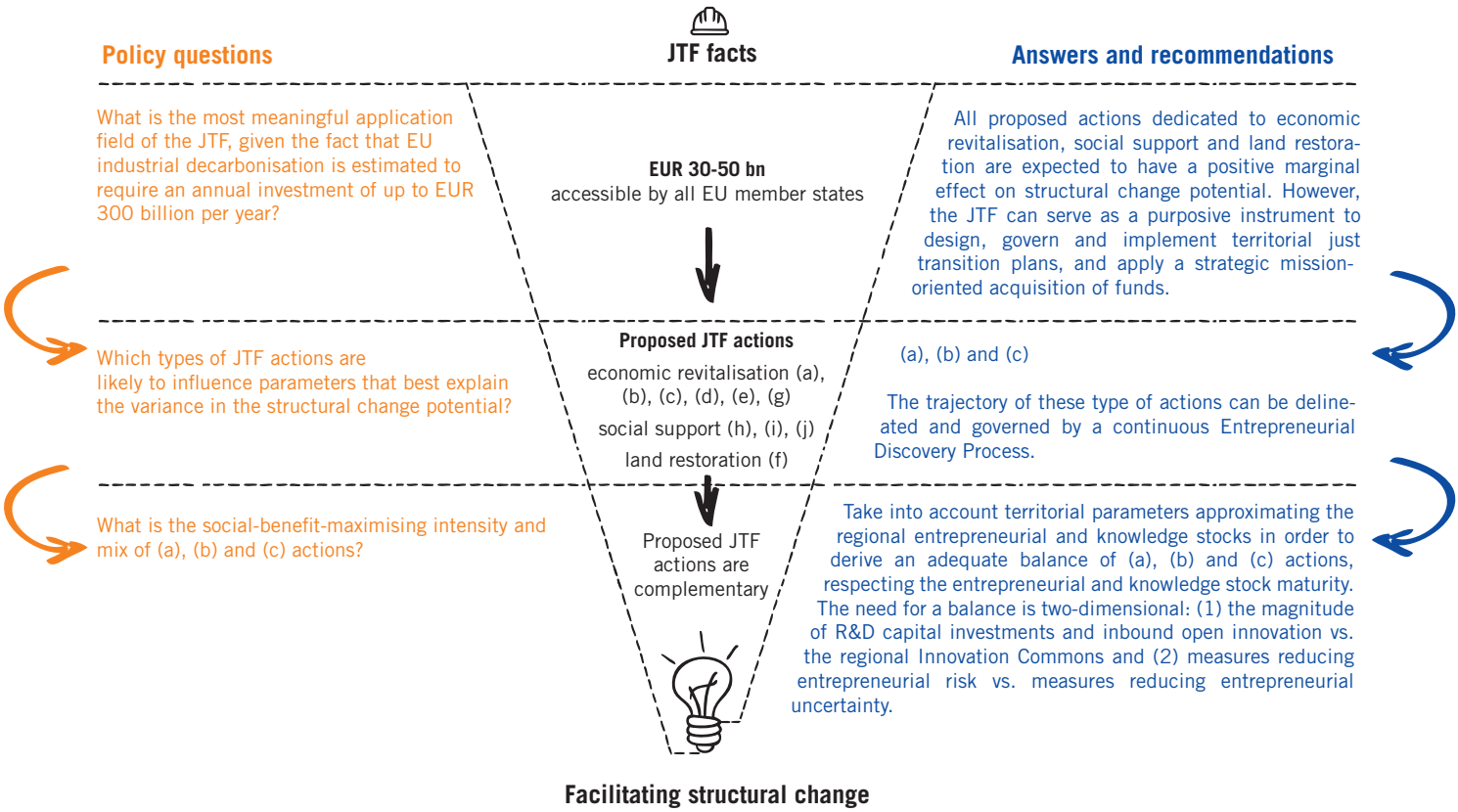
4 Amended by the European Parliament to: 'productive and sustainable investments in microenterprises and SMEs, including start-ups and sustainable tourism, leading to job creation, modernisation, economic diversification and reconversion'.

5 Amended by the European Parliament to: 'investments in the creation of new firms and the development of those existing, including through business incubators and consulting services, leading to job creation'.

THE INNOVATION COMMONS

Allen and Potts (2016) propose the concept of Innovation Commons in analogy to the Commons. They define it as a spatially and temporally mobile space where firms collaborate and experiment in an effort to pool information and acquire tacit knowledge, which is expected to facilitate the discovery of an entrepreneurial opportunity. The Innovation Commons is thought to process entrepreneurial uncertainty; to be ad-hoc and temporary; to appear at the start of an innovation trajectory; to lead to an entrepreneurial action rather than to be a channel for social provisioning of innovation; to facilitate institutional matching; to prevent path dependency and technological lock-in effects and to facilitate small-scale experimentation. Resorting to the Innovation Commons can be reasonable in coal phase-out regions that have a well-established R&D capital and knowledge base. Wirtschaftsregion Lausitz GmbH, an economic development organisation in charge of steering the structural change endeavours in the Lausitz area, embarked on the hackathon concept in order to mobilise dispersed knowledge for projects designed to bring about social benefits. Allen and Potts (2016) refer to hackerspaces as a typical form assumed by the Innovation Commons.

Figure 3
Policy questions, answers and recommendations in a nutshell



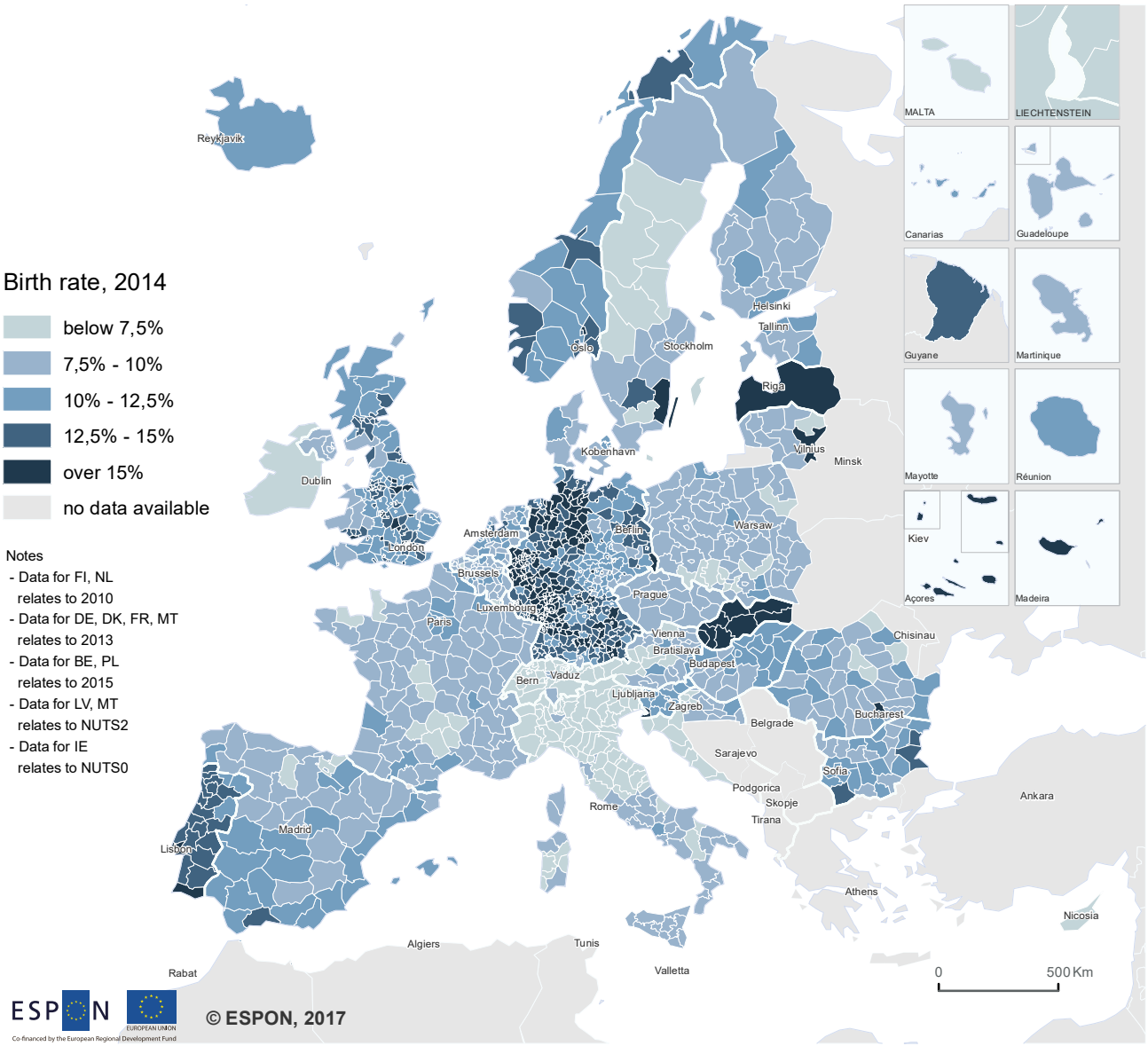
4. Territorial parameters for defining the intensity and nature of R&D and entrepreneurial development policies

