C Scientific report

1 Introduction

The necessity of an in-depth assessment of the territorial and regional effects of EU sectoral policies and directives had already entered the European policy debate during the preparation of the European Spatial Development Perspective (1995-1999). Given the inherently multi-dimensional nature of the possible, intentional and unintentional effects of the Union's policies, often going well beyond the single goals for which policies were built, the need for an integrated assessment came into full view. Furthermore, it was realized in that time that any integrated assessment should address multiple dimensions – the economic, the social, the environmental, the cultural – all of which represent distinct but interconnected aspects of what was increasingly considered as the 'territorial realm'.

Following up on this discussion, the Tampere Action Plan (1999), in which the construction of a Territorial Impact Assessment (TIA) methodology was taken on as a main task for the subsequent action of the Committee for Spatial Development, the mission of this methodological and operational work was assigned to the newly born ESPON 2006 programme.

In time, this mission became even more central in the EU policy debate. *The Third Report on Economic and Social Cohesion "A New Partnership for Cohesion*" (February 2004) introduced the general goal of "territorial cohesion", afterwards confirmed and institutionally strengthened through its inclusion among the main new goals of the Union in the Draft Constitution and the New Treaty. More recently, the *Territorial Agenda* of the Union (May 2007) and the First Action Programme (November 2007), as well as the *Green Paper on Territorial Cohesion* (October 2008), focussed explicitly on the issue of regional diversity, and emphasized the relevance of territorial and regional "uniqueness" for devising appropriate and diversified development strategies. These must be based on local specificities, knowledge and identity.

This last point is particularly relevant for the impact assessment debate: regional diversities imply in fact a different sensitivity to EU LPDs, justifying the increasing attention paid to this precise issue.

Very recently, the Commission itself produced a thorough and consistent document, taking a further step in the development and refinement of a growing tradition of impact studies of EU policies and directives (since 2002): the *Impact Assessment Guidelines* (January 2009) (SEC(2009)92). The general objectives of these guidelines are similar to the ones indicated by ESPON, namely:

- *"to ensure that Commission initiatives and EU legislation are prepared on the basis of transparent, comprehensive and balanced evidence"*,
- to prepare *"evidence for political decision makers on the advantages and disadvantages of possible policy options by assessing their potential impacts"* through ….. "*the likely economic, social and environmental impacts of those options"* (p. 4), both *"intentional"*, i.e. referring to the very objectives of the policies, and *"unintended"* (p. 31);
- to improve "*the quality of policy proposals by providing transparency on the benefits and costs of different policy alternatives"* (p. 6).

The impact assessment in this case refers to the Union in aggregate terms, but a reference is explicitly made to the case in which impacts would *"have a specific impact on certain regions"* or *"on single Member States"* (p. 33). The IA procedure is applied to all policy proposals of the Commission, which means that each year some 100+ Impact Assessments are completed.

In line with the goals of the EU *Impact Assessment Guidelines* ESPON ARTS aims to develop a tool allowing for analysis of the impact of EU legislation against the background of the different sensitivity of regions.

It is important to distinguish the EU legislation: First of all there is a difference between *legislation* and *policies*: in the latter case, support and spending are the key elements, while in the former case decisions take the form of legislative prescriptions. Within legislation, one can further distinguish between *regulations* and *directives*:

- The legislation refers to precise obligations that have to be implemented immediately and in the same way throughout Europe, generally bearing a limited differential territorial impact,
- The directives – represent a form of binding EU legislation aimed at Member States who are called upon to adopt consequent national legislation [12].

The analysis of regional sensitivity to EU directives and policies is to be intended as a simplified, evidence-based procedure of Territorial Impact Assessment (TIA). TIA is defined as "a tool for assessing the impact of spatial development against spatial policy objectives or prospects for an area", working at "any spatial scale" and

[12] Because directives have to be transposed into national legislation they receive an additional dimension, which may result in different impacts across Member States. This means that their final impacts are both predictable and unpredictable. Predictable in the sense that specified results, processes and products have to be delivered following directly from the directive. Unpredictable in the sense that several impacts relate to the transposition of a directive into national legislation and depend on national institutional contexts (see: Zonneveld, Waterhout, 2009).

therefore applicable to large projects, plans and programmes (Williams et al., 2000, ECTP/CSD 2001, Böhme & Eser, 2008).

As far as the impact assessment of EC policies is concerned, since many years the Commission has requested impact studies (CEC, 2002, 2004) on multiple directives, regulations and policy decisions. Generally these studies refer to an aggregate impact on the EU and no regional differentiation of effects is pursued; the different impacts are defined on the basis of accurate logical chains (from policy to impacts).

The ESPON methodology, as developed mainly in the TIPTAP project, was the first approach to implement a methodology for TIA allowing the description of regional differences. The TIPTAP project, is based on a well-established methodology, namely Multi Criteria Decision Analysis [13].

ESPON ARTS takes this experiences on board and tries to develop the methodological approach in line with the vulnerability concept according to the ICCP definition. Furthermore, it intends to come up with easily usable tools for policy makers as well as for practitioners.

2 Territorial Impact Assessment: the general approach

2.1 Main objectives of the research project

The main objectives of the ESPON ARTS project are the following:

(a) presenting a **new and fresh reflection on methodologies** for assessing territorial and regional sensitivity of EU legislation, policies and directives (LPD), on the basis of an accurate and critical evaluation of recent most advanced practices in Member Countries and present achievements inside the ESPON Program;

(b) building a **general common framework** in which assessments concerning single different LPDs could fit;

(c) applying the proposed framework to around **12 EU directives**, chosen in a wider array of recent ones and approved by the ESPON MC and CU;

(d) building a more **in depth assessment of 3 directives**, those in which a more thorough specification of specific territorial impacts will be apparent, specifying the results through tables and maps for European NUTS-2 and possibly NUTS-3 regions;

[13] A review of various types of multicriteria evaluation methods can be found among others in Rietveld, 1980; Nijkamp P., Rietveld P., Voogd H., 1990; Munda, 1995; Janssen and Munda, 1999.

(e) supplying policy makers with an **operational procedure** that could work as a **"evidence based policy support**" in the preparation of new legislation and directives;

The operational procedure should be as easy and simple as possible, indicating cases of excessive regional impact of LPD on some typology of regions or even cases of "outlier", disproportionate impact.

The EU stakeholders (the Commission, national, regional and local authorities) and the ESPON MC will be involved in a dialogue concerning both the methodology and the main results, in order to reach a wider consensus and to strengthen the validity of results.

2.2 Concept and definitions

In the Terms of Reference (ToR) for this project call, territorial and regional **sensitivity** to EU legislation is defined as *"the degree to which a territory (region) is directly and indirectly affected, either adversely or beneficially, by change in European legislation or policy".* It refers therefore to the probability (or risk) of being affected by EU directives, *"an important variable in Territorial Impact Analysis" (p. 172); to the "possible"* or *"potential"* impact of these directives.

This definition seems appropriate, and comes close to the "Potential Impact" (PIM) defined in the ESPON 2013/1/6 project. The PIM is directly and objectively linked to the main logical chain between cause (policy measure) and effect (territorial impact), without (or before) the inclusion of the Desirability and Vulnerability elements that appear more linked to subjective judgements (see the Final Report, October 2009).

The vulnerability concept

The terminology in the ToR in ESPON ARTS is rooted to the vulnerability concept developed by the IPCC[14] and broadly discussed in the impact assessments in natural sciences, especially concerning climate change. This approach allows to assess the impact of a policy by combining the exposure deriving from the effect of a policy measure and the territorial sensitivity (of regions).

However, the definitions between the ToR and the IPPC approach differ. In ESPON ARTS we will stick to the IPPC definitions in order to be able to communicate the TIA concept with this scientific community.

The concept of vulnerability consists of four core elements: exposure, sensitivity, potential impact and adaptive capacity:

- *"**exposure"*** describes the intensity by which EU directives and policies affect European regions ("regional exposure"), involving particular "fields" of the

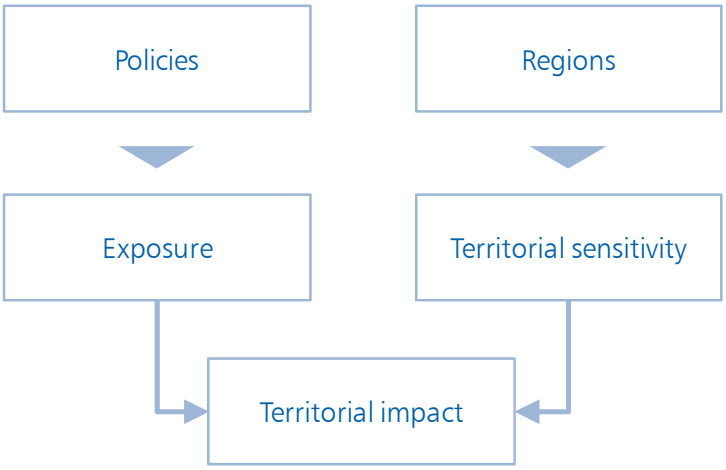
[14] Intergovernmental Panel on Climate Change

territorial realm, e.g. surface water quality, emissions, sectoral production ("field exposure");

- (territorial) ***"sensitivity"*** describes how single territories/regions are sensitive to, or evaluate, impacts in specific exposure fields, due to their socio-economic and geographical characteristics and to the social values and priorities they are likely to show;
- ***"territorial impact***" is the potential effect (in the future) of a given EU policy or directive as a consequence of field exposure, regional exposure and regional sensitivity. Basically the potential impact can be direct or indirect along specific cause-and-effect logical chains.
- The "**adaptive capacity"** is the ability of a system to adjust to the potential impact, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC, 2007). Thus, adaptive capacity is closely linked with governance aspects.

ESPON ARTS focuses on analysing the impact. In contrast to the IPPC-vulnerability concept it does not consider the (possible) adaptive capacity of a territory. However, as we also discuss governance issues in the projects, aspects of the adaptive capacity of territories are taken into account in a qualitative way.

Figure C 1: The territorial impact combining exposure with sensitivity



Looking at the effects to be analysed on the exposure-side in ESPON ARTS three distinct elements/processes are taken into account:

(a) **a *direct and intentional impact of EU directives***, which is proportional to the presence of the territorial assets involved in sectoral EU LPDs.

(b) ***an indirect and mainly unintentional or unexpected impact of the directives***, concerning positive or negative side effects.

(c) the ***response and adaptation capability*** of the regional context: the "filtered" impact. This element would in fact: reduce the effect of potentially negative impacts; emphasize/multiply the effect of potentially positive impacts.

The relevance of the last process is linked to main characteristics of the regional context:

(I) the *complexity and differentiation* of the socio-economic context,

(II) the *redundancy* of potential internal and external linkages,

(III) the local *governance structure*. In fact, *"domestic territorial characteristics and governance systems act as a filter and interface"* between EU directives and territorial actual impacts (Zonneveld, Waterhout, 2009). General results of the same EU intervention are likely to be highly differentiated among regions and territories according to territorial specificities and, particularly, of national/regional/local governance systems. Therefore we speak here about "filtered" impacts. In this case, both a theoretical and an empirical analysis will be carried out through case studies.

All the preceding tasks were carried out on a sample of 12) directives. From these, 3 cases were selected in a second time for more in-depth analysis.

3 The analytical approach

3.1 The selection process of the directives to be analysed

The relevance filter was developed as a tool to screen policies in order to attain a selection of 12 territorial relevant directives. This filter contains 3 steps:

(a) Eur-Lex Filter

The website of Eur-Lex (http://eur-lex.europa.eu/RECH_menu.do) contains all legal documents of the EU. A refinement of the search enquiry is the first filtering step towards the relevant directives:

- Excluding the words 'amending', 'adapting', 'correcting' from the **search terms**. Once the relevant directives are identified, it has to be checked, if there are any important amendments to these specific documents. (Search for: 'directive'; exclude: 'amending', 'adapting', 'correcting')
- Reducing the **time frame**: the coming into effect of the Treaty of Maastricht '93 is the starting point of the time frame (1993.01 – 2010.12)
- Singling out directives as the relevant **document type**, also found under the headline **legislation** (directives). At this step one should **restrict the search to acts in force**
- Using **classification headings** to search within topics (i.e. agriculture, environment…) that were assigned to specific partners. All together there are 20 categories.

(b) Title check

After the Eur-Lex filter, the number of directives decreases significantly. The next steps comprise reading through the titles of the directives and sort out those which

- do not cover the entire EU (directives targeting single states)
- have self evidently no territorial impact (i.e. statistics, marketing measures,…)
- Filter out substantively overlapping directives (e.g. choose only one on water, air, noise, safety, etc) best done by choosing the most recent one.

(c) Text check

This last step involves reading through the directives and assess if it has a potential effect on the territorial based economy of a region, the society and population as well as on the built and natural environment. It also includes rating these potential impacts into no-, low-, high- or unknown relevance. This rating of hypothetical intensity or importance of impact is based on expert judgment.

This quick scan is documented in an excel-sheet, which is decisive for the selection of 5 – 8 directives per partner.

Table C 1: Relevance filter process

Number of directives	Result of Eur-Lex filter	Result of title check	Result of text check – selection for potential analysis
4396 directives	1393 directives	149 directives	28 directives

The implementation of the relevance filter led to 28 directives to be considered for further analysis. Following a discussion with the CU an ensemble of 12 directives were chosen[15] and analysed in terms of their effect on regional exposure:

(1) Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances

(2) Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

(3) Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy

(4) Council Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise

[15] After consultation with the ESPON MC the Directive on the control of major-accident hazards was included due to its highly differentiated territorial impact. It was exchanged with the Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market. Since this directive focuses on the promotion of renewable energy, it is assumed to be similar in their regional territorial impact to the directives on the promotion of clean and energy-efficient road transport vehicles and on the promotion of the use of biofuels or other renewable fuels for transport.

(5) Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

(6) Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage

(7) Council Directive 2004/52 on the interoperability of electronic road toll systems in the Community

(8) Council Directive 2005/36/EC on the recognition of professional qualifications

(9) Council Directive 2008/114 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection

(10) Council Directive 2009/128/EC on the establishing a framework for Community action to achieve the sustainable use of pesticides

(11) Council Directives on the promotion of clean and energy-efficient road transport vehicles

(12) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

The examination of two directives (no 6: directive on the on environmental liability and no 7: directive on the interoperability of electronic road toll systems) showed that no regional differentiation was possible. For these two directive the conceptual model about their intervention logics was set up and the directive exposure matrix was completed, but no further regional differentiated analysis was conducted.

3.2 The conceptual model of a directive

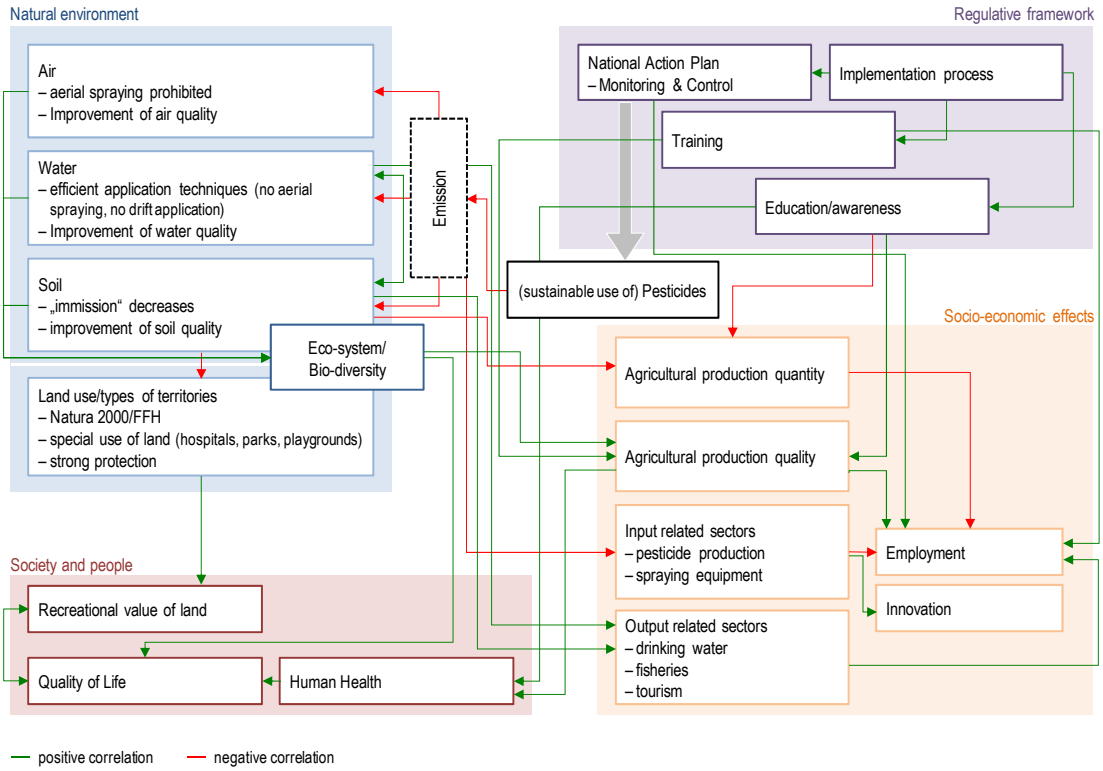
As a first step it is necessary to translate the text of a directive into cause effects relations describing the “intervention logic” of a directive. The cause-effect relations are to be reduced into logic representation schemes picturing the links between the effects deriving from the regulation laid down in the directive (“exposure” in the vulnerability concept) and the receptive capacity of a region (“sensitivity” in the vulnerability concept).

This conceptual model comprises the establishment of relations between all relevant model components and the drawing of systemic borders. The elements of the model are to be selected carefully so that they show a direct relation to the system reality (in our case the causes and effects of EU directives on territorial impacts) and therefore allow for traceability for the user of the model, taking also into account the data availability. It enables to picture cause-effect relations as well as positive and negative feed-back loops of a directive on the development of regions. In the case of EU Directives, model modules were identified as ‘Natural environment’, ‘Regional economy’, ‘Society and people’ and ‘Regulative framework’. Each of them contains several model components that were identified as part of system reality. Links

between the components were drawn, indicating indirect or direct negative and positive relations.

The following figure shows an example of such a conceptual model for the Directive establishing a framework for Community action to achieve the sustainable use of pesticides.

Figure C 2: Conceptual model of the directive 2009/128/EC Directive on the sustainable use of pesticides



3.3 The statistical and assessment tools

One of the goals of the project is to build a "KIS" operational methodology (as simple, comprehensible and user-friendly as possible) in order to define in quali/quantitative and comparative terms the sensitivity of European regions to EU directives. As all European regions have to be inspected and many directives considered, it is necessary to use a statistical and quantitative methodology, as it was done in previous ESPON exercises on Territorial Impact Assessment, namely in the Tequila Models.

Three definitions represent the conceptual pillars on which the quantitative methodology is built: exposure, sensitivity and territorial impact.

The starting point is given by three sets of elements.

(a) a common set of n exposure fields f, the same for all directives,
where f = 1…… f ….n

(b) a common set of m regions r (at NUTS 2 level in this project)
where r = 1 …..r..... m

(c) a common set of 12 EU Directives d,
where d = 1-12 (as agreed with the ESPON CU).

