ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

TARGETED ANALYSIS

CE-FLOWS

Spatial dynamics and integrated territorial development scenarios for the functional area of central Europe

Scientific report // October 2021

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Disclaimer

This document is a Scientific report.

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Abbreviations

CE	Central Europe
ESPON	European Territorial Observatory Network
GIS	Geographic Information System
MASST	MAcroeconomic, Sectoral, Social, Territorial
MRS	Macro-Regional Strategies
NUTS	Nomenclature of Territorial Units for Statistics

1 Spatial dynamics in the CE area

The CE-FLOWS targeted analysis provides in-depth insights into the spatial dynamics and existing flows across regions in central Europe and identifies main development potentials, drivers and bottlenecks in this functional area. Emphasis is placed on how transnational cooperation structures, governance mechanisms and solutions could be tailored to reduce economic and social disparities and foster integrated territorial development in CE.

This report presents the main methodological frameworks applied in this targeted analysis. It introduces conceptual framework and respective methodologic pathways to make the study repeatable and verifiable for possible future research. This report complements other outputs produced in this targeted analysis: the main report presenting the key findings of the study, in addition to a Synthesis report.

The structure of this Scientific report largely follows the main steps and tasks performed throughout the targeted analysis. Section 2 presents the conceptual framework behind the analytical work for each of the tasks as per Terms of Reference (ToR), whilst Section 3 outlines the main approaches to data collection, presenting the identified shortcomings and the related solutions to tackle them.

This report has three annexes attached directly. There are also source files in vector format for the maps and figures as well as geodatabase files for all the maps complementing the report. The annexes included in this Scientific report are:

- Annex 1: Main Maps
- Annex 2: Additional maps with untapped potentials
- Annex 3: Delphi exercise: preliminary results and Delphi questionnaire (1st Round)

2 Methodological framework

2.1 Spatial dynamics in the CE area: Cluster and GIS analyses

In the first step, the project team developed a regional characterisation of the NUTS2 regions in the CE area using a cluster analysis. This step was individual to each thematic flow (i.e. *Economic interactions and networks*, *flow of people*, *environmental hazards*, *accessibility and connectivity*) and is based on relevant socio-economic, environmental, and geographic characteristics associated with a given flow. It further allowed the project team to differentiate between sending and receiving regions. These developed typologies of regions are centred around the types of flows observed in the individual NUTS2 region within the CE area. Sending regions generally present the starting point of a flow. As a second step, each cluster and GIS analysis was conducted with a specific dataset, including thematically relevant indicators.

2.1.1 Cluster analysis

The clustering allows for the identification of patterns (such as innovation-strong areas) within the larger functional area. It also provides the project team an additional layer of information when analysing the types of flows between regions in the following working step, as deeper information on the type of regions found in the functional area is disposable.

Clustering relies on two core principles: *intra-cluster homogeneity* (e.g. territories within the same cluster show similarities regarding their territorial, socio-economic, demographic and/or other thematic profile) and *extra-cluster heterogeneity* (e.g. territories from two distinct clusters show different territorial, socio-economic, demographic and/or other thematic profiles). Upon completion of the clustering, each cluster is characterised along the indicators whose values are standing out in the said cluster and its geographic coverage. This characterisation thus enables the definition of typologies.

For each cluster in this process the main determining variables are identified, along which the typical features of the cluster can be outlined. The cluster analysis based on an extension of the most used KMEANS clustering method, which can deal with missing data, has been conducted in R. Along with the results of the clustering, several statistical key parameters are calculated aiding in the identification of the main determining variables.

For each cluster and each variable, the intra-cluster means and deviation as well as the extra-cluster distances are the core factors considered. In most cases, each cluster is defined by two or three variables with characterising values. Such characterising values can e.g. be high distances to other clusters with minimal deviation of values inside the cluster or significantly different high or low values in comparison to other clusters.

The exact number of clusters is to be determined based on the sample size, the number of indicators used, the maximisation of *intra-cluster homogeneity* and *extra-cluster heterogeneity* as well as the desired number of clusters based on the analytical requirements to ensure both the comprehensiveness and representativeness of each cluster population. The clustering exercise produces a set of distinct clusters, i.e. each cluster includes a set of distinct characteristics among the included socioeconomic indicators.

Upon completion of the clustering, each cluster is characterised:

- along the indicators whose values are standing out in the said cluster; and
- its geographic coverage.

This characterisation thus enables the definition of regional *typologies*.

2.1.2 GIS analysis

To contextualise these typologies, the results of each cluster analysis were paired with a geographic layer or, if applicable, a point-to-point visualisation of flows via geographic information system (GIS) mapping.

This contextual layer illustrates the relationship between each cluster[1] and provides illustrative anchor points on the type of relationship between the clusters.

There are two distinct analysis approaches, depending on the availability of data:

- Analysing the spatial dynamics using point-to-point flow data;
- Analysing the spatial dynamics using a synthetic layer with geo-information.

In the first case, the project team contextualises the findings of the cluster analysis by visualising the region-to-region relations with point-to-point flow data. This is possible when the data value contains multiple geographic identifiers, such as in the case of transport of goods (where the sending and the receiving region are explicitly documented) or in the case of cooperation networks (where the location of the cooperating partners are known). Using this data, the project team created n by n matrices outlining the relationships between the individual regions (symbolised by a value, such as tonnage or number of partnerships between region *i* and region *j*) using the software package R. This data was subsequently cleaned (i.e. implausible values corrected) and visualised using ArcGIS. To enable ease of interpretation, the project team used thresholds, filtering out very low values.

In the second case (where point-to-point data is not available), the project team uses geo-tagged information to provide additional insights into the outputs of the cluster analysis. This data includes World Heritage sites or powerplant locations, NATURA 2000 surface area, or general (car/train) accessibility data. This data enhances the attributes of the cluster analysis and provides additional insights into the relationships between the clusters.

2.2 Analysis of existing partnerships

The analysis of existing partnerships – the third step of our approach – is complementary to the cluster and GIS methods depicted above and relies on two main components: **a quantitative analysis at NUTS2 level**, emphasising the existing links and connections between the CE regions on thematic areas, and a **qualitative study of the different typologies of partnerships and territorial cooperation agreements**, highlighting instruments and policies employed as well as good practices, governance mechanisms and solutions impacting territorial cooperation. The analysis of partnerships has been carried out at NUTS 2 level, covering all the 78 regions of the functional area of Central Europe. Data has been collected with the aim to capture all programmes for which data is available and in which regions from the CE area have been involved, regardless whether the programmes refer only to territorial cooperation dedicated specifically to the CE area or if they include project partners in transnational or interregional programmes across the European territory. In this respect, the quantitative analysis relies on data covering the European Territorial Cooperation (ETC) as depicted in the following Table 1[2], the EU Funding Instrument for the environment and climate action (LIFE)[3] and the Framework Programme for Research and Innovation (Horizon 2020)[4]. Complementary, a qualitative analysis has been conducted, based on an extensive

[1] Most data available describes flow data in a static approach. For example, statistical offices carry data on the share of commuters in each region, however, not on the starting and/or ending point of the respective commute. As such, where possible, the project team uses the point-to-point data in the geographical layer. Where this is not possible due to unavailable data, a contextual layer was added.

[2] Based on the ETC projects available in the Keep.eu database as of end of November 2020

[3] Based on the projects available on the LIFE cooperation programme 2014-2020 data hub as of end of November 2020

[4] Based on the projects available on the CORDIS dashboard as of end of November 2020

literature review of the main typologies of existing instruments and cooperation frameworks. The cooperation programmes considered cover the current programming period (2014-2020).

Based on the territorial coverage of the programmes studied in the quantitative analysis, several types of territorial interaction have been identified:

- Cooperation reflected into the *number of projects* - anytime a region in the CE area is part of a territorial cooperation project, regardless of its territorial scope;
- Cooperation reflected into the *number of organisations participating in projects* - anytime an entity is part of a territorial cooperation project;
- Cooperation within the CE area, defined as any interaction among regions in the CE area, reflected into the *number of pairs of regions* (anytime two regions are part of a project).

The following territorial cooperation programmes have been considered in the quantitative analysis of partnerships:

Table 1 – Territorial cooperation programmes considered in the analysis of partnerships

European Territorial Cooperation	
Cross-border cooperation (Interreg A)	2014 - 2020 INTERREG V-A Austria - Czech Republic
	2014 - 2020 INTERREG V-A Austria - Germany / Bavaria (Bayern - Österreich)
	2014 - 2020 INTERREG V-A Austria - Hungary
	2014 - 2020 INTERREG V-A Belgium - Germany - The Netherlands Euregio Meuse-Rhin / Euregio Maas-Rijn / Euregio Maas-Rhein
	2014 - 2020 INTERREG V-A Czech Republic - Poland
	2014 - 2020 INTERREG V-A France - Germany - Switzerland (Rhin supérieur-Oberrhein)
	2014 - 2020 INTERREG V-A France - Italy (ALCOTRA)
	2014 - 2020 INTERREG V-A Germany - Austria - Switzerland - Liechtenstein (Alpenrhein - Bodensee - Hochrhein)
	2014 - 2020 INTERREG V-A Germany - The Netherlands
	2014 - 2020 INTERREG V-A Germany / Bavaria - Czech Republic
	2014 - 2020 INTERREG V-A Germany / Brandenburg - Poland
	2014 - 2020 INTERREG V-A Germany / Mecklenburg - Western Pomerania / Brandenburg - Poland
	2014 - 2020 INTERREG V-A Germany / Saxony - Czech Republic
	2014 - 2020 INTERREG V-A Italy - Austria
	2014 - 2020 INTERREG V-A Italy - Croatia
	2014 - 2020 INTERREG V-A Italy - France (Maritime)
	2014 - 2020 INTERREG V-A Italy - Malta
	2014 - 2020 INTERREG V-A Italy - Slovenia
	2014 - 2020 INTERREG V-A Italy - Switzerland
	2014 - 2020 INTERREG V-A Lithuania - Poland
	2014 - 2020 INTERREG V-A Poland - Denmark - Germany - Lithuania - Sweden (South Baltic)
	2014 - 2020 INTERREG V-A Poland - Germany / Saxony
	2014 - 2020 INTERREG V-A Poland - Slovakia

	2014 - 2020 INTERREG V-A Romania - Hungary 2014 - 2020 INTERREG V-A Slovakia - Austria 2014 - 2020 INTERREG V-A Slovakia - Czech Republic 2014 - 2020 INTERREG V-A Slovakia - Hungary 2014 - 2020 INTERREG V-A Slovenia - Austria 2014 - 2020 INTERREG V-A Slovenia - Croatia 2014 - 2020 INTERREG V-A Slovenia - Hungary
Transnational Cooperation (Interreg B)	2014 - 2020 INTERREG VB Adriatic - Ionian 2014 - 2020 INTERREG VB Alpine Space 2014 - 2020 INTERREG VB Baltic Sea 2014 - 2020 INTERREG VB Central Europe 2014 - 2020 INTERREG VB Danube 2014 - 2020 INTERREG VB Mediterranean 2014 - 2020 INTERREG VB North Sea 2014 - 2020 INTERREG VB North West Europe 2014 - 2020 INTERREG VB Northern Periphery and Arctic
Interregional cooperation (Interreg C)	2014 - 2020 ESPON 2020 2014 - 2020 URBACT III 2014 - 2020 Interreg Europe
Cooperation at the external borders of the EU	2014 - 2020 Hungary - Slovakia - Romania - Ukraine ENI CBC 2014 - 2020 Interreg IPA CBC Croatia - Bosnia and Herzegovina - Montenegro 2014 - 2020 Interreg IPA CBC Croatia-Serbia 2014 - 2020 Interreg IPA CBC Hungary - Serbia 2014 - 2020 Interreg IPA CBC Italy - Albania – Montenegro 2014 - 2020 Mediterranean Sea Basin ENI CBC 2014 - 2020 Poland - Belarus - Ukraine ENI CBC 2014 - 2020 Poland - Russia ENI CBC
LIFE - The EU Funding Instrument for the environment and climate action	
Horizon 2020 - The Framework Programme for Research and Innovation	

The analysis of partnerships aims to reflect the territorial cooperation dynamics in the CE area and to complement the cluster and GIS analyses that use statistical data on a number of thematic flows. In this context, most project cooperation themes have been clustered by main thematic cooperation areas, corresponding to the thematic flows, as outlined in the following Table 2. At the same time, part of the identified cooperation themes have been aggregated into additional, supporting thematic cooperation areas that contribute to better contextualize and to stimulate the main flows.

In this context, the **cooperation themes have been clustered under main thematic areas depicting the main inter-regional flows and not only**: *commuting patterns*, *electricity and renewable energy, environmental hazards and flows*, *institutional cooperation*, *manufactured goods and transportation flows*

(incl. economic cooperation), *research and development (incl. soft R&D cooperation)*, *institutional cooperation* and *tourism and cultural & natural heritage*.

Table 2 - Project cooperation by main thematic cooperation areas

Project theme (based on the European Territorial Cooperation programmes)	**Main thematic cooperation areas / typology of flow**
Labour market and employment; Demographic change and immigration	Commuting patterns
Energy efficiency; Renewable energy; Green technologies; Traditional energy	Electricity and renewable energy
Sustainable management of natural resources; Managing natural and man-made threats, risk management; Risk management; Climate change and biodiversity; Waste and pollution; Water management; Coastal management and maritime issues; Construction and renovation; Soil and air quality	Environmental hazards and flows
Transport and mobility; Improving transport connections; Waterways, lakes and rivers; Multimodal transport; Logistics and freight transport	Manufactured goods and transportation flows
New products and services; Knowledge and technology transfer; Innovation capacity and awareness-raising; ICT and digital society; Scientific cooperation	Research and development
Tourism; Cultural heritage and arts	Tourism and cultural & natural heritage
SME and entrepreneurship; Clustering and economic cooperation; Agriculture and fisheries and forestry	Economic cooperation *(a thematic cooperation area that is analysed under Manufactured good and transportation flows)*
Institutional cooperation and cooperation networks; Social inclusion and equal opportunities; Regional planning and development; Community integration and common identity; Urban development; Rural and peripheral development; Cooperation between emergency services; Governance, partnership; Evaluation systems and results; Safety	Institutional cooperation *(a cross-cutting thematic cooperation area, which is not related to only one typology of flows)*
Thematic priority description (based on Horizon 2020 data)	**Main cooperation theme / type of flow**
Access to risk finance; Industrial Leadership (Cross-theme); Innovation in SMEs; Integrate society in science and innovation; Secure societies - Protecting freedom and security of Europe and its citizens; Transnational networks of National Contact Points	Economic cooperation *(a thematic cooperation area that is analysed under Manufactured good and transportation flows)*
EURATOM; Secure, clean and efficient energy	Electricity and renewable energy
Anticipating and assessing potential environmental, health and safety impacts; Climate action, environment, resource efficiency and raw materials; Food security, sustainable agriculture and forestry, marine and maritime and inland water research	Environmental hazards and flows
Advanced manufacturing and processing; Smart, green and integrated transport	Manufactured goods and transportation flows
Develop the accessibility and the use of the results of publicly-funded research; Develop the governance for the advancement of responsible research and innovation; Encourage citizens to engage in science; ERA chairs; Improve knowledge on science communication; Make scientific and technological careers attractive for young people; Promote gender equality in research and innovation; Spreading excellence and widening	Research and development (support) *(a thematic cooperation area that is analysed under Research and development)*

participation (Cross theme); Supporting access to international networks; Teaming of excellent research institutions and low performing RDI regions; Twinning of research institutions	
Advanced materials; Biotechnology; European Research Council; Future and Emerging Technologies; Information and Communication Technologies; Marie Sklodowska-Curie actions; Nanotechnologies, Advanced Materials and Production; Research infrastructures; Science with and for Society (Cross theme); Space	Research and development
LIFE sub-programmes	**Main cooperation theme / type of flow**
Environment Climate action	Environmental hazards and flows

The analysis reveals that numerous structures and measures have been developed and implemented over the years, providing tools for the establishment of partnerships that contribute to an integrated development of the central Europe region both within the territory and in relation to neighbouring areas. The dimensions considered to differentiate and describe the main typologies of partnership are:

- Main delivery models;
- Territorial scale;
- Spatial emphasis;
- Territorial coverage;
- Typologies of stakeholders involved;
- Areas of cooperation; and
- Available instruments.

Annex 4 presents the different typologies of partnerships, according to the dimensions identified for their classification.

2.3 Untapped potentials

International borders pose several obstacles that can prevent the optimal exploitation of socio-economic and environmental resources. A particularly relevant obstacle due to missed integration is associated with legal and administrative barriers (Camagni et al., 2019). When more integration of legal and administrative norms takes place, resource potentials can be fully and better exploited.

Untapped potentials may exist both in the use of local resources and of resources of nearby regions. In the case of local resources, the presence of the border does not allow to expand the size of the market to neighbouring regions (Capello et al., 2018a), while in the case of nearby resources firms and individuals cannot exploit the existence of a resource present in the neighbouring area (Capello et al., 2018b). Integrated labour markets, larger industrial markets, integrated areas from a social and environmental point of view (with the same legal and administrative rules in the field of environmental protection) are all cases associated with better quality of life and socio-economic development and growth.

Untapped potentials are therefore resources not efficiently used because of the existence of a border; a removal of the border, i.e. a higher integration in terms of legal and administrative rules, would allow the regional economies to exploit the untapped potentials. It is here important to stress that the range of regional characteristics affected by the existence of untapped potentials ranges from the economy to the society, from the environment to regional governance.

The Interreg CE area is not an exception in this respect. The situation of missed development can even be higher given the high potential synergies that this area offers when a higher socio-economic integration is developed. The existing borders among the countries involved in the area (Austria, Croatia, the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Germany, and Italy, following the formal definition of the CE area in Interreg Central Europe, 2015) represent a barrier that, once removed, can enhance scale economies stemming from a large market for inputs, and for intermediate and final goods, both within each region as well as across CE area regions.

The identification of untapped potential results from a traditional statistical analysis linking socio-economic development and the regional assets (Capello et al., 2018c). The statistical analysis, explained in detail in the tables below, shows whether the use of each resource mentioned in Table 3 is as efficient in the CE area as in European regions where no borders exist. A barrier to the full exploitation of the untapped potential is here interpreted as a factor characterising the intensity of the border between regions belonging to two EU countries. Because of the method adopted, regions suffering from the inefficient exploitation of both internal and external regional assets, are all those located along borders in the CE area. However, the general impact of missed integration is felt in all the countries involved, via spillover effects.[5] We provide a calculation of the effects of a missed development on the whole country.

Table 3. Regional resources per thematic field

Thematic field	Resource	Indicator
Economic interactions and networks	Trust	Percentage of people answering they trust others “A lot” or “Enough” to the European Values Study question “”
	Cultural heritage[6]	Number of museums per 1,000 inhabitants[7]
	Human capital	Percentage pop. with tertiary degree
	Manufacturing activity	Gross value added in manufacturing activities over total regional value added
	Agglomeration economies	Population density
	Regional quality of governance	Regional score in University of Gothenburg’s Regional Quality of Government Index
	Public safety[8]	Number of recorded crimes per 1,000 inhabitants
	Degree of innovation	Trademark applications to the EPO per 1m inhabitants
	Market potential	Percentage of GVA in manufacturing in neighbouring areas
	Financial capital flows	Propensity to save in neighbouring areas
Flow of people	Local labor market	Employment rate
	International partnerships	Number of Framework Programme co-participations

[5] It could be argued that often missed integration is due to the (in)action of capital regions, that may not make governance choices that work best for border regions. In this sense, international partnerships may potentially display a very good potential of mitigating border obstacles, even at the local level. We thank a member of Interreg CE for this comment to a previous version of this document.

[6] The link between cultural heritage and economic performance has been recently identified in the empirical literature (see e.g. Cerisola, 2019, and citations therein).

[7] Other indicators have been also included in the analyses as a robustness check, also for capturing the regional endowment with cultural heritage, but no statistically significant result has been found.

[8] Crime is usually found to be negatively associated to a number of economic outcomes, both because higher crime rates increase uncertainty, thus providing negative incentives for firms to invest (Detotto and Otranto, 2010), as well as indirectly, by decreasing social capital (Akçomak and Ter Weel, 2012).

Environmental hazards	Compact urban form[9]	% of artificial urban fabric
	Waste management[10]	% of waste recycled
	Pollution	PM10 emissions
	Green energy	Photovoltaic emissions per square kms
	Soil erosion	Capacity of ecoystems to avoid soil erosion
Connectivity	Accessibility	Multimodal accessibility
		Intensity of online sales
	Touristic receptivity	Number of bed places per 1,000 inhabitants

The quantification of the untapped potentials in the CE area was run through the following two main regression models:

$$\Delta Y=\alpha+\Sigma\beta_k*control_k+\gamma*border+\delta_i*assets_i+\vartheta_i*border*assets_i+ \quad (1.)$$
$$+\mu_{ij}*border*assets_i*inst\_barrier+\ \Sigma\rho c*country_{c=1..n}+\varepsilon_{ij}$$

where ΔY is the 2008-2018 regional growth rate, i refers to assets, inst_barrier to whether the region suffers from institutional and legal barriers more than the average, and c to countries. δi measures the impact of each regional growth asset i[11] on regional growth, ϑi measures specifically the impact of asset i on the growth of international border regions with respect to all other regions, and μij measures the impact of assets i on the growth of border regions characterized by legal and administrative barriers j, with respects to all other regions.

When μij is found to be negative and significant, this suggests that CE regions characterised by legal and administrative barriers have a lower growth impact from a specific asset with respect to all other EU regions; in turn, this suggests that, given the presence of legal and administrative borders, this asset is not exploited as in all other regions.

Results of this first set of estimates are shown in Table 4. The numbers to be employed for the identification of untapped potentials are the estimated parameters for the interactions among each internal asset, the border region dummy, and the dummy that equals 1 when the area suffers from an institutional barrier. For ease of comparison, significant estimates are highlighted in green in the table, and correspond to the values shown in the maps. The same framework can be next applied to the analysis of the costs of borders on the exploitation of neighbouring resources, defined as the potential resource spillovers from nearby regions. This implies estimating the following equation:

$$\Delta Y=\alpha+\Sigma\beta_k*control_k+\gamma*border+\delta_i*external\ assets_i+ \quad (2.)$$
$$+\vartheta_i*border*external\ assets_i+\mu_{ij}*border*external\ assets_i*inst\_barrier+$$
$$+\ \Sigma\rho_c*country_{c=1..n}+\varepsilon_{ij}$$

[9] Burgess (2000) defines this concept as the strive to "'increase built area and residential population densities; to intensify urban economic, social and cultural activities and to manipulate urban size, form and structure and settlement systems in pursuit of the environmental, social and global sustainability benefits derived from the concentration of urban functions".