Enterprise birth and death rates

The ESPON applied research project *Small and Medium-Sized Enterprises in European Regions and Cities* (2018a) calculates enterprise birth rates as the number of enterprise births in one year divided by the total number of active enterprises in the same year. Death rates of enterprises denote the number of enterprise deaths in one year divided by the total number of active enterprises in the same year.

Among the regions estimated to suffer the most severe job losses by 2025 and 2030 (Alves Dias et al., 2018), the regions with the lowest birth rates in 2014 were Śląskie, Karlovy Vary, Ústí nad Labem, Moravskoslezský, in contrast to the governmental districts of Köln and Düsseldorf, which exhibited the highest birth rates. Małopolskie, the provinces of Stara Zagora, Sliven, Pernik and Kyustendil, and the Lausitz area appeared to be mid-range performers in new firm creation (Map 3).

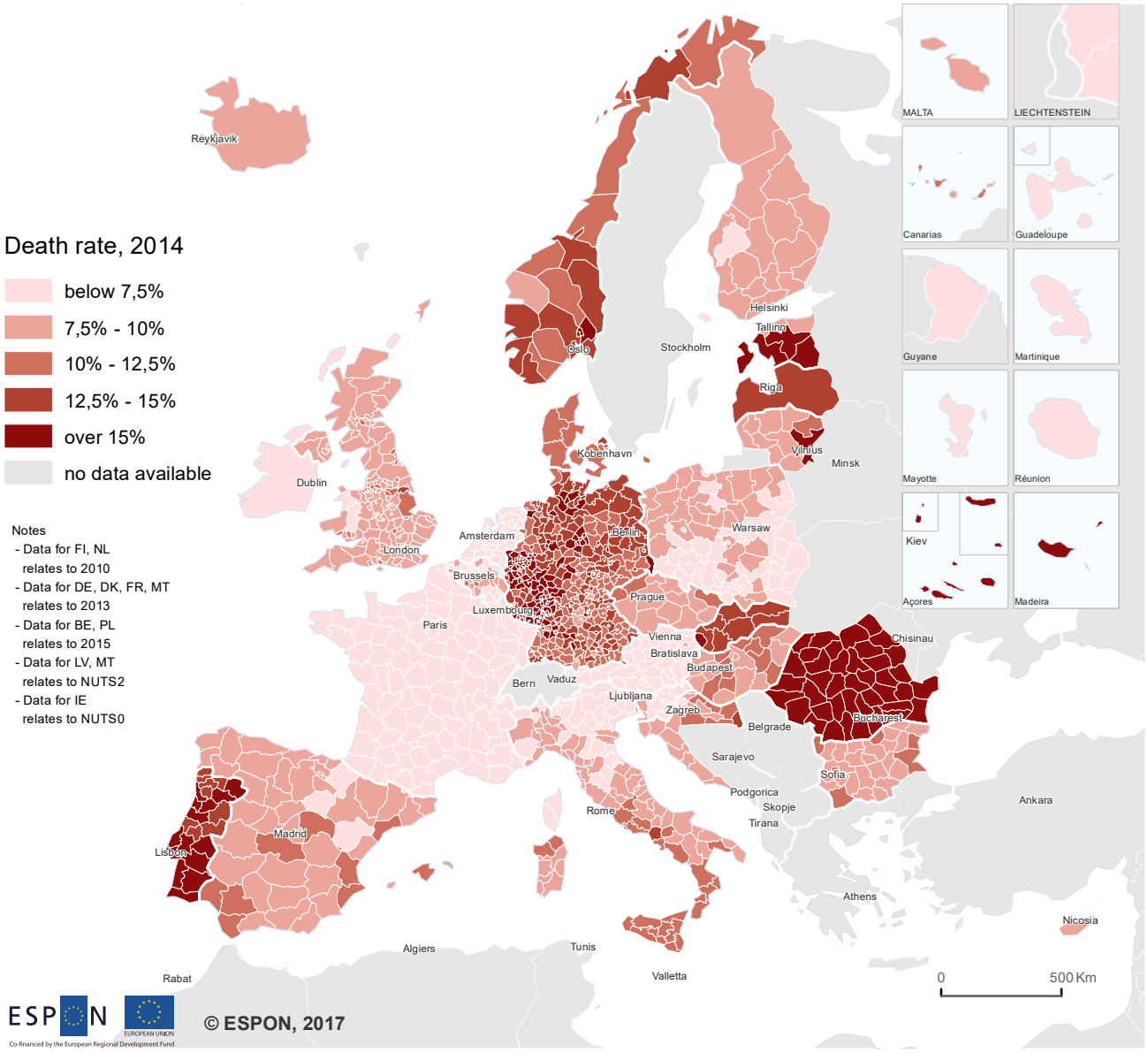
Map 3
Enterprise birth rates 2014



Regional level: NUTS 3 / NUTS 2 / NUTS 0 (version 2013)
Source: ESPON SME, 2017
Origin of data: Eurostat Business demography, Statistics Belgium Demografie Ondernemingen, Bundesamt für Statistik Unternehmensdemographie, Orbis Database, Gewerbeanzeigenstatistik, Statistics Estonia Business demography, NACE B-S, Financial Agency, Statistics Iceland, Chamber of Commerce, Statistics Norway, Central Statistical Office of Poland, Statistics Sweden Structural Business Statistics Tillväxtanalys, Statistical Office of the Republic of Slovenia and own calculations (EIM), Office for National Statistics Business Demography SIC 2007 C G-N P-R
CC - UMS RIATE for administrative boundaries

The highest enterprise death rates in 2014 are observed in the governmental districts of Köln and Düsseldorf, the German state of Sachsen-Anhalt, the Romanian development regions of Sud-Vest Oltenia and Vest, and the Slovak regions of Trnava Region, Trenčín and Nitra. Having the lowest death rates in 2014, the Polish voivodships of Małopolskie and Śląskie, the Bulgarian provinces of Stara Zagora, Sliven, Pernik and Kyustendil, and Eastern Slovenia exhibit more stable enterprise ecosystems (Map 4).