Given the fact that three dimensions are involved – exposure fields, regions and directives – the problem at hand looks statistically complex and has to be simplified without missing relevant information or trivializing the entire procedure [16].

The methodology resides in the construction and combination (multiplication) of **three indicators, organised respectively in three matrices**, which represent the three logical steps of the methodology itself (Figure C 3):

A – the Directive/Exposure Matrix, indicating the intensity of exposure of each field to each single directive,

B – the Regional Exposure Matrix, indicating the intensity of exposure of each region to each single directive,

C – the Regional Sensitivity Matrix, indicating the intensity by which each region is sensitive to impacts in each specific exposure field.

3.3.1 The Directive/Exposure Matrix

The Directive/Exposure Matrix – with two dimensions: n fields on rows and 12 directives on columns – presents the evaluation of the intensity by which each Directive acts on the different Exposure Fields. As said before, exposure fields relate to different dimensions of environment, economy, society and territory.

[16] For each directive, n Territorial Impacts on m regions have to be indicated and computed, namely 41 x 287 = 11.767. Multiplied by 12 directives this gives 141.204 potential territorial impacts. Of course, many impacts are nil, as some fields might not be touched by some directives or some regions might not be exposed to some directives. The TIMs may be organized logically into the Directives/Impact Cube (see Fig. 3.2).

Table C 2: List of exposure fields

Natural environment				
Soil	Water	Air	Climatic factors	Fauna/Flora/Habitat
erosion pollutants in soil share of artificial areas/soil sealing	water consumption pollutants in ground/surface water	pollutants in air	emissions of CO_2 heavy rain/flood hazard/occurrence of landslides	biodiversity conservation of natural heritage (landscape diversity) conservation of cultural heritage
Regional economy				
Economic development	Agriculture	Industry	Services	Tourism
economic growth innovation entrepreneurship market barriers	employment in primary sector % of arable area, permanent grass/-crop area	employment in secondary sector	employment in tertiary sector	overnight stays
Society and people				
Social disparities	Demography	Accessibility	Built environment	Governance
disposable income in PPS per capita equal income distribution employment rate	out-migration/brain drain/"shrinking" regions number of people exposed to noise accident rate in transport accident risk: industry/energy supply healthy life expectancy at birth	daily accessibility by air daily accessibility by waterways daily accessibility by road daily accessibility by rail renewable energy fossil fuel consumption	increase of urbanization relative to population growth mixed land use	efficiency of government/governance mechanisms duration or complexity of planning procedures participation rate societal transfers (e.g. tax added) transnational cooperation between member states

Intensity of exposure of these fields to directives is assessed by experts judgement, thorough the careful identification of the logical chains from EU decisions to territorial impact. The regional dimension is absent here.

The generic value of the indicator of intensity of exposure in each cell of the matrix is:

$_{d}EXP_{f}$ (intensity of exposure of field f to directive d)

In this project, the Exposure values are indicated by positive and negative scores, as follows:

1,5 = high positive exposure intensity
1 = low positive exposure intensity
0 = no exposure
- 1 = low negative exposure intensity

- 1,5 = high negative exposure intensity

The sign of impact scores is assigned looking at the likely direction of field indicators when exposed to a directive. In the Directive/Exposure Matrix, on each row indicating the different exposure fields, it is clearly indicated whether an increase in the indicator has to be considered a benefit or a cost [17].

A case that often presents itself – given the complexity of the single directives, the multiplicity of policy indications eventually encompassed, the multiplicity of the logical chains that each directive generates, from decision to impact – is the impossibility of treating in a single vector of the Directive/Exposure Matrix the potential effects of a Directive on the different exposure fields. In this case is necessary to devise a "*branching*" of the effects of the directive into two or more logical chains, and consequently impacts. In Fact, the effects of the directive on a single exposure field (e.g. air quality) could be different in the different branches of the logical chain, and impact differently on different classes of regions: for example, a directive supporting the production of electric engines for cars will improve the air quality in regions where the new cars will be adopted, but worsen air quality in regions where the new cars will be produced, due to increases in emissions from plants and transport involved.

In this case, the directive splitting in two branches is treated as two separate directives (Directive Xa and Xb) in both the Directive/Exposure Matrix and the following one, the Regional Exposure Matrix. Of course, at the end of the elaboration process, the results of the two branches are summed up term by term in a single Territorial Impact Matrix.

3.3.2 The Regional Exposure Matrix

The Regional Exposure Matrix – with two dimensions: m regions on rows and 12 directives on column – encompasses the exposure of single regions to each directive, i.e. the fact that EU directives may or not affect the single regions. In fact, a directive could touch only particular regions – e.g. coastal regions, peripheral regions, regions with presence of particular productions or facilities like nuclear power plants or else – and not being relevant for other regions. As a consequence, only regions directly hit by the directives are considered; indirect and side effects, both expected or generally unexpected, are supposed to take place only inside the regions directly affected and not to spill-over the regional borders.

In this project, this matrix is a dychotomic, NO/YES matrix (0/1). Two possible complexifications of the method could be envisaged, though:

- considering also interregional *spillover effects* (very difficult to model for the entire European territory), and

[17] This is particularly relevant as far as a "summative" territorial impact should be calculated, comparing the impacts on different fields.

- considering the *intensity of exposure* in the single regions. This second refinement is more easy to handle, and could be introduced in future projects in case a single Directive is in depth explored in its territorial impacts [18].

The generic value of the regional exposure matrix in each cell is:

$_d$REXP$_r$ (intensity of regional exposure of region r to directive d).

In this case, the exposure field dimension is absent. The matrix is filled (with 0/1 scores) according to the results of the logical chain inspection on the single directives: regions are classified in different categories, relevant for the single exposure potentials indicated in the logical chain description, according to the ESPON definitions: rural/urban, central/peripheral, coastal/mainland, advanced/lagging, high/low presence of sectors or specific productions considered by some directive, presence of protected natural areas, ...- The indicators and thresholds for considering a region exposed/non-exposed is given in the following section 3.4.

3.3.3 The Regional Sensitivity Matrix

The Regional Sensitivity Matrix – with two dimensions: m regions on rows and n exposure fields on columns – encompasses the general sensitivity of each region to single exposure fields (an element which was directly taken into consideration in the previous Tequila models), with no reference to any specific directive. This sensitivity depends on socio-economic and geographical characteristics of the single regions, their social values and the political priorities attached to the different policy fields. A region might be particularly sensitive to economic impacts (on GDP or employment levels), given its relative backwardness; another could be particularly sensitive to environmental impacts given the presence of very sensitive natural or mountain areas; a further region could be very sensitive to impacts on congestion given its present high level of traffic density and traffic jams. In this case, the directive dimension is not present.

The Regional Sensitivity matrix is built, for each exposure field, using relevant statistical indicators from a regional data base. In general, on the basis of experts judgement and data availability, a region is hypothesized to be more sensitive to "pressure" indicators in direct proportionality to the present pressure condition (e.g., in the field of emissions, air or water quality), and more sensitive to status conditions in inverse proportionality (e.g. in the field of GDP and employment). Details are given in the relative table in the following section 3.4.

The generic value of the regional sensitivity in each cell of the matrix is:

S$_{r,f}$ (intensity of sensitivity of region r concerning exposure field f).

[18] This refinement could be relevant in the case of directives hitting single sectors, where the intensity of regional exposure could be assumed proportional to the importance of the sector or sectoral *filière.*

Each term of the S matrix has the form of a correction coefficient, amplifying or reducing the potential impact of directives on each exposure field in each region (given by the multiplication of the previous two matrices, as it will be explained below). It was decided to allow a correction of ± 25% to potential impact: therefore the coefficients range from 0,75 to 1,25 in the entire array of regions and are proportional to the specific sensitivity indicators chosen for each exposure field.

In further research works, the sensitivity matrix could encompass the effect of the analysis on regional reaction or adjustment capability with respect to the potential effects of EU directives, taking into consideration the internal governance structure and performance in each region. In the present research project this last issue is only tackled in theoretical terms.

3.4 The Territorial Impact Matrices.

The **Territorial Impact Matrices** are built through empirical investigation and statistical elaborations on:

- the 12 chosen Directives,
- all European regions of EU 28 countries. The other countries of the ESPON space are not considered, due to data availability problems but mostly because their sensitivity to EU Directives that do not engage them directly bears a completely different meaning than for present Member Countries;
- the checklist of 41 Exposure Fields, defined for any directive on the basis of the Commission's suggestions in its *Impact Assessment Guidelines* (January 2009: SEC(2009)92) and other considerations concerning data availability and possibility of impacts definition.

The three matrices previously mentioned and duly elaborated, bring to the definition of the Territorial Impact of the Directives, represented in a series of Impact Matrices, one for each Directive, as shown in Figure C 3. The impact of directives is indicated as TIM (Territorial IMpact).

The elements of the three matrices presented in the previous section are multiplied by each other, term by term (not in the linear algebra way), and the general term obtained will be:

$$dTIM_{r,f} = dEXP_f \,.\, dREXP_r \,.\, S_{r,f} \qquad (1)$$

indicating the likely impact of directive d on the exposure field f in region r. Given the three dimensions encompassed (d,f,r: directives, impact fields and regions), the results are organised in a series of 12 matrices (one for each directive), each of them indicating likely impact on exposure fields (on columns) in all regions (on rows) for each directive. In a more compact geometrical presentation, the results are encompassed in a cube with regions, fields and directives on the three axes: the **Directives/Impact Cube** (Figure C 4).

The logics of the general model may be split in two parts, concerning the first multiplication and then the second one. The first multiplication refers to the application of the Directives/Exposure matrix to the case of each region, according to the fact that the region is exposed or not to the single directives. The result, that could be considered as a sort of "potential impact" (POTIM), is presented in a series of matrices, one for each directive:

$$dPOTIM_{r,f} = dEXP_{f} \,.\, dREXP_{r} \qquad (1a)$$

For each single directive, the POTIM matrix has a dimension mxn, with the m regions on rows and the n exposure fields on columns. There are 12 matrices of this kind. [19]

In a second step, the potential impact matrices POTIM (one for each directive) are multiplied by the same regional Sensitivity matrix, adding the further information concerning the relevance for the single regions of the single potential impact forecasted. The result is given by:

$$dTIM_{r,f} = dPOTIM_{r,f} \,.\, S_{r,f} \qquad (1b)$$

The final territorial impact TIM is encompassed in a matrix mxn (with regions on rows and impact fields on columns) indicating likely impact of one single directive on the different exposure fields in each region. There are 12 such matrices, one per Directive (see also the previous compound formula under 1).

As a consequence of the scores attributed in the first matrix (± 1,5, 1, 0) and in the third one (0,75-1,25), the final scores emerging in the TIM matrices are continuous scores ranging from – 1,875 to – 1,875. In maps, impacts are aggregated in three classes (plus the 0 class, indicating no exposure): "high, moderate and minor impact", the medium class merging cases with a high and low initial Directive/Exposure impact (1 and 1,5).

It is clear from what precedes that the three Matrices presented above are simple two-dimensional matrices (with two subscripts of their terms each), while the final result is represented by a series of matrices, one per directive (three subscripts); the mapping of results (TIM of directive X on exposure field Y) implies a map for each column Y of the matrix referring to directive X.

A further elaboration (a further column in a TIM matrix of a directive) concerns the possibility of calculating a "summative" impact of a directive on each region, considering together all impacts on the different fields. Two solutions exist in this case:

- the simplest solution: counting all fields in which the impact on the region was considered "high": is the solution utilised in the present project;

[19] Algebraically, for each single directive, the POTIMP matrix (mxn, with regions on rows and exposure fields on columns) is given by the linear multiplication of the column vector (mx1) directive/regions (one column of the second matrix, the Regional Exposure one) by the row vector (1xn) directive/exposure fields (one column of the first matrix, the Directives/Exposure one).

- the complex solution: computing a weighted multi-criteria impact index, in the same way as it was done in the ESPON Tequila Models. This solution implies the definition of a shared system of weights for the single impacts (through experts judgement, policy maker's priorities, etc.) and of some thresholds beyond which compensation among impacts is excluded (the FLAG methodology in the Tequila 2 model). This is something left to possible future extensions of the project.

The summative impact as realised in this project focuses on the need communicate the result of the TIM in an easily comprehensible way. It allows merging branched directives to show the directive's combined impacts, although the positive and negative summative impacts are kept apart.

The impact fields on which the directive has a high impact (± 1,2 and higher) are marked. The more impact fields per region are hit (meaning marked), the higher the summative positive respectively negative impact on the region. A map of a directive's summative impact (either positive or negative) depicts the intensity of impacts that can be deduced from the directive.

More detailed knowledge about which impact field led to what kind of impact in which region cannot be illustrated in these maps. To gather this kind of information it is necessary to consult the comprehensive Territorial Impact Matrix.

Figure C 3: Assessment process of regional sensitivity to EU Directives

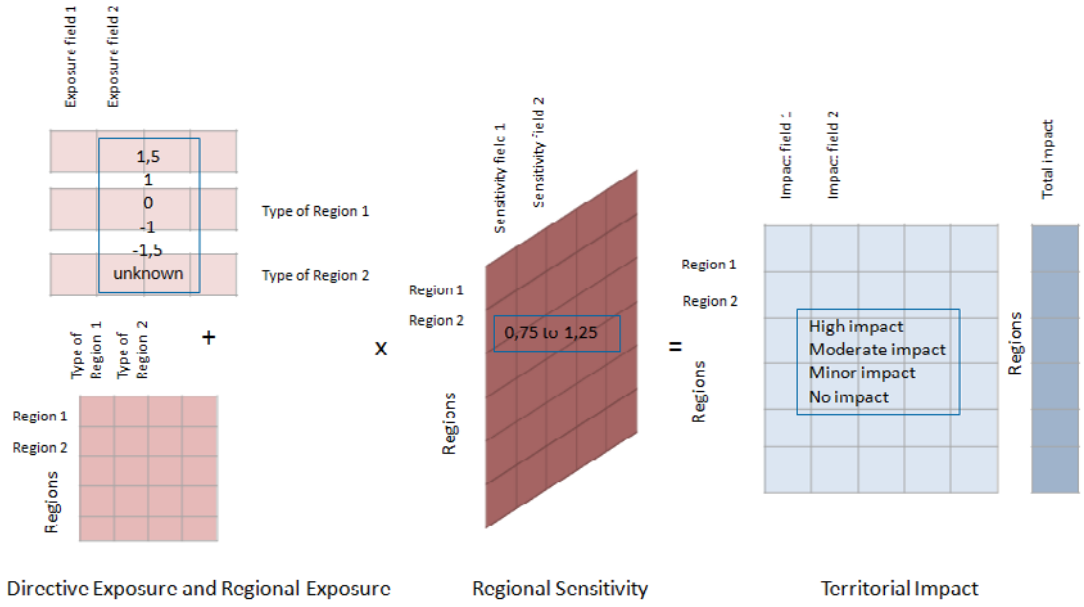
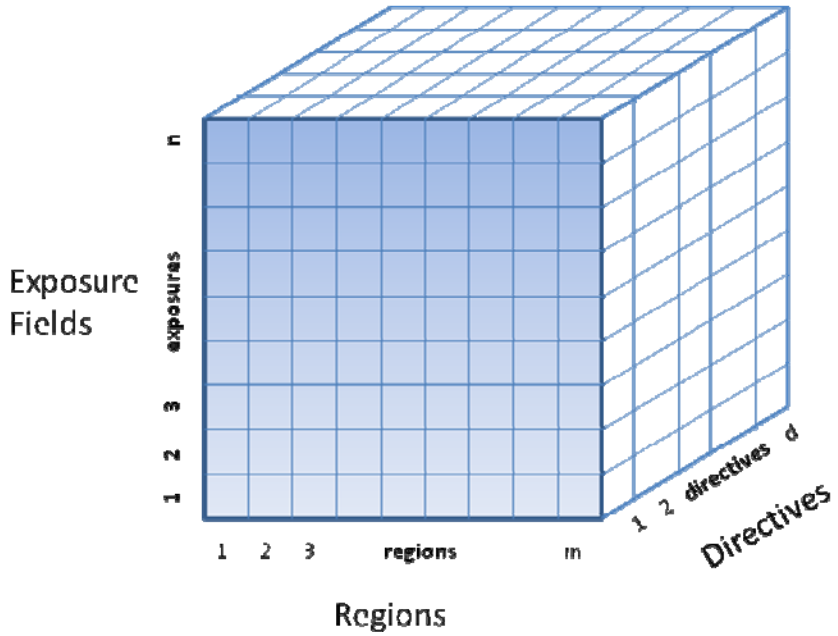


Figure C 4: The Directives/Impact Cube



3.5 Empirical definition of exposed regions and regional sensitivities

The empirical definition of the exposed regions (to each directive) and their sensitivity to each exposure field is accomplished via a simple statistical elaboration. In the first case, as explained before, regions are divided by classes and attributed to a 0/1 condition according to their belonging to some specific classes explicitly indicated in the analysis of the logical chain from directive to potential impact. In the second case, regional sensitivities to field exposure are computed working on continuous regional data sets encompassing the relevant indicators chosen for each field.

The TPG undertook a rather extensive data collection exercise to build up the Regional Exposure Matrix (REM) and the Regional Sensitivity Matrix (RSM). The tables below summarize the main data collected, their source and the indicators computed to fill in these matrices.

Table C 3 below refers to REM and shows for each (sub-)directive (column 1) the types of regions considered as exposed (column 2), the operationalization of these definitions in specific indicators and their measurement (column 3) and the sources of the data used to implement such definitions (column 4). All indicators are coded as dummy variables, taking value 1 if a region meets the relevant definition and 0 otherwise.

In section 4, the rationale behind this classification of exposed regions will be clarified in relation to each specific (sub-directive).