[10] Incomplete integration of CE Countries prevents from the full exploitation of waste management integration processes, thus causing an environmental hazards (see e.g. the recent literature cited in Vaverková et al., 2018)

[11] The complete list of assets included in our analyses is reported in Table 3.

The logic remains the same as in Eq. (1.). When μ_{ij} is negative and significant, an external resource *i* has a lower growth impact in regions characterised by legal and administrative barriers within the CE area with respect to a region without these barriers. The removal of the barrier would make the access to the resource easier, and its exploitation more efficient.

Again, complete results of the estimates are presented in Table 4 below, with the code above anticipated: green cells indicate significant estimated interaction parameters, thereby suggesting the existence of an untapped potential in the exploitation of that specific external resource.

Table 4. Untapped potentials in internal resources

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Dep. variable: 2008-2013 growth of total value added												
Log of total 2008 value added	-0.00209	0.00170	-0.00334	-0.00166	-0.00220	-0.00217	-0.00291	-0.000960	-0.00505	-0.00410	-0.00211	-0.00685**	-0.00213
	(-0.81)	(0.58)	(-1.19)	(-0.64)	(-0.86)	(-0.84)	(-1.01)	(-0.29)	(-1.64)	(-1.52)	(-0.80)	(-2.49)	(-0.83)
Rural region dummy	0.0237***	0.0150**	0.0251***	0.0229***	0.0229***	0.0228***	0.0216***	0.0226***	0.0233***	0.0247***	0.0232***	0.0184***	0.0233***
	(3.82)	(2.11)	(3.58)	(3.65)	(3.64)	(3.59)	(3.41)	(3.61)	(3.74)	(3.97)	(3.66)	(2.80)	(3.74)
Urban region dummy	0.00806	0.00210	0.0102*	0.00697	0.00748	0.00663	0.00712	0.00828	0.00859*	0.00861*	0.00827	0.00546	0.00799
	(1.58)	(0.36)	(1.77)	(1.35)	(1.45)	(1.22)	(1.41)	(1.61)	(1.67)	(1.70)	(1.61)	(1.02)	(1.56)
Border region dummy	0.00256	0.00180	0.00179	0.00192	-0.000617	0.00378	-0.000851	-0.00149	-0.00116	-0.000324	-0.00110	-0.000753	-0.00142
	(0.53)	(0.39)	(0.39)	(0.40)	(-0.14)	(0.76)	(-0.20)	(-0.36)	(-0.27)	(-0.08)	(-0.26)	(-0.17)	(-0.33)
Dummy, =1 if NUTS3 belongs to CE area	0.0323***	0.0322***	0.0294***	0.0320***	0.0293***	0.0320***	0.0287***	0.0300***	0.0287***	0.0256***	0.0284***	0.0282***	0.0287***
	(4.58)	(4.54)	(4.19)	(4.54)	(4.28)	(4.42)	(4.16)	(4.38)	(4.34)	(3.88)	(4.06)	(4.20)	(4.27)
% of people saying	0.00475												

others can be trusted			
	(0.40)		
Interaction trust border-legal barrier-CE dummy	-0.00935*		
	(-1.69)		
LQ of multi-modal accessibility in 2006, EU27=1		-0.0310***	
		(-2.64)	
Interaction accessibility border-legal barrier-CE dummy		-0.0158*	
		(-1.86)	
Population density			0.00000276*
			(1.74)
Interaction urbanization border-legal barrier-CE dummy			-0.0000127

	(-1.53)			
Employ-ment rate		-0.0468**		
		(-2.05)		
Interaction employment rate border-legal bar-rier-CE dummy		-0.0187		
		(-1.37)		
Importance of thrift			0.00897	
			(0.79)	
Interaction thrift-bor-der-legal barrier-CE dummy			-0.0135	
			(-0.69)	
Manufactur-ing speciali-sation				0.0582
				(1.42)
Interaction manufactur-ing				-0.0557*

specialization-border-legal barrier-CE dummy		(-1.83)	
Number of monuments	0.000000132		
	(1.01)		
Interaction monuments- border-legal barrier-CE dummy	-0.000000685		
	(-0.19)		
Patent applications to the EPO per mil. pop.		-0.000000385	
		(-0.15)	
Interaction patents-border-legal barrier-CE dummy		-0.000008079	
		(-1.23)	
Trademark applications to the EPO			0.0000460***

per mil. pop.			
	(2.75)		
Interaction trademarks-border-legal barrier-CE dummy	-0.0000499*		
	(-1.68)		
Share of higher college graduates		0.124**	
		(2.40)	
Interaction graduates-border-legal barrier-CE dummy		-0.0371	
		(-0.62)	
Quality of institutions			-0.000329
			(-0.05)
Interaction institutions-border-legal barrier-CE dummy			0.00871
			(0.80)

Bed places per mil. Pop. (touristic potential)												0.000000190***	
												(3.18)	
Interaction tourism-border-legal barrier-CE dummy												-7.54e-08	
												(-0.55)	
Online sales													0
													(.)
Interaction online sales- border-legal barrier-CE dummy													0.0000309
													(0.04)
Constant	0.111*	0.0739	0.138**	0.138**	0.115*	0.105*	0.133*	0.0911	0.179**	0.152**	0.108*	0.220***	0.114*
	(1.69)	(1.17)	(2.09)	(2.21)	(1.88)	(1.69)	(1.92)	(1.18)	(2.50)	(2.41)	(1.68)	(3.40)	(1.86)
Observations	1295	1291	1153	1296	1296	1294	1291	1176	1294	1296	1254	1159	1295
Adjusted R^2	0.628	0.632	0.540	0.630	0.628	0.631	0.629	0.591	0.627	0.630	0.626	0.542	0.628

t statistics in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01

Table 5. Untapped potentials in external resources

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
							Dep. variable: 2008-2013 growth of total value added						
Log of total 2008 value added	-0.00232	0.000272	-0.00314	-0.00229	-0.00199	-0.00197	-0.00194	-0.00102	-0.00217	-0.00293	-0.00211	-0.00458*	-0.00229
	(-0.90)	(0.10)	(-1.14)	(-0.89)	(-0.77)	(-0.77)	(-0.74)	(-0.37)	(-0.83)	(-1.15)	(-0.80)	(-1.72)	(-0.89)
Rural region dummy	0.0235***	0.0189***	0.0252***	0.0232***	0.0233***	0.0230***	0.0234***	0.0218***	0.0232***	0.0239***	0.0233***	0.0203***	0.0231***
	(3.71)	(2.84)	(3.63)	(3.71)	(3.74)	(3.69)	(3.73)	(3.44)	(3.68)	(3.83)	(3.68)	(3.09)	(3.70)
Urban region dummy	0.00822	0.00440	0.00951*	0.00780	0.00773	0.00762	0.00812	0.00795	0.00765	0.00833	0.00833	0.00732	0.00773
	(1.55)	(0.79)	(1.68)	(1.53)	(1.52)	(1.49)	(1.59)	(1.55)	(1.48)	(1.64)	(1.63)	(1.37)	(1.50)
Border region dummy	-0.000700	-0.00132	-0.000477	-0.00108	0.00410	0.00523	-0.00116	-0.00249	-0.00144	-0.00113	-0.000933	0.000433	-0.000927
	(-0.16)	(-0.31)	(-0.10)	(-0.25)	(0.80)	(1.01)	(-0.27)	(-0.59)	(-0.34)	(-0.27)	(-0.22)	(0.10)	(-0.21)
Dummy, =1 if NUTS3 belongs to CE area	0.0302***	0.0286***	0.0266***	0.0293***	0.0353***	0.0364***	0.0288***	0.0304***	0.0290***	0.0270***	0.0286***	0.0280***	0.0296***
	(4.37)	(4.17)	(3.73)	(4.26)	(4.48)	(4.65)	(4.16)	(4.42)	(4.37)	(4.13)	(4.15)	(4.16)	(4.28)
External % of people saying others can be trusted	-0.0142												
	(-0.93)												

Interaction external trust border-legal barrier-CE dummy	-0.00408												
	(-0.65)												
External LQ of multi-modal accessibility in 2006, EU27=1		-0.0253**											
		(-2.52)											
Interaction external accessibility border-legal barrier-CE dummy		-0.00324											
		(-0.33)											
External population density			0.00000157										
			(1.13)										
Interaction external urbanization border-legal barrier-CE dummy			0.0000380										
			(1.10)										
External employment rate				-0.00185									
				(-0.08)									
Interaction external employment rate border-legal barrier-CE dummy				-0.00463									

				(-0.30)									
External importance of thrift					0.00255								
					(0.04)								
Interaction external thrift-border-legal barrier-CE dummy					-0.484**								
					(-2.00)								
External manufacturing specialisation						0.0306							
						(0.30)							
Interaction external manufacturing specialization-border-legal barrier-CE dummy						-1.034**							
						(-2.30)							
External number of monuments							-0.000000452						
							(-0.37)						
Interaction external monuments- border-legal barrier-CE dummy							0.000000128						
							(0.03)						

External patent applications to the EPO per mil. pop.								-0.0000327					
								(-1.44)					
Interaction external patents- border-legal barrier-CE dummy								-0.0000162					
								(-0.31)					
External trademark applications to the EPO per mil. pop.									-0.00000589				
									(-0.37)				
Interaction external trademarks- border-legal barrier-CE dummy									-0.0000130				
									(-0.44)				
External share of higher college graduates										0.0799**			
										(1.98)			
Interaction external graduates- border-legal barrier-CE dummy										-0.0230			
										(-0.41)			
External quality of institutions											-0.000770		

											(-0.12)		
Interaction external institutions- border-legal barrier-CE dummy											0.00654		
											(0.54)		
External bed places per mil. Pop. (touristic potential)												9.93e-08	
												(1.19)	
Interaction external tourism- border-legal barrier-CE dummy												-4.52e-08	
												(-0.19)	
External online sales													0
													(.)
Interaction external online sales- border-legal barrier-CE dummy													-0.000361
													(-0.42)
Constant	0.144**	0.0940	0.132**	0.121*	0.112*	0.108*	0.110*	0.0925	0.116*	0.126**	0.111*	0.169***	0.120*
	(2.12)	(1.52)	(2.01)	(1.95)	(1.74)	(1.71)	(1.75)	(1.44)	(1.86)	(2.07)	(1.74)	(2.67)	(1.95)
Observations	1295	1291	1153	1296	1296	1296	1291	1176	1294	1296	1254	1159	1296
Adjusted R^2	0.628	0.631	0.539	0.628	0.629	0.629	0.629	0.592	0.626	0.629	0.626	0.540	0.628

In terms of the empirical results anticipated in the main report, the following major findings have been identified.

All border regions in Europe have untapped potentials in exploiting the advantages of large cities (agglomeration advantages) and labor market advantages. If barriers were removed, the existence of large cities and large markets would be more efficiently for exploited for a better socio-economic development. This is true for all border regions in Europe, the CE area included (Camagni et al., 2019).

Other resources are instead untapped potentials that weight more in the CE area' development than in other border regions in Europe. This is the case of local trust, accessibility, local labour market and financial capital flows. This result is particularly telling: the CE area already presents some features of more integrated areas, both for historical reasons, as well as for the intense cooperation among these Countries. Hence, many instances of transnationally integrated labor markets (e.g. several areas across the German-Polish border) and urban areas (e.g. the Vienna-Bratislava metropolitan region) provide excellent examples of good practice in economic, social, and functional integration that could be better exploited.

Lastly, there are resources that are untapped only in the CE area. This is the case of manufacturing activities, innovation, and, very relevantly for the peculiar nature of the Central and Eastern Europe area, International partnerships. It comes as no surprise that at the date this is being written as many as 138 projects are being carried out, and 78 have been accomplished, on fostering cooperation among transnational CE partners for fostering innovation (Interreg CE, 2020).

This is no wonder, if we consider that while Gross Value Added (GVA) in manufacturing (excluding construction) represents 26 per cent of total production in CE Countries, against an average of 17 per cent for the European Union as a whole.[12] According to the same official figures, the CE area produces roughly 68 per cent of total value added in manufacturing in the whole EU.

Other factors relatively uniformly affected by the presence of untapped potentials include the (potential) financial flows and market integration among CE regions. While the impact of each of these two factors remains relatively minor, they still cause geographically dispersed losses all over the area.

Lastly, factors characterised by untapped potentials only for the EU as a whole, but whose consequences are felt also at the CE area level, include agglomeration economies and productive capacity. For both these factors, untapped potentials are particularly felt in Austria, Czech Republic, and Hungary, although positive losses are found nearly everywhere.

Other assets cause instead more Country-specific losses. For instance, accessibility represents a legal barrier-induced untapped potential mostly in Austria, Croatia, and Italy. Not by chance these Countries are, among those in the CE area, with some of the highest mountains on the border, thus significantly limiting transnational accessibility on land (rail and road). By the same token, the untapped potential due to the inefficient exploitation of compact cities (avoiding sprawling developments) is causing non-negligible losses in Austria and Italy, most notably in the areas hosting Vienna and Milan. In the latter case, urban developments in the past few decades let the city substantially extend to the East (where other relevant cities in the Lombardy region, viz. Bergamo and Brescia, are located) and the North, towards Como and Switzerland.

One last important remark is related to some factors that are even in the first place extremely highly concentrated, viz. the degree of innovation and International partnerships. In both cases, regions most directly affected by the presence of untapped potentials are Austria, Italy, and, to a lesser extent, given its nature of a large market also for advanced innovative activities, Germany. It goes per se that this does not imply that regions located in other Countries in the same area should be denied access to policy support in these fields. While our results must be read as deviations from the EU, it must also be recognized that other Countries are lagging in terms of their endowment with these growth factors in the first place, and were this lag be removed, they would likely also suffer from untapped potentials.

[12] Source: EUROSTAT data base, data related to average 2015-2016 (the latest full vectors available as of May 26, 2020) gross value added in current Euros.

All in all, our results also suggest that given the relatively homogeneous nature of regions belonging to the CE area, the number of factors whose exploitation is hampered by the presence of legal barriers is relatively larger than in the case of the whole EU.

2.3.1 Costs of existing untapped potentials for Central Europe

The existence of untapped potentials provides a social and economic cost, since resources are available, but not fully exploited because of legal and administrative barriers. More simply formulated, if the untapped potentials were utilised, a higher socio-economic development would be achieved.

In this section a detailed assessment of the value of existing untapped potentials in Central Europe is presented. Costs are quantified in terms of percentage of socio-economic development missed for the non-exploitation of the untapped potentials.

Table 6 shows percentage losses of socio-economic development because of the presence of untapped potentials. All in all, roughly 5 per cent of total GDP in the CE area is lost due to the inefficient exploitation of internal and external resources. This means that, by removing legal and administrative borders, socio-economic development of the CE area would be 5 per cent higher.

Table 6 provides a complex and rich story on how such costs are distributed among Countries. The final effects depend on the number of regions at the border of a country, and on the intensity of the phenomenon, and results have to be read taken these two elements into account.

A first striking result is related to the intensity of losses across various CE Countries. Some are more significantly affected (chiefly, Austria and the Czech Republic), which reflects their very nature: relatively small, open Countries, with a significant share of their territories very close to transnational borders, and therefore most directly affected by the presence of barriers. This first result does not imply that other CE Countries are not affected at all: in fact, all Countries would still gain a substantial increase in their socio-economic development if these legal barriers were removed.

These general costs have different origins in the different countries, in that resources register different untapped potentials. Table 6 also suggests that some factors appear to almost universally be affected by the presence of legal barriers within the CE area. This is for instance the case of manufacturing activities, which limits socio-economic development in all CE Countries, with the largest impact being felt in Czech Republic, Slovenia, and Slovakia.

Table 6. Costs of existing untapped potentials in Central Europe and by Country

Area	Total losses from missed integration (% of GDP)	of which due to inefficient exploitation of									
		Agglomeration economies	Local labor market	Trust among people	Accessibility	Manufacturing activities	Innovation	International partnerships	Compact urban form	Financial capital flows	Market integration
CE	*5.52%*	*0.03%*	*0.04%*	*1.88%*	*0.52%*	*0.75%*	*1.34%*	*0.18%*	*0.62%*	*0.10%*	*0.07%*
Austria	18.01%	2.19%	1.61%	5.92%	1.56%	1.08%	3.41%	1.48%	0.50%	0.15%	0.11%
Czech Republic	13.57%	1.45%	2.24%	7.62%	0.00%	1.94%	0.00%	0.00%	0.00%	0.18%	0.14%
Germany	1.57%	0.10%	0.30%	0.84%	0.07%	0.19%	0.02%	0.01%	0.00%	0.03%	0.02%
Croatia	2.04%	0.00%	0.00%	0.00%	0.38%	1.35%	0.00%	0.00%	0.00%	0.17%	0.14%
Hungary	4.60%	1.40%	1.42%	0.00%	0.00%	1.48%	0.00%	0.00%	0.00%	0.17%	0.13%
Italy	4.37%	0.10%	0.78%	0.00%	0.66%	0.52%	2.12%	0.06%	0.12%	0.08%	0.05%
Poland	3.13%	0.13%	0.36%	2.11%	0.00%	0.45%	0.00%	0.00%	0.00%	0.05%	0.04%
Slovenia	3.74%	0.15%	1.56%	0.00%	0.00%	1.70%	0.00%	0.00%	0.00%	0.18%	0.15%
Slovakia	3.73%	0.21%	1.67%	0.00%	0.00%	1.58%	0.00%	0.00%	0.00%	0.15%	0.12%

Source: Authors' calculations

2.4 Synthetic technical description of the MASST4 model[13]

Among the vast number of regional growth forecasting models, the past fifteen years witnessed the emergence of the MAcroeconomic, Sectoral, Social, Territorial (MASST) model. The MASST model aims at merging macroeconomic elements with territorial features for forecasting regional growth trajectories.

The model was created with the aim to overcome the dichotomous approaches interpreting regional growth either as a bottom-up process without macroeconomic elements, or a top-down one, whereby national growth rates are reassigned to regions according to their weights, neglecting any role to regional propulsive forces (Capello, 2007; Capello and Fratesi, 2012; Capello et al., 2017). The model has now reached its fourth generation (Capello and Caragliu, 2020a).

The MASST model is a macroeconometric regional growth model built to simulate regional growth in the medium and long-run. The acronym contains the different dimensions – Macroeconomic, Sectoral, Social and Territorial – on which the model is built. Regional growth is in fact explained by macroeconomic elements that play a prominent role in national growth trajectories, capturing the national/global demand framework which involves all regions. However, macro-economic conditions are only part of the story, and in particular regional competitiveness, i.e. the supply side of growth, is explained by the sectoral, social and territorial aspects characterizing the region. In particular, regional competitiveness is explained by:

- *single quantified tangible and intangible elements*: different assets of territorial capital, especially those with an intangible nature, linked to the ways in which actors' perceptions, to relational elements, and to cooperation attitudes that arise and grow thanks to local socio-economic specificities present in the local context explain regional competitiveness;
- *territorial complexity*: the set of context specificities and synergies that characterize regional growth, like differentiated territorial patterns of innovation, regional urban structure, net agglomeration economies, urban structural dynamics are captured through specific regional equations explaining, in their turn, regional competitiveness.

The model runs across two stages. In an estimation stage, structural relations between explanatory and dependent variables in various national and regional equations are estimated over a long run time span through a set of equations included in the model. In the simulation stage, instead, estimated coefficients are employed for simulating likely future growth patterns (usually, over a 15-20 years' horizon), and given an internally coherent sets of assumptions forming regional growth scenarios.

Figure 1 presents the structure of the model in its most updated version. The model merges national and regional growth-enhancing factors by explaining regional growth (ΔY_r) as a decomposition between a national growth rate (ΔY_N) and a regional differential shift (*s*) (Eq. A1.; Capello and Caragliu, 2020a):

$$\Delta Y_N = \Delta Y_N + s;\ r \in N \qquad \text{(A1.)}$$

The national sub-model is based on a Keynesian quasi-identity, whereby GDP growth (ΔY_N) depends on the growth rates of consumption, investment, public expenditure, export and import. The national sub-model aims at capturing macroeconomic/national determinants of regional growth within a partial equilibrium setting. This part of the model captures macroeconomic (national) effects generated by exogenous trends and/or policies for regional growth; macroeconomic policies and trends in interest rates, in public expenditure, in inflation rates, in investment rates differ radically among European Countries (especially between Eastern and Western Countries, and between Northern and Southern Countries). The national growth component allows to capture individual Country effects on local growth.

The regional differential shift (*s*) is instead explained by regional competitiveness, measured as efficiency of local resources, increases in the quality and quantity of production factors, such as human capital and population, infrastructure endowment, energy resources, European funds, and, finally, interregional spatial linkages, capturing the growth externalities that influence a region located close to fast-growing areas.

In its most recent evolution, the MASST4 model made some relevant steps forward in the regional section, in turn based on some recent evolution in the structure of European regional economies, allowing us to identify through updated econometric evidence (discussed in Capello and Caragliu, 2020a) major structural breaks.