Map 4
Enterprise death rates 2014



Regional level: NUTS 3 / NUTS 2 / NUTS 0 (version 2013 / 2010)
Source: ESPON SME, 2017
Origin of data: Eurostat Business demography, Statistics Belgium Demografie Ondernemingen, Bundesamt für Statistik Unternehmensdemographie, Orbis Database, Gewerbeanzeigenstatistik, Statistics Estonia Business demography, NACE B-S, Financial Agency, Statistics Iceland, Chamber of Commerce, Statistics Norway, Central Statistical Office of Poland, Statistics Sweden Structural Business Statistics Tillväxtanalys, Statistical Office of the Republic of Slovenia and own calculations (EIM), Office for National Statistics Business Demography SIC 2007 C G-N P-R
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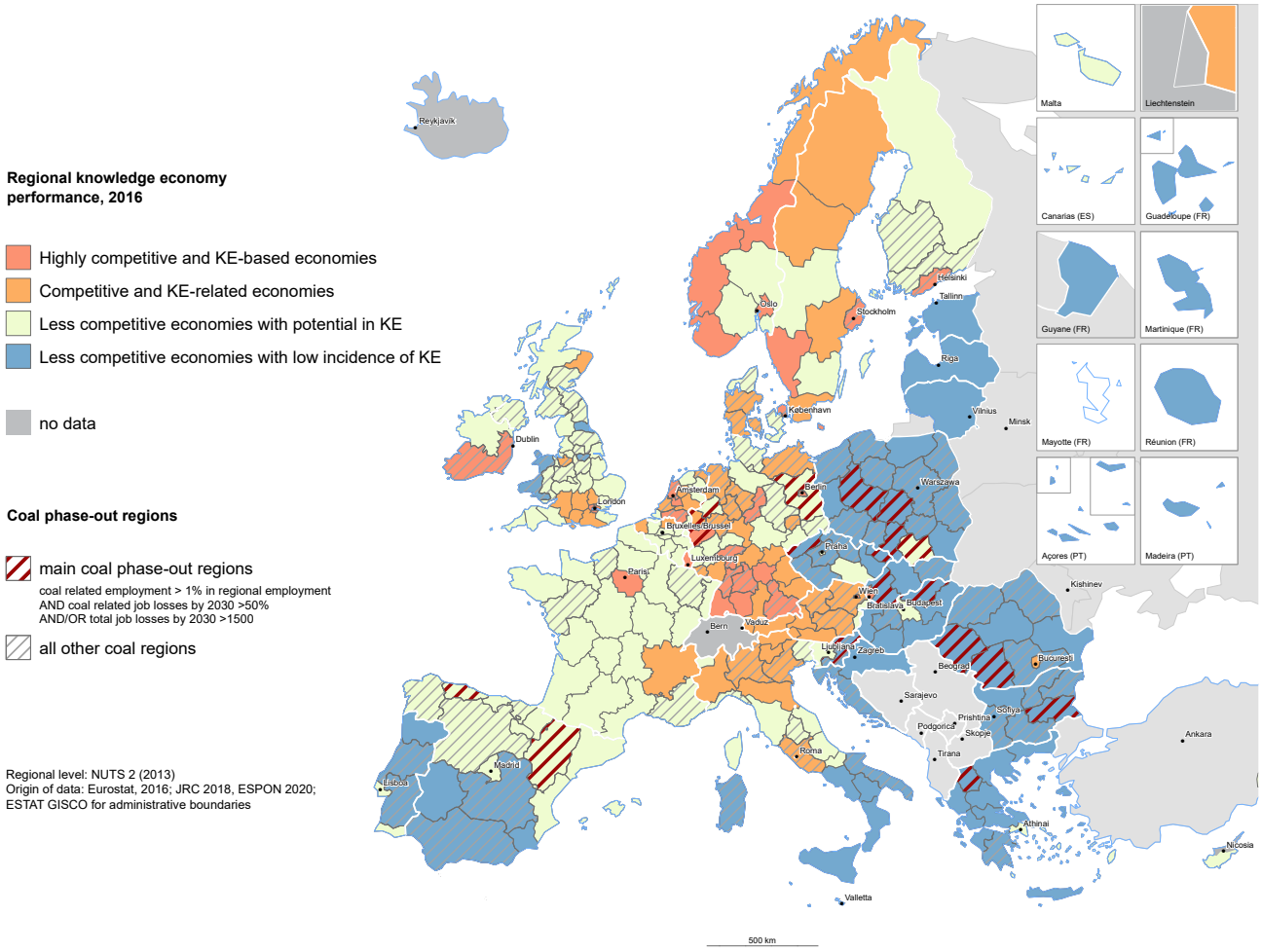
Knowledge economy

The ESPON applied research project *Geography of New Employment Dynamics in Europe* (2018b) introduced a classification of EU regions with respect to their potential for the KE. The classification was based on regional indicators approximating the following regional parameters:

- labour market (young not in employment, education or training; adult and youth employment and unemployment rates);
- migration and population dynamics (crude rates of natural change and net migration; old-age dependency ratio);
- KE potential (total intramural R&D expenditure as a share of Gross Domestic Product (GDP); human resources in science and technology; patent applications per million inhabitants; share of population in the age segment 30-34 with a tertiary education);
- regional GDP per inhabitant.

The classification resulted in four clusters (Map 5).

Map 5
KE clusters 2012-2015 and coal phase-out regions



Cluster 1: Highly competitive and KE-based regions. This cluster includes 35 regions, mostly northern and continental ones with large metropolitan areas. These regions show the highest average and growing values for KE indicators, as well as the best labour market and socio-economic conditions in the EU. Among the regions expected to register severe coal-related job losses (Alves Dias et al., 2018), this cluster includes only the governmental district of Köln. The average employment rate for the population aged 25-64 reached 78.5 per cent (vs. an average value of 71.7 per cent for the EU-28). The population in these regions has been increasing, particularly owing to the migrant component (+ 9.1 per thousand inhabitants vs. + 3.3 per thousand of natural change), and the old age dependency ratio (measured as the percentage of the population over 65 years compared with the working age population) was the lowest among the clusters.

Cluster 2: Competitive and KE-related regions. The cluster includes 54 regions, including the governmental district of Düsseldorf. Akin to cluster 1, these regions exhibit higher KE levels than the EU average, higher productivity and good labour market conditions. In contrast to cluster 1, regions assigned to this cluster have experienced more severe damage caused by the global economic and financial crisis of 2007–2008, particularly in relation to youth labour market conditions. The employment rate of young people declined to 45.2 per cent from 48.7 per cent between 2004 and 2007; and the youth unemployment rate increased to 14.1 per cent compared with 12.5 per cent between 2005 and 2007. On average, these regions exhibit a negative natural change and a higher old-age dependency ratio than cluster 1 but registered population growth due to immigration, albeit to a lesser extent than cluster 1.

Cluster 3: Less competitive regions with potential in the KE. With 110 regions, particularly in Mediterranean countries and the UK, this cluster is the largest. It includes the voivodship Małopolskie, the communities in the Lausitz area and the German state of Sachsen-Anhalt. These regions exhibit values slightly worse than average for most indicators. However, compared with the pre-crisis years, they show an improvement in KE indicators (e.g. expenditure on R&D and high-skilled human resources). As for demographic conditions, cluster 3 regions are characterised by a stable population but a high and growing old-age dependency ratio. They are mostly regions of arrival as 81 out of 110 register a positive crude rate of net migration.