Table C 3: Regional Exposure: Definition of exposed regions, measurement and related data sources

Directive	Exposed regions	Indicator and measurement	Source
1	Urban	Regions classified as URBAN according to ESPON typology	ESPON DB
1	Agglomerated	Regions classified as AGGLOMERATED according to ESPON typology	ESPON DB
2	All regions		
3	Areas at highest technological/environmental risk	Regions falling in the top P10 of technological and/or environmental risk distribution	ESPON DB
4	Urban	Regions classified as URBAN according to ESPON typology	ESPON DB
4	Agglomerated	Regions classified as AGGLOMERATED according to ESPON typology	ESPON DB
4	Densely populated	Regions falling in the top P10 of population density distribution	ESPON DB
4	High density of road	Regions falling in the top P25 of density distribution of km of road on usable land	ESPON DB
4	High density of rail	Regions falling in the top P25 of density distribution of km of rail on usable land	ESPON DB
4	Major airport location	Regions endowed with airport with more than 500000 passengers per year	ESPON DB
5a	Rural	Regions classified as RURAL according to ESPON typology	ESPON DB
5a	Unprofitable farming	Regions falling in the bottom P10 of the average farm size distribution	DG Agriculture – Rural Development Report
5a	Natural areas	Regions with a share of natural areas above EU average	DG Agriculture – Rural Development Report
5a	Forest	Regions with a share of forest areas above EU average	DG Agriculture – Rural Development Report
5b	Harbour regions	Regions with portual areas	ESPON DB
6	Industrial regions	Regions with GVA in manufacturing above EU average	EUROSTAT
7	Highest density of high speed/highways	Regions falling in the top P10 of density distribution of km of road and rail on usable land	ESPON DB
8a	Wealthy regions	Regions with GPD per capita in PPS 50% above EU average	ESPON DB
8a	Urban	Regions classified as URBAN according to ESPON typology	ESPON DB
8a	Agglomerated	Regions classified as AGGLOMERATED according to ESPON typology	ESPON DB
8b	Shrinking regions	Regions with population loss due to migration and/or death	German Federal Institute for Research on Building, Urban Affairs and Spatial Development
9	Highest density of rail and road network	Regions falling in the top P10 of density distribution of km of road and rail on usable land	ESPON DB

Direc-tive	Exposed regions	Indicator and measurement	Source
9	Areas at highest technological/environmental risk	Regions falling in the top P10 of technological and environmental risk distribution	ESPON DB
10a	Rural	Regions classified as RURAL according to ESPON typology	ESPON DB
10b	Chemical industries	Regions with a number of chemical plants above EU average	ESPON DB
11a	Agglomerated	Regions classified as AGGLOMERATED according to ESPON typology	ESPON DB
11b	Highest share of employment in automotive	Regions falling in the top P25 of density distribution of the share of employment in automotive	EUROSTAT
12	Urban	Regions classified as URBAN according to ESPON typology	ESPON DB
12	Agglomerated	Regions classified as AGGLOMERATED according to ESPON typology	ESPON DB

Similarly, Table C 4 below refers to Regional Sensitivity and shows for each of the 41 Exposure fields (column 1 to 3), the indicator and related definition proposed (column 4) and the sources of the data used to implement such definitions (column 5). All indicators have been normalized according to a linear transformation, setting the minimum observed value of the indicator at 0,75 and the maximum observed value at 1,25.

Below, for each exposure field, we present a few lines explaining its rationale and direction of impact.

Natural environment

F1 – erosion: regions showing a greater share of areas at risk of soil erosion are expected to be more sensitive to directives whose implementation has some impact on its reduction. Sensitivity is thus directly proportional to the share of areas at risk of soil erosion.

F2 and F5- pollutants in soil: regions showing a higher density of land use are expected to be more sensitive to directives aimed at a reduction of soil and water pollution. Higher density of land use is here as a proxy of the ratio between population plus employment divide by usable land. Sensitivity is thus directly proportional to the density of land use.

F3 – share of artificial areas/soil sealing: regions showing a greater share of artificial areas are expected to be more sensitive to directives aimed at a reduction of soil sealing. Sensitivity is thus directly proportional to the share of artificial areas.

F4 – water consumption: regions having a greater share of inland water may experience lower constraints of water consumption. Sensitivity is thus inversely proportional to the share of inland water areas.

F6 – pollutants in air: regions showing greater concentration of particular matter (PM10) on surface are expected to benefit more from directives aimed at its reduction. Sensitivity is thus directly proportional to PM10 concentration.

F7 – emissions of CO_2: emissions of CO_2 is largely dependent on vehicles emissions (which in turn increase with population density). Regions showing greater density of vehicles fleet on population are expected to be more sensitive to directives aimed at reducing CO_2 emissions. Here, we proxy vehicles emissions as by the average of the number of vehicles per 1000 inhabitants and population density. Sensitivity is thus directly proportional to this indicator.

F8 – heavy rain/flood hazard/occurrence of landslides: regions showing a greater risk of flood hazard are expected to be more sensitive and benefit more from directives aimed to a reduction of this risk. Due to data availability, we focus on flood hazard only. Sensitivity is thus directly proportional to the risk of flood hazard.

F9 – biodiversity: regions showing greater area of protected biodiversity (such as areas in Natura2000 network) are expected to be more sensitive to directives having some impact on biodiversity conservation. Sensitivity is thus proportional to the share of areas protected under the Natura 2000 program.

F10 – conservation of natural heritage (landscape diversity): regions showing larger natural areas surfaces are expected to be more sensitive to directives having some impact landscape diversity. Sensitivity is thus proportional to the share of natural areas.

F11 – conservation of cultural heritage: similarly, regions hosting a larger number of artistically and historically valuable monuments (as documented by 3 stars in the Italian Touring Club (TCI) guidebooks) are expected to be more sensitive to directives aimed at cultural heritage conservation. Sensitivity is thus proportional to the number of sites showing 3 stars in the TCI guidebooks.

Regional economy

F12 – economic growth: regions with lower GDP per capita are expected to benefit more from directives aimed at GDP growth increase. Sensitivity is thus inversely proportional to the level of GDP per capita.

F13 –innovation: all regions are equally sensitive to actions aimed at innovation promotion, since innovation is crucial both for keeping competitiveness as well as to catch up. Sensitivity is thus set at 1.

F14 – entrepreneurship (share of private enterprises): entrepreneurship is here captured as the share of self-employed on total employment. Regions showing lower level of self-employment are expected to benefit more from actions aiming at its promotion. Sensitivity is thus inversely proportional to the share of self employment.

F15 – market barriers: all regions benefit from greater competition in terms of lower prices and better quality products and services on the market. Sensitivity is thus set at 1.

F16 – employment of primary sector : regions showing a higher GDP per capita may be more sensitive to an increase of the level of employment in the primary sector because of likely saturation of job opportunities in the other sectors and an increasing demand of agricultural related product (better quality agri-food, agri-tourism etc.). Sensitivity is thus expected to be directly proportional to GDP per capita.

F17 – share of arable area, permanent grass area, permanent crops area: regions showing a greater share of share agricultural areas are likely to be more sensitive to directives with some impact on this field. Sensitivity is thus directly proportional to the share of agricultural areas.

F18 and F19 – employment in the secondary sector and in tertiary sector: all regions may equally benefit from an increase in the level of employment whatever the sector of employment. Sensitivity is thus set at 1 for both exposure fields.

F20 -overnight stays: regions showing lower tourism influx (here proxied as the total number of nights spent in accommodations on total population) may benefit more from an increase in tourism as compared to regions already congested by tourism. Sensitivity is thus inversely proportional to the total number of nights on population.

Society and people

F21 – disposable income in PPS/capita: regions with lower disposable income per capita (in PPS) are expected to benefit more from directives aimed at disposable income increase. Sensitivity is thus inversely proportional to the level of disposable income per capita in PPS.

F22 – (equal) income distribution: regions affected by greater income distribution disparities are likely also to experience greater poverty. Sensitivity is thus set as directly proportional to the poverty index developed in the 5th Cohesion Report.

F23 – employment rate: regions experiencing lower employment levels (i.e. higher unemployment rates) are likely to benefit more from a reduction of unemployment. Sensitivity is thus directly proportional to the unemployment rate.

F24 – out-migration/brain drain/"shrinking" of regions: regions already experiencing higher brain drain will benefit more from actions aimed at its reduction. Sensitivity is thus inversely proportional to the net migration balance (i.e. immigration minus outmigration on total population).

F25 – number of people exposed to noise: exposure to noise is largely an urban phenomenon. Regions with a higher share of population living in urban areas are likely to benefit more from actions aimed at noise reduction. Sensitivity is thus proportional to the share of population living in urban areas.

F26 – accident rate in transport: regions already experiencing high rates of accidents in transport (here proxied as road fatalities per million inhabitants) are expected to benefit more from actions aimed at fatalities prevention. Sensitivity is thus directly proportional to road fatalities.

F27 – accident risk (industry/energy supply): regions experiencing greater technological and/or environmental risk are expected to benefit more from measures aimed at its reduction. Sensitivity is thus proportional to this indicator.

F28 – healthy life expectancy at birth: regions in which life expectancy is lower are likely to benefit more from policy measures aimed at its increase. Sensitivity is thus inversely proportional to life expectancy at birth.

F29 – daily accessibility by air: this is proxied by potential accessibility by air. Regions with lower potential accessibily will benefit more from its increase. Sensitivity is thus inversely proportional to accessibility by air.

F30 – accessibility by waterways: accessibility by water is rather a matter of regional exposure (e.g. being a region coastal or endowed with a large share of inland water) than regional sensitivity. Sensitivity is thus set at 1.

F31 – daily accessibility by road: this is proxied by potential accessibility by road. Regions with lower potential accessibily will benefit more from its increase. Sensitivity is thus inversely proportional to accessibility by road.

F32 – daily accessibility by rail: this is proxied by potential accessibility by rail. Regions with lower potential accessibily will benefit more from its increase. Sensitivity is thus inversely proportional to accessibility by rail.

F33 – renewable energy: regions with limited access to renewable energies are more dependent on fossil fuel consumption and will benefit more from measures aimed at reducing this dependency, which we proxy as by the indicator of vulnerability to climate change developed in the 5th Cohesion Report. Sensitivity is thus proportional to this indicator.

F34 – fossil fuel consumption: regions highly dependent on fossil fuel consumption will benefit more from measures aimed at reducing this dependency, which we proxy as by the indicator of vulnerability to climate change developed in the 5th Cohesion Report. Sensitivity is thus proportional to this indicator.

F35 – increase of urbanization relative to population growth: this is measured as share of discontinuous urban fabric areas. Regions showing greater shares are expected to benefit more from policy measures aimed at its reduction. Sensitivity is thus proportional to share of discontinuous urban fabric areas.

F36 – mixed land use: all regions are expected to be equally sensitive to this field. Sensitivity is thus set at 1.

F37 – efficiency of government/governance mechanisms (efficiency/effectiveness of public administration): all regions are expected to be equally sensitive to this field. Sensitivity is thus set at 1.

F38 – duration or complexity of planning procedures (introduction of new administrative tasks/mechanisms/units/structure): all regions are expected to be equally sensitive to this field. Sensitivity is thus set at 1.

F39 – participation rate: all regions are expected to be equally sensitive to this field. Sensitivity is thus set at 1.

F40 – societal transfers (e.g. tax added) : all regions are expected to be equally sensitive to this field. Sensitivity is thus set at 1.

F41 – transnational cooperation between member states: whereas all regions may equally benefit by increases in transnational cooperation, cross border regions are more likely to be actually involved and interested in such agreements. Sensitivity is thus set at 1 for all no cross-border regions and at 1, 25 for border regions.

The geographical level of analysis is NUTS2 and accordingly all data and indicators have been computed at this scale.

Data in many cases cover the ESPON case (EU27+NO, CH, IS, LI). However, European directives have to be implemented only in MS and consequently effects in non MS may be only indirect via spillovers, which at the present stage are not modeled in our assessment exercise. Also, data coverage is less complete than for MS, especially for data coming from EUROSTAT, CLC and the 5th Cohesion Report.

Data coverage on TR, MK, HR is highly incomplete. Additionally, the reasoning presented above for NO, CH, IS+LI holds also for these countries. Therefore, it was decided not to include them in the analysis. As to Western Balkans countries data unavailability prevents any inclusion in the assessment exercise.

Lastly, it is worth mentioning that some data were available at NUTS3 level only (namely, the indicator on technological/environmental risk, the indicator on road and rail network, the indicator on airport traffic, the indicator of concentration of PM10, and the indicator on the migratory balance). Data have been next aggregated at NUTS2 level accordingly.

Table C 4: Regional Sensitivity: Definition of indicators, measurement and related data sources

Natural environment	**Soil**	**erosion**	**% areas at risk of soil erosion**	**CLC**
		pollutants in soil	(pop+empl)/usable land	ESPON
		share of artificial areas/soil sealing	% artificial area	CLC
	Water	water consumption	% inland water	ESPON on CLC
		pollutants in ground/surface water	(pop+empl)/usable land	ESPON
	Air	pollutants in air	concentration of PM10	5th Cohesion Report
	Climatic factors	emissions of CO_2	((vehicles per 1000 inhab)+(dens pop))/2	EUROSTAT+ESPON
		heavy rain/flood hazard/occurrence of landslides	risk of flood hazard	ESPON
	Fauna/Flora/Habitat	biodiversity	areas in Natura2000	University of Natural Resources and Life Sciences, Vienna
	Landscape and cultural heritage	conservation of natural heritage (landscape diversity)	% natural areas	DG Agriculture – Rural Development Report
		conservation of cultural heritage	n° of TCI 3-stars	ESPON ATTREG Project

Regional economy	**Soil**	**erosion**	**% areas at risk of soil erosion**	**CLC**
	Economic development	economic growth (GDP/capita)	GDP per capita	ESPON
		innovation	1	
		entrepreneurship	% self employment	EUROSTAT
		market barriers	1	
	Agriculture	employment in primary sector	GDP per capita	ESPON
		% of arable area, permanent grass area, permanent crops area	% agricultural areas	ESPON on CLC
	Industry	employment in secondary sector	1	
	Services	employment in tertiary sector	1	
	Tourism	overnight stays	nights on population	EUROSTAT+ESPON
Society and people	Social disparities	disposable income in PPS per capita	disposable income per capita	ESPON
		equal income distribution	poverty index	5th Cohesion Report
		employment rate	unemployment rate	5th Cohesion Report
	Demography	out-migration/brain drain/"shrinking regions"	net migration balance	5th Cohesion Report
	Health	number of people exposed to noise	% population in urban areas	CLC
		accident rate in transport	road fatalities	5th Cohesion Report
		accident risk: industry/energy supply	technological &/or environmental risk	ESPON
		healthy life expectancy at birth	life expectancy at birth	EUROSTAT
	Accessibility	daily accessibility by air	potential accessibility by air	ESPON Data Base
		daily accessibility by waterways	1	
		daily accessibility by road	potential accessibility by road	ESPON Data Base
		daily accessibility by rail	potential accessibility by rail	ESPON Data Base
		renewable energy	vulnerability to climate change	5th Cohesion Report
		fossil fuel consumption	vulnerability to climate change	5th Cohesion Report
	Built environment	increase of urbanization relative to population growth	% discontinuous urban fabric	ESPON on CLC
		mixed land use	1	
	Governance	efficiency of government/governance mechanisms	1	
		duration or complexity of planning procedures	1	
		participation rate	1	
		societal transfers (e.g. tax added)	1	
		transnational cooperation between member states	1	

4 Detailed results of the Case Study Directives

4.1 Directive relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

This directive is one of the daughters of the 1996 Air Quality Framework directive. It provides for the measurement of air quality and designates an air quality standard that applies universally. This standard is especially exceeded in urban areas, which is exactly where most people live.

Logical chain and exposure

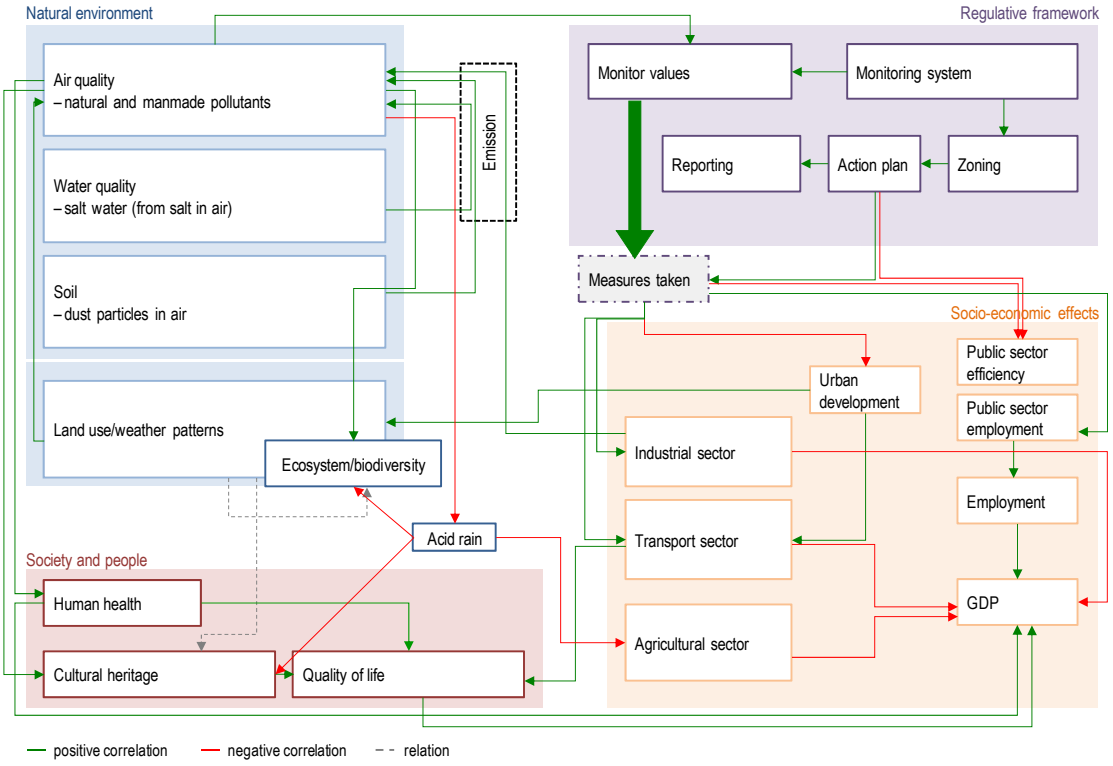
This directive does not specify policy options. Member states are free to decide for themselves which measures to take to improve air quality in areas not meeting the standards. In practice, a wide range of possibilities of measures can be taken, each of which can form its own 'branch'. These include redirecting traffic, traffic reduction, urban design measures (planting trees, building walls, tunnels, etc.). It can also include prohibiting all new spatial developments in areas which exceed cut-off values in order not to generate extra traffic in these areas (thus exacerbating the problem) and prevent more people from being exposed to poor air quality. Other measures can be directed towards reducing emissions by industry or agricultural facilities (Tennekes and Hornis 2007, VROM-Council, 2008).

In a first round of analysis two 'branches' were considered: traffic measures in cities (adapting strategy) and measures to reduce emissions for polluting industries (targeting the source). The first was assumed to impact urban areas with high levels of traffic and high-volume motorways. The second branch could also affect industrial plants built away from urban areas, due to the pollution they generate. The potential impacts of the second branch was, in addition to the positive impacts brought about by reduced air pollution, negative impacts on economic production (due to increased costs of industry), but positive impacts on innovation, as this would force industry to become more environmentally friendly.

Because this directive was not selected for an in-depth analysis, only the most probable situation was taken into account in the final analysis: traffic measures in urban areas. The assumption of the analysis is that these measures are successful in reducing traffic in non-compliance areas, and hence in reducing emissions of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. Indirect effects are perceptible in the environment due to less contamination of soil and water and reduction of acid rain (which also harms historic buildings – and hence cultural heritage – and natural habitats of species and agricultural crops). Traffic reduction measures are also seen as potentially improving

urban quality of life, but on the other hand, will involve more planning effort and provide additional complexity and challenges when planning projects in urban areas. This can have a negative impact on public sector efficiency.

Figure C 5: Logical chain of the directive



The regions affected by the directive

All areas will be affected by the directive in so far that all areas have to measure air quality. However, only in areas where the thresholds have been exceeded will experience impacts caused by nationally or locally implemented 'measures' stemming from this directive. The regions selected in the exposure matrix were restricted to urban and agglomerated areas, due to the decision not to branch the directive. A map depicting regions affected can be found in A5.