The first structural break identified by means of these panel estimates relates to what has been termed the *4.0 industrial revolution*. While prior to the crisis, and following global trends in advanced Countries, Europe had been deindustrializing

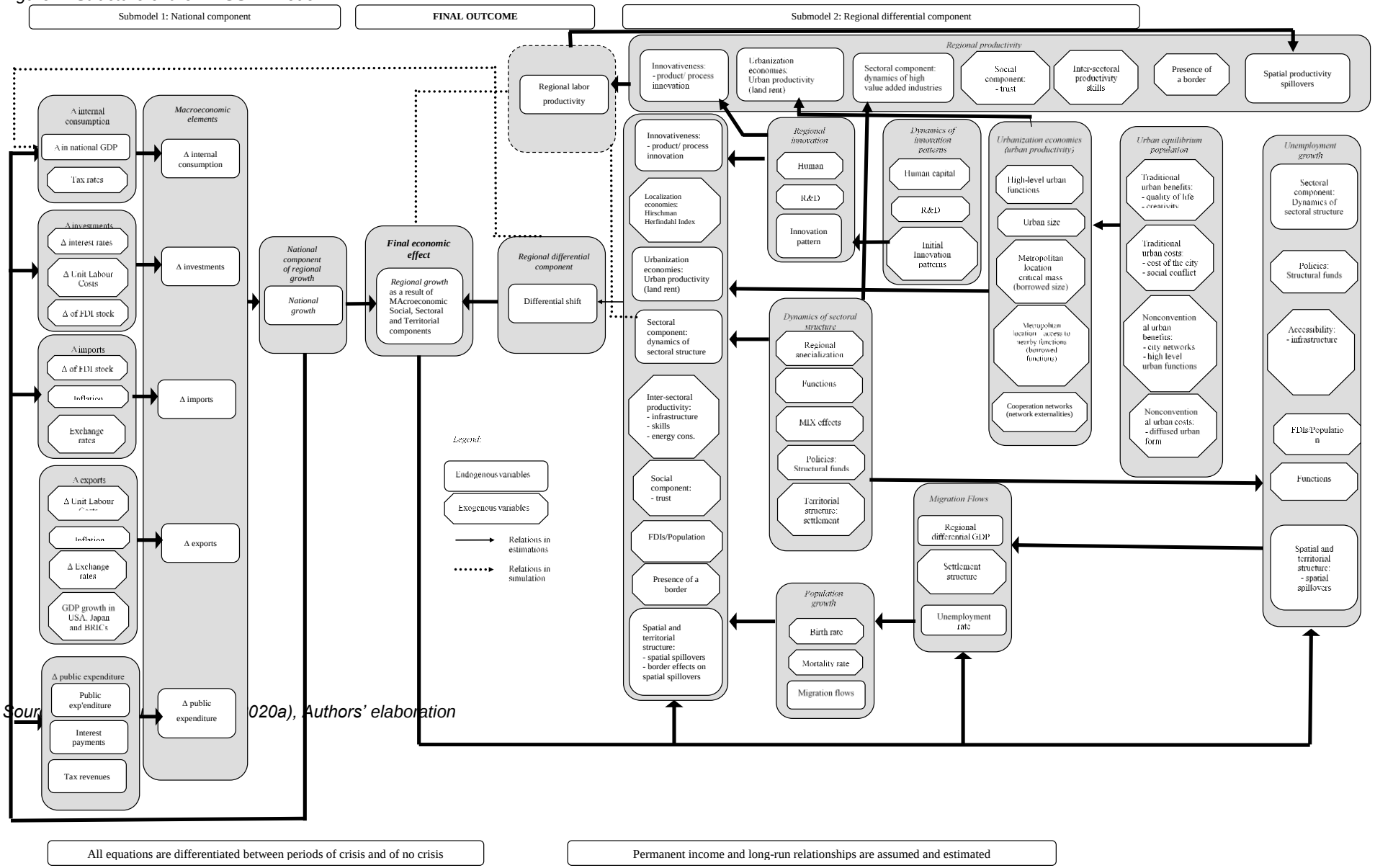
[13] The interested reader is referred to Capello and Caragliu (2019) for a synthetic discussion of the scenario building approach underpinning the MASST model for policy appraisal and to Capello and Caragliu (2020b) for a review of the way the MASST evolved from its first generation.

(Rodrik, 2016), after the end of the crisis (by convention identified in MASST4 in 2012 for all EU Countries), several EU economies witnessed a renewed acceleration in manufacturing employment growth, driven by the new technological paradigm labeled *Industry 4.0*. The new paradigm is shifting the technological frontier in a few selected hotspots capable of both efficient production and diffusion of these new technologies centered around general-purpose technologies whose adoption cuts across several manufacturing industries. In MASST4, this process is modeled with an enhanced component of the regional sub-model explaining the probability of a region to experience a structural evolution in its territorial innovation patterns (Capello and Lenzi, 2018).

The second major trend that can be detected in post-crisis estimates refers to the strain through which economic and political institutions in several EU Countries are presently walking. The most important example is the relatively recent decision by the UK to leave the European Union (henceforth, *Brexit*). After holding a close call referendum on June 23, 2016, UK decided to withdraw its membership of the European Union, which it had achieved after roughly twelve years of negotiations beginning in 1961 and ending in 1973 with the UK's admission to the EU (UK and EU, 2018). The MASST4 model has been updated in order to allow the modeler to assess the regional effects of Brexit, while also leaving the chance to model similar events for other EU Countries (Capello et al., 2018).

A third and fundamental trend is related to the growing role of cities as engines of national growth. After a two decades renaissance of research on empirical urban economics and in particular on the nature and extent of agglomeration economies, a relatively recent debate has been sparked over whether large (capital) cities catalyze economic growth, which then diffuses to the rest of their Countries, or whether instead these large agglomerations, more directly hit by the crisis, actually slow down full recovery at Country level (Parkinson et al., 2015; Capello et al., 2015a; Dijkstra et al., 2015).

Figure 1. Structure of the MASST4 model



Sour 020a), Authors' elaboration

MASST4 absorbs this debate and models the role of cities in stimulating national economies through their capability to meet new challenges. Empirically, this translates into estimating an additional equation whereby urban agglomeration economies (measured by urban land rent) depend on high quality functions hosted, on the quality of local institutions, and on the capability of cities to cooperate with other cities (Camagni et al., 2016). Agglomeration economies estimated by this module enter then the regional differential shift as an additional explanatory factor.

One last relevant addition to the regional sub-model represents a landmark in the evolution of MASST. In fact, until the third generation, labor productivity was exogenously determined by the modeler and represented a lever that exogenously determined the simultaneous co-variation between employment and GDP growth. MASST4 made a significant leap forward in endogenizing regional labor productivity, with major normative implications: from a regional economics perspective, employment and wages adjust to national and global shocks through a geographical reallocation that guarantees spatial equilibrium. This crucial determinant of the observed spatial variability in economic growth rates is now fully absorbed by the model.

With fifteen years behind the back, but also with these challenges in sight, MASST appears to be getting close to full maturity. Regional growth still presents many important issues to be explained and interpreted, and MASST will likely provide many additional insights in the years to come.

2.4.1 Methodology and additional results for the non-economic foresights

In order to translate our economic outcomes into non-economic ones covering the thematic fields in this study, the following method was followed.

We first identified suitable indicators capturing, or proxying, several thematic fields with data covering the whole CE region. Based on the literature dealing with scaling laws (see e.g. Bettencourt et al., 2007, and Ribeiro et al., 2020), we econometrically estimated the relation between each non-economic outcome and the economic size of CE regions, including GDP and population. Predicted values of non-economic outcomes are then obtained by applying the estimated coefficients, shown in Table 6 below, to the values of GDP and population as of 2030 simulated with the MASST4 model in the three scenarios.

Table 7. Determinants of the non-economic foresight outcomes

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	*Pollution*	*Recycling*	*Cooperation*	*Accessibility*	*Trust*
Regional GDP in constant prices	-0.0000450*	0.00000165***	0.0000150***	0.00000886**	0.00000165***
	(-2.35)	(7.85)	(5.22)	(3.28)	(4.15)
Regional population	0.00000188*	-6.71e-08***	-0.000000370***	-0.000000691***	-6.17e-08***
	(2.36)	(-7.74)	(-3.97)	(-4.49)	(-4.92)
Constant	0.459	0.239***	-10.11***	2.411***	0.362***
	(0.76)	(19.57)	(-80.16)	(7.35)	(20.44)
Observations	246	229	276	276	276
Adjusted R^2	0.065	0.220	0.184	0.052	0.135

t statistics in parentheses.
*** p < 0.05, ** p < 0.01, *** p < 0.001**

2.5 Qualitative analysis: Delphi method

Given the spatial dynamics of Central Europe and its scenarios for development, qualitative analysis is conceived as complementary to the analysis of the partnerships and to the quantitative analysis (cluster analysis, untapped potentials and MASST model), outlined in this document. Stakeholders' and experts' comments and feedback are currently gathered through the **Delphi method**. The added value of combining qualitative and quantitative methods lies in the involvement of those who have direct experience and knowledge of the region and its trends. This strengthens the outcome of the forecast exercise and provides inputs and information that might not be available through the cluster analysis, the analysis of the partnerships and the quantitative models. The Delphi process involves 30-50 stakeholders (academics, professionals working in the thematic fields within the scope of the study, local, regional and national authorities): the aim is to gather feedback and additional insights from these interviewed stakeholders (belonging mostly to CE regions with some actors at EU level). Rather than representing a 'validation tool', the **Delphi method has a twofold objective:**

providing a qualitative assessment of the results of the quantitative analysis of the spatial dynamics;

being a "forum" to discuss the scenarios for the development of the CE area, offering insight to the study team on the formulation of policy options and recommendations.

Ideally, the **experts' opinion allows for data triangulation by combining different research methodologies and tools**. This triangulation provides robustness to the findings of the analysis, expands the quantitative analysis and adds up qualitative evidence to the explanation of certain assumptions drawn through the model, the cluster analysis and the analysis of partnerships. The sample of surveyed stakeholders per country and thematic expertise is presented in Table 8.

Table 8: List of stakeholders by country and thematic expertise

Country	Economic networks and tourism and cultural heritage	Environment and natural heritage	Flows of people, accessibility, and connectivity	Stakeholder consortium	Total per country
AT	1		1	3	**5**
CZ	4		1		**5**
CZ, Europe	1				**1**
DE		3	3	3	**9**
EU			2		**2**
HR	1	1	1		**3**
HU	3	1	2	3	**9**
IT	3	2	1	4	**10**
PL	3	2		2	**7**
SI	1	1			**2**
Grand Total	**17**	**10**	**11**	**15**	**53**

A copy of the first round of the Delphi questionnaire is provided in Annex 3 together with the written findings of the exercise. The findings of the Delphi survey presented in this document constitute the evidence gathered during the written round, which has subsequently discussed in a set of focus groups and a final validation workshop whose main evidence is discussed in the main report.

3 Data collection: overview and shortcomings

The data collected for the analysis of spatial dynamics comes from uniform datasets, primarily available via Eurostat. The cluster and the GIS analysis required different types of data. The cluster analysis is based on data which is clearly tied to an individual NUTS2 region. This data was collected from Eurostat, the ESPON database, and comparable sources. The GIS analysis required grid data (e.g. the NATURA 2000 surface area or car accessibility) or data which is tied to multiple geographical coordinates (such as the post codes of the partners of a H2020 project or the point of origin and the destination of annual rail cargo flows between regions).

At the same time, quantitative data on partnerships required specific data on projects funded under the cooperation programmes applicable at the CE area level. Data is covering the European Territorial Cooperation (ETC)[14], the EU Funding Instrument for the environment and climate action (LIFE)[15] and the Framework Programme for Research and Innovation (Horizon 2020)[16]. The editable format in which data was provided allowed for the coding of NUTS2 regions, project themes and CE versus non-CE territorial coverage, which made it possible to categorise and calculate interactions between regions and project partners in a matrix form.

The data collected for the analysis of untapped potentials derives from a variety of datasets. The main source is the standard Eurostat regional database, to which different sources of raw data have been added, including European Values Study, ESPON, European Census, Regional Quality of Government, CORDIS, and EPO data. All data have been harmonized at the NUTS3 level in the 2013 classification.

For the design of the development scenarios, MASST analyses are in their turn based on a combination of different sources, all harmonized at the 2013 version of NUTS2 regions. Sources of raw data include the Eurostat regional data base for most series, while also comprising ESPON, European Values Study, European Census, Regional Quality of Government, CORDIS, Community Innovation Survey, JRC, and EPO data.

3.1 Identified shortcomings and compensating measures

The data collection efforts for the cluster and GIS analyses encountered a substantial lack of region-to-region flow data. Most available data sets provide indications on the starting or destination point of the flow, generally not on the relationship between the two points. Uniformly available commuting data, for example, generally provides only the share of commuters in a given region, not their destination. Retrieved point-to-point data was primarily used. These data limitations are compensated by a combination of cluster analysis and GIS analysis. The cluster analysis provides indications on the types of flows in a (set of) region(s). The GIS analysis visualises the interlinkages between the regions and clusters.

The general data basis for the cluster, the GIS and the untapped potentials analyses was assembled based on NUTS 2013. As the data underlying the analysis was collected and analysed at NUTS 2013, the visualisation of the analysis results of these activities are restricted to NUTS 2013. Using a different NUTS classification to visualise the results of the analysis (such as NUTS 2016) would result in data loss (i.e. regions without values). The partnership analysis is able to accommodate a shift to NUTS 2016, as per stakeholder feedback.

Regarding the analysis of existing partnerships, despite relying on three major data sources covering the most relevant cooperation instruments at the CE area level and not only, there are also some limitations to be considered. These limitations are more present in specific topics, considering that each project theme was allocated to a certain broader thematic area, leading to possible mismatches between the purpose of the project and the thematic area to which it was allocated (i.e. transport, coastal management). At the same time, a series of limitations have been identified regarding certain areas / regions (e.g. given their position in the CE, Italian and German regions are more active in cooperation projects simply because they have more neighbours), but quantifying and displaying the intensity of cooperation on maps allows for the visualisation of the overall picture.

Other limitations refer to the incomplete data available on certain programmes regarding the name and location of project partners or the typology of partners, therefore resulting in incomplete results in the number of projects and project partners

[14] Based on the ETC projects available in the Keep.eu database as of end of November 2020

[15] Based on the projects available on the LIFE cooperation programme 2014-2020 data hub as of end of November 2020

[16] Based on the projects available on the CORDIS dashboard as of end of November 2020

or in a lower number of partnerships for a limited number of programmes. This is the case for some of the programmes covering cooperation at the external borders of the EU. However, the large number of projects and partner regions included in the analysis allows for meaningful conclusions to be drawn, despite not capturing the full picture. Finally, the Keep.eu database includes 92.8% of all projects funded under ETC programmes, with differences across programmes, according to the official disclaimer regarding representativeness and adjusted for the CE area[17], but it does include all existing programmes. Consequently, results should be interpreted cautiously in the case of the following programmes:

Name of programme	Keep.eu representativeness
2014 - 2020 INTERREG V-A France - Italy (ALCOTRA)	86%
2014 - 2020 INTERREG V-A Italy - France (Maritime)	84%
2014 - 2020 INTERREG V-A Poland - Denmark - Germany - Lithuania - Sweden (South Baltic)	89%
2014 - 2020 INTERREG V-A Germany - Austria - Switzerland - Liechtenstein (Alpenrhein - Bodensee - Hochrhein)	89%
2014 - 2020 INTERREG V-A Slovakia - Czech Republic	65%
2014 - 2020 INTERREG V-A Poland - Slovakia	69%
2014 - 2020 INTERREG V-A France - Germany - Switzerland (Rhin supérieur-Oberrhein)	30%
2014 - 2020 INTERREG V-A Poland - Germany / Saxony	81%
2014 - 2020 ESPON 2020	78%
2014 - 2020 INTERREG V-A Germany / Mecklenburg - Western Pomerania / Brandenburg - Poland	66%
2014 - 2020 INTERREG V-A Slovakia - Austria	77%
2014 - 2020 Poland - Russia ENI CBC	52%

The data collection efforts for the untapped potential faced a major sub-endowment of regional data collected at NUTS3 level: the four main topics of this study (economic interactions and networks, environmental hazards, connectivity and flows of people) fields are not evenly represented in these analyses, because, despite all efforts to retrieve as much information as possible, data for economic interactions and networks are way more easily identifiable than information on non-economic indicators. However, efforts have been made to cover all conceptual areas (e.g. additional indicators have been collected) and there is still potential for further analyses towards the next steps of the study in a more qualitative manner (e.g. through the review of the most updated academic literature and through stakeholder engagement).

As for the development of the scenarios, the MASST4 model has been employed in a way that it hasn't previously, i.e. to produce forecasts of the regional breakdown of the short-term costs of the COVID-19 crisis in the spring of 2020. This represents a major bottleneck, especially in view of applied studies working on the immediate or short-term consequences of exogenous shocks, which currently suffer from the substantial lag (often, two to three years) before regional data become available on the Eurostat website.

[17] https://keep.eu/representativeness/

3.2 Detailed data sources

Table 9: Overview of data sources

Name	Description	Analysis	Year	Source
tour_occ_arn2	Arrivals at tourist accommodation establishments by NUTS 2 regions	Cluster	2017	Eurostat
tour_occ_nin2	Nights spent at tourist accommodation establishments by NUTS 2 regions	Cluster	2017	Eurostat
tour_cap_nuts2	Number of establishments, bedrooms and bed-places by NUTS 2 regions	Cluster	2017	Eurostat
tour_occ_anor2	Net occupancy rate of bed-places and bedrooms in hotels and similar accommodation (NACE Rev. 2, I, 55.1) by NUTS 2 regions, Bedplaces	Cluster	2017	Eurostat
sbs_r_nuts06_r2	SBS data by NUTS 2 regions and NACE Rev. 2 (from 2008 onwards)	Cluster	2017	Eurostat
avia_paoa	Air passenger transport by main airports in each reporting country: Passenger, Passenger carried, Total, Total transport	Cluster	2018	Eurostat
tour_dem_tnw	Number of nights spent by country / world region of destination: Number, Total, 1 night or over	GIS	2018	Eurostat
CEBM_EMP	Circular economy business models (employment): Number of persons employed	Cluster	2018	ESPON
tran_r_avpa_nm	Air transport of passengers by NUTS 2 regions: Passengers carried, Thousand passengers	Cluster	2016	Eurostat
tran_r_vehst	Stock of vehicles by category and NUTS 2 regions: All vehicles (except trailers and motorcycles), Number	Cluster	2018	Eurostat
UI-PM10-emission	Atmospheric emissions of PM10 (Europe)	Cluster	2020	JRC
LF-521	Capacity of ecosystems to avoid soil erosion (Europe)	Cluster	2020	JRC
RE_MSW	Municipal Solid Waste in Europe – Generated	Cluster	2020	JRC
NATURA2000	Natura 2000 data - the European network of protected sites	GIS	2019	DG ENV
lfst_r_lfe2ecomm	Employment and commuting by sex, age and NUTS 2 regions: from 20 to 64 years, foreign country	Cluster	2019	Eurostat
nama_10r_3gva	Gross value added at basic prices by NUTS 3 regions: Total - all NACE activities	Cluster	2017	Eurostat
TGS00004	Regional gross domestic product (million PPS) by NUTS 2 regions	Cluster	2018	Eurostat
TGS00102	Employment rate of the age group 20-64 by NUTS 2 regions	Cluster	2019	Eurostat
Delineation1_Grid_TT-D1_TT	For each grid cell of 2.5x2.5 km, the car travel time to the next regional centre is given	GIS	2019	ESPON
PEPF_data-2015-2019	Physical Energy & Power Flows	GIS	2017	ENTSO-E
bd_hgnace2_r3	Business demography and high growth enterprise by NACE Rev. 2 and NUTS 3 regions	Cluster	2017	Eurostat
road_go_na_rl3g	National annual road freight transport by regions of loading (NUTS 3) and by group of goods (1 000 t), from 2008 onwards: Total transported goods	Cluster	2018	Eurostat
road_go_na_ru3g	National annual road freight transport by regions of unloading (NUTS 3) and by group of goods (1 000 t), from 2008 onwards: Total transported goods	Cluster	2018	Eurostat
tran_r_regio	Railway goods transport by loading/unloading NUTS2 region in 5 year intervals	GIS	2015	Eurostat
RII2017	Regional Innovation Scoreboard 2017 - Relative performance to EU in "2011"	Cluster	2017	ec

rd_e_gerdreg	Intramural R&D expenditure (GERD) by sectors of performance and NUTS 2 regions: Business enterprise sector	Cluster	2017	Eurostat
rd_p_persreg	Total R&D personnel and researchers by sectors of performance, sex and NUTS 2 regions: Business enterprise sector	Cluster	2017	Eurostat
H2020 Projects	CORDIS - EU research projects under Horizon 2020 (2014-2020)	GIS	2020	data.europa.eu
Energy_cons_resid	Cooling and heating degree days at NUTS2 level. Final energy consumption in the residential building sector	Cluster	2012	ESPON
Energy_cons_transp	Final energy consumption of petroleum products in the road transport sector	Cluster	2012	ESPON
Photovoltaic	Electricity generation by photovoltaic technology	Cluster	2012	ESPON
Wind	Electricity generation by wind onshore technology	Cluster	2012	ESPON
powerplants	A GLOBAL DATABASE OF POWER PLANTS	GIS	2019	World Resource Institute
whc_sites	List of World Heritage Sites	GIS	2019	UNESCO
ACCSCEN_PotAcc_2001-2014_Index	Train Accessibility by NUTS3 region	GIS	2014	Spiekermann & Wegener
Keep EU Database available at: https://keep.eu/	Database of projects indexed by cooperation programme and NUTS2 region	Partnerships	2014-2019	Keep EU
up_manufacturing	Untapped potentials in manufacturing activities	Econometric/OLS	2013	EUROSTAT
up_trust	Untapped potentials in trust	Econometric/OLS	2013	EVS
up_agglomeration	Untapped potentials in agglomeration economies	Econometric/OLS	2013	EUROSTAT
up_innovation	Untapped potentials in innovation	Econometric/OLS	2013	EPO
up_potential	Untapped potentials in local labor market	Econometric/OLS	2013	EUROSTAT
up_financial_flows	Untapped potentials in financial capital flows	Econometric/OLS	2013	EVS
up_partnerships	Untapped potentials in international partnerships	Econometric/OLS	2013	CORDIS
up_compact_form	Untapped potentials incompact urban form	Econometric/OLS	2013	EUROSTAT
up_accessibility	Untapped potentials in accessibility	Econometric/OLS	2013	ESPON
pred_gdp_ref	Simulated regional GDP in five classes in the reference scenario	MASST4 model simulation	2020-2030	Various
pred_gdp_int_1	Simulated regional GDP in five classes in the integration scenario without permanent COVID effects	MASST4 model simulation	2020-2030	Various
pred_gdp_int_2	Simulated regional GDP in five classes in the integration scenario with permanent COVID effects	MASST4 model simulation	2020-2030	Various