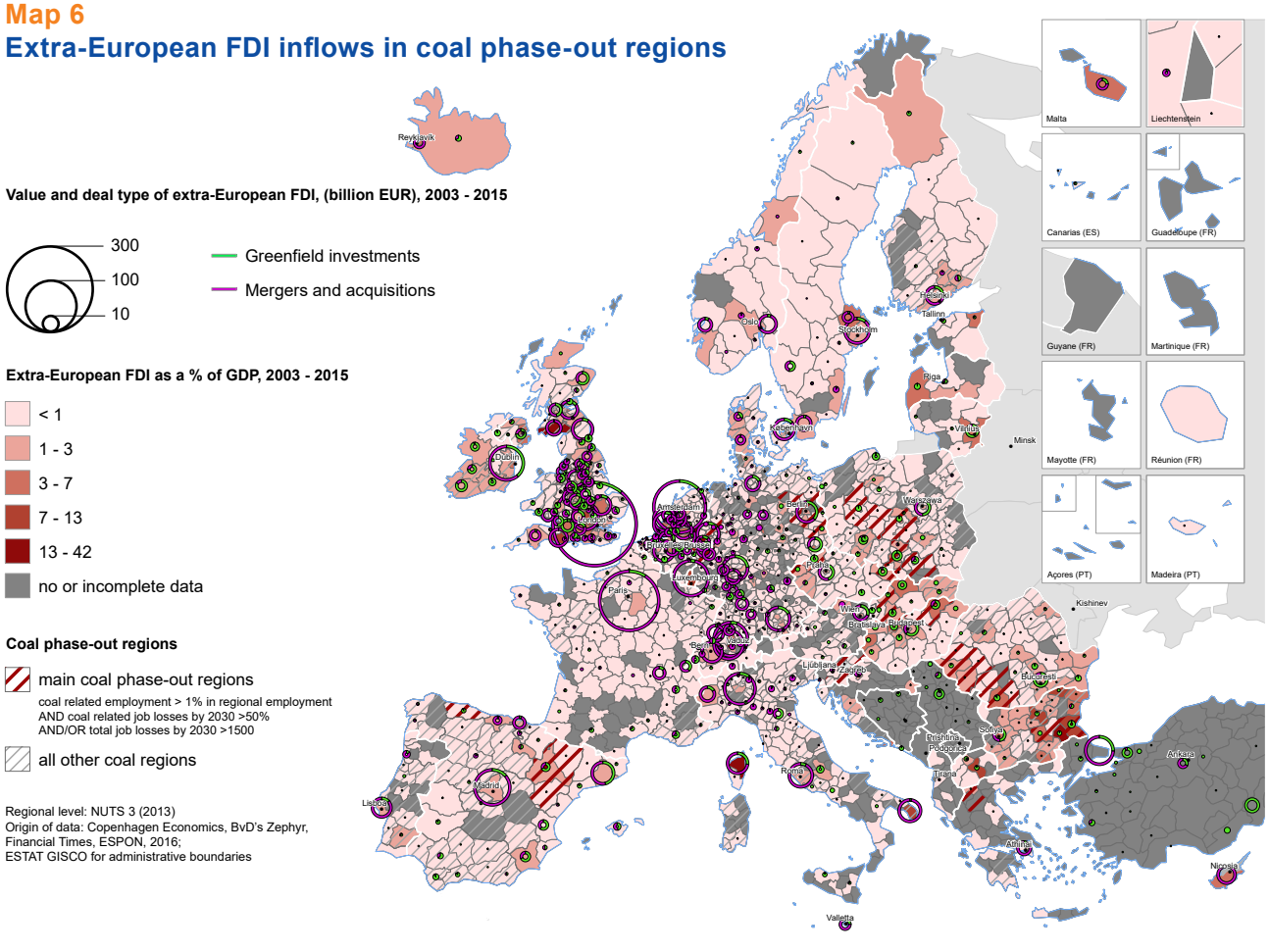
Cluster 4: Less competitive regions with low incidence of KE. This cluster includes 83 regions, largely eastern European regions and regions in Greece, the south of Spain, Italy and Portugal. It hosts most of the regions with high coal-related job loss projections (Alves Dias et al., 2018) including the voivodship Śląskie, the Czech regions of Karlovy Vary, Ústí nad Labem and Moravskoslezský, the Bulgarian provinces of Stara Zagora, Sliven, Pernik and Kyustendil, Western Macedonia, the Romanian development regions of Sud-Vest Oltenia and Vest, and the Slovak regions of Trnava, Trenčín and Nitra. The average GDP per capita in these regions reaches only 64 per cent of the EU average. On average, these regions also exhibit the lowest values of KE indicators (e.g. the average number of patent applications is 8 per million inhabitants vs. an EU average of 83) and the worst labour market and socio-economic conditions: the average employment rate (25–64 years old) is only 64.1 per cent compared with 78.5 per cent in cluster 1, while the employment rate of young people (15–24) is only 20.9 per cent compared with over 40 per cent in clusters 1 and 2, and the youth unemployment rate reaches 35.7 per cent. They also have a declining population due to a negative crude rate of net migration and natural demographic change. These regions have been severely affected by the economic crisis.

Non-local knowledge approximated through extra-European FDI

The ESPON applied research project *The World in Europe: Global FDI Flows towards Europe* (2018c) studied a sample of 52,061 FDI projects by non-European investors recorded during the period 2003-2015 and mapped 44,373 at the NUTS[6]3 level (Map 6).

6 Nomenclature of Territorial Units for Statistics.

Map 6
Extra-European FDI inflows in coal phase-out regions



The research project analyzed the distribution of FDI across European regions and made inference about knowledge spillovers. The research team applied three different indicators:

- the share of non-European firms among the total number of firms in a region, measuring a region's ability to attract non-European firms in the first place as well as making them stay and survive in the longer term;
- the value of FDI inflows into the region as a share of total FDI inflows to Europe, measuring a region's competitiveness and ability to attract large FDI projects with a significant capital injection into the local economy;
- the number of FDI projects in the region as a share of the total number of FDI projects in Europe, measuring a region's competitiveness and ability to attract a large amount of FDI.

This type of territorial findings can be used to approximate the level of regional dependency on knowledge spillovers with nonlocal routes so as to derive additional conclusions about the intensity and balance of JTF actions listed under (c), i.e. investments in research and innovation activities and fostering the transfer of advanced technologies.