The Territorial impact of the directive

The main impact of the Directive is expected to be on the **natural environment**, and specifically on air quality (F6), the objective of the directive. From the model results, we see especially high impacts in cities such as Bucharest (RO), Slaskie (PL), Brussels and Közép-Magyarország (H). More indirect effects expected on the environment include **pollutants in ground and water** (F2 and F5). Since measures to reduce air pollution by vehicles generally result in less emissions in general, we also assume that **CO_2** will be reduced (F7) in addition. Due to the reduction of acid rain caused by pollutants, this directive is also seen as positively affecting the

protection of historical buildings and hence **cultural heritage** (F11). We see high values of this variable in Tuscany.

Impacts on the **regional economy** are generally seen as negative, due to the efforts and investments required to implement the directive. The impact on **economic growth** (F12) is most significant in areas where the regional sensitivity is highest, namely the poorer regions (see Map C 1). The top five most affected regions are all in Romania and Bulgaria. There is some slight positive impact on **services** (F20) due to the need for setting up measurement systems, drafting air quality plans in non-compliance zones and consultants.

The impact on **society and people** mainly regards the health benefits generated by breathing cleaner air. This is expected to contribute positively to **healthy life expectancy** (F28). Partly due to the regional sensitivity, the regions which show the highest impact are Latvia, Estonia, Észak-Magyarország (H), Sud-Est (RO) and both Ciudad Autónoma de Ceuta and Melilla (ES).

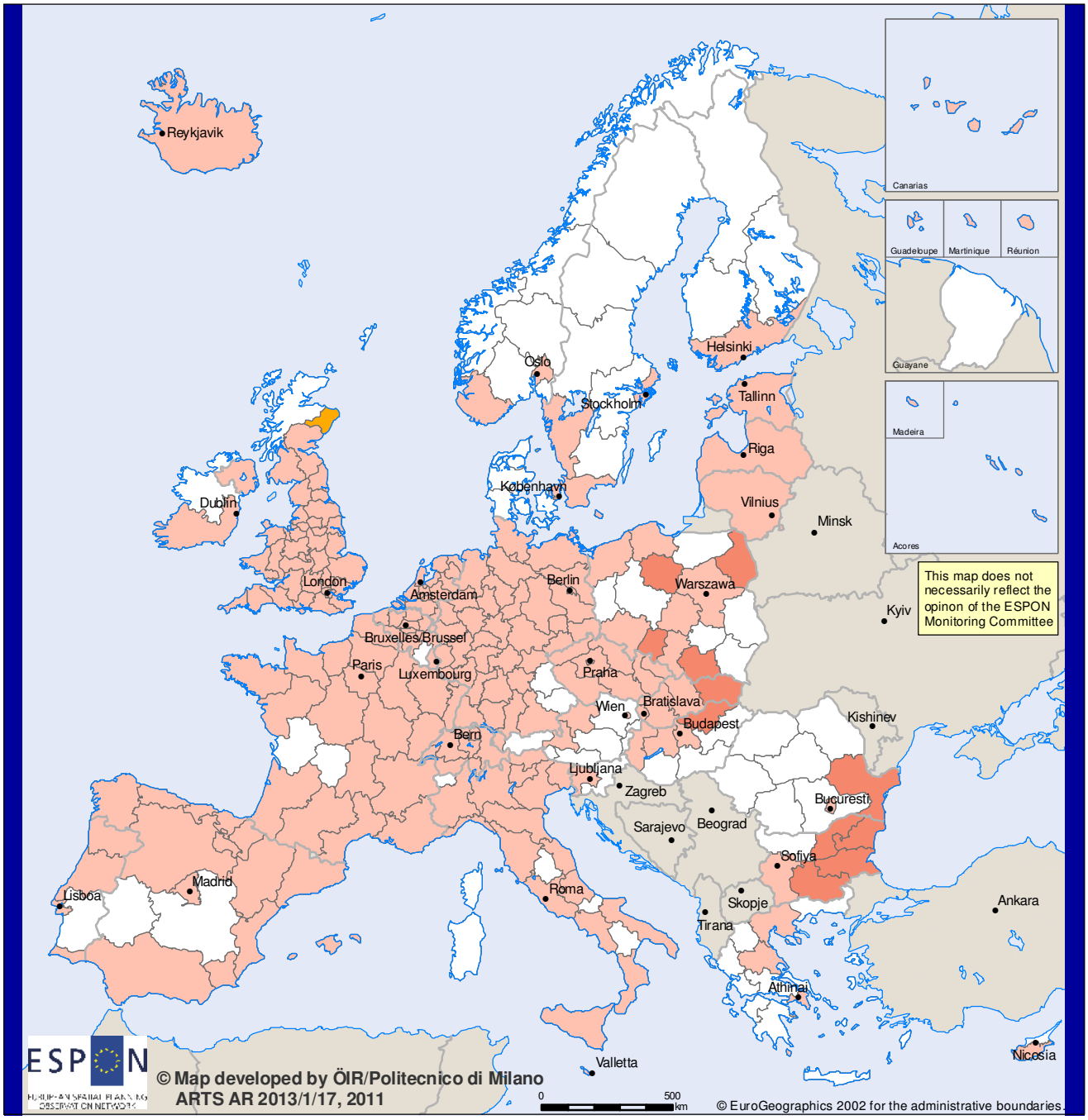
Finally, the air quality directive is not expected to have a major impact on accessibility in general. An indirect negative effect on **road accessibility** (F31) is expected from measures which reroute traffic or attempt to reduce the amount of vehicles travelling in polluted areas. Regions where this factor is expected to have the greatest impact includes, Canarias (ES), Ciudad Autónoma de Melilla (ES), Malta, Cyprus and Iceland.

Map C 1: Territorial Impact of Directive 1 on economic growth (GDP/capita)

Map C 2: Summative positive impact of Seweso Directive

[following pages]

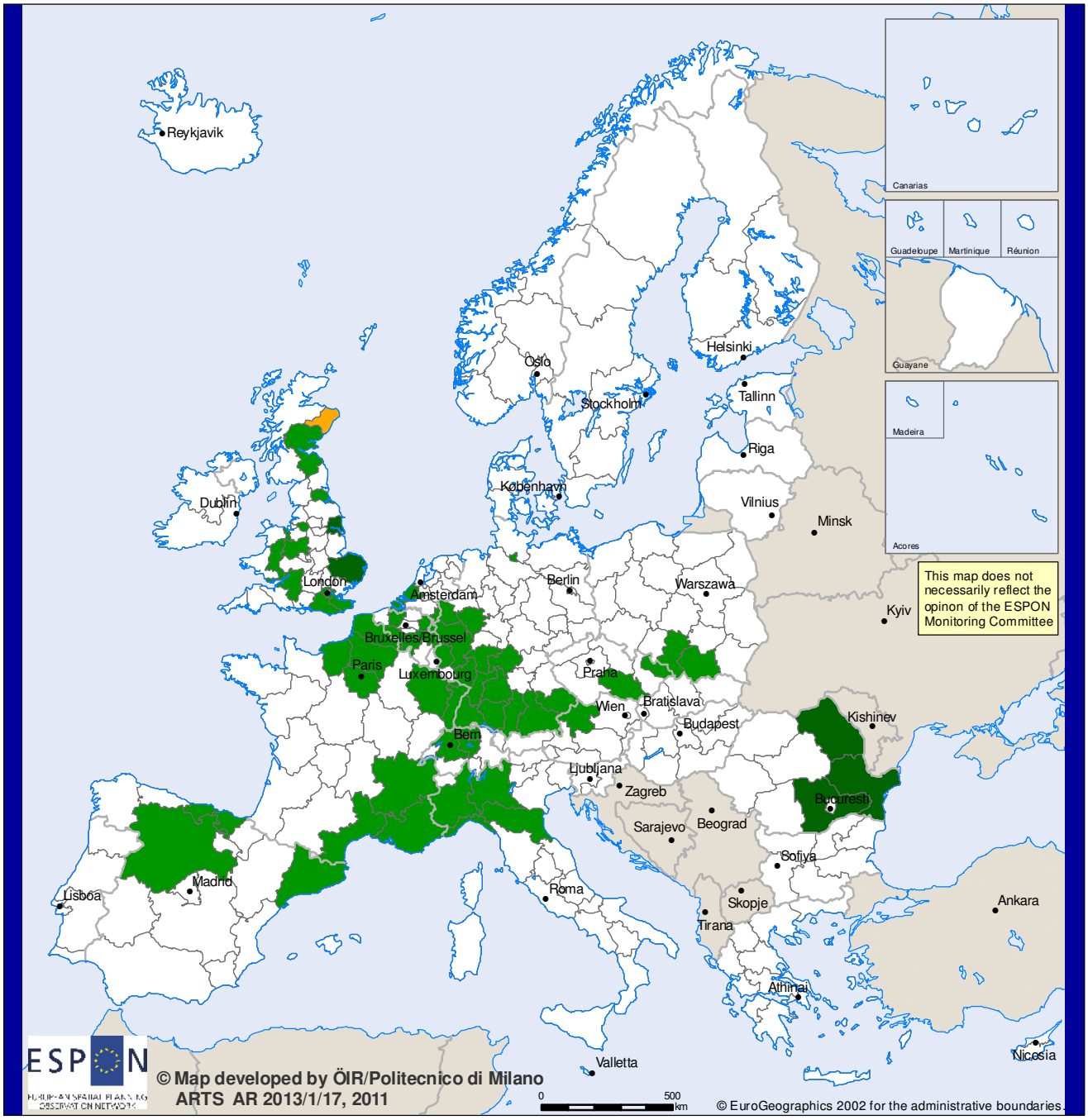
ESPON ARTS



Territorial Impact of Directive 1 on economic growth (GDP/capita)

Negative Impact	Positive Impact	
Very high impact	Minor impact	No Data
High impact	Moderate impact	Neighbourhood Countries
Moderate impact	High impact	
Minor impact	Very high impact	
Not affected		

Types of regions affected: urban, agglomerated, industrial regions



Summative positive impact of Seweso Directive

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: areas at highest technological/environmental risk

4.2 Directive establishing a framework for Community action in the field of water policy

The Water Framework Directive (WFD) concerns a comprehensive package of regulations on water. It applies to all types of inland water, including ground, transitional (i.e. from sweet to salt) and coastal waters. It therewith covers the entire water system, from spring to sea and from sweet to salt and provides a uniform regulatory framework for the management and protection of water across the European Union.

Logical chain and exposure

Its main aim is to secure good water quality. The focus is on chemical, system, nutrients and ecological quality indicators. The background is that water is a vital resource for both humans and nature. The aims and objectives of the WFD overlap greatly with existing EU (and domestic) policies, such as Natura 2000, Swimming water directive and the Nitrate directive.

In order to reach the overall aim, the WFD focuses on a number of indicators: chemical quality (priority hazardous substances), nutrients (phosphorous, nitrogen), ecological/aquatic quality (plants, algae, micro and macro fauna, and fishes) and the condition and morphology of water system. Groundwater levels and quality influence amongst others ecological quality of surface water bodies. The WFD has high ambitions too for the marine water environment and aims at the complete elimination of priority hazardous substances.

To achieve these goals member states are required to develop water management plans at a water (river) basin level, by 2009. These plans outline the measures and instruments taken in order to achieve the objectives. A good ecological and chemical water quality should be achieved by 2015 or at maximum by 2027 in case of technological constraints or excessive costs. There is a possibility for exception subject to convincing argumentation. In so doing a reasonable balance is to be achieved between water quality objectives and costs.

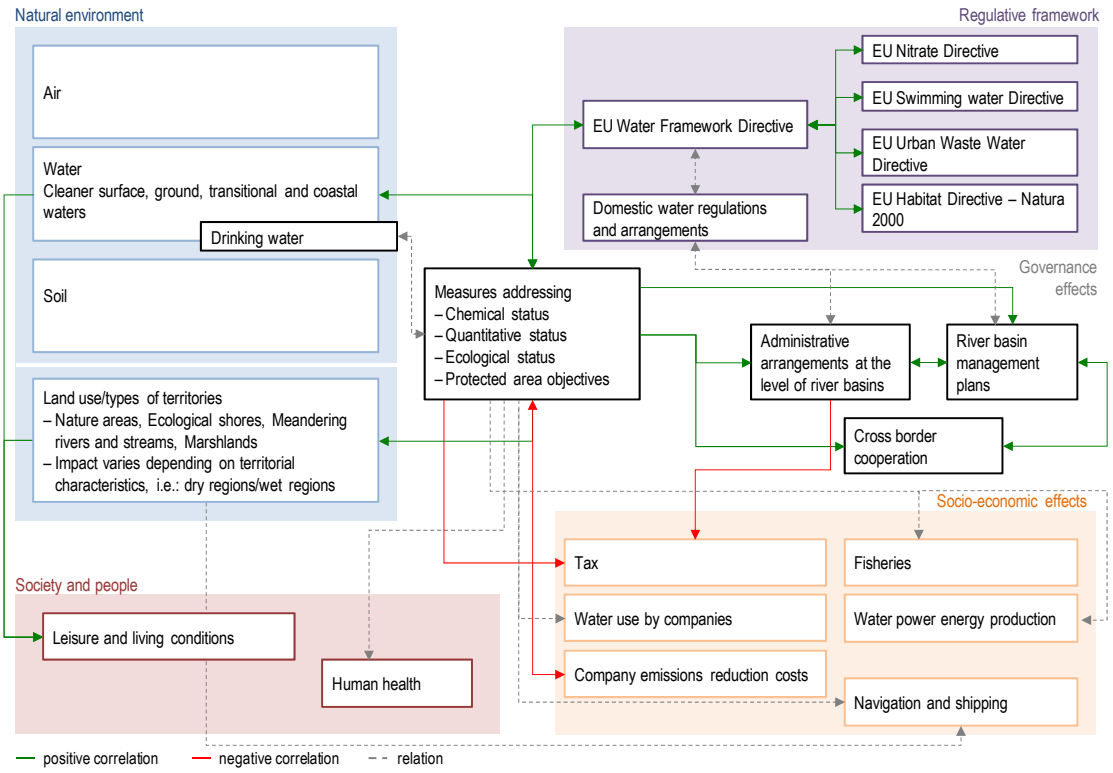
Plan development at river basin level requires coordination between national and regional level as well as cross border. Also the WFD requires the participation of stakeholders in setting objectives and plan development.

The WFD has significant territorial impact. The WFD applies to the complete water system in Europe which means that all regions in Europe will be affected to some extent. It means that in all areas where water quality does meet the thresholds additional measures are to be taken. Measures range from filtering, end-of-pipe solutions, ecological improvement, restoring traditional morphology to, finally, change or restrictions on certain types of land use, for example agriculture (F16/F17). The overall territorial impact should in particular benefit environmental aspects, such as a reduction of pollutants in ground and surface water (F5), biodiversity (F9), reduction

of flood hazards (F8) and conservation of natural heritage (F10). What is not clear is the whether the WFD will have consequences for shipping purposes, the production of hydro energy and inland fishing industry.

Due to the requirement of developing management plans at the level of water basins the WFD requires a redefining of the EU territory in terms of functional boundaries that follow the water system. This means that in regions where there already was a governance system for water management this system may need to attune to the logic of water basins, if it not did so already. Regions that do not have a water management governance system will need to install such a system. Since regional jurisdictions do not always neatly overlap with functional water basin boundaries, regions may be forced to co-operate with each other and develop joint water management plans. Where water basins cross national borders regions need to start to co-operate with regions in neighboring countries that make part of the same water basin. In the case of large rivers that flow through various countries this means that multinational co-ordination bodies need to be established. Changes upstream have impact on downstream regions. This is in particular apparent in the context of high rise water and flooding (subject to a WFD daughter directive on water flooding), but also with regard to pollution. An infamous case was the accident in the Sandoz Chemical plant, Basel, in 1986 that caused a massive chemical pollution of the Rhine. Significant impacts are to be expected in the fields of efficient governance system (F37), complexity of planning procedures (F38) and cross-border cooperation (F41)

Figure C 6: Logical chain of the directive



The regions affected by the directive

Given the objectives relating to chemical and ecological water quality it is possible to become more specific about regions that will be affected relatively more thoroughly than others due to specific territorial characteristics and land uses. This concerns regions where the water quality is relatively bad or under pressure due to intensive and/or polluting territorial functions. Regions that will be relatively highly affected concern:

- Regions with a high share of agriculture (see Map C 3)
- Urbanized regions
- Regions with high share of inland water

A map depicting regions affected can be found in A5.

The Territorial impact of the directive

Such functions concern: industry and agriculture (F16/F17), which generally cause **pollution to surface and ground water** (F6). In particular **regions where intensive agricultural production**, which in contrast to industry cause a dispersed pattern of pollution, takes place will be affected. Following the available indicator and data, in this case ESPON data, much of the EU territory can be characterized as agricultural and is expected to be affected. In terms of regional differentiation it could be expected that in particular areas with intensive agriculture will be affected as well as areas where agricultural sector is one of the main sources of income. With the current data, however, this is difficult to show. Interestingly, the indicator '**agriculture as part of GDP'** points out that in particular in highly urban areas, such as Vienna, Brussels, Ile de France, Inner London, rather than in rural areas, the share of agriculture is significantly higher. This counterintuitive outcome probably can be explained from the fact that agricultural products are traded in these urbanized areas where also the headquarters of large food multinationals are located.

Other types of land where water quality is under pressure concern **urbanized regions** in general which produce considerable amounts of urban waste water. It means that in these regions the WFD will have a high positive impact in terms of a **reduction of pollutants in surface and groundwater**. This is also the outcome of the model (F5). At the same time it has to be realized that the reduction of pollutants requires significant effort. This means that the outcomes (of F5) could also be read inversely, i.e. as negative impact. The outcomes then show the regions where additional investments are required.

A last type of region where impact can be expected is simply those **regions with a high share of natural water bodies** as a percentage of the total surface. Such regions are more prone to water quality issues. Moreover such regions will need to spend considerable effort in maintaining the ecological and morphological conditions of the water system.

The ambitions of the WFD are high and generally exceed those of individual member states. Regions that are highly affected by the WFD will be required to make considerable additional effort in order to comply with the objectives. It is to be expected that this translates in **higher taxes** (F40), and thus slightly **lower disposable income** (F21), in order to fund these efforts.