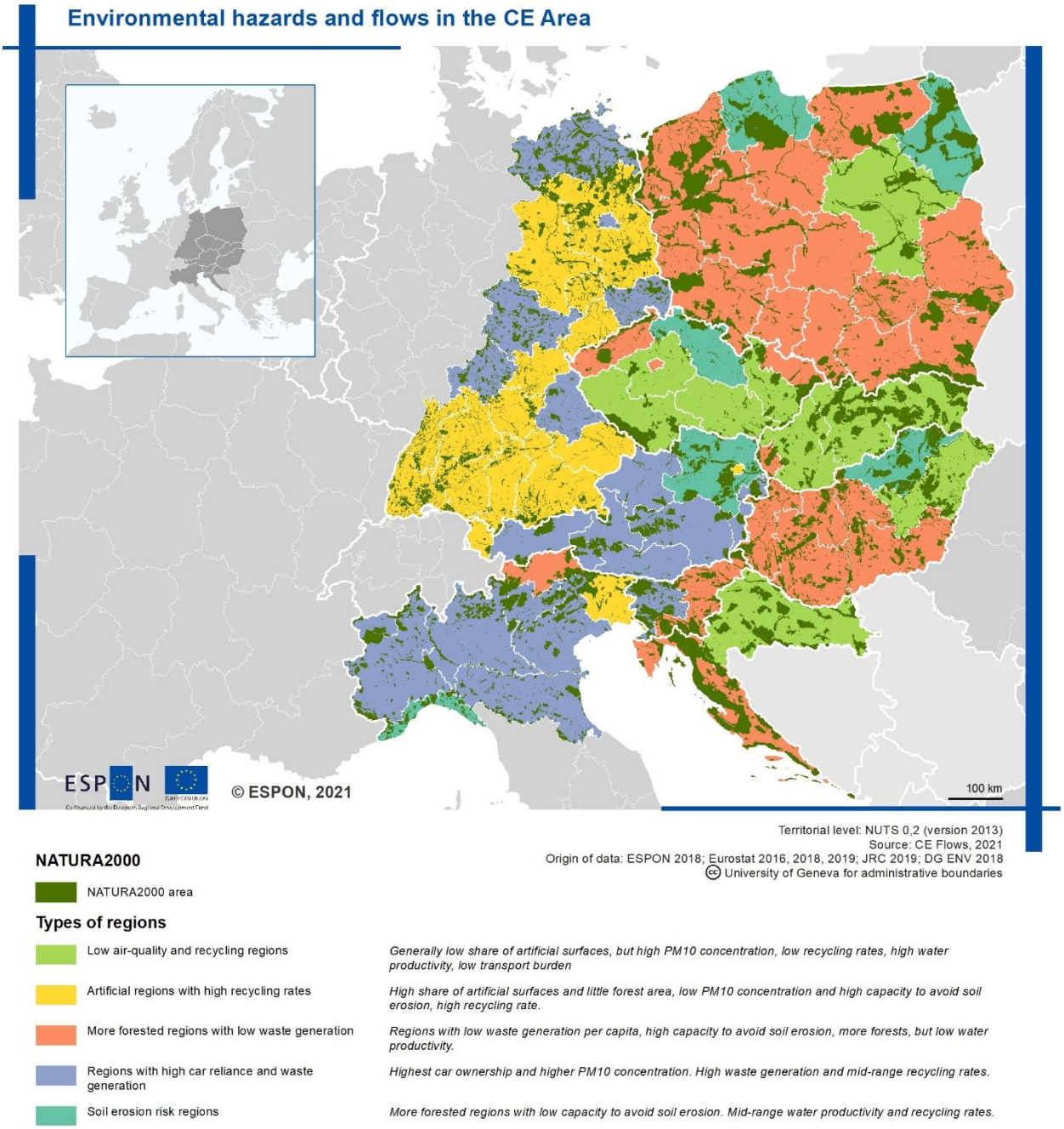
Source: Project team, 2020

Annex 1: Main Maps

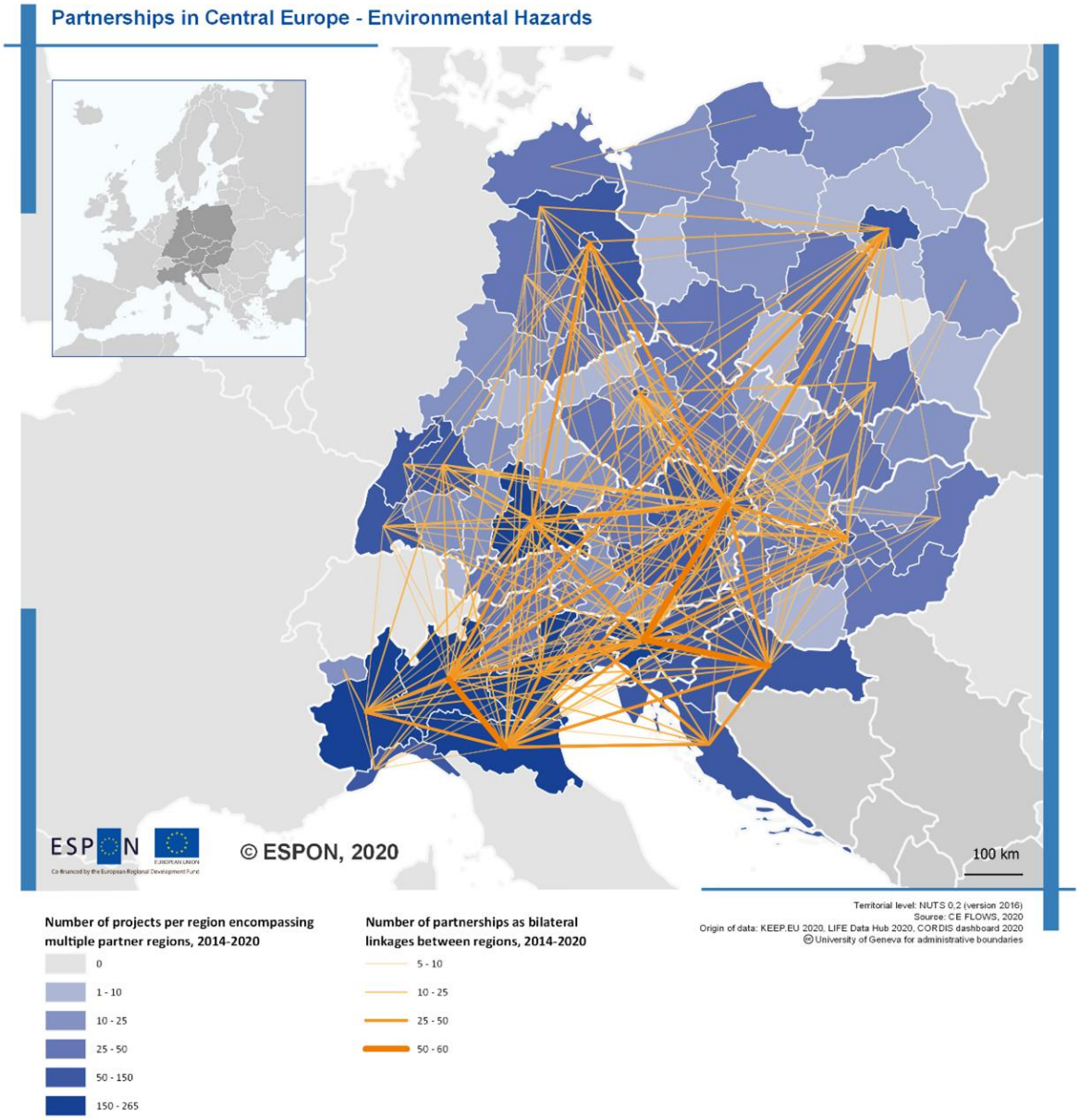
Environmental hazards and flows

The project team illustrated these findings with a contextual layer localising the NATURA 2000 areas in the programme area: the NATURA 2000 areas are represented by a green gradient. This provides an overview of the environmental characteristics of the regions via the cluster typology and the locations of relatively well-performing areas via the NATURA 2000 layer.

Map 1. Environmental hazards in the CE Area

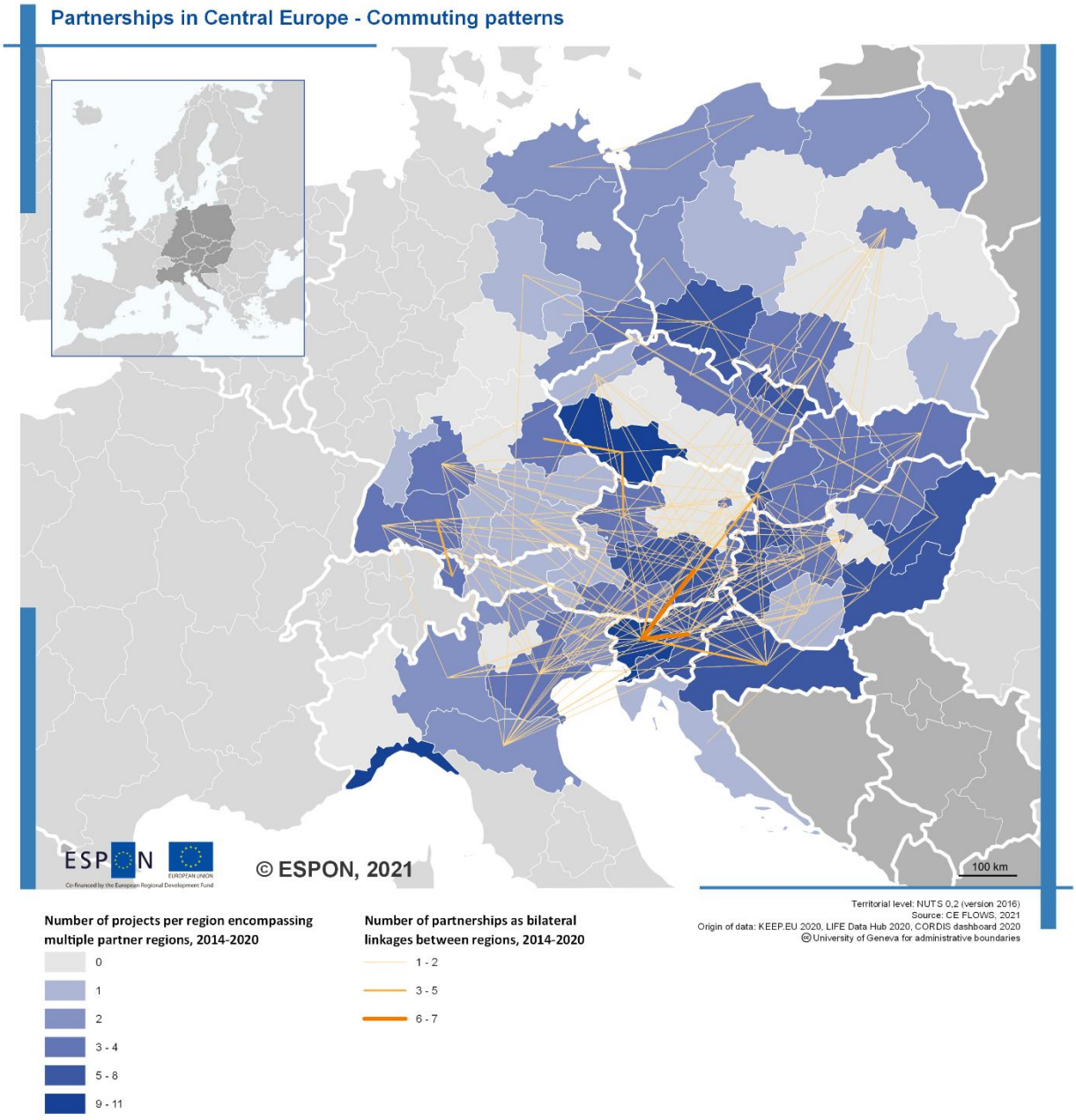


Map 2. Number of partnerships on environmental hazards and flows between CE countries during 2014-2020 programming period



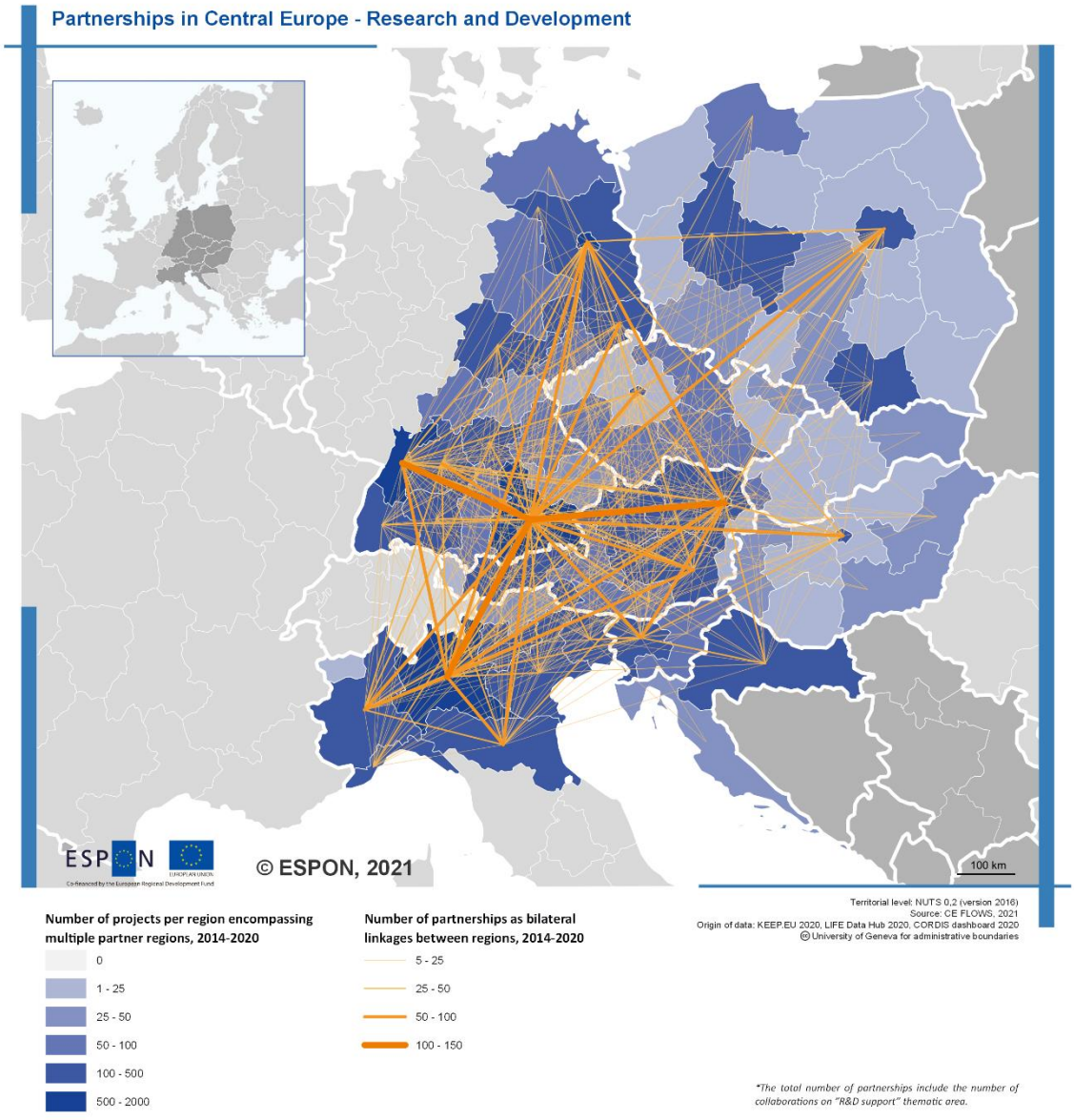
Commuting patterns

Map 3. Number of partnerships on commuting patterns between CE countries during 2014-2020 programming period



Research and development flows and patterns

Map 4. Number of partnerships on research and development between CE countries during 2014-2020 programming period

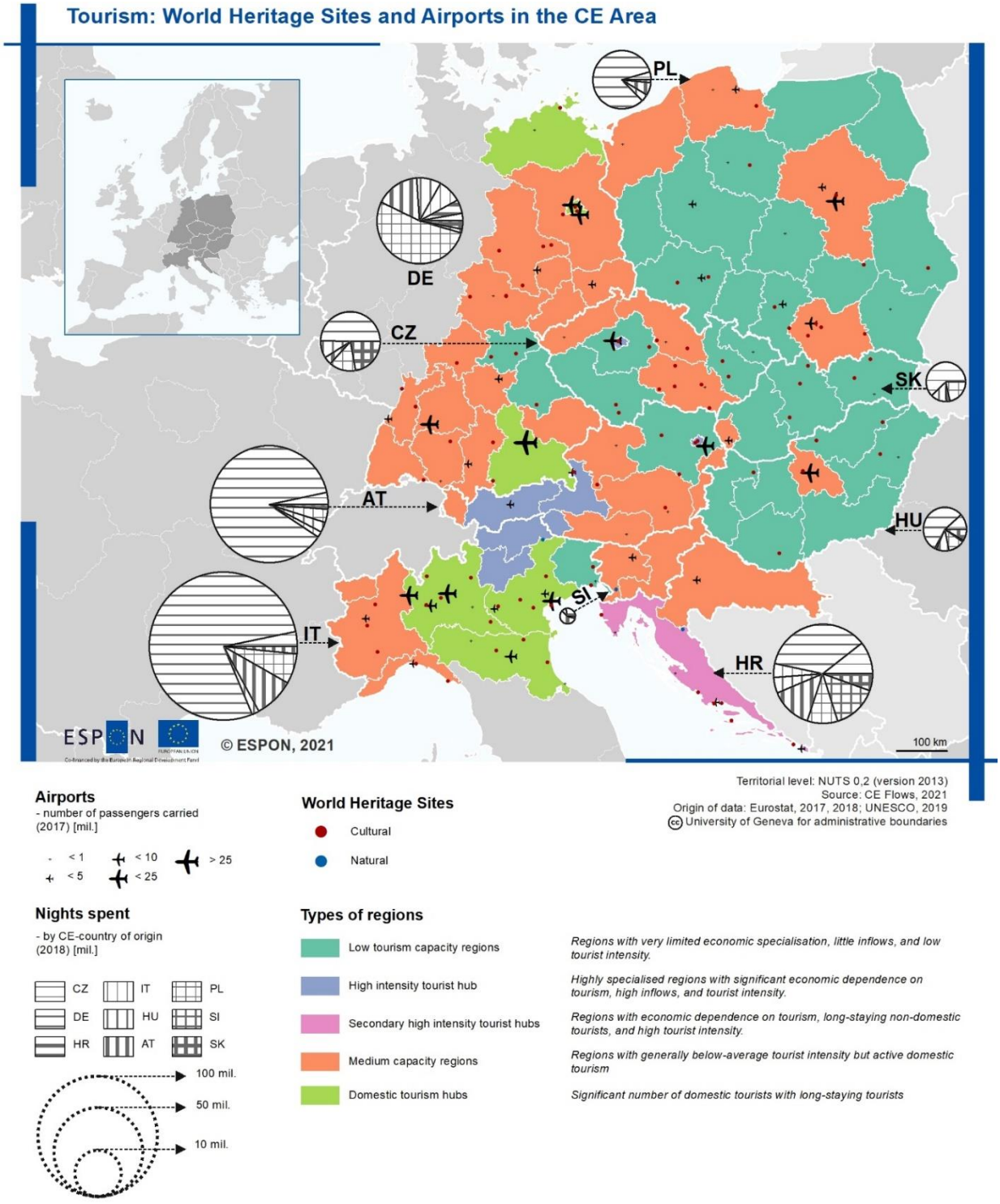


Tourism and cultural & natural heritage flows

These typologies are augmented by a contextual layer, visualising the major airports and the country-to-country flows of CE area tourists, visualised by pie charts. Tourist flows across Europe, and the CE area in particular, are retrievable by their country of origin and the destination country. In addition, the major airports by annual passenger volume are visualised to indicate the relative popularity of the clusters, as well as the world heritage sites[18].

[18] World heritage sites were retrieved from UNESCO for 2018, the passenger volumes per country and airport from Eurostat for 2017.

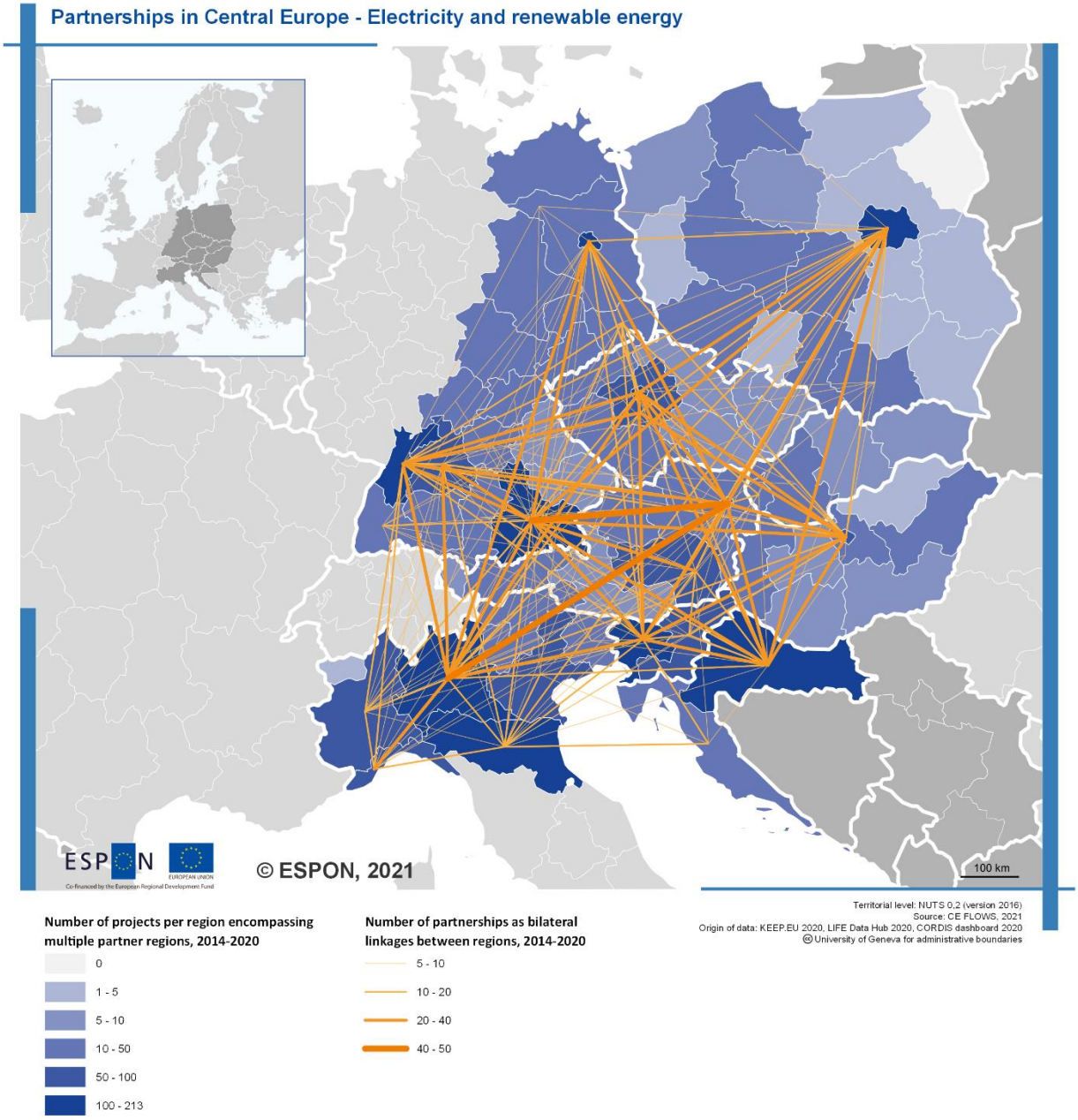
Map 5. Tourism: World Heritage Sites and Airports in the CE Area[19]



[19] Airports are differentiated by annual passenger volumes, with larger symbols corresponding to larger passenger volumes. The size of the pie-charts illustrates the volume of incoming trips, with a larger chart corresponding to more trips. The gradient of the respective segment of the chart represents the "sending" country. As this data is only available on country level, this analysis includes the entire volume of German and Italian tourists travelling to other CE Area countries.