New islands of innovation

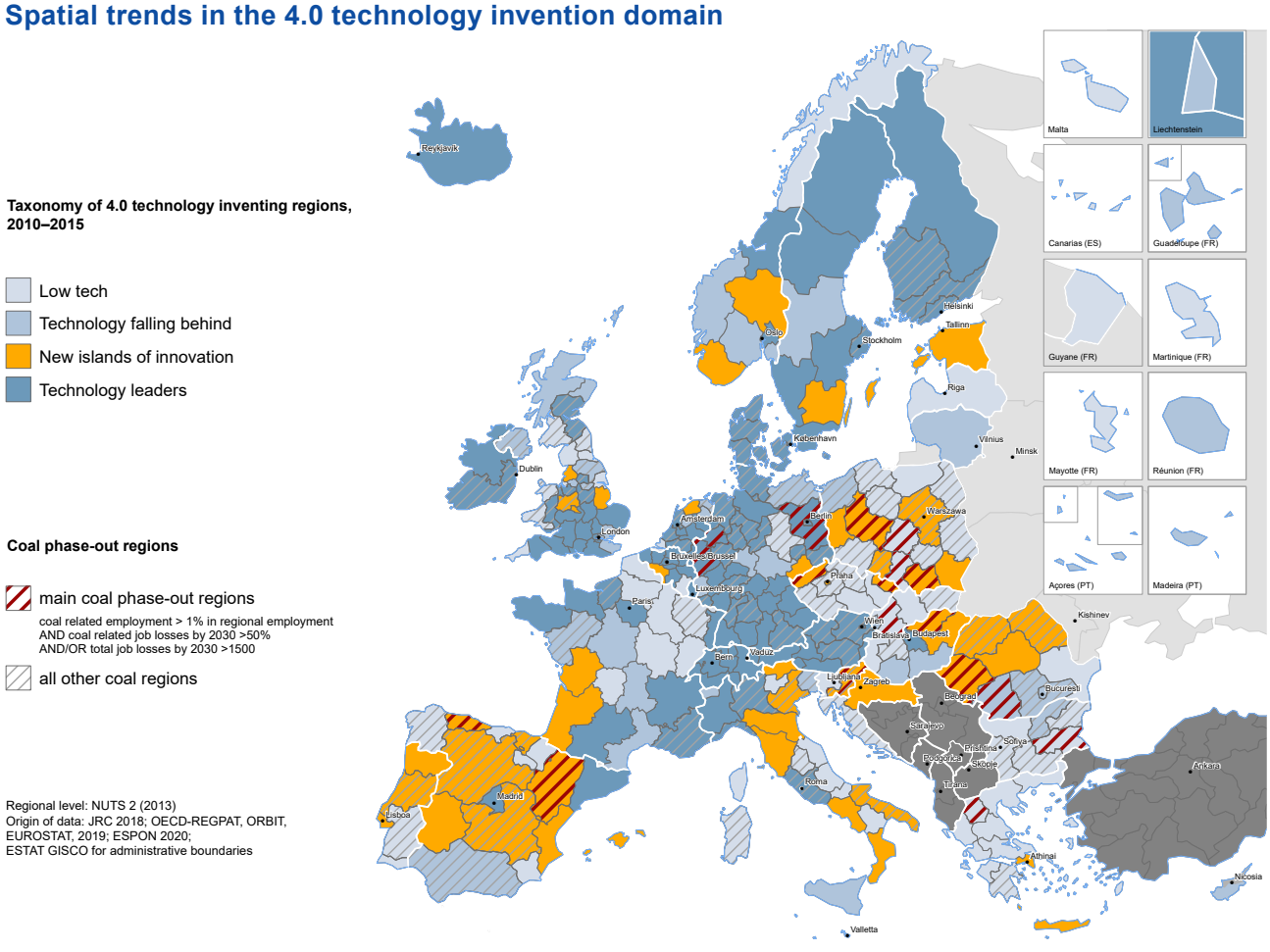
The ESPON applied research project *Technological Transformation & Transitioning of Regional Economies* (2020) introduced the notion of innovation islands. We use their findings in order to test for consistency of the KE clusters and to discover leapfrogging potential induced by the transition to industry 4.0[7] on the one hand as well as risks of reverse development against expectations derived from the KE potential.

The capacity to reap new emerging technological opportunities is not universal across space. An advantage in this respect are technological capabilities driving the previous technological revolution (i.e. 3.0[8]).

7 4.0 denotes a set of wide-ranging technological fields including: artificial intelligence, robotics, internet of things, autonomous vehicles, additive manufacturing, virtual reality, 3D printing, nano-technologies, biotechnology, energy storage with application such as smart home, smart transport, smart energy grids, intelligent robotics, smart factories, etc.

8 3.0 denotes high-tech technologies according to EUROSTAT definition (e.g. pharmaceuticals, ICT, semiconductors and optics, aviation technology).

Map 7
Spatial trends in the 4.0 technology invention domain



In other words, the presence of 3.0 technologies are expected to predict and explain the emergence of 4.0 technology opportunities. More interestingly, the project tested as to whether previous 3.0 technological knowledge is necessary to enter the 4.0 technology creation market or, instead, 4.0 technological opportunities can also emerge in areas where 3.0 technologies were weak if not absent.

In order to test these assumptions, the researchers applied a two-step approach. In the first step, regions were classified in terms of their patent specialisation and their patent intensity in the creation of 4.0 technologies in the period 2010–2015, obtaining:

- **4.0 leader regions** with a patent intensity in 4.0 technologies greater than the European median intensity and with a share of 4.0 technologies in their patent portfolio greater that the European one (i.e. regions specialised in 4.0 technologies);
- **4.0 niche regions** with a patent intensity in 4.0 technologies lower than the European median intensity but a share of 4.0 technologies in their patent portfolio greater than the European one (i.e. regions specialised in 4.0 technologies);
- **4.0 producing regions** with a 4.0 patent intensity greater than the European median intensity but without specialisation in 4.0 technologies;
- **no 4.0 regions** in which 4.0 patent intensity and the share of 4.0 technologies in their patent portfolio are below the European values.

The same classification was applied to 3.0 technologies in the previous period 2000–2009, obtaining:

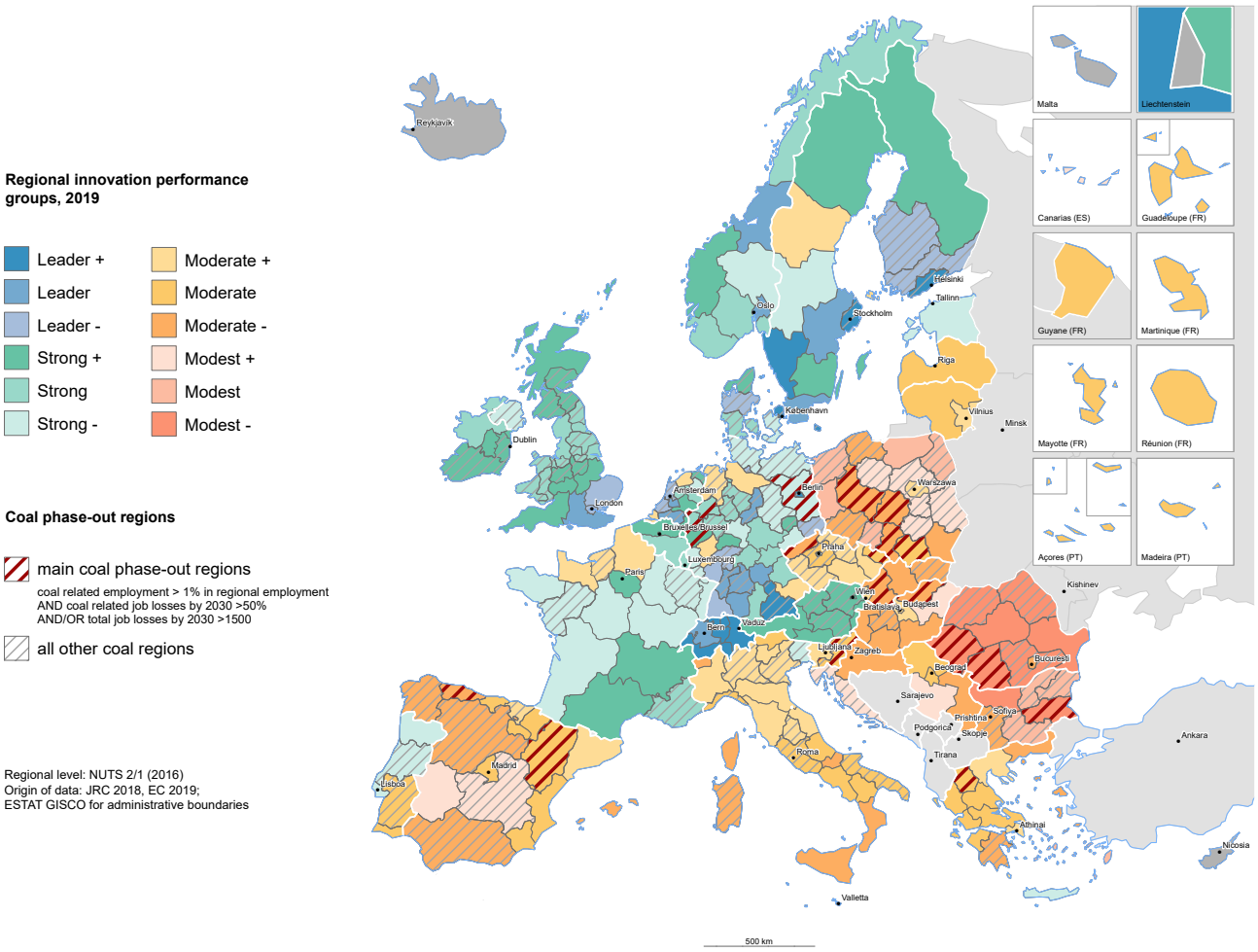
- **3.0 leader regions** with a patent intensity in 3.0 technologies greater than the European median intensity and with a share of 3.0 technologies in their patent portfolio greater that the European one (i.e. regions specialised in 3.0 technologies);
- **3.0 niche regions** with a patent intensity in 3.0 technologies lower than the European median intensity but a share of 3.0 technologies in their patent portfolio greater than the European one (i.e. regions specialised in 3.0 technologies);
- **3.0 producing regions** with a 3.0 patent intensity greater than the European median intensity but without specialisation in 3.0 technologies;
- **no 3.0 regions** in which 3.0 patent intensity and the share of 3.0 technologies in their patent portfolio are below the European values.