Map C 3: Territorial Impact of Directive 2 on share of arable area, permanent grass area, permanent crops area

Map C 4: Summative positive impact of Waterframework Directive

[following page]

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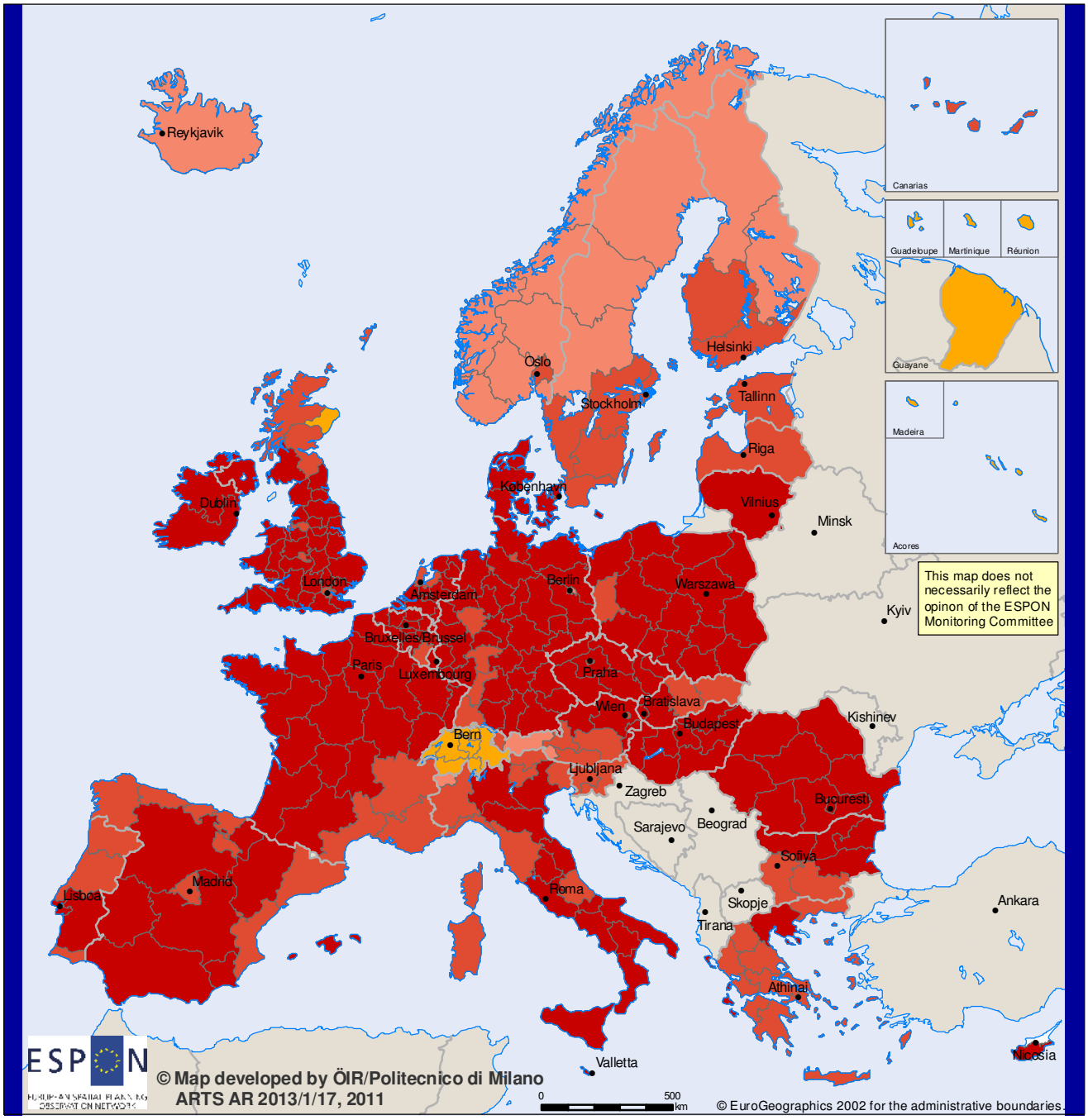

Territorial Impact of Directive 2 on share of arable area, permanent grass area, permanent crops area

Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: all regions

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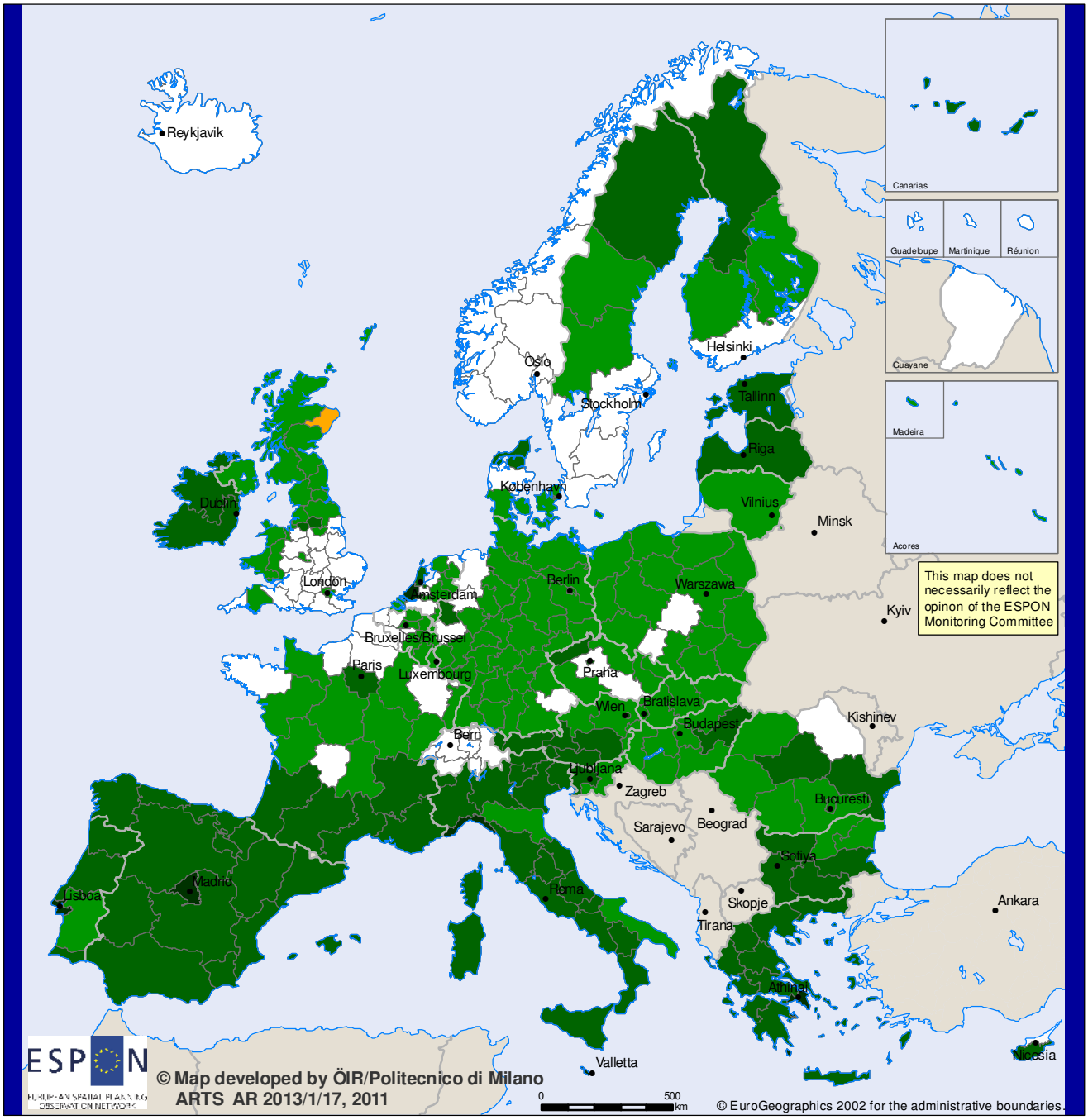


Summative positive impact of Waterframework Directive

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: all regions

4.3 Directive on the control of major-accident hazards involving dangerous substances (so-called Seveso II Directive)

This Directive is aimed at the prevention of major accidents which involve dangerous substances, and the limitation of their consequences for man and the environment, with a view to ensuring high levels of protection throughout the Community in a consistent and effective manner.

Logical chain and exposure

This Directive induces a comprehensive regulative framework. The operator of plants dealing with dangerous substances must notify the competent authority of the particular member state about its establishment and installation. He also has to submit reports covering safety issues as well as the operator's major-accident prevention policy. In addition intern as well as extern emergency plans must be prepared. The public has to be able to access the safety report and give its opinion on the planning of new plants and developments around existing establishments. The appointed competent authority's assigned tasks are to monitor and inspect the establishments and to provide expedient information for other member states and the public in case of major accidents. This introduction of new administrative tasks has two implications. Firstly, it allows to increase the transnational cooperation (F41) and mitigates the risk of major-accident hazards (F27), hence it increases the efficiency of governance (F37). Secondly, it complicates matters for operators leading to increased consumer prizes and consequently to a decline of a household's disposable income (F21).

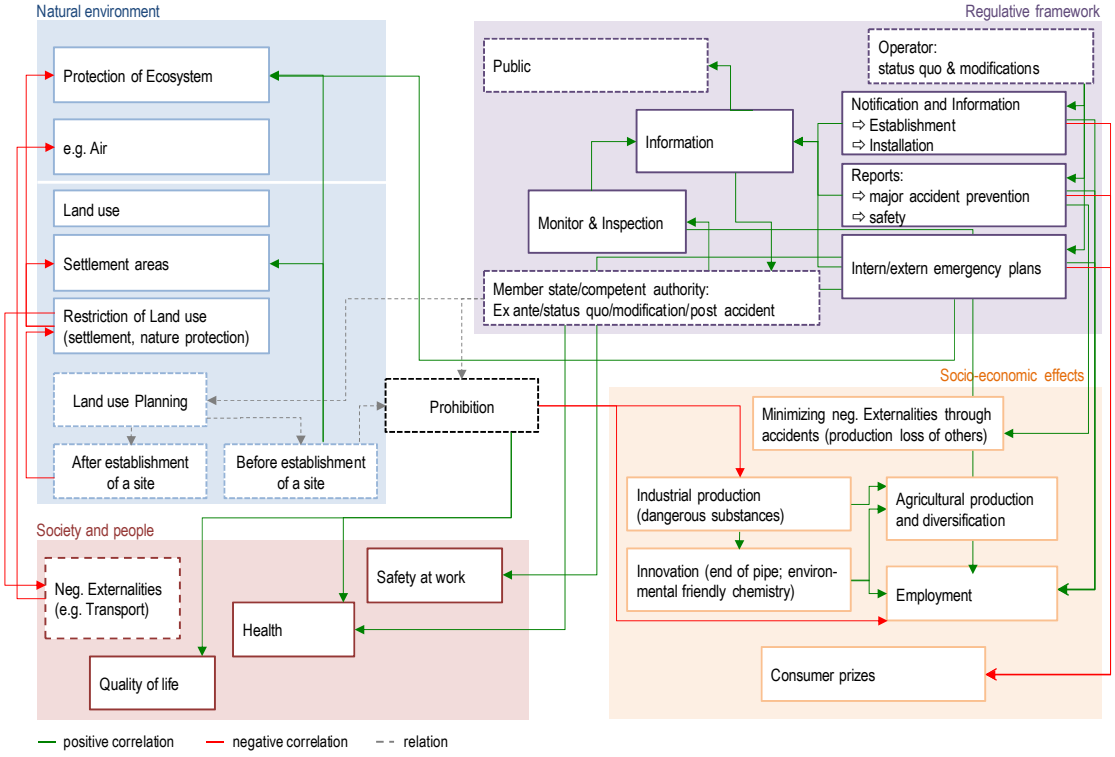
The member states have the option to influence land use planning depending of the state of affairs: After the establishment of a site, it can restrict land use in terms of settlement areas or in order to protect nature. This restraint might unbundle the mix of land uses (F36) and leads to isolated industrial districts and the emigration of resident population. Before the establishment, the options range from prohibiting the installation to specific measure to protect the ecosystem.

These measures have effects on the regional economy. They form market barriers (F15) and hamper production in industries related to that Directive but at the same time push innovation (F13) in end-of-pipe technologies and environmental friendly chemistry as well as lessen negative externalities. The employment is affected diversely. In the industrial sector (F18) there is a balance between the loss of jobs in hazardous industries and the gain of workplaces in end-of-pipe technology. In the service sector people are needed to deal with the enlarged administrative tasks (F19). In agriculture environmental friendly chemistry asks for increased production and diversification as an input which increases the need for employment in that sector (F16).

The Directive's most direct effects are on the environment (F2, F5, F6, F9) and human health in case of an accident with hazardous substances. Better and more efficient repair measures have positive effects on the quality of soil, water and air, ameliorate general health (F28) as well as safety at work.

Deducing from the logical chain the directive is likely to affect several fields (18 fields out of 41). Most of the effects can be considered positive for the regions, only three fields are negatively affected: mixed land use (F36), soil sealing (F3) and disposable income (F21). The highest positive effects occur on human health (F28) and transnational cooperation (F41).

Figure C 7: Logical chain of the directive



The regions affected by the directive

For reasons described above we expect regions showing a high technological/environmental risk are likely to be affected by this Directive. We identify those regions as those falling in the top 10 percentile of the technological/environmental risk distribution. They are scattered through the UK, include northern and central Spain as well as north eastern France and French region boarding the Mediterranean Sea. Also affected are great parts of Belgium, south western regions of Germany, northern Italy and Switzerland. In Romania, Czech Republic and Poland the eastern Regions are affected. A map depicting regions affected can be found in A5.

The Territorial impact of the directive

On all regions exposed the impacts on the **natural environment** are predominantly minor positive and not highly differentiated. This is true for **impacts on soil** (F2), **water** (F5) and **air quality** (F6). An exception being that biodiversity (F9) in Languedoc-Roussillon, Provence-Alpes-Côte d'Azur in France and Sud-Est in Romania is moderately positively affected. Impacts on **soil sealing** (F3) tend to be negative and minor. Cities, having already a high share of artificial area like Greater Manchester, Outer London and Hamburg are affected moderately.

Minor positive impact on the **regional economy** shows on the **employment in the primary sector** (F16) and a moderate positive impact on **the share of agricultural areas** (F17). The British regions, East Anglia and East Riding and North Lincolnshire experience a high impact of the latter.

Moderate negative impacts on a household's **disposable income** (F21) can be observed in all affected region albeit Nord-Est in Romania is strongly affected, being very sensitive to this exposure already (see Map C 6).

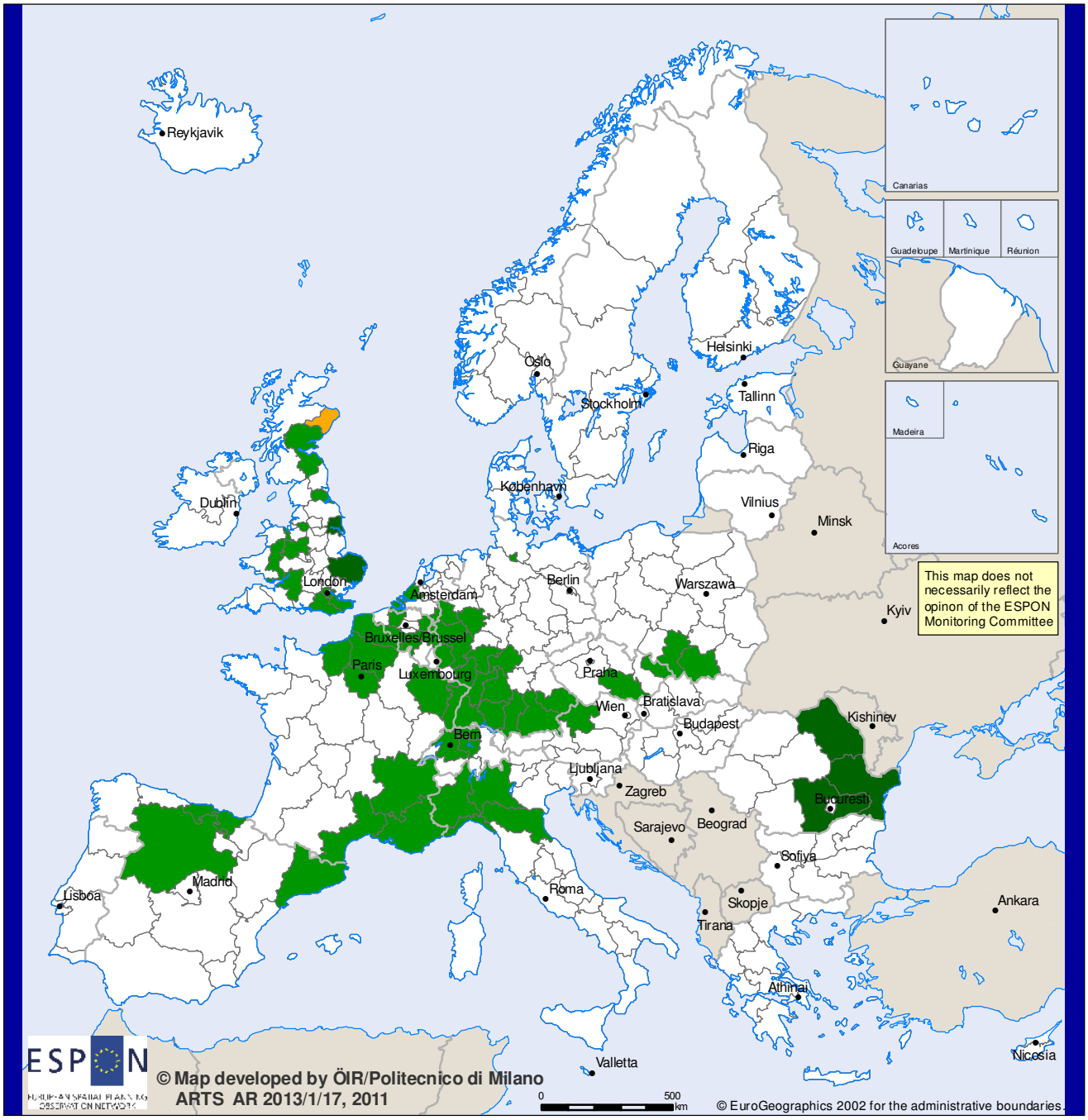
Impacts **on technological and/or environmental risk** (F27) of regions are pervasively positive and very strong which also shows positive (although differentiated) impacts on **health** (F28): Eastern European regions displaying stronger impacts (moderately in Moravskoslezko in Czech Republic, Malopolskie, Slaskie in Poland; strong impacts in Nord-Est, Sud-Est and Sud in Romania) than all other affected regions, the impact there being minor (see Map C 7)

Map C 5: Summative positive impact of Seweso Directive

Map C 6 Territorial Impact of Directive 3 on disposable income in PPS/capita

Map C 7: Territorial Impact of Directive 3 on healthy life expectancy at birth

[following pages]



Summative positive impact of Seweso Directive

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: areas at highest technological/environmental risk