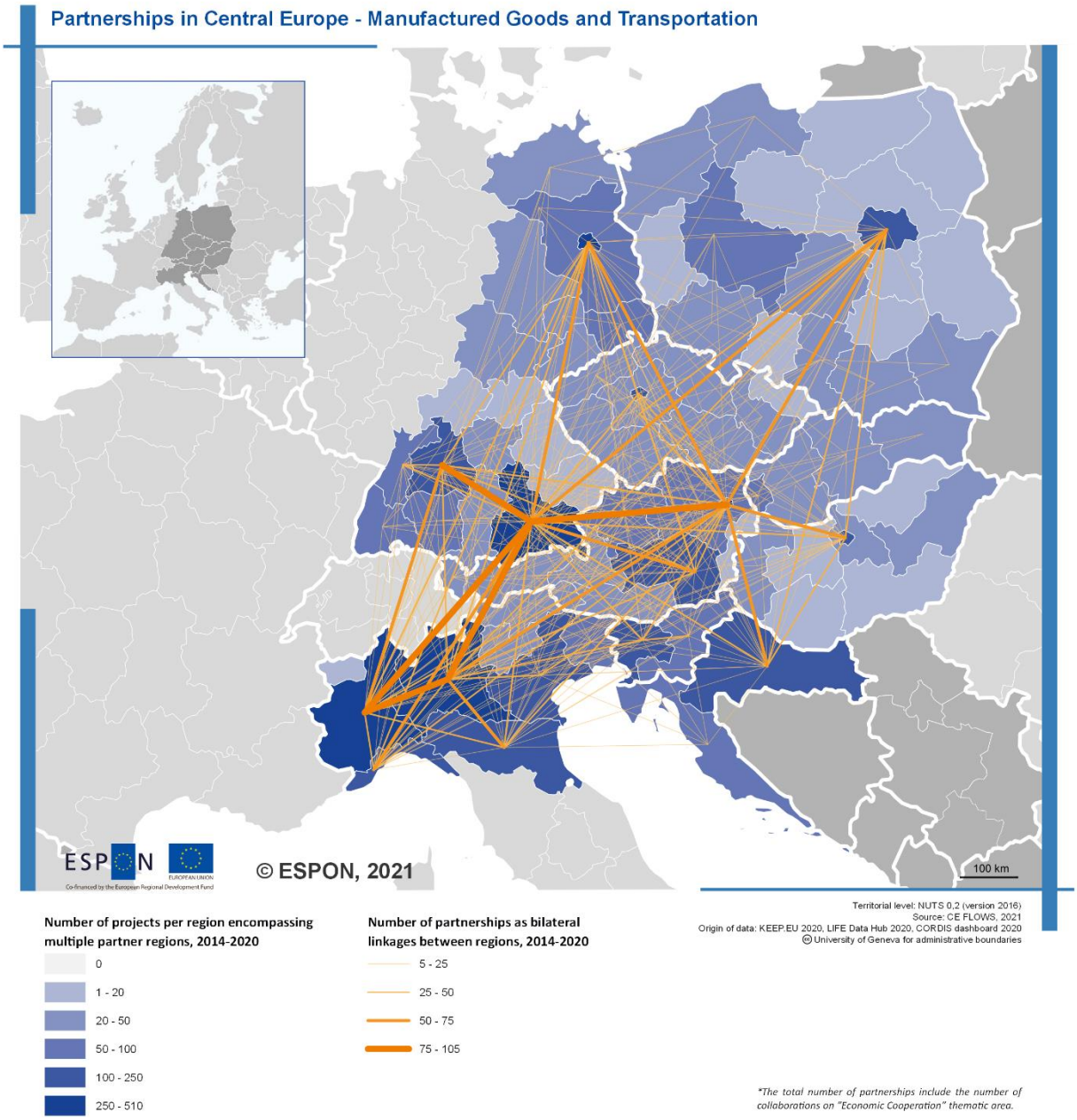
Electricity and renewable energy

Map 6. Number of partnerships on electricity and renewable energy between CE countries during 2014-2020 programming period



Manufactured goods and transportation flows

Map 7. Number of partnerships on manufactured goods and transportation flows between CE countries during 2014-2020 programming period

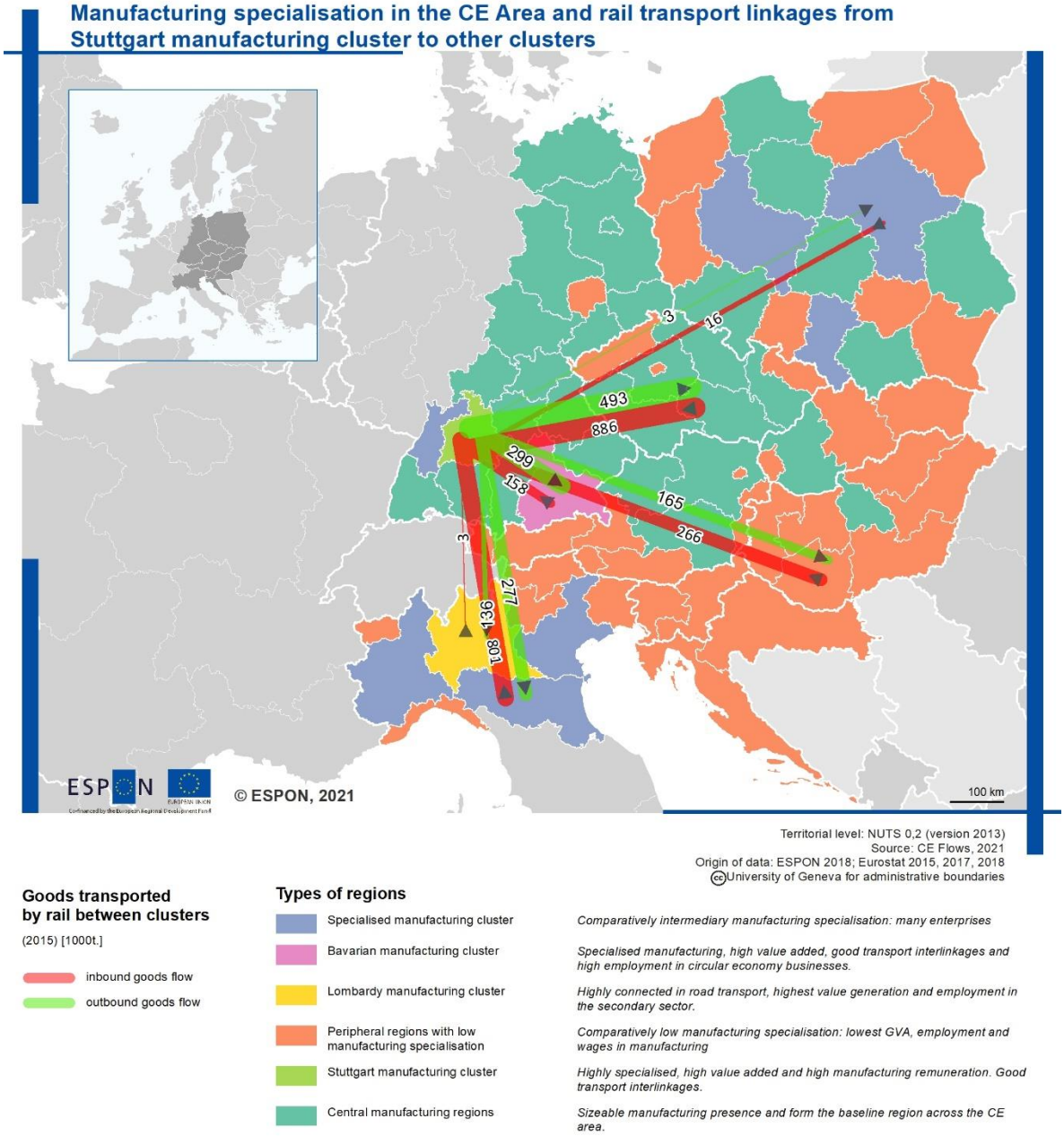


Cluster analysis - Additional maps

The assessment of the manufacturing capacities and the rail transport flows between the manufacturing hotspots of the CE Area produced one map per cluster, as each map illustrates the rail cargo flows between the individual clusters. This is an extension of the analysis presented in the main report. The clusters visualised in the maps below follow the characterisation presented in main report.

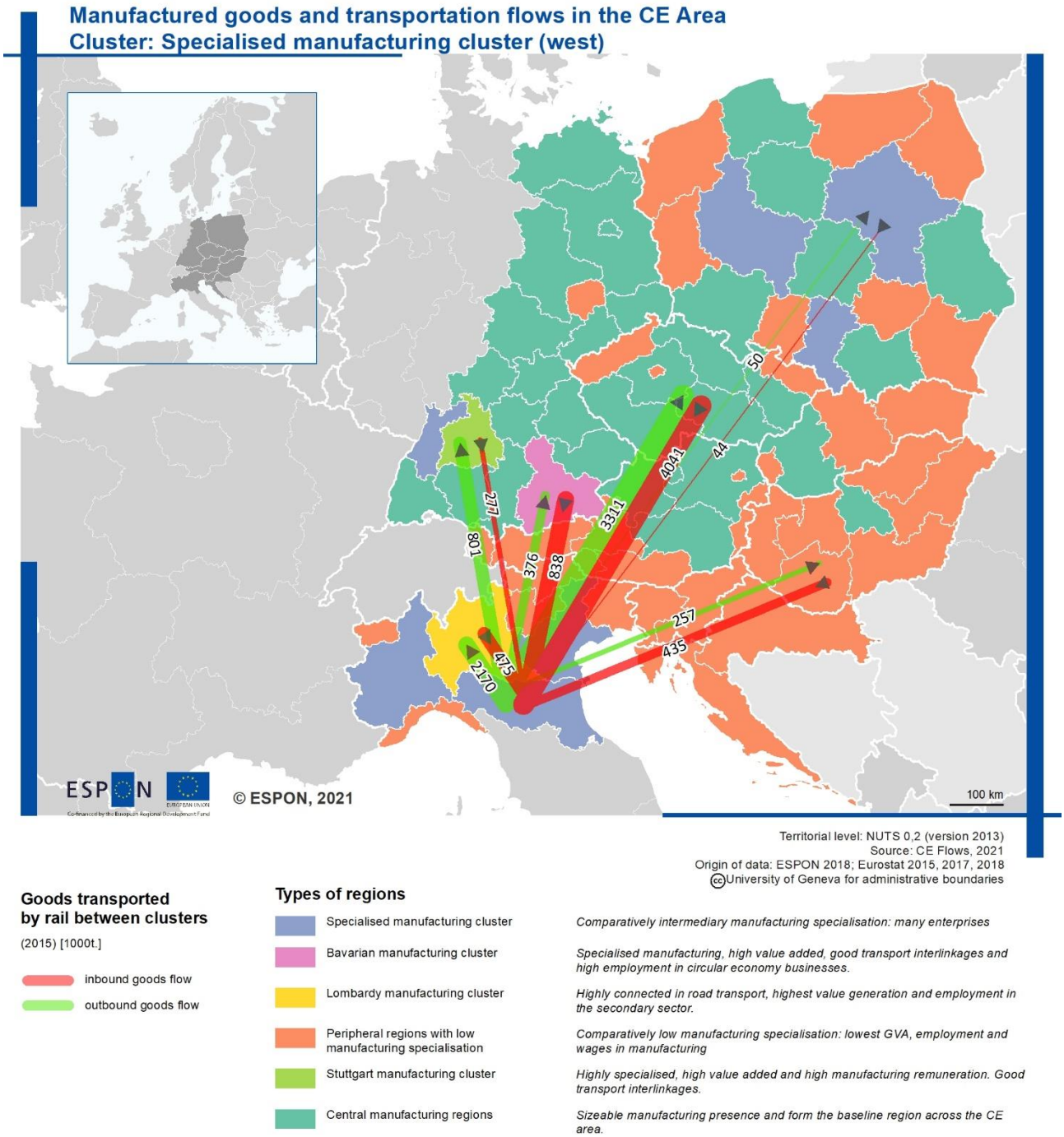
The rail cargo transport volumes originating in the *Stuttgart manufacturing cluster* are presented in Map 8. The *Stuttgart manufacturing cluster* is one of the most specialised manufacturing regions in the CE Area. From the goods flows to other clusters, the Stuttgart manufacturing cluster is most interlinked with the *central manufacturing regions,* the *specialised manufacturing cluster (west),* and to a lesser extent the *Bavarian manufacturing cluster*. This is likely due to the highly developed transport infrastructure (see main report) and the proximity to other manufacturing hotspots.

Map 8. Manufacturing goods and rail transport: Stuttgart manufacturing cluster



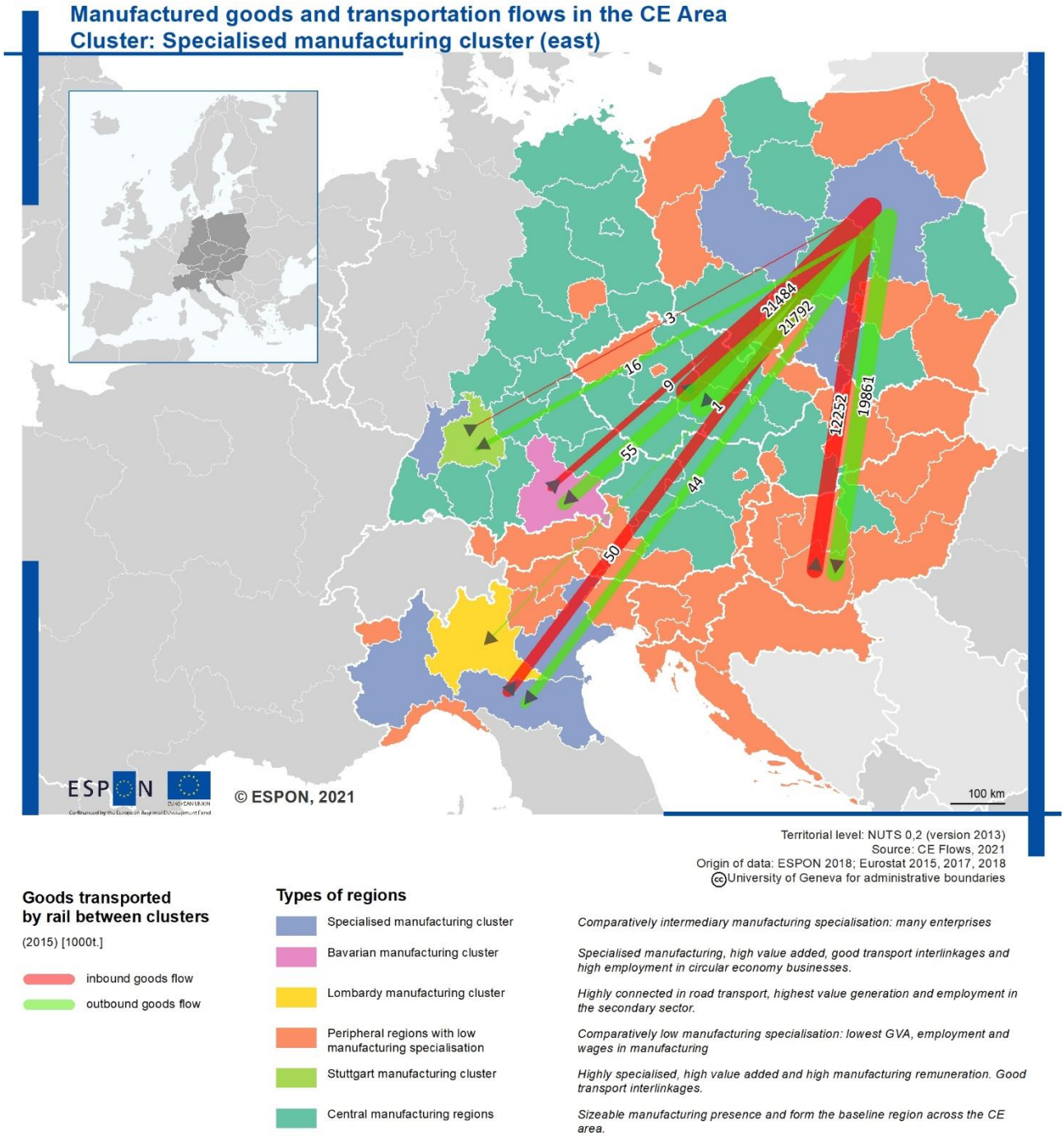
The *specialised manufacturing cluster (west)* as one of the leading manufacturing zones in the CE Area follows similar patterns (see Map 9) as the *Stuttgart manufacturing cluster.* Interlinkages (measured by rail cargo flows) are strongest to the *Lombardy manufacturing cluster* and *central manufacturing regions*, followed (to a significantly lower extent) by the two German manufacturing hotspots. Well-developed infrastructure and overall synergies created by a high density of specialised manufacturing companies fuel these exchanges.

Map 9. Manufacturing goods and rail transport: Specialised manufacturing cluster (west)

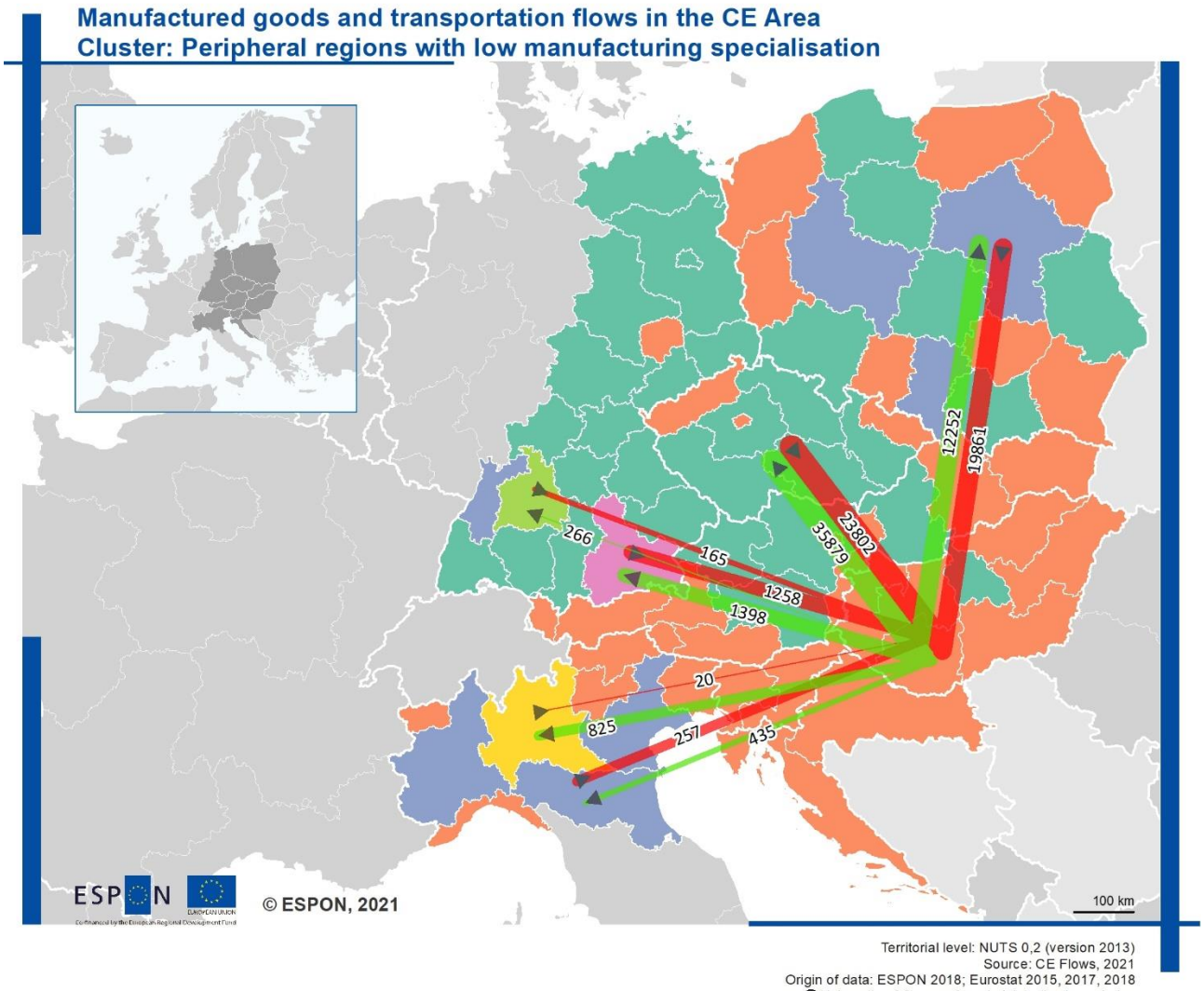


The *specialised manufacturing cluster (east)* mirrors the characteristics of its western peer (see main report). It is situated in the heartland of Poland. The cluster is well-interlinked (Map 10) with the two geographically closer clusters, the *central* and *peripheral* regions. This pattern is also illustrated for the *peripheral regions* in Map 11.