Next, the two classifications were compared to obtain the following taxonomy of 4.0 inventing regions:

- **low tech regions**, i.e. no 4.0 regions that in the previous period were no 3.0 regions;
- **technology falling behind regions**, i.e. no 4.0 regions that in the previous period were 3.0 producing or 3.0 niche or 3.0 leader regions;
- **new islands of innovation**, i.e. 4.0 producing, niche or leader regions that in the previous period were no 3.0 regions or 3.0 producing regions;
- **technology leader regions**, i.e. 4.0 leader or niche regions that in the previous period were 3.0 leader or niche regions.

Innovation islands with considerable coal-related activities include the voivodship Małopolskie, the Czech regions of Karlovy Vary, Ústí nad Labem and Moravskoslezský, the Vest development region in Romania and Eastern Slovenia. Interestingly, the classification of Małopolskie is consistent with findings of the ESPON applied research project Geography of New Employment Dynamics in Europe. We, therefore, attempt a triangulation with other data sources, notably the regional profile of Małopolskie released by the Secretariat Technical Assistance to Regions in Transition (START). The profile paper reports on improvements of the regional innovation ecosystem thanks to R&D spending and cooperation between enterprises and academia that is reflected in better scoring in regional innovativeness rankings than other Polish coal regions (Map 8). At the same time, the profile of Śląskie lists the low level of cooperation and weak links between the R&D sector and other sectors among the challenges for the transition. Reportedly, Śląskie stakeholders have embraced the notion of cooperation with the industry in the context of smart specialization in an effort to stimulate economic diversification amidst the coal transition. Similar endeavours are referenced in the Karlovy Vary profile paper. A business accelerator project launched by the regional authority and the Karlovy Vary Business Development Agency seeks to support diversification by discovering entrepreneurial opportunities and developing triple-helix cooperation models. These reports signal confidence in the proposed policy framework (Figures 3 and 5)

Map 8
Coal phase-out regions and innovation performance 2019

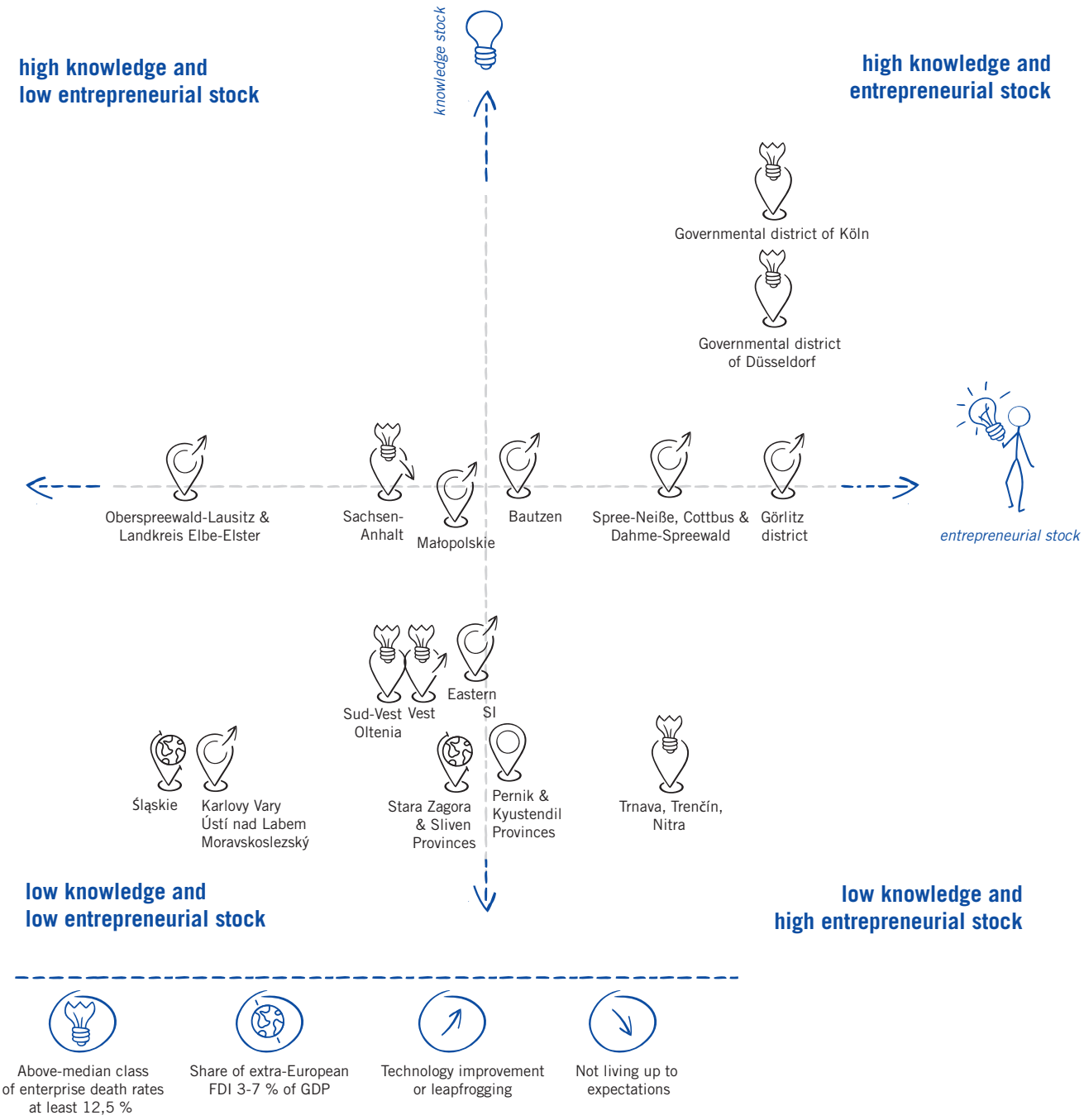


Based on the territorial parameters presented, we plot the estimated position of the sample regions along the knowledge and entrepreneurial stock trajectories, which demonstrates variance in the regional potential for structural change (Figure 4) but more importantly helps to approximate the desirable balance of the proposed (a), (b) and (c) actions under the JTF (Figure 5).