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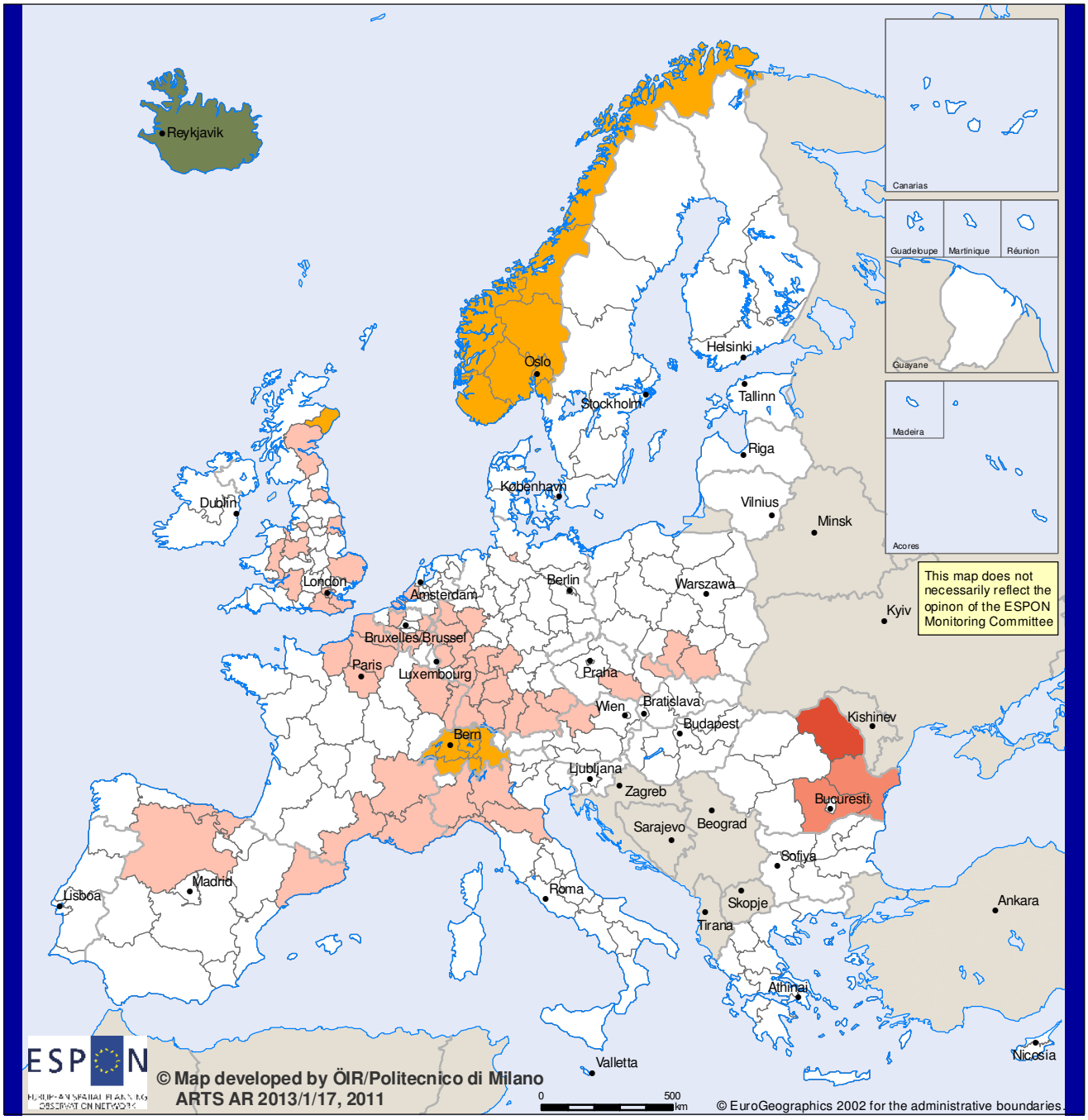

Territorial Impact of Directive 3 on disposable income in PPS /capita

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: Areas at highest technological/environmental risk

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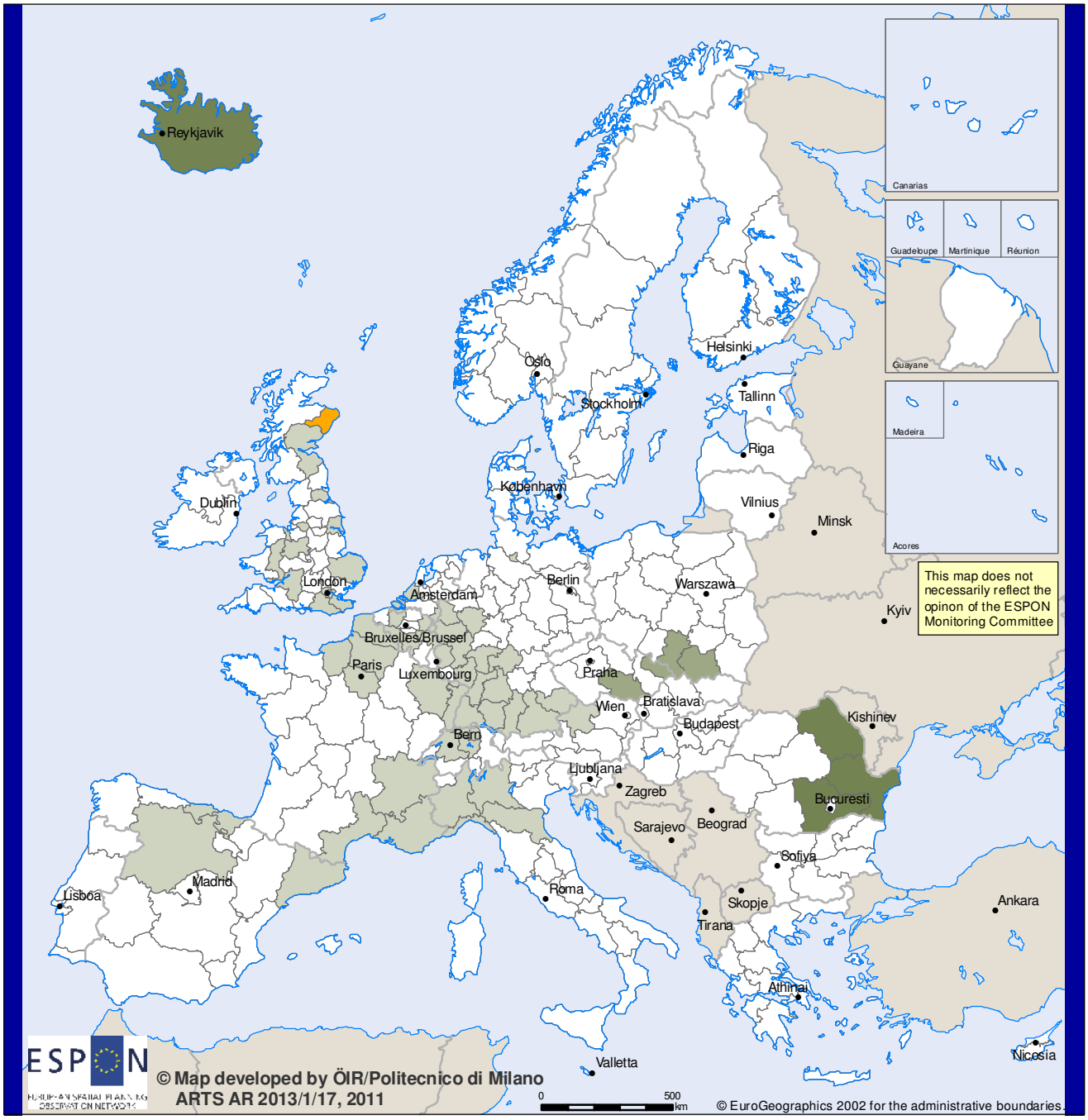


Territorial Impact of Directive 3 on healthy life expectancy at birth

Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: Areas at highest technological/environmental risk

4.4 Directive relating to the assessment and management of environmental noise

Member States shall make noise maps and action plans for agglomerations, major roads, major railways and major airports. Exceeding limit values shall cause competent authorities to consider or enforce mitigation measures[20] such as land use planning, systems engineering for traffic, traffic planning, abatement by sound insulation measures and noise control of sources.

Logical chain and exposure

This Directive envisages determining exposure to environmental noise through noise mapping and subsequently developing action plans in order to prevent or reduce this noise (F25). The public is involved in this process, not only by having access to information but also by being given the opportunity to participate in the preparation of the actions plans. These provisions aim at increasing the efficiency of governance (F37) by providing information and empowering the people (F39). At the same time, these additional procedures increase the complexity of administrative tasks (F38).

Differences in administrative and juridical system will determine to some extent whether these norms affect land-use planning. The consequence of reducing the exposure to noise of quiet areas is the disentangling of land use types (F36).

Generally the Directive leaves the member states a great amount of leeway – the specifications in the action plan determine the Directive's potential territorial effects. In that sense the accessibility by road and rail decreases (F31, F32) if traffic is restricted partly as e.g. in case of night traffic bans. Measures like speed limits or traffic telematics lead to retrogressive fossil fuel consumption (F34) and road accident rate (F26).

The decline of fossil fuel consumption reduces CO_2 emissions (F7) and other pollutants which induce positive effects on the quality of water and air (F5, F6)). Measures specified in the action plans aim primarily at reducing the number of people exposed to noise. Less noise also provides better habitat conditions and helps to sustain biodiversity (F9). Positive effects on the environment and level of noise cause strong positive direct effects on health (F28).

Also positive effects are expected on the regional economy. Innovations (F13) in the input related sectors (e.g. noise barriers, silent asphalt, active noise filters, traffic telematics, green jobs,…) boosts the economic growth (F12) and employment in the industrial and service sector (F18, F19). In the latter additional workplaces are

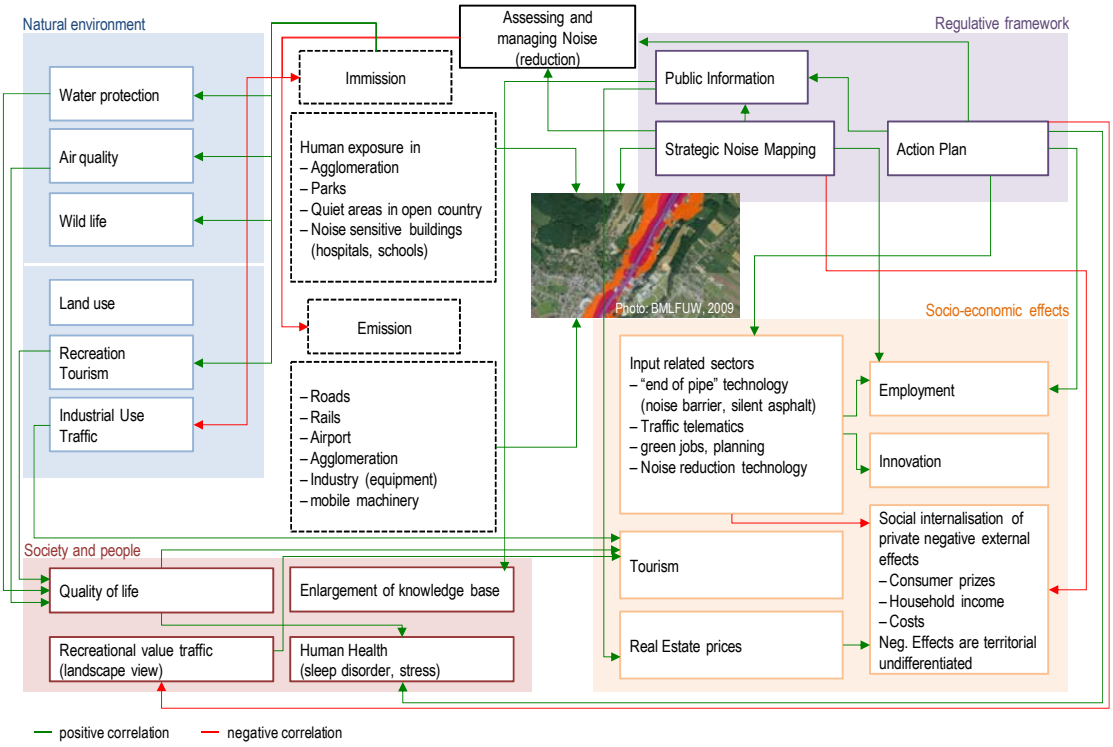
[20] limit values may be different for different types of noise (road-, rail-, air-traffic noise, industrial noise, etc.), different surroundings and different noise sensitiveness of the populations; they may also be different for existing situations and for new situations (where there is a change in the situation regarding the noise source or the use of the surrounding);

established for the mapping exercises and in tourism (F19), where the increased recreational value attracts more visitors.

These economic developments together with declining health expenditures have possible effects on the disposable household income (F21), opposed by increased prices for mobility (e.g. road tolls).

The logical chain allows to conclude that this Directive affects 24 out of 41 fields. Effects on the environment, the regional economy and social disparities are positive throughout. Especially human health (F28), people exposed to noise (F25), economic growth (F12) and innovation (F13) as well as employment in the secondary and tertiary sector are affected highly positive.

Figure C 8: Logical chain of the directive



The regions affected by the directive

Measures are implemented in areas where there is a high exposure to noise, caused especially by high traffic volumes. We identify these regions by aggregating those that fall either in an urban or agglomerated area, in the top 10 percentile of population density distribution, in the top 25 percentile of density distribution of road and rail kilometres or regions endowed with an airport with more than 500000 passengers per year.

When applying these regional filters on NUTS 2 regions, almost all (276 out of 287) European regions are indicated. Only very remote regions are not affected by this Directive, namely Burgenland (AT), Niederbayern and Oberpfalz (DE), Castilla-la

Mancha (ES), Guyane (FR), Dél-Dunántúl (HU), Basilicata and Molise (IT), Swietokrzyskie (PL), Sud (RO), Slovenia (SL). A map depicting regions affected can be found in A5.

The Territorial impact of the directive

The Directive's primary objective is to reduce the **number of people exposed to noise** (F25). Strong positive impacts on this field mirror this effort, especially in densely populated areas. A reduction of exposure to noise is beneficial for people's health. Consequently a high positive effect on the **healthy life expectancy** (F28) is shown for all affected regions. Although the impact intensity ranges from moderate to very high, in the case of healthy life expectancy a high intensity prevails, in the case of noise a very high intensity prevails (see Map C 8 and Map C 9)

Also generally positive but limited are the Directive's effects on **road fatalities** (F26) albeit Sterea Ellada in Greece sticks out as being impacted highly due its present sensitivity to this to road accidents.

The Directive's impact on the **environment** is consistently positive and limited to minor and in a very few cases moderate and high. Latter is the case in Ciudad Autónoma de Ceuta (ES) on **water quality** (F5), in Bucharest (RO) on **air quality** (F6), Inner London on **CO_2 emissions** (F7), the Canaries on **biodiversity** (F9) and highly sensible Tuscany on **cultural heritage** (F11).

In case of measures relating to traffic bans (spatial and/or temporal) negative impacts on the **accessibility by road** (F31) and **rail** (F32) are expected. Although mainly minor, islands like Iceland, Malta and the Canarias are affected more. Consequently **fuel consumption** (F34) decreases and leads to positive albeit limited impacts on the affected regions. More pronounced is this positive effect in Greece, Spain, Portugal and Italy, where the sensitivity is very high.

The **regional economy** is positively affected across all affected regions. Most pronounced are these effects on **economic growth** (F12), where they can be considered mainly as high. Poorer regions profiting more than wealthier ones: Most of Romania and Bulgaria, many regions of Poland, Hungary's East and Východné Slovensko in Slovakia show a very high impact. Similar a high positive impact on **income distribution** (F21) can be noted in Bulgaria and Romania, while other regions are affected only minor. The positive impact on the economy also shows on the **entrepreneurship** (F13) and on the share of **agricultural area** (F17) although on a smaller scale, the latter mostly in British regions.

Map C 8: Territorial Impact of Directive 4 on number of people exposed to noise

Map C 9: Territorial Impact of Directive 4 on healthy life expectancy at birth

Map C 10: Summative positive impact of Directive on managing environmental noise

[following pages]

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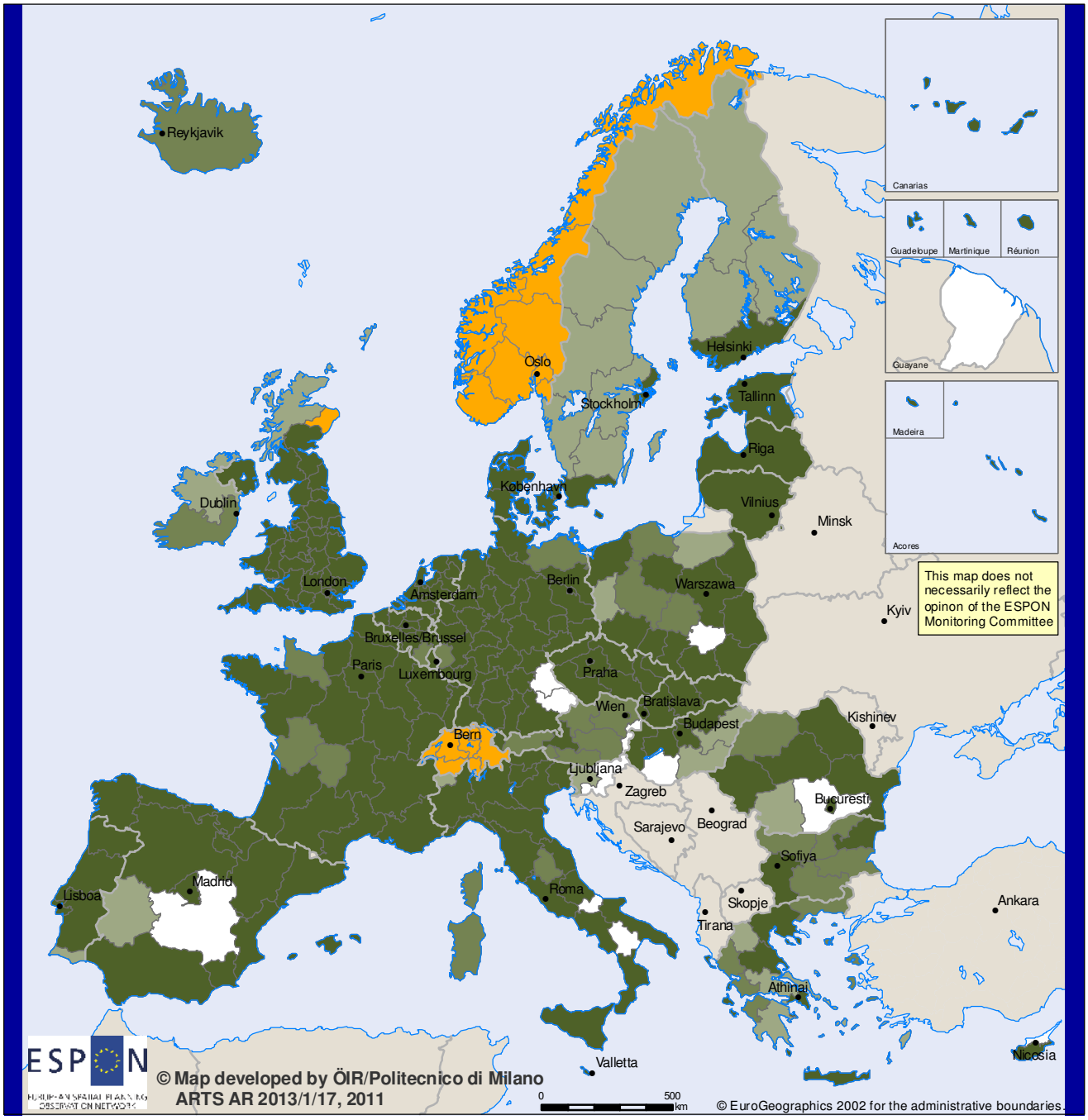

Territorial Impact of Directive 4 on number of people exposed to noise

Negative Impact	Positive Impact	
Very high impact	Minor impact	No Data
High impact	Moderate impact	Neighbourhood Countries
Moderate impact	High impact	
Minor impact	Very high impact	
Not affected		

Types of regions affected: urban, agglomerated, densely populated, high density of road, high density of rail, major airport location