Map 10. Manufacturing goods and rail transport: Specialised manufacturing cluster (east)



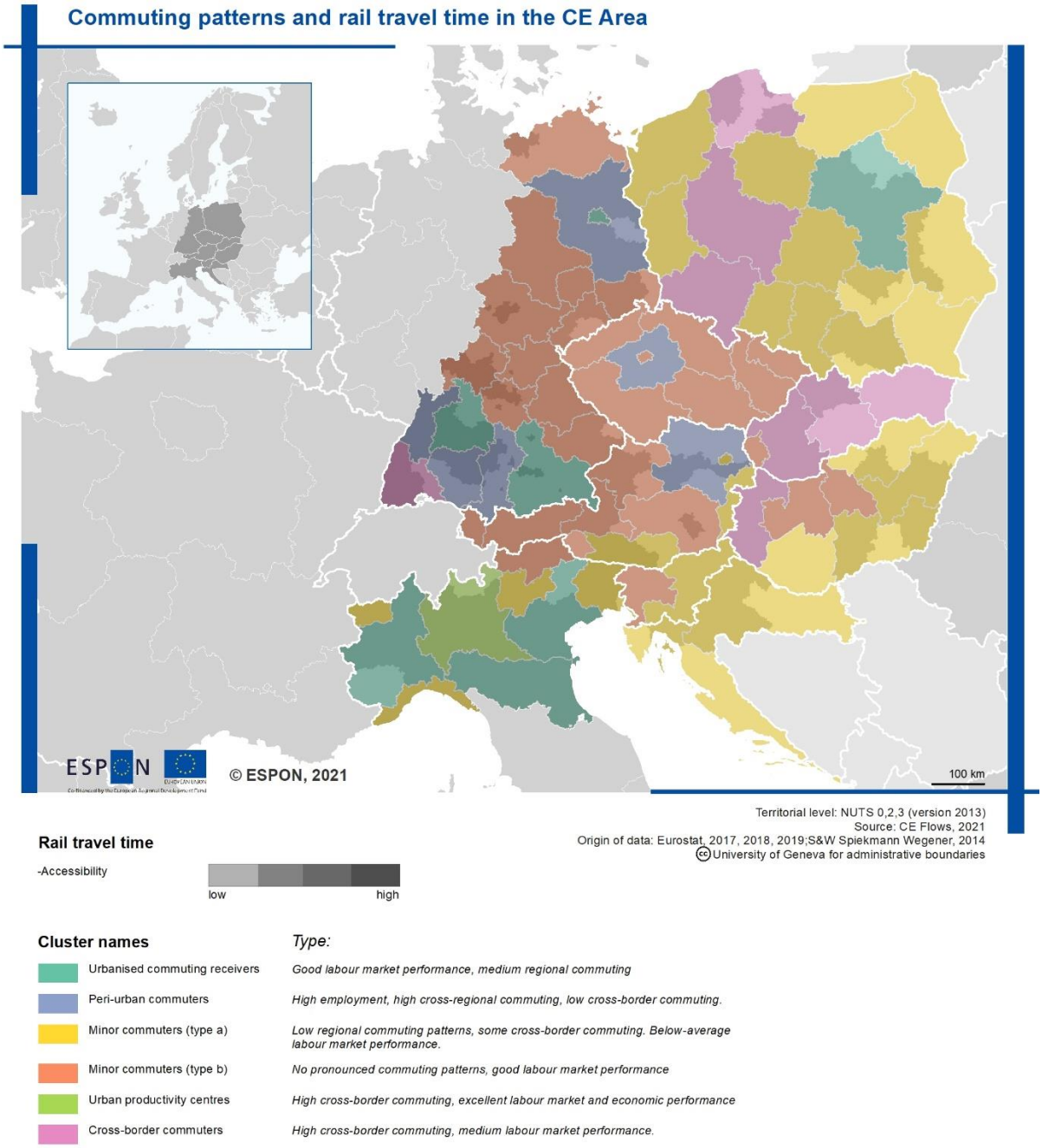
Map 11. Manufacturing goods and rail transport: Peripheral regions with low manufacturing specialisation



These two maps (Map 10 and Map 11) highlight the East-West Axis still apparent in the CE Area. Despite the significant manufacturing output of the eastern manufacturing cluster and the peripheral regions, this part of the CE Area lacks the manufacturing hotspots of the western regions. However, judging by the rail cargo flows, interlinkages with the remainder of the programme area occur predominantly via the central manufacturing regions.

Via the cluster analysis, the project team identified six types of regions in the context of commuting and labour market's attractiveness in the CE area[20]. As commuting data across the CE area generally only provides one point of the commute (the beginning or the end), cross-border accessibility[21] of the individual NUTS2 areas can contextualise the regional commuting characteristics identified in the cluster analysis. Further, it allows regions with a large share of cross-border and cross-regional commuters and regions which are absorbing these commuter flows to be distinguished.

Map 12: Commuting patterns in the CE Area (train accessibility)



[20] The indicators are: employment and commuting by sex, age and NUTS 2 regions: from 20 to 64 years, foreign country & in another region, gross value added at basic prices by NUTS 3 regions: Total, regional gross domestic product (million PPS) by NUTS 2 regions, employment rate of the age group 20-64 by NUTS 2 regions

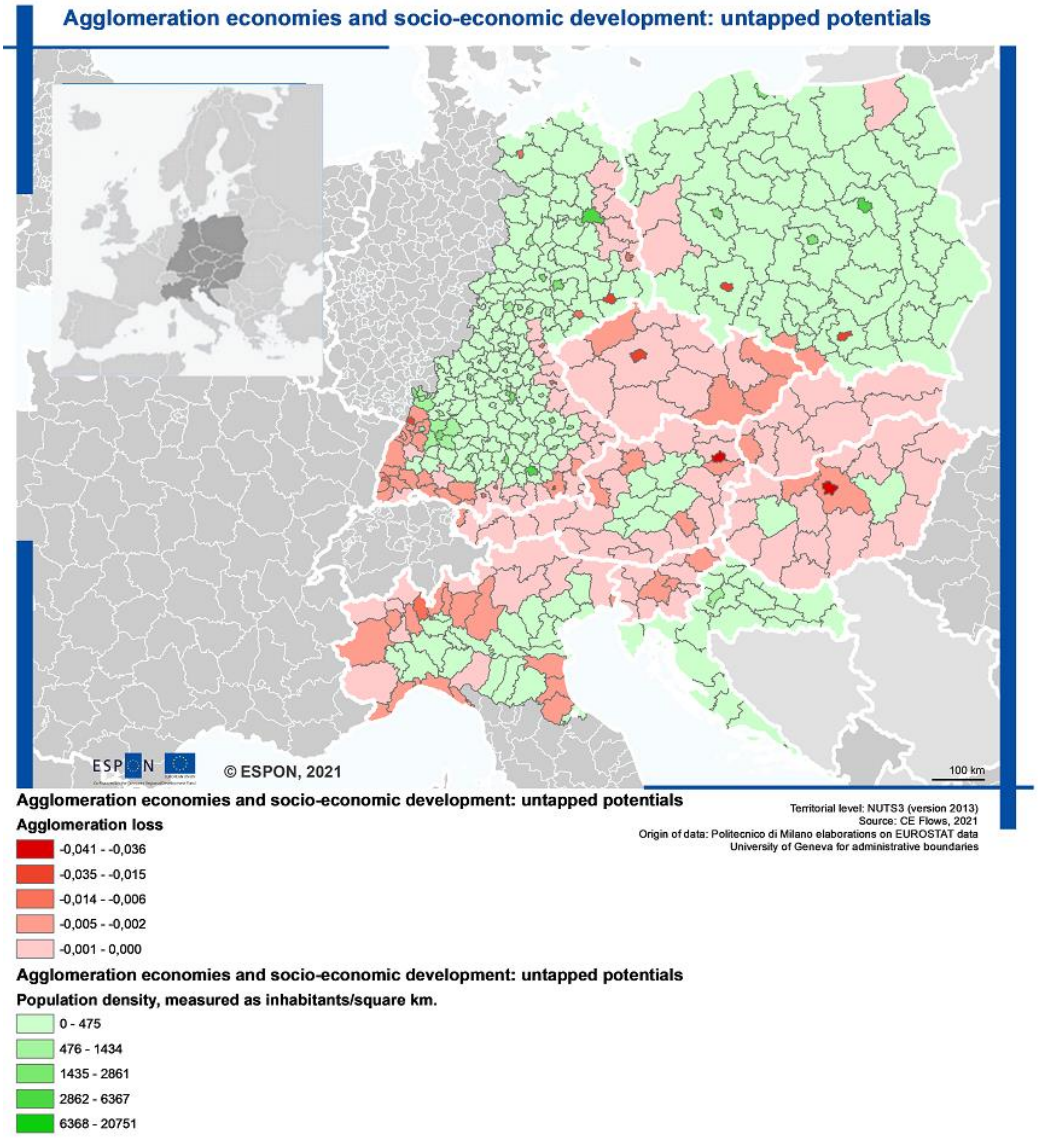
[21] Via Christodoulou, Aris; Christidis, Panayotis (2017)

Annex 2: Additional maps with untapped potentials

In the first two maps (Map 13 and Map 14, respectively) untapped potentials in CE regions are represented for those resources that register untapped potentials for the whole border regions in the EU.

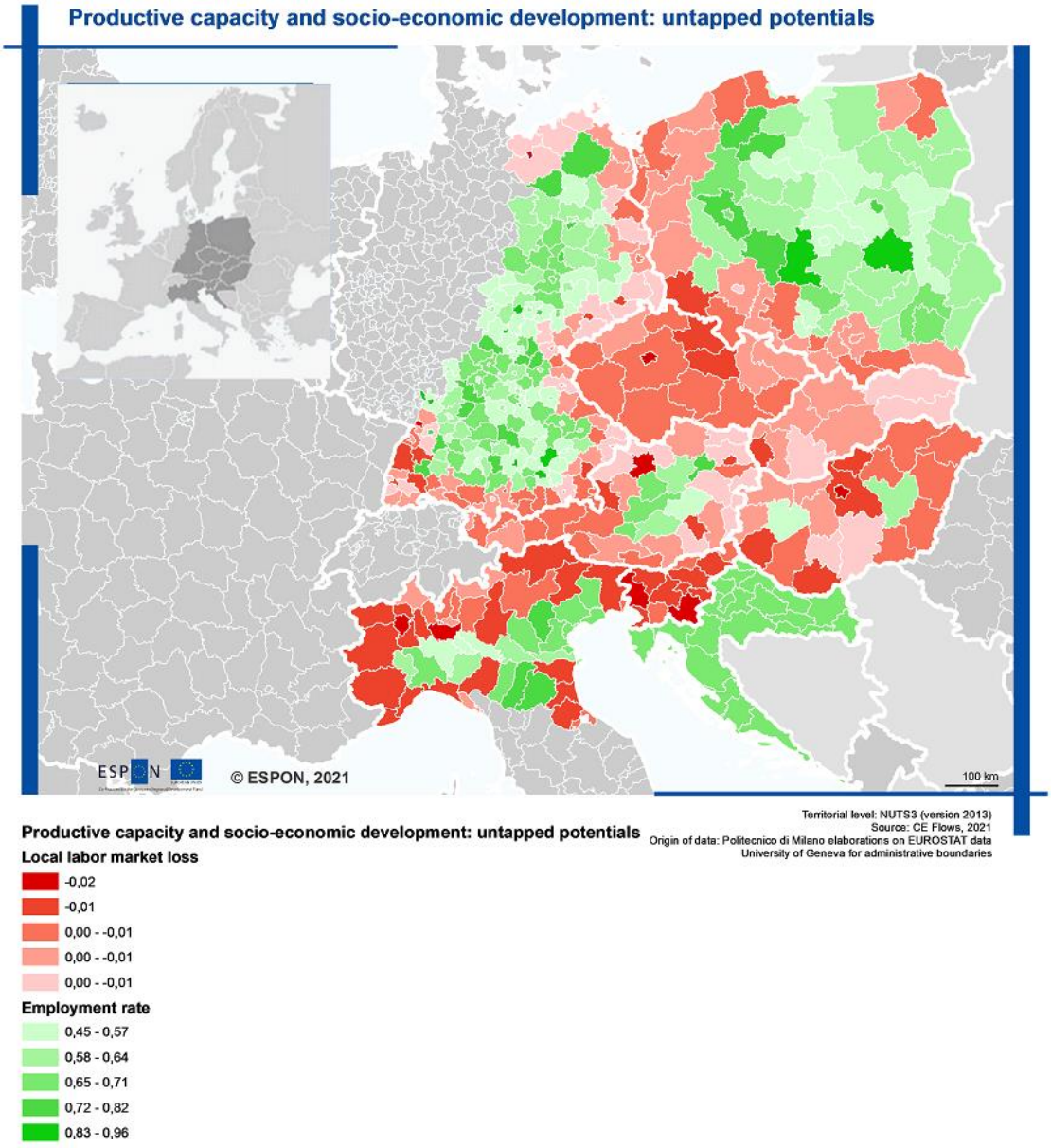
Map 13 represents untapped potentials in agglomeration advantages, while Map 14 shows untapped potentials in the local labor market. Map 13 displays that, while relatively mild in absolute terms, untapped potentials in agglomeration economies are distributed mostly along a West-to-East belt stretching all the way from North-Western Italy to South-Eastern Hungary. Because of the way this untapped potential has been identified, this result points at a substantial potential for these areas to further integrate both with other urban areas outside of the scope of the CE zone (e.g.: Turin to the North-West towards France, Milan to the North towards Italian-speaking Swiss Cantons, Munich and Augsburg to the German-speaking Swiss Cantons, etc.) and within the CE zone (e.g. Wien providing advantages to the Western part of Slovakia, Bratislava in primis, and vice-versa, Bratislava playing a complementary role in some activities for the Austrian, like the Bratislava airport useful for low cost flights to Wien).

Map 13. Agglomeration economies and socio-economic development: untapped potentials



By the same token, the lack of an efficient integration of local labor markets across EU borders induces a spatial distribution of untapped potentials in Map 14 that resembles closely Map 13, with the exception of a broader spatial coverage, extending also to rural areas. More integrated labour markets (same administrative rules, for example) would be of benefit for a high number of areas, rural areas included.

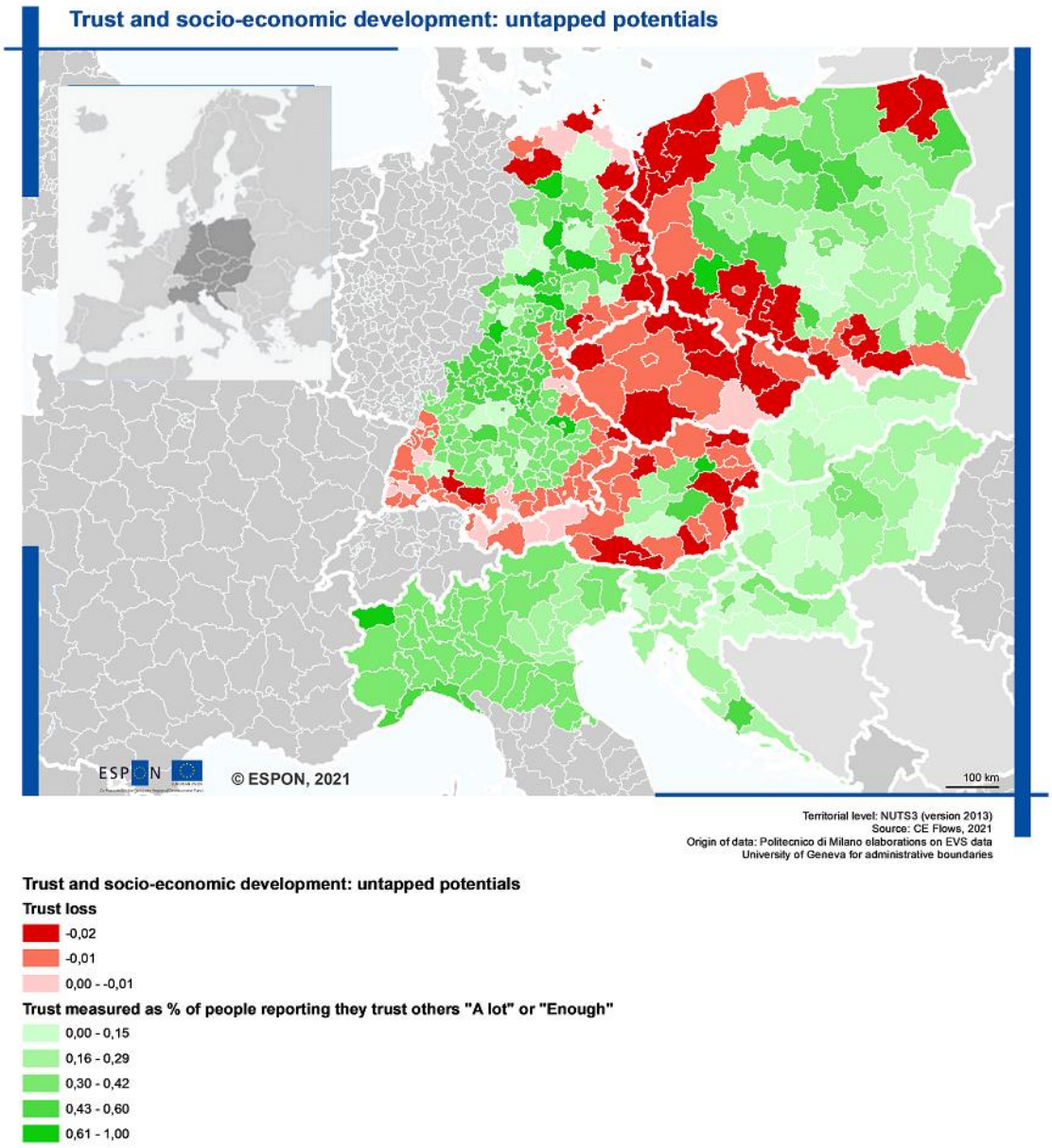
Map 14. Local labor market and socio-economic development: untapped potentials



We then move on to the analysis of untapped potentials that are either stronger than in the EU as a whole or that are untapped only in the CE area.

Map 15 represents the areas where trust is an untapped potential. The map displays significant spatial heterogeneity: a core belt of areas in and around Austrian and Czech regions. While this result may be also due to the Czech- and Austria-centric nature of the CE area, it is also reflected in the overall higher untapped potentials also identified for these Countries as a whole. In fact, for both these Countries losses due to the inefficient exploitation of trust represent by far the largest sources of border-related losses. A relevant potential of further integration for the efficient exploitation of trust as a growth-enhancing factor (Zak and Knack, 2001) therefore exists in these countries.

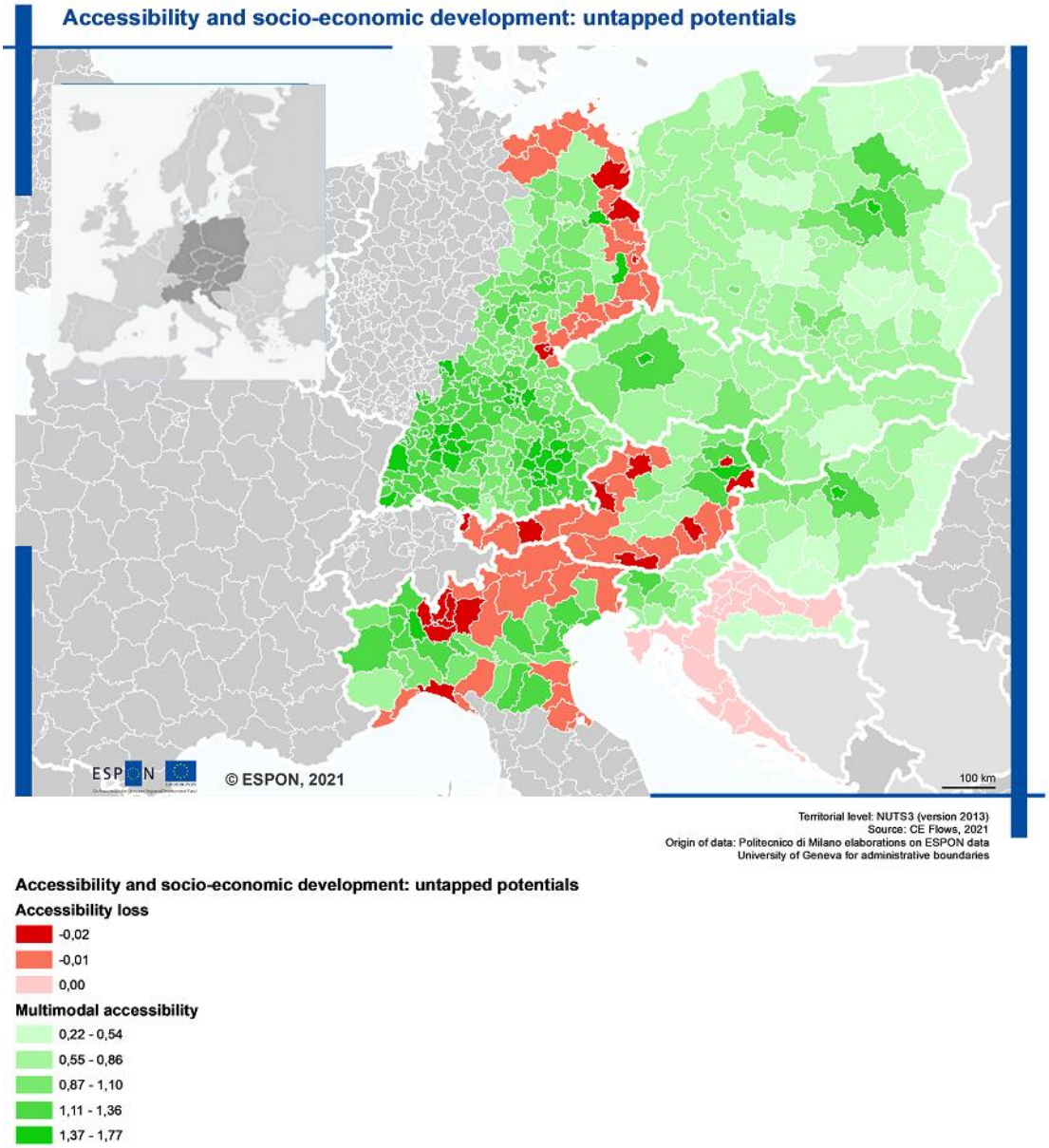
Map 15. Trust and socio-economic development: untapped potentials



Map 16 provides a relatively different picture for the spatial distribution of untapped potentials in accessibility. The CE area is rather peculiar in this respect: despite being geographically core for the EU, it also comprises a substantial share of all mountainous regions in Europe, with consequent little accessibility.

While on average the CE area registers 0.5 per cent cost in having untapped potentials in accessibility, regions located in Austria, Germany, and Italy mostly exceed this figure. In most regions of these three Countries untapped potentials fall in the interval 1.5-2.5%, which explains the presence of several red colors in Map 16 in these three areas. Areas particularly affected include the East Germany border to Poland, the Austrian-Italian border, and the border between Austria and Hungary, on the Austrian side. A non-negligible untapped potential in accessibility also exists in several Croatian regions.