Low enterprise birth rates, i.e. a comparably low entrepreneurial stock in coal phase-out regions with high shares of direct and/or indirect coal-related employment, would signal excessive dependence on incumbent industries and the need to induce a sustainable entrepreneurial culture. Neffke et al. (2018) suggest that, while unrelated diversification required for structural change originates mostly from new establishments with non-local roots, subsidiaries of incumbent firms are more likely to induce durable structural change in regions. Acs et al. (2009) suggest that intellectual property that remains unused by incumbent firms is the source of knowledge spillovers to start-ups that seek to appropriate such knowledge residuals. Business incubation and consultancy can positively moderate such processes and reduce entrepreneurial risks. The Entrepreneurial Discovery Process as a proposed JTF governance mechanism can plug in other parameters, which are expected to explain a low entrepreneurial stock such as the proportion of creative workers and the diverse environment in a certain locality (Audretsch and Belitski, 2013) and additionally resort to amendments made by the European Parliament in relation to JTF investments in culture and community building.

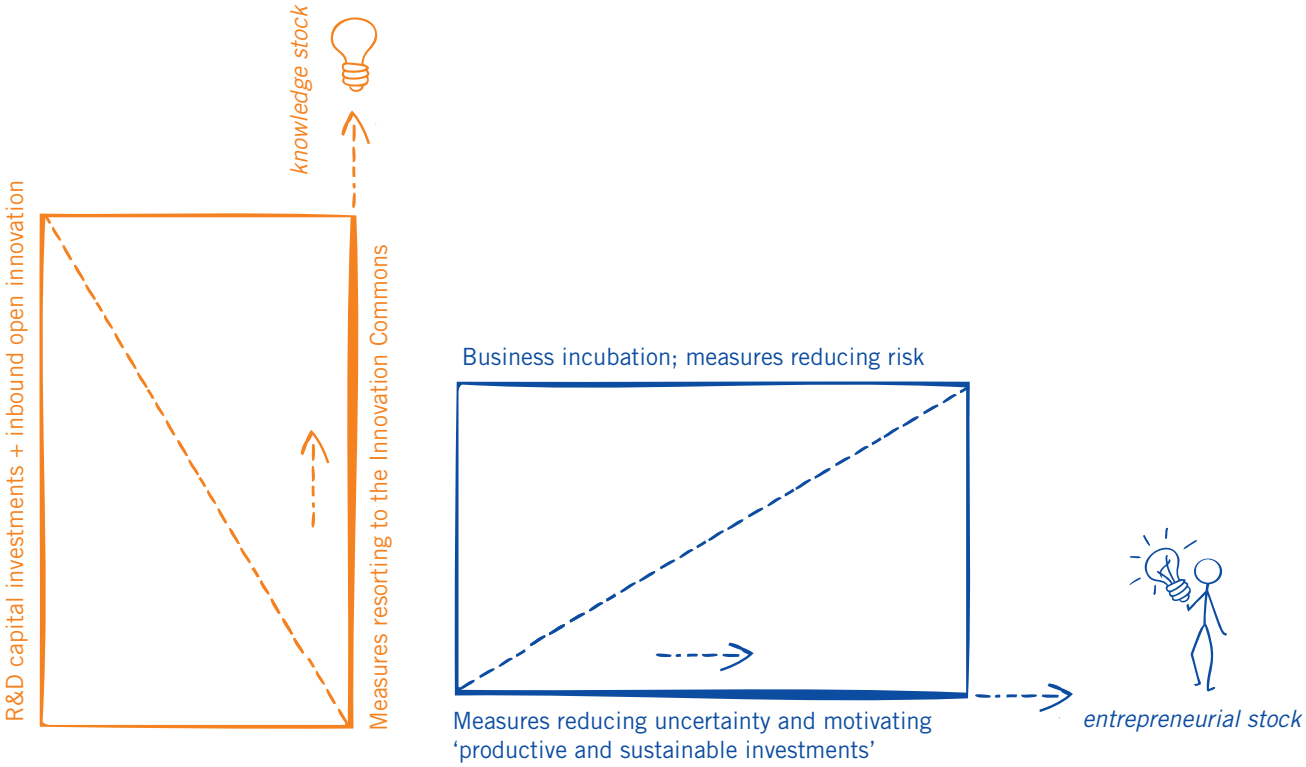
More importantly, more reliable conclusions for a JTF action mix can be drawn based on the relative position along both trajectories. Regions such as Śląskie and the provinces of Stara Zagora and Sliven, with a comparably low knowledge and entrepreneurial stock compounded by higher dependency on non-local knowledge sourced from FDI, would ascertain the necessity to build up a pro-

Figure 4
Regional positioning along the knowledge and entrepreneurial stock trajectories



ductive and durable regional Innovation Commons, resulting in the need to channel investments towards R&D capital and inbound open innovation. The latter can be a systemised action within a Territorial Just Transition Plan that would seek to entice pilot and experimental projects preparing the market roll-out of new technologies within the framework programme for research and innovation. Business incubation and consultancy may be expected to positively moderate such efforts.

Figure 5
JTF policy mix according to the knowledge and entrepreneurial stock maturity



Regions with comparably good knowledge and entrepreneurial stock will tend to resort to the Innovation Commons, seeking to stimulate outbound open innovation (e.g. licensing or technology spin-offs) and consequently further diversification. The interaction between the two – actions aimed at activating the Innovation Commons and reducing entrepreneurial uncertainty (thus motivating productive investments) – is likely to have a more significant positive marginal effect on the economy in regions with comparably high knowledge and entrepreneurial stock.

Looking at both trajectories can be particularly helpful to design adequate actions in cases of high enterprise death rates. Combined with the low level of the regional knowledge stock, higher enterprise death rates may make regions such as Trnava Region, Trenčín and Nitra more vigilant with regard to productive investments, in particular taking into account the amendment of the European Parliament from productive investments to 'productive and sustainable investments'. Such investments can be positively moderated through R&D capital investments and inbound open innovation that reduce entrepreneurial uncertainty attributable to the regional knowledge stock.

On the other hand, regions such as the governmental districts of Köln and Düsseldorf that also exhibit high enterprise death rates but perform better in terms of their knowledge stock may find it more reasonable to invest in measures that reduce entrepreneurial uncertainty through desirability assessment, e.g. double-track regulatory and technology-oriented public-private partnerships (e.g. publicly funded simulations of the social and environmental effects of new market-ready technologies aiming at both regulation and market roll-out).