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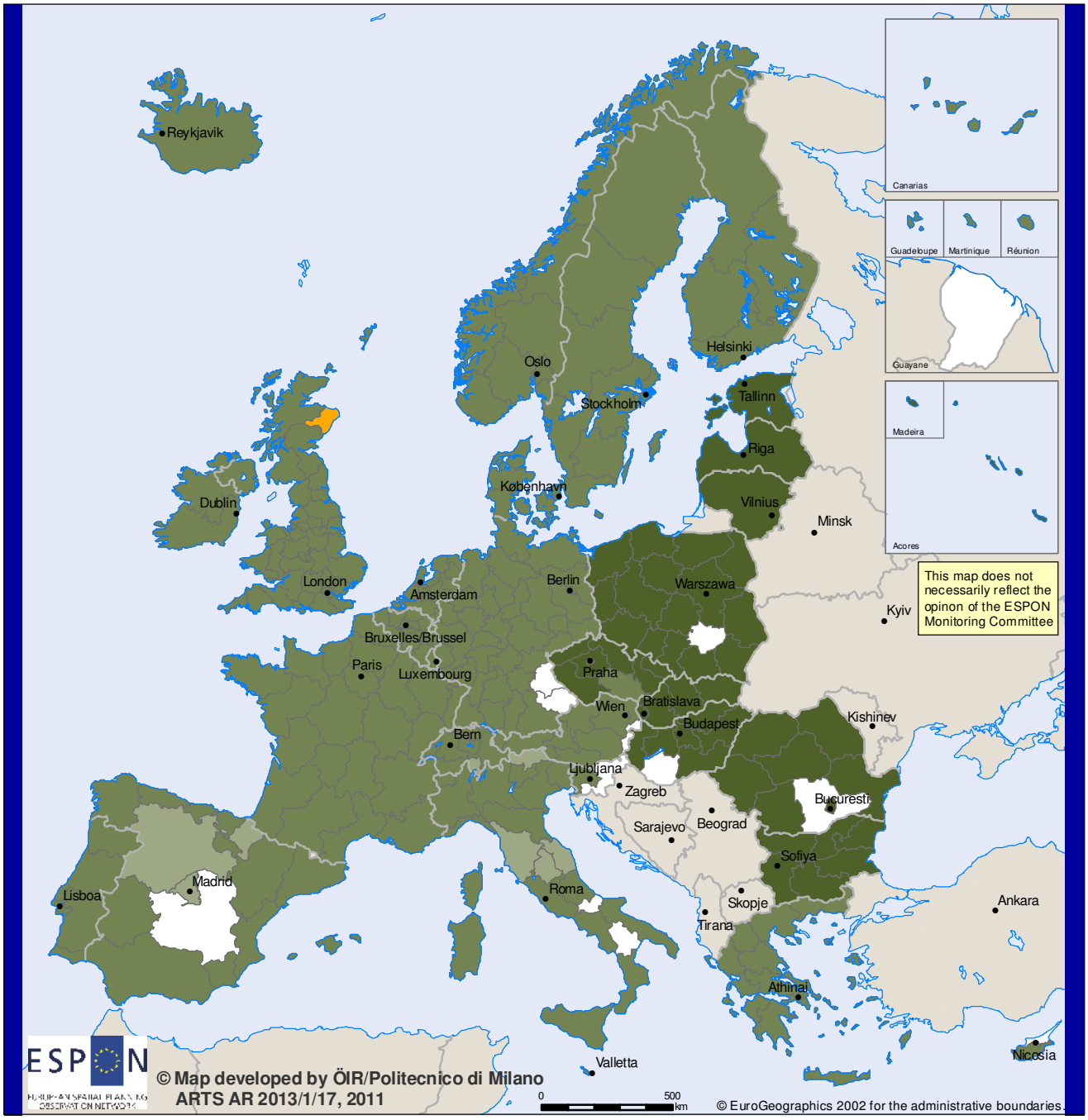

Territorial Impact of Directive 4 on healthy life expectancy at birth

Negative Impact	Positive Impact	
Very high impact	Minor impact	No Data
High impact	Moderate impact	Neighbourhood Countries
Moderate impact	High impact	
Minor impact	Very high impact	
Not affected		

Types of regions affected: urban, agglomerated, densely populated, high density of road, high density of rail, major airport location

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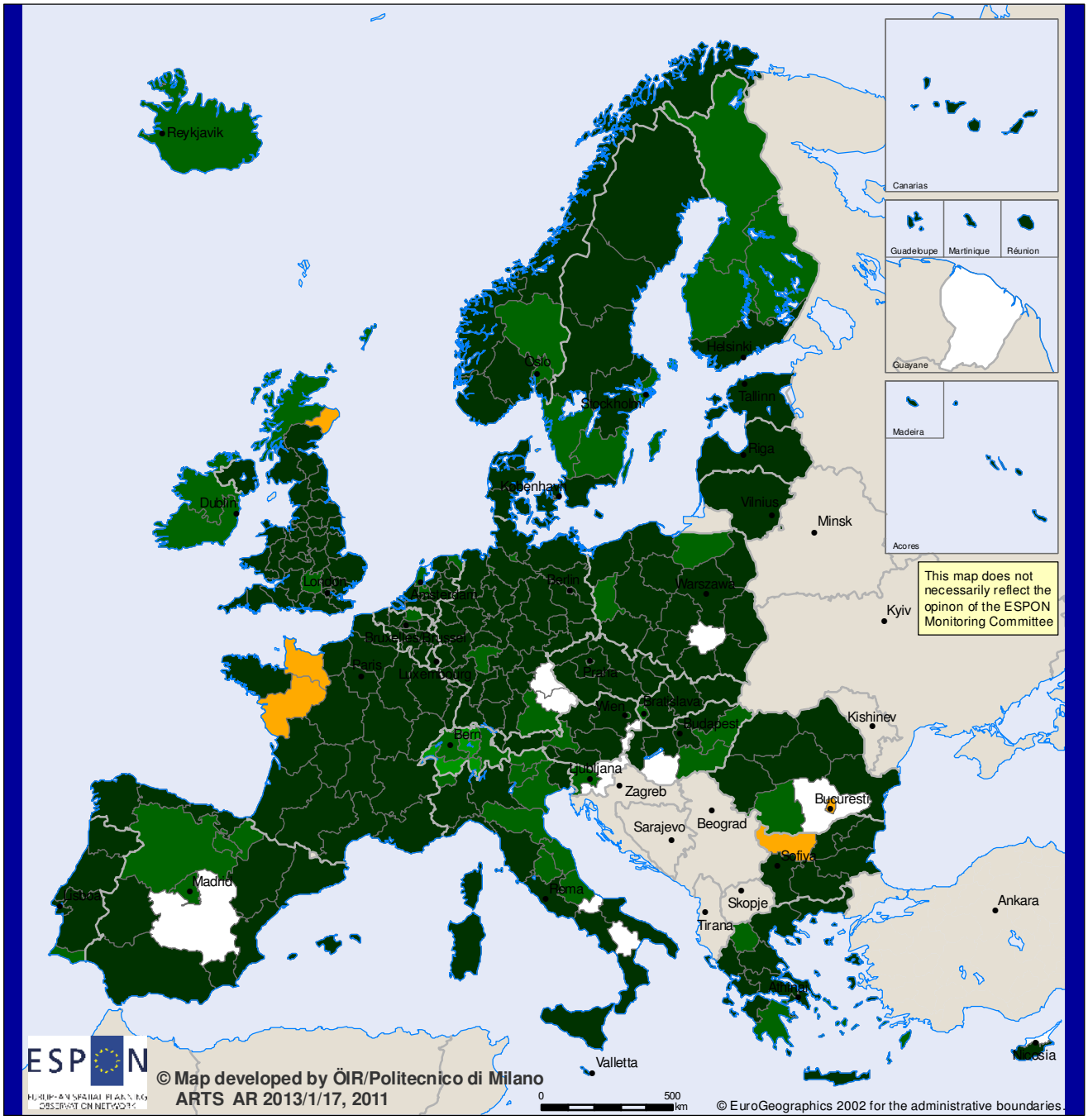


Summative positive impact of Directive on managing environmental noise

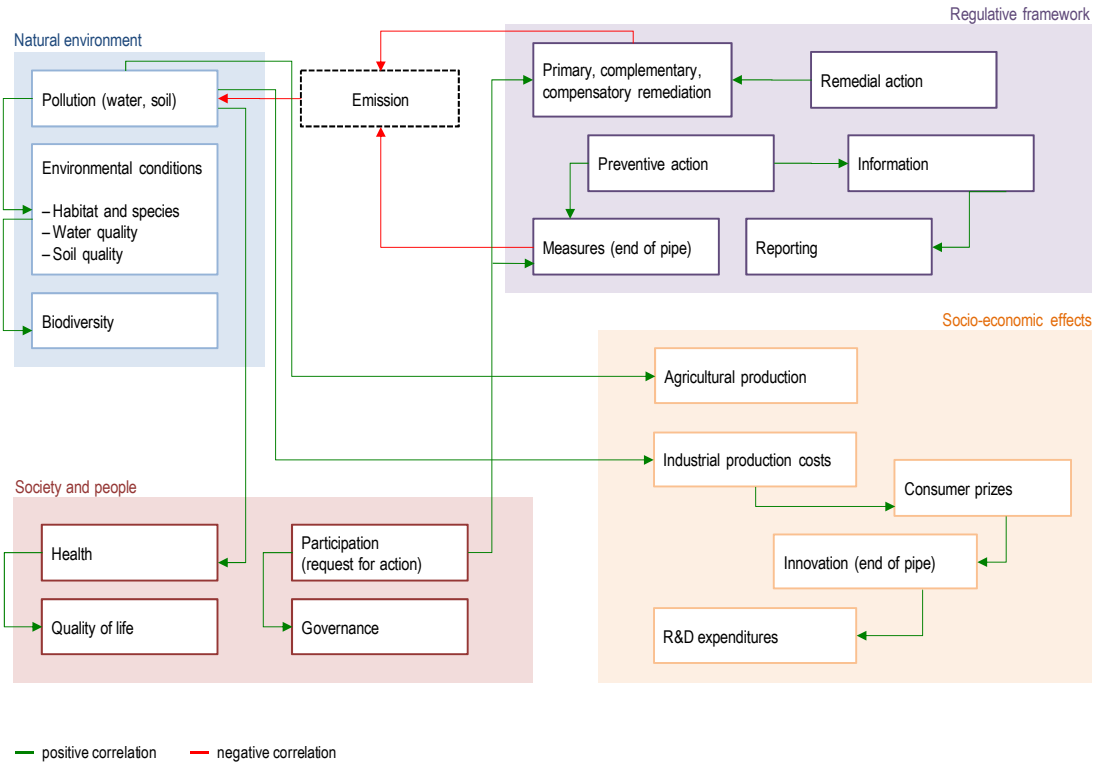
Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: urban, agglomerated, densly populated, high density of road, high density of rail, major airport location

4.5 Directive on environmental liability with regard to the prevention and remedying of environmental damage

Figure C 9: Logical chain of the directive



This Directive introduces a framework of environmental liability based on the polluter-pays principle, to prevent and remedy environmental damage. This directive provides for holding an operator responsible whose activity has caused environmental damage or the imminent threat of such. This Directive allows for the concerned public to express a request for action.

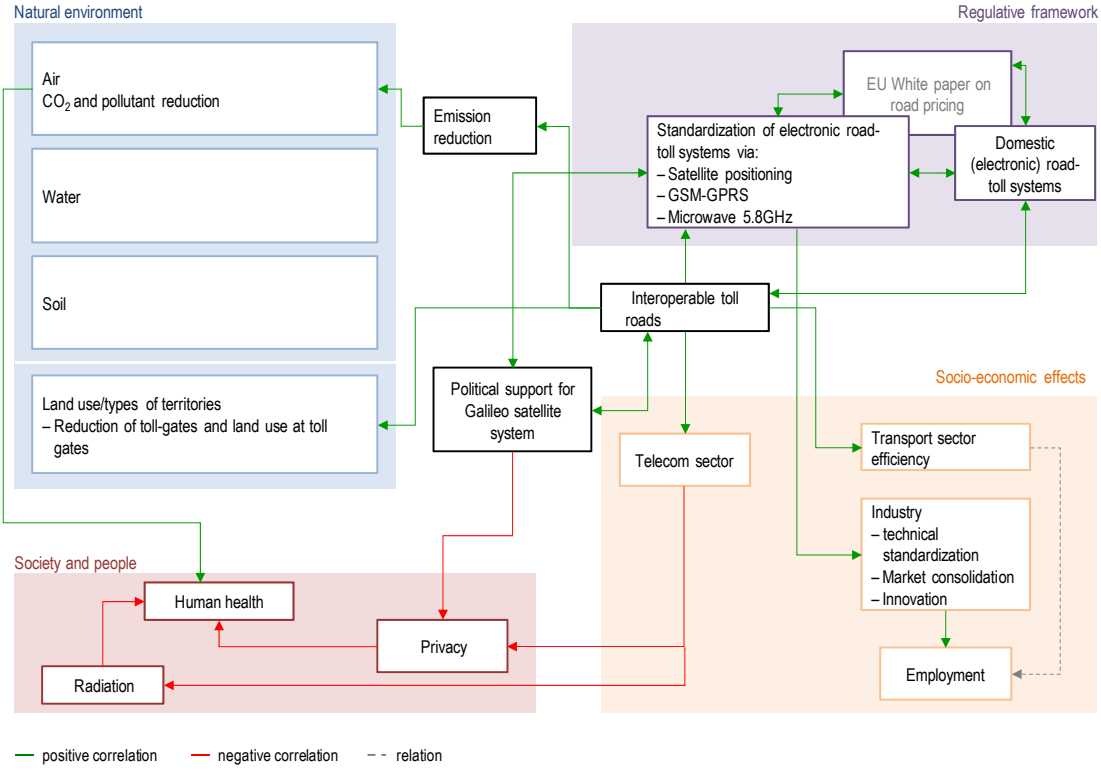
Remedial action (primary, complementary or compensatory) mitigates pollution of water, soil and air while at the same improves the otherwise severely damaged condition for the habitat. In case of preventive action, whether this means providing information or implementing end-of-pipe measures, similar effects can be expected since the measures aim at reducing the operator's carelessness. In either case, the positive effects for the environment respond positively to human health.

Another effect of the Directive is that additional expenses for the industry are passed on to the consumers through increased costs which consequently reduce their disposable income. In order to find ways to decrease the production costs new processes or products are invented.

Although one can deduce this logical chain from the directive, all regions are equally exposed to these effects. Even if not equally sensible, territorially differentiated impacts cannot be derived from this Directive.

4.6 Directive on the interoperability of electronic road toll systems in the Community

Figure C 10: Logical chain of the directive



This directive lays down the conditions necessary to ensure interoperability of electronic toll system in the EC. This is of relevance to the removal of artificial barriers to the operation of the internal market. The directive is part of a larger body of policies that together aim at a more uniform road pricing system in Europe. The combined territorial impact of this policy package is expected to be rather high.

In contrast the territorial impact of this single directive is expected to be rather modest. Interoperability of electronic road toll systems (namely for highways) is a means to improve road traffic and accessibility, mainly in cross-border regions, thus improving economic performance and reducing emissions and congestion time; it will also impact on competitiveness of road vs rail.

Effects will occur where road toll systems are in place, or will be, that are not interoperable. This potentially affects all regions with a high share of motorways. However, it is to be expected that electronic systems within member states already are interoperable, which means that in the case of this directive impact is to be expected mainly in cross border regions.

Based on available data and indicators (high share of motorways) no regional differentiation was found.

4.7 Directive on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection

This directive establishes a procedure for the identification of European critical infrastructures ('ECIs) and a common approach to the assessment of the need to improve the protection of people. The specific focus of the directive is on energy and transport sectors.

To achieve this goal, the directive envisages the definition of a European programme for critical infrastructure protection (EPCIP), teamed with the development of operator security plans (OSPs), the strengthening of contacts with Security Liaison Officers in owners/operators of designed ECIs and the institutions of ECIs contact points (ECICP) to facilitate communication, coordination and cooperation at national and Community level.

All in all, this directive provides common methodologies for the identification and classification of risks, threats and vulnerabilities of infrastructure assets.

Logical chain and exposure

The expected impact of the directive is likely to be relatively more relevant in two fields.

First, on the natural environment. In this regard, the implementation of the directive could lead to a lower risk of environmental and technological disasters, although this may come at the cost of extra investments in constructions protection which may eventually negatively impact on the natural heritage.

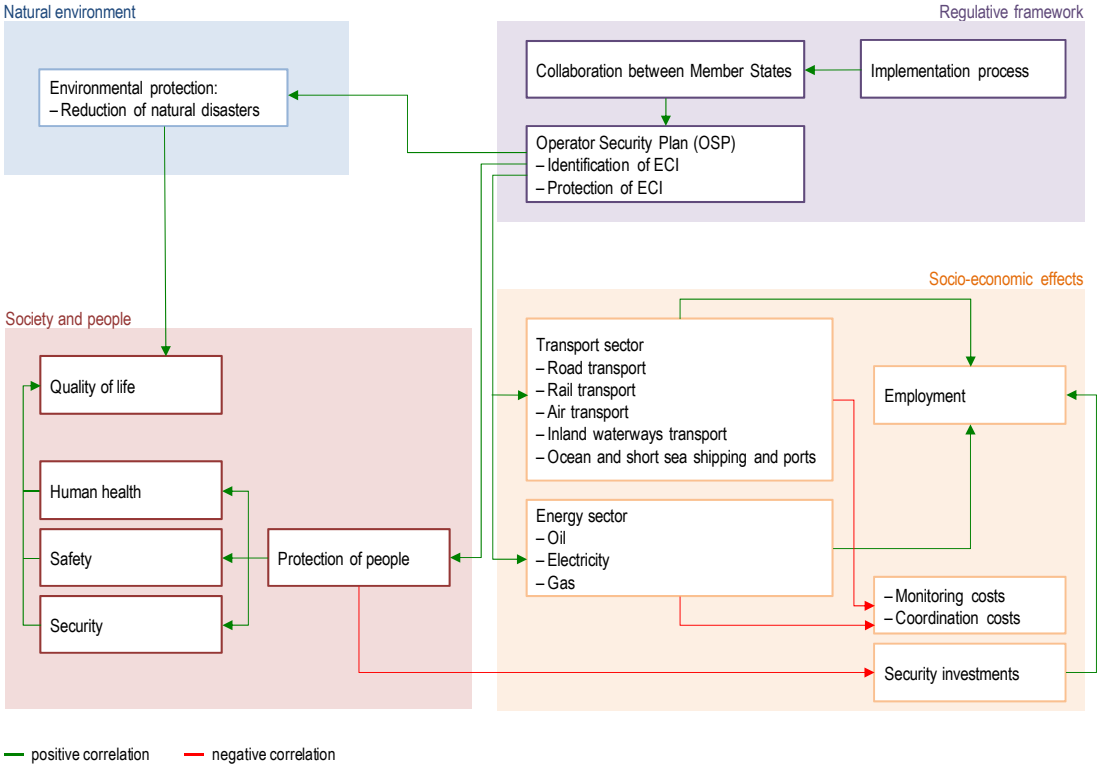
Second, and probably more importantly, on accessibility. Greater protection of critical infrastructure such as airport, rail and road networks may positively impact on accessibility and in turn on economic growth (i.e. GDP) and, marginally, on employment, especially in security services and construction sector. GDP and employment may also benefit from the extra investments undertaken to improve critical infrastructure safety conditions.

Overall, these have some impact on people safety, both in terms of reduced accident rates and lower technological/environmental risk.