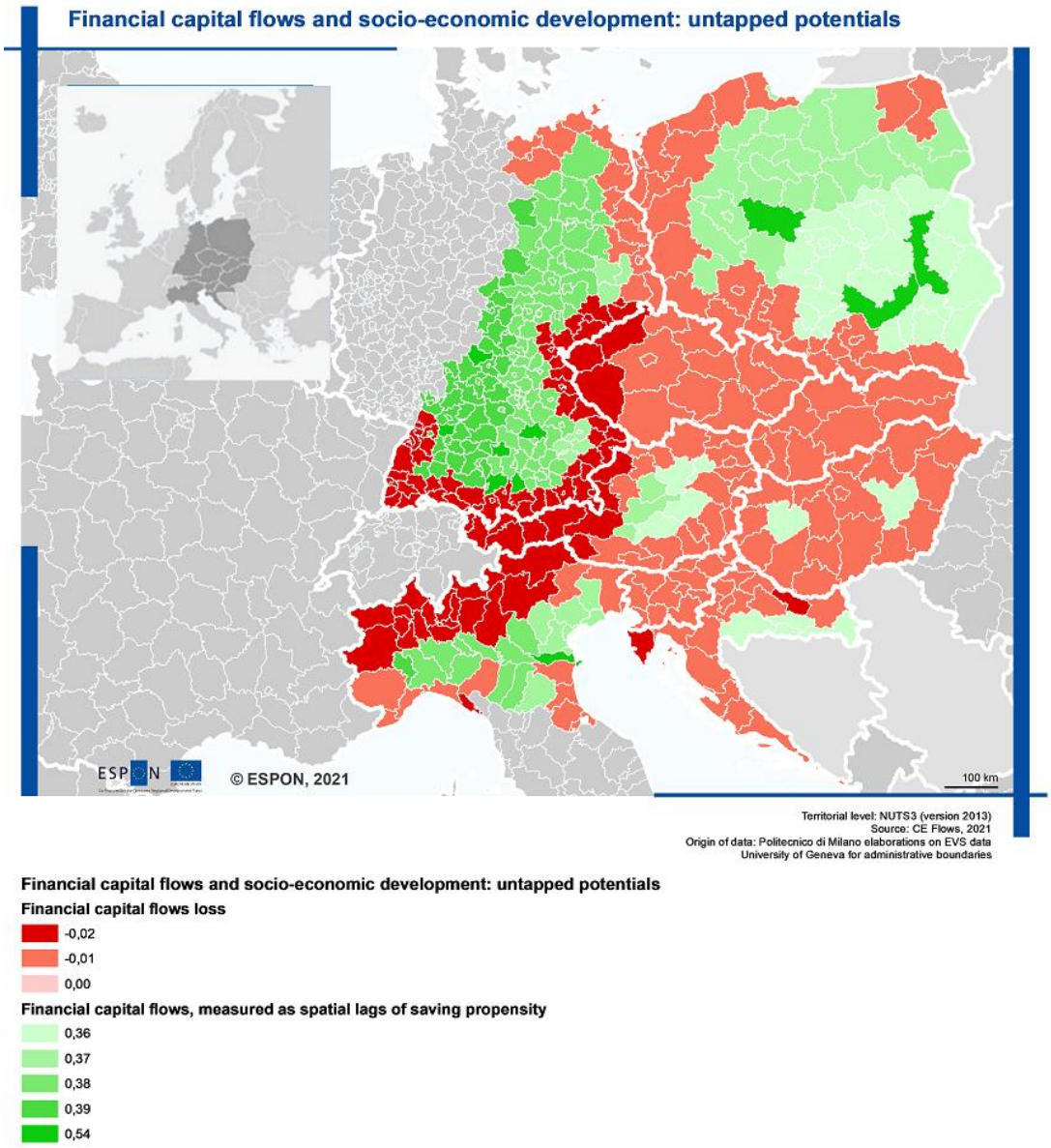
Map 16. Accessibility and socio-economic development: untapped potentials



Map 17 displays the spatial distribution of untapped potentials in *financial capital flows* (measured as savings of neighbouring regions). While orthodox economic theory posits that capital flows freely across borders, a celebrated result in macroeconomics (known as the Feldstein–Horioka puzzle) finds that capital mobility is in reality imperfect across borders.[22] Our results suggest that international legal barriers among CE countries, due to imperfect integration within-CE area, cause a non-negligible loss in terms of imperfect capital mobility (roughly equal to 0.1% on a yearly basis according to aggregate estimates). Some CE countries can lose up to 0.18% in Czech regions and 0.17% in Hungarian and Croatian ones.

[22] See Feldstein and Horioka (1980).

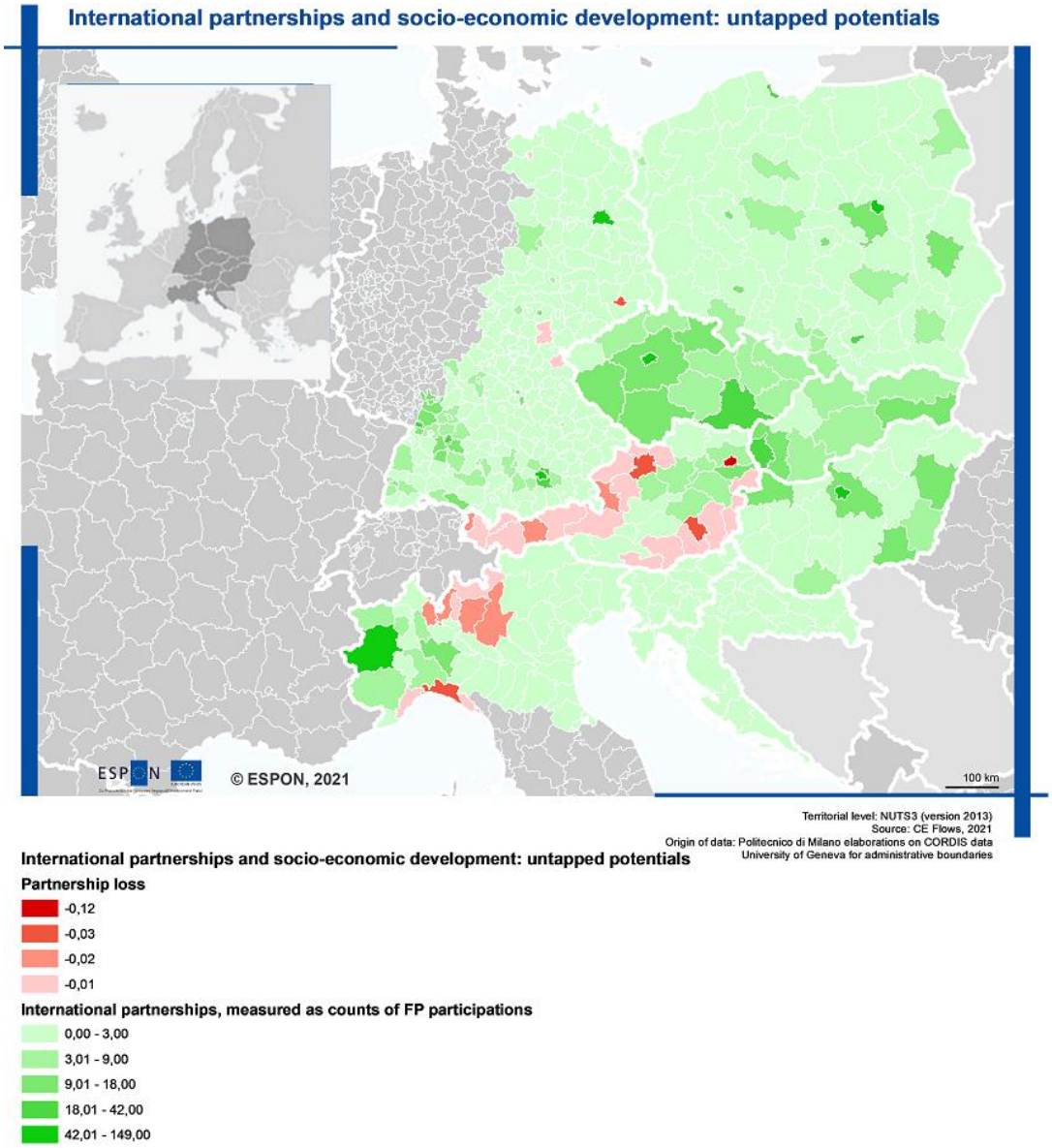
Map 17. Financial capital flows and socio-economic development: untapped potentials



Map 18 provides an even more concentrated picture for International partnerships activities in innovation. As amply demonstrated by a prior literature debate, transnational networks are usually highly concentrated, both based on a general and all-encompassing definition of networks (Godfrey and Zhou, 1999; Derudder, 2006), as well as when dealing more specifically with innovation and science-related networks (Camagni, 1991; Maggioni and Uberti, 1999; Capello and Caragliu, 2018).

It therefore comes as no surprise that untapped potentials in transnational networks are also spatially concentrated in the areas that may potentially reap the highest benefits from them. These include most regions located on borders in Austria, as well as some selected high-performance areas in Italy (including the metro areas of Brescia, Bergamo, and, to a lesser extent, Genoa).

Map 18. International partnerships and socio-economic development: untapped potentials

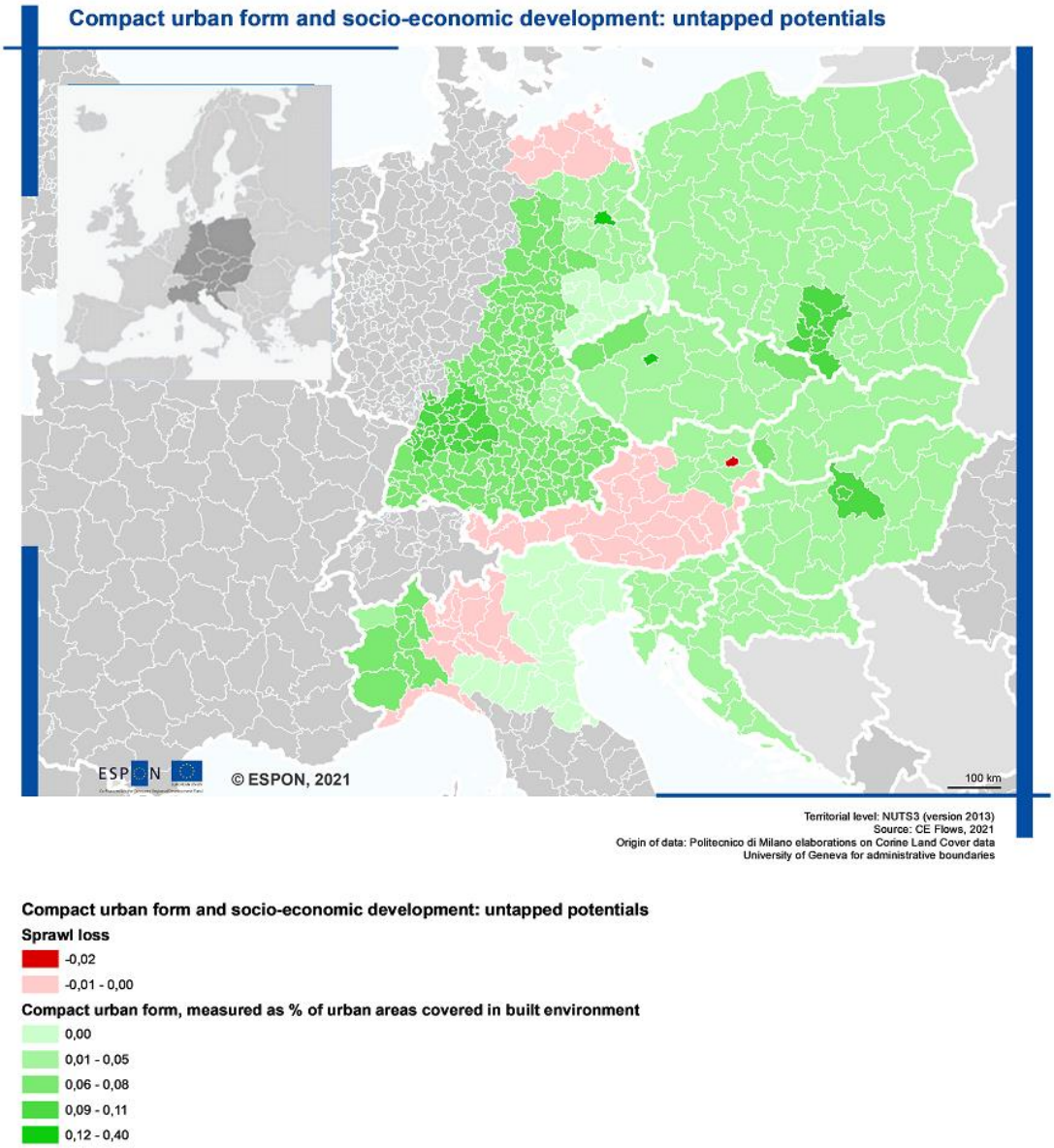


In Map 19, the untapped potential of a compact urban form is represented. By this we mean the lack of exploitation of the advantages (in terms of efficient use of environmental and energy resources) coming from a compact urban form (Hamidi and Zandiatashbar, 2019; Carlino et al., 2007; Camagni et al., 2013).[23]

Map 19 displays that the advantages associated to a compact urban form could be better exploited in mostly major urban areas in Lombardy (Milan, Brescia, and Bergamo); Liguria (Genoa); most Austrian areas (notably including Vienna and Innsbruck); and the North-Eastern German regions south of Berlin and north of Dresden.

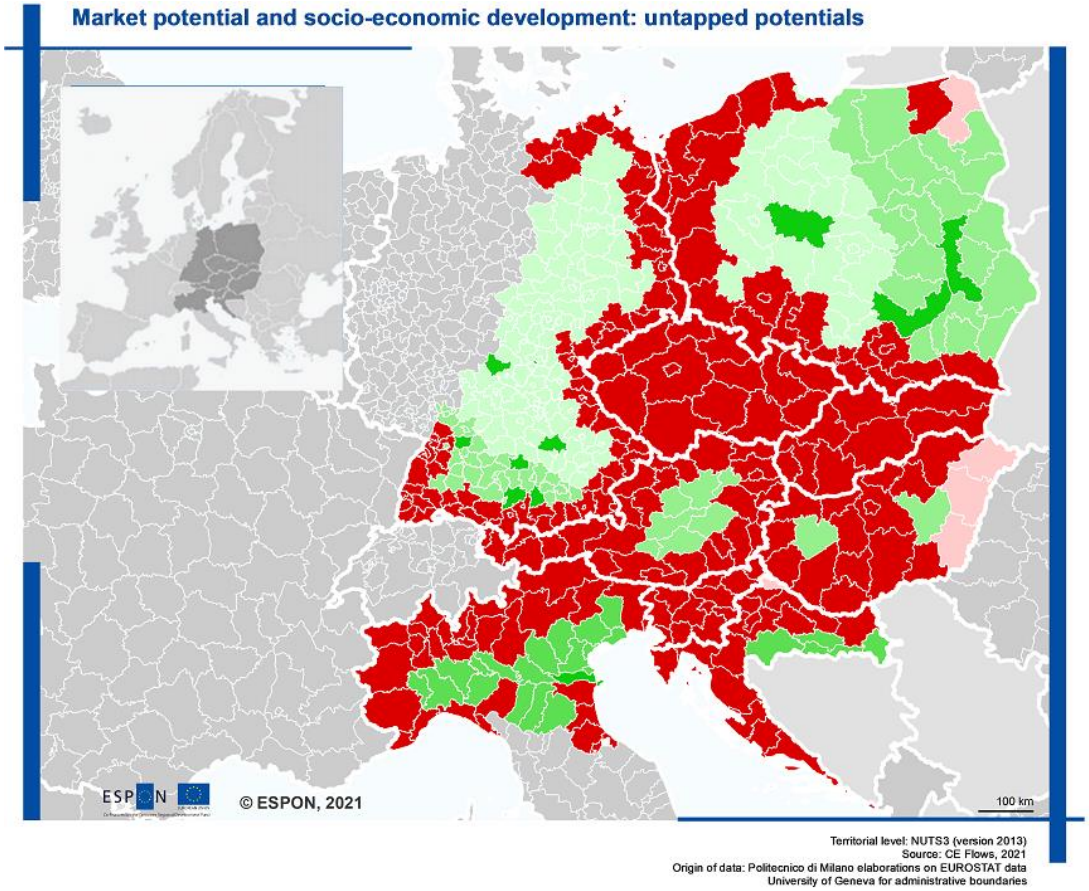
[23] It must be acknowledged that the same view is often opposed in the US academic world; see, among many, Brueckner and Fansler (1983) and Glaeser and Kahn (2004).

Map 19. Compact urban form and socio-economic development: untapped potentials



Slightly less relevant in absolute terms, but still rather important, is the missed market potential (Map 20). The past two decades saw an unprecedented wave of development and segmentation of global value chains. Several stages of final production have been delocalized from Western Countries to Central and Eastern Europe. Production ties are particularly strong between Germany on the one hand and Hungary and Slovakia on the other hand; Italy on the one hand, and Romania on the other hand; France, on the one hand, and the Czech Republic, on the other hand.

Map 20. Market potential and socio-economic development: untapped potentials



For CE regions, this means that several high-value added labor intensive activities are constantly being moved to areas where labor still presents some competitive advantage with respect to EU15 Countries, while at the same time offering major employment opportunities for several areas in the region. The existence of untapped potentials for a larger market means that socio-economic development in these regions would be further enhanced when legal barriers were fully removed within the CE region. Furthermore, Map 20 shows that losses are quite extensive and affecting a very large number of regions.

Annex 3: Delphi exercise: results of the written round and Delphi questionnaire

Results of the Delphi survey on the development scenarios for CE

In addition to the results presented in the main report for each thematic flow, the participants in the Delphi survey offered insights into drivers, bottlenecks and future scenarios of the CE area.

Bottlenecks and drivers

Nearly half of the 28 respondents **agreed or partially agreed that legal barriers hindering the potential of financial capital mobility across borders are less important than other conditions (such as inefficient exploitation of innovation) in what concerns a potential loss of GDP**. On the one hand, the respondents disagreeing with the statement referred to the importance of legal barriers as pointed out by the Global Competitiveness Report, or considered legal barriers to be *"relevant issues impacting on almost all the growth opportunities coming from integration and from the identification of functional areas […] since cross-border cooperation builds on policies and on legal instruments (e.g. bi-lateral agreements, treaties, etc.)".*

Other interesting comments emphasised the **importance of innovation and the barriers preventing innovation exploitation across regions** (such as lack of qualified personnel or available funding), as well as related to **SMEs' access to resources**. The **venture capital market is considered to be underdeveloped in the CE area compared to the European level, and the mobility of financial capital could be further improved**.

Another respondent considered the flow of capital and the factors impeding that flow as *"not being an issue of cooperation programmes"*, while another referred to the effect of **lowering legal barriers as a positive influence for tourism flows**.

Concerning market integration, *"participation on the common market" is considered "crucial",* or *"deeper economic integration of CE countries and regions"* is regarded as a trigger for the activation of mechanisms of innovation. Additionally, if the **lack of exploitation of innovation accounts for a bigger loss than the current low market integration**, there is an agreement that **better market integration can play a more important role in ensuring a positive socio-economic development**. In this expert's view, socio-economic development could be achieved through e.g. implementation of new e-commerce regulations or new rules on the mutual recognition of goods or enforcement of green procurement in particular Member States. Additionally, from the perspective of the concentration of R&D expenditure in research and innovation in urban regions and large companies, one respondent believes that more integration is needed, as suggested by the specific objective 1.1. of the next Interreg Programme that will be devoted to strengthening innovation capacities in the CE area.

Other respondents considered that there is potential for better integration of single market rules in many CE countries, but better exploitation (be it locally-based or through international innovation transfer) would lead to faster unlocking of the regional potential for growth. Moreover, respondents thought that *"the socio-economic potential related to market integration is higher (i.e. **integration of labour markets and cross-border opportunities are hampered if market integration is not exploited**) and can **benefit areas at different levels of development and more or less dependent on innovation driven sectors***". As such, the respondents claimed that the socio-economic development linked to a better market integration within the CE area is strong and should be valorised.

Concerning the topic of compact urban form[24], one respondent claimed that this has numerous advantages in terms of efficient use of environmental and energy resources. Other respondents provided supporting facts on this matter, highlighting that **urban agglomerations offer good conditions for improving energy efficiency, lowering emissions and using renewable energies** by, for example, shifting from individual to centralised heating systems that are renewable energy-based, by using waste heat recovery concepts or by applying circular economy approaches. Furthermore, **cities have great potential for exploiting synergies between different energy sectors**. This enables more intermittent energy sources to be integrated, **increases energy efficiency** of the entire energy system and reduces CO_2 emissions. According to these respondents, these approaches can be observed, for example, in concepts of smart cities with smart energy systems as their integral part. **Such improvements on the environmental side also offer economic potential for the CE area**. Additionally, another respondent observed that "*as urban areas are still growing, and population numbers in less urbanised areas are declining"* this topic will become more relevant. Finally, another respondent noted that the current urban sprawl processes around the CE area are not sustainable.

Another batch of respondents is more cautious on the relevance of the topic in the CE area or does not believe that it is of relevance for the economic potential:

- Several respondents believed that the exploitation of environmental and energy resources are not specific urban issues, but rather for rural areas and also that this situation is not specific for the CE area, but it is rather common to most urban areas around the world.
- The use of environmental and energy resources is still relatively small in compact urban development. Increasing this efficiency is a good research topic and can be very beneficial in knowledge transfer.
- The fabric of most CE urban areas (from small to middle sized and, to a lesser extent, some large urban areas) is difficult to be transformed into a 'compact one'. On the other hand, research shows how urban sprawl is pushed by inefficiencies in transports (especially if we consider second or lower tier cities) and government fragmentation that have an impact also on environmental issues.

Although some respondents did not provide any insight on this matter, there was agreement overall that **legal barriers influence public service provision across borders.** This is reflected in several answers, indicating that a flexible legal background which incentivises cooperation is needed for developing cross-border public services. **Cross-border public transport is regarded as a hot issue by most respondents** (13 out of 20), who considered that cross-border transport, connectivity and e-mobility should be improved in order to boost the economy, especially in those cases where **functional urban areas spread across borders** (e.g. Vienna airport is a key node for Austria, Czech Republic, Slovakia and even Hungary).

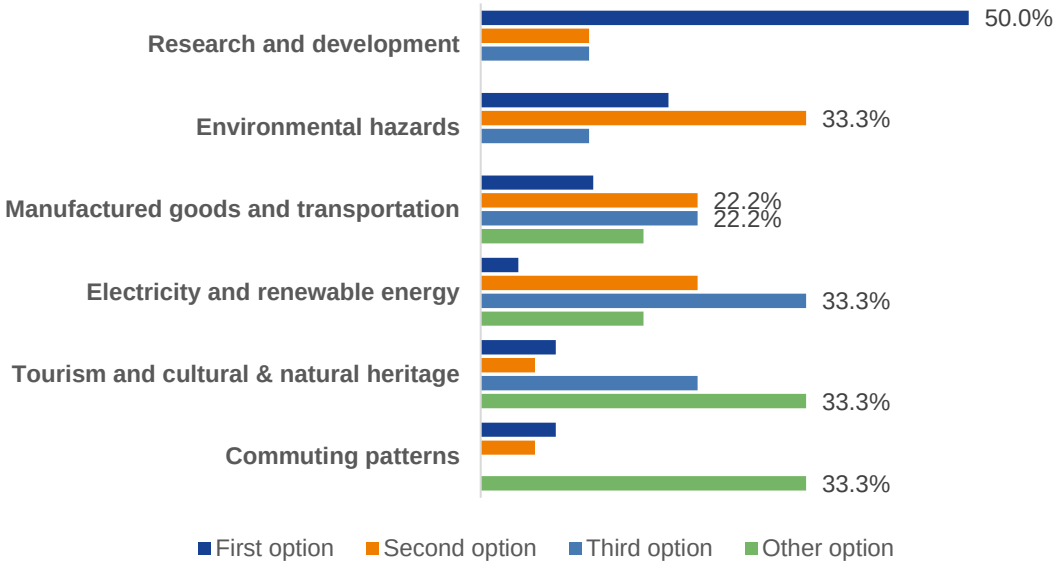
Only three respondents (out of 29) indicated disagreement, considering that the single market is quite developed and there are no major barriers related to cross-border service provision.