The bottom line is that balancing investments based on territorial parameters related to the knowledge and entrepreneurial stock is expected to reduce deadweight losses and engender higher social returns. The assessment above does not pretend to be able to compose an accurate action mix for the coal regions expected to be most severely affected but is designed to offer a conceptual framework for JTF governance. Our advice is that such governance shall be framed as an Entrepreneurial Discovery Process, which involves regional stakeholders from public authorities, industry and research. Such a governance model is (a) expected to stimulate technological leapfrogging in regions with comparably low knowledge stock and (b) likely to be best suited to monitor territorial parameters related to the knowledge and entrepreneurial stock and derive conclusions for the social-benefit-maximising intensity and mix of JTF actions.

References

Acs, Z.J., Braunerhjelm, P., Audretsch, D.B. and Carlsson, B. 2009. 'The Knowledge Spillover Theory of Entrepreneurship'. *Small Business Economics*, vol. 32, no. 1, pp. 15-30.

Allen, D.W.E. and Potts, J. 2016. 'How Innovation Commons Contribute to Discovering and Developing New Technologies'. *International Journal of the Commons*, vol. 10, no. 2, pp. 1035-1054.

Alves Dias, P. et al. 2018. *EU Coal Regions: Opportunities and Challenges Ahead*. Publications Office of the European Union, Luxembourg, doi:10.2760/064809.

Audretsch, D.B. and Belitski, M. 2013. The missing pillar: the creativity theory of knowledge spillover entrepreneurship. *Small Business Economics*, vol. 41, no. 4, pp. 819-836.

Cameron, A., Claeys, G., Mideos, C. and Tagliapietra, S. 2020. Assessment of the Just Transition Fund Proposal. BRUEGEL. https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/629213/IPOL_BRI(2020)629213_EN.pdf (accessed 14 September 2020).

Chesbrough, H. 2006. 'Open Innovation: A New Paradigm for Understanding Industrial Innovation'. In Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds.), *Open Innovation: Researching a New Paradigm*. Oxford University Press, Oxford, pp. 1-12.

Colli, F. 2020. *The EU's Just Transition: Three Challenges and How to Overcome Them*. Egmont Institute. www.jstor.org/stable/resrep24705 (accessed 14 September 2020).

ESPON 2018a. *Small and Medium-Sized Enterprises in European Regions and Cities.* Luxembourg.

ESPON 2018b. *Geography of New Employment Dynamics in Europe.* Luxembourg.

ESPON 2018c. *The World in Europe: Global FDI Flows towards Europe.* Luxembourg.

ESPON 2020. *Technological Transformation & Transitioning of Regional Economies.* Luxembourg.

European Commission 2020. Proposal 2020/0006 (COD) for a regulation of the European Parliament and of the Council establishing the Just Transition Fund. Brussels.

European Court of Auditors 2018. *EU Support for Productive* I*nvestments in Businesses – Greater Focus on Durability Needed*. https://www.eca.europa.eu/Lists/ECADocuments/SR18_08/SR_DURABILITY_EN.pdf (accessed 14 September 2020).

European Parliament 2020. Report on the proposal for a regulation of the European Parliament and of the Council establishing the Just Transition Fund (COM(2020)0022 – C9-0007/2020 – 2020/0006(COD)). Committee on Regional Development.

Foray, D. 2015. *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Routledge, London and New York.

Foray, D., David, P.A. and Hall, B. 2009. *Smart Specialisation: The Concept.* Knowledge for Growth: Prospects for Science, Technology and Innovation. Publications Office of the European Union, Luxembourg.

Harrahill, K. and Douglas, O. 2019. 'Framework Development for "Just Transition" in Coal Producing Jurisdictions'. *Energy Policy*, vol. 134.

Hausmann, R. and Rodrik, D. 2003. 'Economic Development as Self-Discovery'. *Journal of Development Economics*, vol. 72, no. 2, pp. 603-633.

Neffke, F., Hartog, M., Boschma, R. and Henning, M. 2018. 'Agents of Structural Change: The Role of Firms and Entrepreneurs in Regional Diversification'. *Economic Geography*, vol. 94, no. 1, pp. 23-48.

Pinto, H., Nogueira, C., Carrozza, C. and D'Emery, R. 2019. 'Smart Specialisation and the Entrepreneurial Discovery: A New Approach to Design Structural Change'. In Cagica Carvalho, L., Rego, C., Lucas, M., Sánchez-Hernández, M. and Backx Noronha Viana, A. (Eds.), *New Paths of Entrepreneurship Development. Studies on Entrepreneurship, Structural Change and Industrial Dynamics*. Springer, Cham, pp. 55-75. https://doi.org/10.1007/978-3-319-96032-6_4

Rodríguez-Pose, A. and Wilkie, C. 2015. 'Institutions and the Entrepreneurial Discovery Process for Smart Specialisation'. *Papers in Evolutionary Economic Geography,* no. 15.23, pp. 1–27.

Skoczkowski, T., Bielecki, S., Kochański, M. and Korczak, K. 2020. 'Climate-Change Induced Uncertainties, Risks and Opportunities for the Coal-Based Region of Silesia: Stakeholders' Perspectives'. *Environmental Innovation and Societal Transitions*, vol. 35, pp. 460-481.

WWF Germany 2020. *Just Transition to Climate Neutrality. Doing Right by the Regions.* Berlin.

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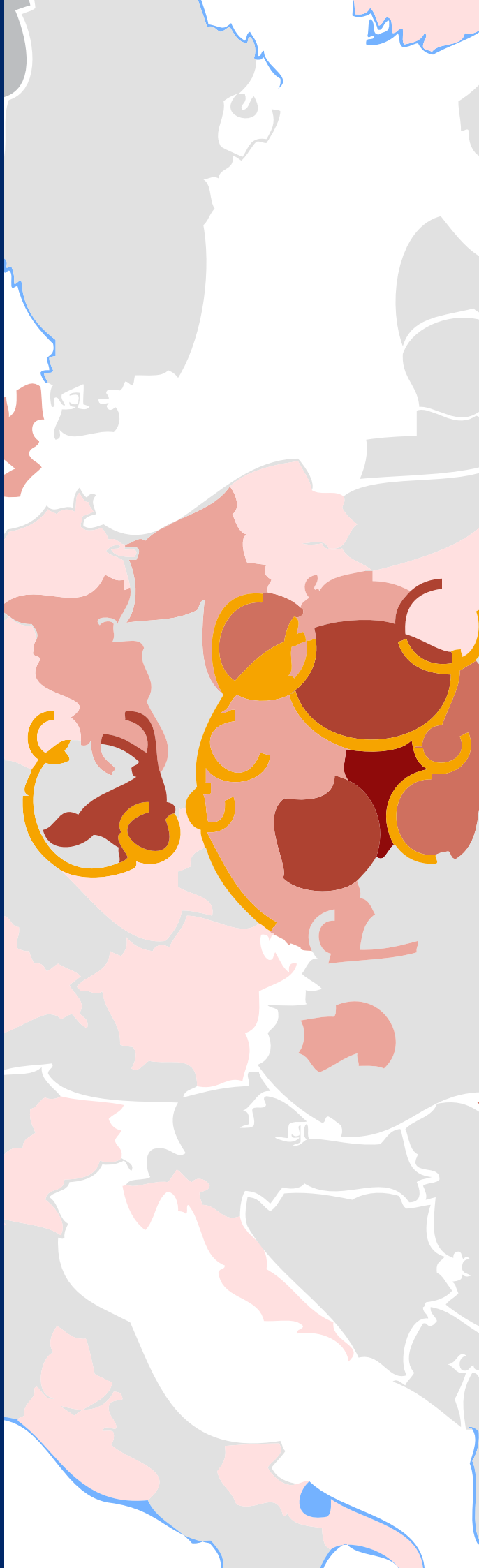

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