Main development potentials

Regarding the main development potentials for the typologies of flows identified in this study, the Delphi survey provided valuable results, especially in terms of identifying those typologies that should/could be better exploited for a greater integrated territorial development of the CE area:

[24] As defined by Burgess (2000), the compact urban form is the striving to "increase built area and residential population densities; to intensify urban economic, social and cultural activities and to manipulate urban size, form and structure and settlement systems in pursuit of the environmental, social and global sustainability benefits derived from the concentration of urban functions".

Figure 2. Main development potentials for the CE area integration



Source: Authors' elaboration

'Research and development' is considered as top priority by 50% of all options indicated as first choice, followed by 'Environmental hazards' and 'Manufactured goods and transportation'.

In terms of existing bottlenecks which hamper the development of partnerships and flows in the CE area, the respondents identified multiple issues, some of them considered likely to produce negative effects in the future as well:

- Lower involvement of regional and local actors;
- Legal barriers;
- Quality of public management;
- Mental barriers (i.e. competition stronger than cooperation);
- Language barriers (the use of English as business and research language should be encouraged);
- Unknown effects of the pandemic;
- Different legislation notably on environmental policy;
- Infrastructure and accessibility gaps; and
- Cultural barriers.

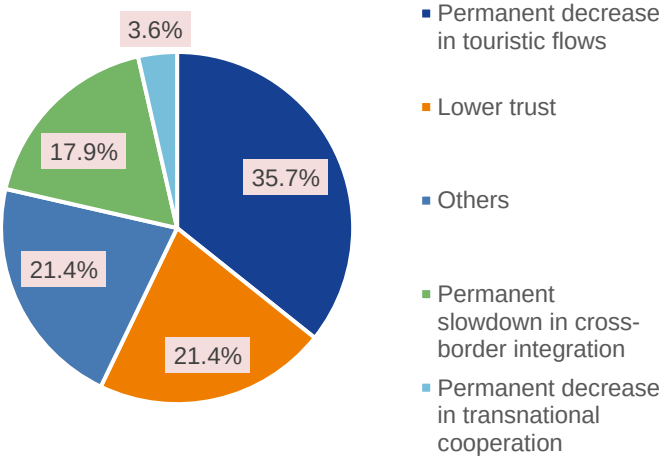
Scenarios for development and the effects of the pandemic

Regarding the alternative development scenarios built in the main report, the Delphi survey provided **consistent results with the assumptions of the modelling exercise**. In terms of **expected effects observable in the future, with respect to the future CE integration in the context of the pandemic** (Figure 3), 35.7% of respondents expect a

Source: Authors' elaboration

permanent decrease in touristic flows, 21.4% expect lower trust, 17.9% expect a permanent slowdown in cross-border integration and 3.6% expect to see a permanent decrease in transnational cooperation.

Figure 3. Stakeholder opinion on the impact of COVID-19 on the future CE integration



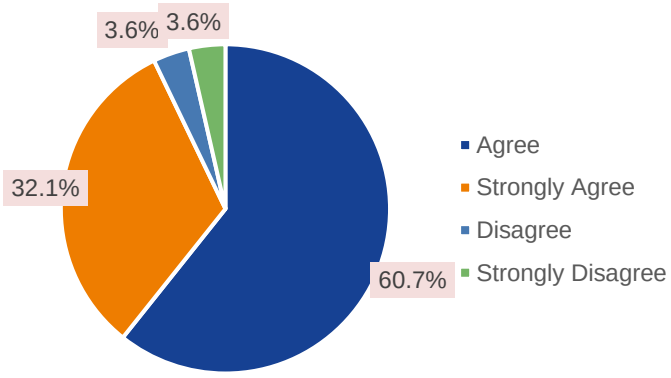
Other expected effects mentioned by the stakeholders include: social distancing generating 'mental barriers' related to the closed borders, as well as irrational behaviour which could lead to nationalist surges and populistic decision-making, thus weakening regional cooperation. This goes hand in hand with **lower trust between economic partners and higher protectionism**, which can be reversed with the help of the EU Recovery Fund, as **cooperation is regarded as a fundamental value of the EU**. However, there is **no expectation among the stakeholders of a permanent trend of economic decrease,** and a swift return to a 'normal outlook' is foreseen once the pandemic is over.

On international connectivity, with a focus on international trade, touristic flows, infrastructure projects, or other related aspects, the COVID-19 pandemic is expected by the stakeholders to produce the following outcomes:

- Not only touristic flows will permanently slowdown, but there will also be a change in their composition, with less incoming international tourists;
- Infrastructure projects are either expected to slow down due to border closure and on the long run, due to indebted public budgets, or are likely to increase if they receive EU funding;
- Other aspects: less demand for manufactured goods (e.g. in Slovakia due to the high dependency on the automotive sector), less subsidies for research institutions, less creativity and civic engagement in university cities due to lower numbers of resident students.

Regarding the possibility that domestic tourism could compensate for the reduction in terms of transnational travellers in CE regions highly depending on international tourism, more than 90% of respondents (out of 28 answers) *agreed* or *strongly agreed* on the statement, as indicated by Figure 4.

Figure 4. Stakeholder opinion on domestic tourism compensating the reduction of international travellers in the CE area



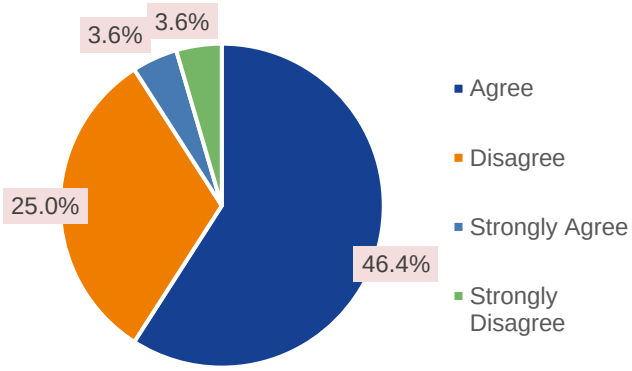
Source: Authors' elaboration

Disagreement with the statement is justified by the existing differences across the area with respect to the role played by tourism in the respective national economy (e.g. for Croatia, the respondent would agree, but for Germany, where tourism is 1.1% of GDP, no).

Disagreement is also reflected in the following considerations: "*consumption of international travellers is much higher compared to the domestic one, and the length of stay is longer*" and the fact that governments' subsidies to the tourism sector cannot account for all the losses and this is not sustainable. Additionally, one respondent noted that **facilities and services largely dependent on international demand are not always able to adapt to national demand**. For instance, the domestic demand for hotel accommodation is lower than international demand as domestic tourists tend to use second homes and other forms of accommodation (house rental, B&Bs and staying with friends and relatives). Finally, **mountainous areas are expected to be able to compensate better for the loss of international travellers as the share of domestic tourists is quite high already**.

According to Figure 5, considering the 22 answers received, more than 85% of respondents *agreed* or *strongly agreed* on the statement that **"Due to the ongoing COVID-19 pandemic, CE regions less dependent on international/interregional trade (and with bigger fiscal resources) will experience the smallest GDP decline"**.

Figure 5. Stakeholder opinion: CE regions less dependent on international/interregional trade will experience the smallest GDP decline



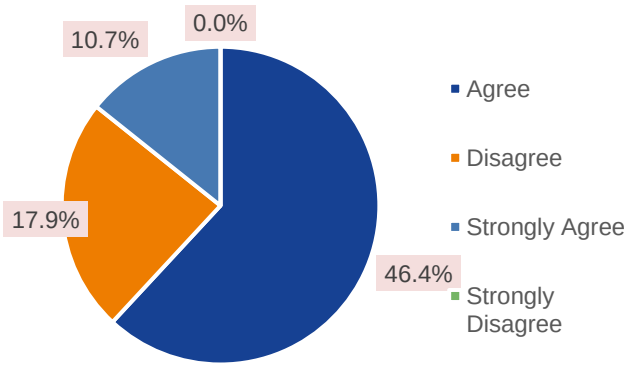
Source: Authors' elaboration

Disagreement is reflected in the fact that all regions are somehow interlinked and less able to individually determine their GDP decline, while agreement is justified by ideas such as the fact that the crisis could be an opportunity for the **companies and for the interested regions to create new productive value chains and to relocate less**, and that *"the GDP decline also relates to the suitability of counterbalancing public policy measures aiming at saving the jobs (e.g. short-time work or short-time allowance) and keeping the employability levels of labour force high. There are not so many regions with big fiscal resources, which are at the same time independent of international trade. In general, if a region has some budget surplus it can introduce programmes for restoring the regional economy and the same applies to an agile reshaping of supply chains".* The respondent argued that there are no signals at the moment that the strongest CE regions will be able to have and to exploit this potential.

Regarding the foreseen involvement of national governments in the countries' economic life, coupled with a lower degree of international cooperation, more than 80% of respondents *agreed* or *strongly agreed* with this possibility, indicating that national governments tend to focus less on international relations that are less attractive in times of crisis, or that it depends on how governments handled the crisis so far. **Nevertheless, cooperation is still expected on economic or health issues**. On the other hand, respondents that do not expect higher involvement of the government believe that **most CE countries do not suggest more invasive taxation**, rather the opposite (in line with the neo-Keynesian paradigm). Governments will even more realise how much they need cooperation to foster international trade and flows of goods and people (**even at the beginning of the pandemic, flows of people in key sectors was allowed, flows of goods too and this was a result of collaboration of governments from different countries**).

On the increasing role of cities in the economy, considering the 21 answers received, more than 55% of respondents *agreed* or *strongly agreed* that "**the CE area will witness a bigger role of cities in the economic life"** (Figure 6). No answer was recorded for strong disagreement.

Figure 6. Stakeholder opinion on the impact of COVID-19 on a greater role played by cities in economic life



Source: Authors' elaboration

On the one hand, respondents believed that the development of cities is COVID-independent, continuing the tendency already observed regarding the concentration of services, business and research in urban areas. On the other hand, respondents consider that the importance of rural areas increased during the pandemic, mainly due to the increased reliance on teleworking that has the ability to change (at least partially) the destination of migration flows from cities and economically dynamic areas to more environmentally attractive rural areas.

Below is displayed a copy of the questionnaire that was disseminated among stakeholders for the written round of the Delphi process.

Delphi questionnaire (written round)

Valdani, Vicari & Associati (VVA), together with Politecnico di Milano, ÖIR, and CIVITTA are conducting a study on "Spatial dynamics and integrated territorial development scenarios for the functional areas of central Europe – CE FLOWS". The study is mandated by ESPON (the European Territorial Observatory Network), a European programme aimed at promoting and fostering a European territorial dimension in development and cooperation by providing evidence, knowledge transfer and policy learning to public authorities and other policy actors at all levels. The overall objective of this study is to develop an effective set of policy actions for the integrated territorial development of Central Europe (hereinafter, 'CE') in view of 2030, thereby supporting transnational, national and regional policy interventions in the area. (https://www.espon.eu/ce-flows)

Thank you for agreeing to partake in a Delphi survey exercise for this research project. Your participation will be completely confidential and you will remain completely anonymous throughout this process. The data gathered within this survey will not be subject to any public disclosure and is for use only as part of the ESPON CE FLOWS study.

The following survey is the first of two rounds of a survey questionnaire submission. This is designed to obtain your personal opinion on some aspects such as the following:

- the features of spatial dynamics and linkages in the CE area, focusing on thematic fields such as environment, energy, economic activities (R&D and manufacturing), transport within the regions, tourism and cultural heritage;
- main economic development potentials and bottlenecks in the CE area; and
- economic, environmental and social scenarios for 2030 in the CE area;

Instructions:

1. Please provide an answer to each statement and open-ended question on which you have an informed opinion concerning the subject matter.
2. If you are not informed about the specific issue in one or more of the questions below, please state this in the space below the question;
3. We use a four-level "Likert scale" for rating your answers to the proposed statements. Please choose only one score of the following agreement scale for each statement:

- Strongly disagree
- Disagree
- Agree
- Strongly agree

Together with selecting one of these options, please provide an explanation for your choice: we kindly ask you to describe the drivers, the factors and/or the bottlenecks justifying your answer.

4. All the statements proposed in this questionnaire are based on the findings from our analysis: please find the full analysis in the .pdf document which you received together with this questionnaire.
5. For further information please contact:

- Francesco Romano (f.romano@vva.it)
- Endre Hunnyadi (endre.hunnyadi@civitta.com)

Personal information:

Please leave the table empty if you would like to submit your answers anonymously

Name	Country/Region	Institution	Position	E-mail

Section 1: Spatial dynamics in the CE area

Research and development flows and partnerships

1)

Statement			
Cooperation themes directly or indirectly related to 'innovation and research' (such as new products and services, knowledge and technology transfer, innovation capacity and awareness-raising, ICT and digital society) as well as 'scientific cooperation', are well represented in the CE area			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

2)

Statement					
In which of the following areas is your country/region most involved in flows and partnerships with other CE countries/regions?					
New products and services	**Knowledge and technology transfer**	**Innovation capacity and awareness-raising**	**ICT and digital society**	**Scientific cooperation**	**Others**

Please provide some evidence justifying your answer:

3)

Statement			
Cooperation themes related to 'innovation and research and 'scientific cooperation' are popular themes of partnerships between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

4)

Statement			
R&D activities in the CE area take place mostly in urbanised hubs situated in the western regions of the programme area. Without better networking of R&D actors from other parts of the CE area, sustainable and long-term integration of R&D channels across the entire CE area is hampered.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

5)

Statement			
Many, particularly less urbanised regions in the Czech Republic, Croatia, Hungary, Poland, Slovakia, Slovenia as well as some Italian regions (Aosta Valley, Friuli Venezia Giulia and Liguria) are characterised by shortages of human capital in the research and development field (low public and private R&D expenditure and low employment in knowledge-intensive industries): the innovation output of these regions is low.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Environmental hazards, flows and partnerships

6)

Statement			
Environmental hazards-related forms of cooperation (e.g. projects aiming to protect endangered or vulnerable areas, to tackle climate change, etc) are not popular in the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Statement
In which of the following areas is your country/region most involved in flows and partnerships with other CE countries/regions?

Sustainable management of natural resources	**Managing natural and man-made threats, risk management**	**Climate change and biodiversity**	**Waste and pollution**	**Water management**
Coastal management and maritime issues	**Construction and renovation**	**Multimodal transport**	**Soil and air quality**	**Others**

7)

Please provide some evidence justifying your answer:

Statement			
Cooperation themes related to 'environmental hazards' are not popular themes of partnerships between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

8)

Please provide some evidence justifying your answer:

Statement			
The CE area is highly endowed in environmentally valuable areas, as illustrated by a large coverage of NATURA 2000 areas. However, environmental quality is lower around the more industrialised manufacturing hubs in the Western part of the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

9)

Please provide some evidence justifying your answer:

Statement			
In light of the COVID-19 crisis, the development of the natural quality of the CE area in the long-term, is uncertain: with increasing economic turbulence, economic actors may perceive a need to compensate for lost production, resulting in higher pollution and waste generation levels			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

10)

Please provide some evidence justifying your answer:

Manufactured goods and transportation, flows and partnerships

11)

Statement			
Cross-border cooperation on 'multimodal transport' (e.g. transport and mobility, freight transport, etc.) is not popular in the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

12)

Statement				
In which of the following areas is your country/region most involved in flows and partnerships with other CE countries/regions?				
Transport and mobility	**Improving transport connections**	**Waterways, lakes and rivers**	**Logistics and freight transport**	**Others**

Please provide some evidence justifying your answer:

13)

Statement			
Partnerships on 'economic cooperation' (e.g. entrepreneurship, clustering and economic cooperation on SMEs, etc.) are widespread within the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

14)

Statement			
Cooperation themes related to 'economic cooperation' are not popular themes of partnerships between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

15)

Statement			
The manufacturing sector plays an important role across most regions in the CE Area. Flows of goods between distinct manufacturing hubs (such as transnational like between Southern Germany and Northern Italy) are relatively low compared to the interlinkages with their surrounding regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Statement

16)

Strong East-West manufacturing channels are visible: manufacturing hubs in the Western regions are supplied by intermediate suppliers in the Eastern regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

17)

Statement			
The degree of manufacturing specialisation varies significantly within the CE regions between higher on lower value added in the sector.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Commuting patterns, flows and partnerships

18)

Statement			
Cross-border cooperation on 'labour market and employment' is not popular in the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

19)

Statement			
Cross-border cooperation on 'demographic change and immigration' is not popular in the CE area.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

20)

Statement			
Cooperation on 'demographic change and immigration' is not popular between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

21)

Statement			
Cooperation on 'labour market and employment' is not popular between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Statement

The commuting patterns are heterogenous across the CE area: significant disparities in terms of car and rail accessibility can still be observed across the CE area (e.g. border regions feature lower accessibility compared to urbanised areas).			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

22)

Please provide some evidence justifying your answer:

Statement			
Border regions (particularly French-German, the Czech-Polish, the Austrian-Hungarian and Austrian-Slovakian borders) in the CE Area are characterised by high cross-border commuting. In most regions, commuting occurs within the country, generally between urban areas and their surrounding regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

23)

Please provide some evidence justifying your answer:

Tourism and cultural & natural heritage, flows and partnerships

Statement			
Compared to other thematic fields of cooperation, 'tourism and cultural & natural heritage' scores a high number of partnerships (on average) in each CE region, including the ones with a lower touristic potential.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

24)

Please provide some evidence justifying your answer:

Statement			
Besides Italy and certain areas in Hungary, cooperation on 'tourism and cultural & natural heritage' is not popular between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

25)

Please provide some evidence justifying your answer:

Statement			
A unifying characteristic of most regions in the CE area is the relatively high degree of domestic and cross-border tourism: this feature should ensure the resilience of the sector vis-à-vis the shocks due to the international travel restrictions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

26)

Please provide some evidence justifying your answer:

Statement

Certain CE regions (notably the border region between Austria, Slovakia and Hungary) are generally characterised by non-air travel for incoming tourists, although these regions feature many regional airports.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

27)

Please provide some evidence justifying your answer:

Electricity and renewable energy, flows and partnerships

Statement			
Cross-border cooperation on electricity and renewable energy is heterogeneous within the CE area: overall it is not popular, despite certain regions scoring a high degree of partnerships (e.g. Emilia-Romagna in Italy, Croatia and Slovenia).			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

28)

Please provide some evidence justifying your answer:

Statement				
In which of the following areas is your country/region most involved in flows and partnerships with other CE countries/regions?				
Energy efficiency	**Renewable energy**	**Green technologies**	**Traditional energy**	**Others**

29)

Please provide some evidence justifying your answer:

Statement			
Cooperation themes related to electricity and renewable energy are not usually targeted in partnerships between CE regions and non-CE regions.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

30)

Please provide some evidence justifying your answer:

Statement			
Flow transmission channels for energy are well-developed and highly functional across the area, allowing for diverse regional specialisation and subsequent compensation in the case of generation deficits.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

31)

Please provide some evidence justifying your answer:

Statement

32)

The electricity and energy networks of the CE Area are largely country-specific: heterogeneities are given by the different levels of specialisation within the countries rather than between countries.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

Section 2: Main development potentials, drivers and bottlenecks

33) *Although imperfect, the potential GDP loss due to legal barriers hampering the cross-border mobility of financial capital within the CE area, is lower compared to other development potentials (such as missed opportunities due to the inefficient exploitation of innovation).*

Please provide some evidence explaining whether you agree or not with this finding from our analysis:

34) *The socio-economic development linked to a better market integration within the CE area, although it has some potential, is lower compared to other development potentials (such as missed opportunities due to the inefficient exploitation of innovation).*

Please provide some evidence explaining whether you agree or not with this finding from our analysis:

35) *The lack of exploitation of the advantages (in terms of efficient use of environmental and energy resources) coming from a compact urban form is a very relevant issue for the economic potential of the CE area.*

Please provide some evidence explaining whether you agree or not with this finding from our analysis:

36) *According to the findings of our analysis, Austria and Czech Republic due to their relatively small size, with a significant share of their territories very close to transnational borders, are the two most directly affected countries (in terms of potential GDP loss) by the presence of barriers (e.g. administrative, legal).*

Please provide some evidence explaining whether you agree or not with this finding from our analysis:

37) *International legal barriers among CE countries, cause a non-negligible GDP loss in terms of imperfect capital mobility and hamper cooperation in public service delivery (e.g. cross-border public transport or joint resources management).*

Please provide some evidence explaining whether you agree or not with this finding from our analysis:

38) Based on the typologies of flows presented in Section 1 ('*Research and development*', '*Environmental hazards*', '*Manufactured goods and transportation*', '*Commuting patterns*', '*Tourism and cultural & natural heritage*', '*Electricity and renewable energy*'), which do you consider to be the main development potentials (please name at least 3 possible options) that should/could be better exploited for a greater integrated territorial development of Central Europe?

39) Based on the typologies of flows presented in Section 1, which do you consider to be the main bottlenecks (please name at least 3 possible options) that hamper the development of partnerships and the flows established between CE countries in these fields?

Section 3: Scenarios for development of the CE area towards 2030

40) Which of the identified bottlenecks (Question 39) do you consider that will continue to have the greatest impact on the integrated territorial development of Central Europe by 2030?

41) Which of the identified drivers for the typologies of flows presented in Section 1 ('*Research and development*', '*Environmental hazards*', '*Manufactured goods and transportation*', '*Commuting patterns*', '*Tourism and cultural & natural heritage*', '*Electricity and renewable energy*') do you consider that should be further capitalised for a greater integrated territorial development of Central Europe by 2030?

42)

Statement				
Do you expect CE integration to be hampered by the COVID-19 pandemic? If yes, which could be the main effects observable in the future?				
Lower trust	**Permanent decrease in touristic flows**	**Permanent decrease in transnational cooperation**	**Permanent slowdown in cross-border integration**	**Others**

Please provide some evidence justifying your answer:

43) What would you expect COVID-19's consequences to be on the international connectivity of your region? Please provide some evidence and/or driver justifying your answer, focusing on the impacts on:

- International trade;
- Touristic flows;
- Infrastructure projects;
- Others (please specify)

44) What would you expect to be the results and outcomes of key EU policy priorities such as the EU Green Deal and the effort towards digitalisation on the process of integration of Central Europe?

45)

Statement			
Due to the ongoing COVID-19 pandemic, CE regions highly dependent on transnational tourism flows will experience the sharpest GDP decline: an increase in domestic tourism flows might not compensate the reduction in terms of transnational travellers.			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

46)

Statement			
Due to the ongoing COVID-19 pandemic, CE regions less dependent on international/interregional trade (and with bigger fiscal resources) will experience the smallest GDP decline			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

47)

Statement			
In the aftermath of the COVID-19 pandemic, the CE area will witness a bigger role of national governments in the economic life (e.g. more invasive taxation), but less international cooperation			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

48)

Statement			
In the aftermath of the COVID-19 pandemic, the CE area will witness a bigger role of cities in the economic life (e.g. increased concentration of GDP in highly urbanised areas).			
Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**

Please provide some evidence justifying your answer:

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