Lastly, the implementation of the directive foresees the creation of specific plans and bodies. This may ultimately impact on governance. For example, the increased duration or complexity of planning procedures as well as coordination and monitoring costs could come together with some positive impact on the efficiency and the effectiveness of public administration in terms of better coordinated and more cooperative intervention. Also, the necessity to develop in some cases joint OSP may enhance transnational cooperation between member states.

These linkages are depicted in the following figure.

Figure C 11: Logical chain of the directive



This directive is likely to affect several fields (overall 16 out of 41), ranging from society and people and natural environment, to economy and governance.

The field most affected by this directive is accessibility by road, rail and air. An improvement in critical infrastructure protection and safety may generate a quantum jump in accessibility. This in turn may bear positive effects on GDP and employment.

Also, the effect on soil is of relevance although we expect that the impact of the directive in this field is moderate. For example, the overall level of pollution depends not only on improvement in safety conditions of critical infrastructure but also on firm and consumers behaviour. Similarly, the effect on the share of natural areas depends also on new construction being built up which are not necessarily related to the protection of critical infrastructure. Overall, this leads to a moderate reduction of accidents in transport as well as technological and environmental risk.

Lastly, the directive may produce moderate impact on governance. The introduction of OSPs may lead to an increase of duration or complexity of planning procedures; at the same time, the institution of ECIPs and their relative contact points may lead to efficiency gains in terms of better coordination at the national level. Lastly, this may positive influence the possibility for transnational (mainly cross-border) cooperation.

The regions affected by the directive

We expect that regions showing either a relatively high technological/environmental risk or with a relatively high density of rail and road networks are likely to be more

affected by this directive since they are more likely to be endowed with critical infrastructures.

We identify these regions as those falling in the top 10 percentile of the distribution of an aggregated index of technological/environmental risk and/or in the top 10 percentile of the distribution of rail and road network density.

These regions are concentrated in Central Europe, namely Germany, Austria, Belgium, The Netherlands, and Switzerland.

Differently, Eastern countries are limitedly exposed to this directive with a few exceptions in Zahodna Slovenija, East and South Romania and Malopolskie and in Slaskie Poland, Jihovýchod and Moravskoslezko in Czech Republic. Southern Europe as well is not widely affected. For example, Greek regions are not at all affected. However, a few exceptions exist, especially in Northern Italy (Lombardia, Piemonte, Liguria, Valle d'Aosta and Emilia-Romagna, Provincie Autonome di Trento e Bolzano), in Northern Spain (Cantabria, Pais Vasco, Comunidad de Madrid, Castilla y León, Cataluña) and Lisboa and Algarve in Portugal. Mediterranean and Alpine regions in France look exposed to this directive as well as Northern ones, pointing to the fact that more central regions seem the one to be hit by this directive. Lastly, some Nordic regions too turn to be exposed to this directive especially in Norway (Hedmark og Oppland and Sør-Østlandet), Sweden (Norra Mellansverige, Mellersta Norrland, Övre Norrlandand),and, to a larger extent, in the UK.

A map depicting regions affected can be found in A5.

The Territorial impact of the directive

Impacts on the **natural environment** will be somehow limited. **Soil erosion** (F1), in fact, show positive albeit minor impact in all the exposed regions as well as **pollutants in soil** (F2), the latter with the exception of two regions, Région de Bruxelles and Ciudad Autónoma de Ceuta which are, respectively, moderately and highly affected. Impacts on **soil sealing** (F3) tend to be positive and minor as well, but with some exception, notably Wien, Région de Bruxelles, Hamburg, Ciudad Autónoma de Melilla, Greater Manchester, West Midlands and Outer London, showing moderate impact. Lastly, impact on the **conservation of natural heritage** (landscape diversity, F10) will be overall minor and negative with some regions that look moderately affected, namely, Tirol, Vorarlberg, Cantabria, Comunidad de Madrid, Corse, Valle d'Aosta, Provincia Autonoma Bolzano, Övre Norrland, Eastern Scotland.

Impacts on the **regional economy** will be as well relatively limited and to some extent not highly differentiated. More in detail, impact on **economic growth** (F12) looks positive albeit minor in all the exposed regions but four all in Eastern Europe, namely East and South Romania and Malopolskie and Slaskie in Poland where it

looks moderate. On the other hand, impact on **employment** both in **manufacturing** (F18) and **services** (F19) will be positive and moderate in all the regions.

Impacts on the **society and people** touch a greater number of fields and are, on average, of greater magnitude. As to **accidents in road transports** (F26), impacts will be overall positive although minor and become moderate in a handful number of regions, namely Prov. Namur, Castilla y León, Corse, Provincia Autonoma Bolzano, Emilia-Romagna and Algarve. As to **accident risk in industry/energy supply** (F27), most of regions show positive and moderate impacts with only a few of them showing either minor impact (namely, Ciudad Autónoma de Ceuta and Ciudad Autónoma de Melilla in Spain, Norra Mellansverige and Mellersta Norrland in Sweden) or high impact (namely, Hamburg, Haute-Normandie, Nord – Pas-de-Calais, Alsace, Piemonte, Liguria, East Riding and North Lincolnshire). More interesting, it is the case of impacts on accessibility. As to **air accessibility** (F29), impacts look on average positive and high, being however moderate in western capital regions such as Bruxells, Madrid, Paris, London, Zurich, Wien, Hovedstaden on the one hand, and very high in a few regions, namely Hedmark og Oppland, Nord-Est and Sud-Est in Romania (Map C 11, below). Differently, impact on **road accessibility** (F31) look pervasively positive and moderate across all European regions exposed to this directive and high in just three Nordic regions, namely Hedmark og Oppland, Mellersta Norrland and Övre Norrland. Similarly, impact on **rail accessibility** (F32) look pervasively positive and moderate across all European regions exposed to this directive and high only in the Swedish region of Övre Norrland.

Lastly, impacts on governance will be moderately positive in terms of **efficiency of government/governance mechanisms** (F37) albeit moderately negative in terms of **duration or complexity of planning procedures** (F38). This effect will be equal across all European regions exposed to this directive. Finally, **transnational cooperation between member states** (F41) seems to be enhanced by this directive. Among the exposed regions, especially border regions seem to highly benefit from it. On the other hand, British regions and some capital regions such as Bruxells, Paris, Madrid, Wien will moderately benefit from it.

Map C 11: Territorial Impact of Directive 9 on daily accessibility by air

Map C 12: Summative positive impact of Directive on critical infrastructure

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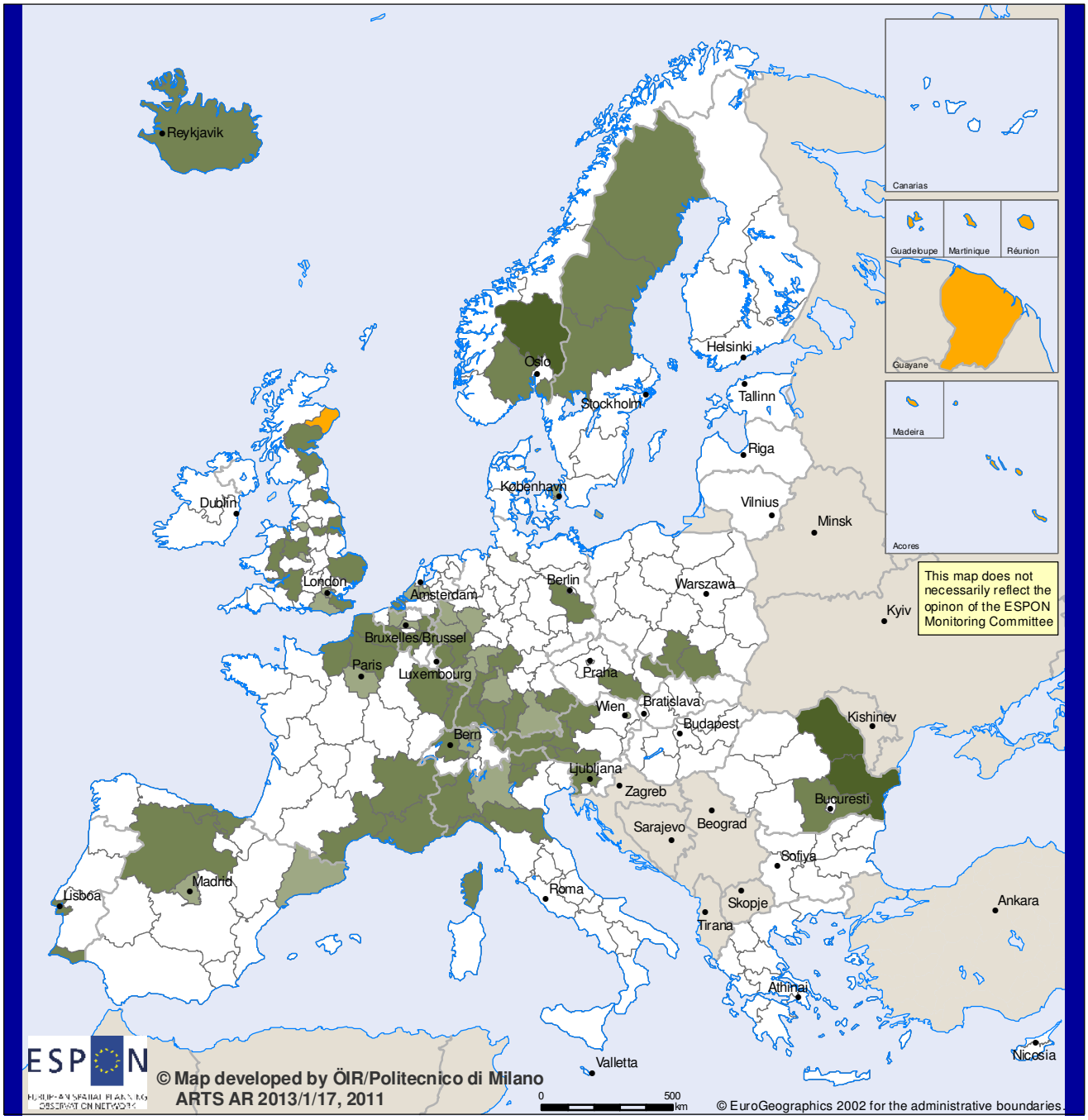

Territorial Impact of Directive 9 on daily accessibility by air

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: highest density of rail and road network, areas at highest technological/environmental risk

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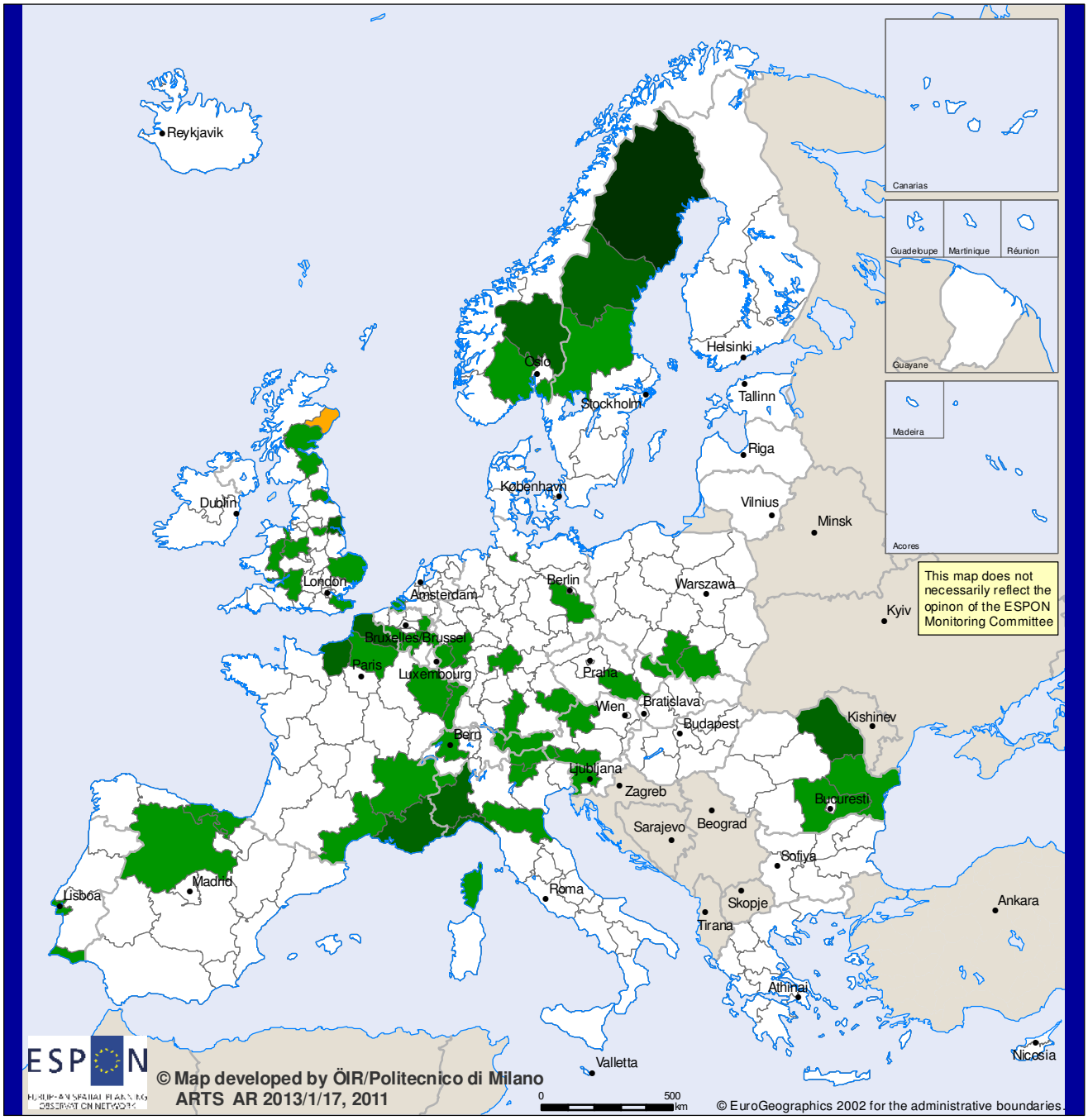


Summative positive impact of Directive on critical infrastructure

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: highest density of rail and road network, areas at highest technological/enviromental risk

4.8 Directive on the establishing a framework for Community action to achieve the sustainable use of pesticides

This Directive establishes a framework to achieve a sustainable use of pesticides by reducing the risks and impacts of pesticide use on human health and the environment and promoting the use of integrated pest management and of alternative approaches or techniques such as non-chemical alternatives to pesticides

Logical chain and exposure

The aim of the Directive is to ensure that Member States draw up action plans to reduce the potential damage to human health and environment caused by pesticides. The Directive also requires that appropriate inspections of equipment are carried out and training and certification schemes for all professional users of pesticides are set up. Furthermore necessary measures are adopted to inform the general public on health and environmental hazards relating to pesticide use and awareness raising programmes on those dangers and possibilities of switching to non-chemical alternatives are drawn up (F39). These added administrative tasks provide jobs in the service sector (F38, F19). This directive is expected to affect rural regions (branch a) differently than it affects regions with a high number of chemical plants (branch b). The first being the recipient and the latter being the producer of pesticides.

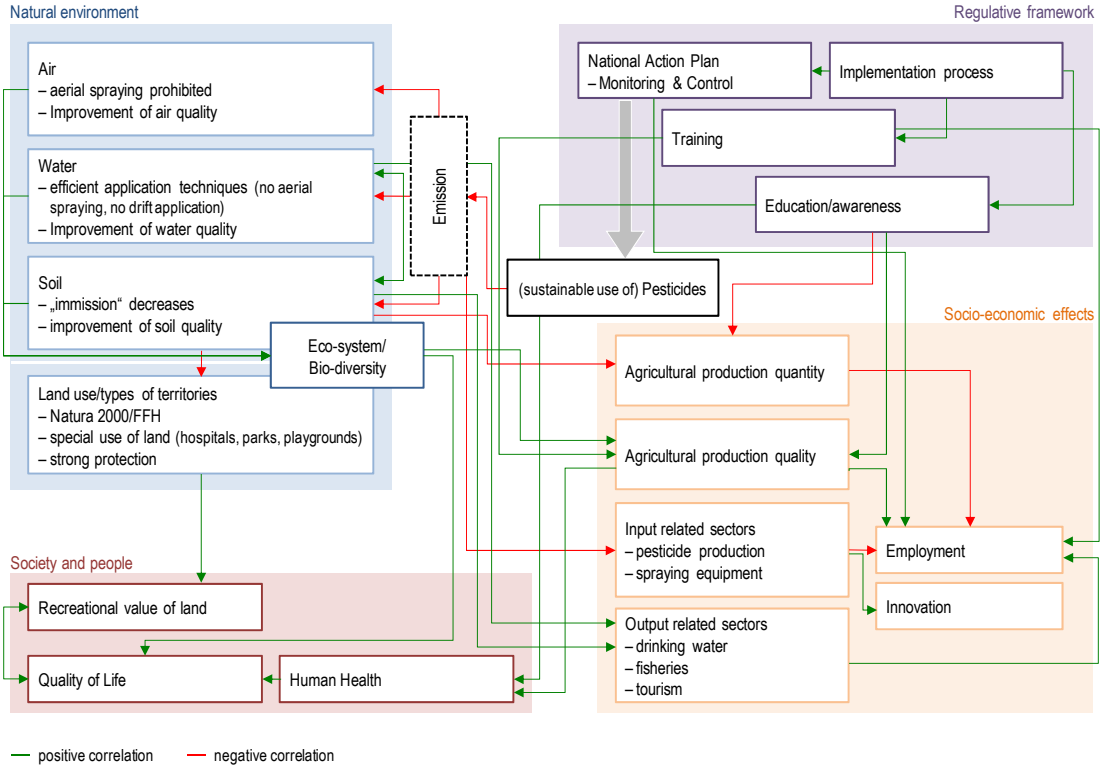
Regulations concerning the sustainable use of pesticides constrain their use and bring about less pollution in water, soil and air (F2, F5, F6). The prohibition of aerial spraying which has caused harm to the environment and human health through spray drift contributes to the decline in pollutants. Additionally chemical industries reduce the production of pesticides which also decreases their level of emissions. Obligatory establishment of buffer- and safeguard zones (i.e. for surface and groundwater used for the abstraction of drinking water, areas used by the general public or by vulnerable groups) involves changes in land use. The decrease in quantity but much more the regulations concerning transport and storage of pesticides mitigate the risk for users but also accidents in chemical industries (F27).

On one hand, these developments have positive effects on the eco-system (F9) and public health (F28); on the other hand they hinder economic growth (F12). Producers of pesticides and other input related sectors suffer financial losses as do agricultural producers due to falling crop yield, at least in the short run. The promotion of alternative approaches fosters innovation (F13), alters the region's range of arable crop and entails labour intensive agricultural production (F17). Low regional labour costs lead to substitution gains from replacing pesticide costs with labour; however in regions with high labour costs (especially in areas with high competition for labour) the reverse effect shows (F23 branch a and b). High value-added farm products due to environmentally benign production jointly with inelastic demand for aliments increase the disposable income of rural population (F21 branch a). The opposite is true for jobholders in the chemical industry (F21 branch b). First-tier effect of losses

and gains in different sectors lead to a short term imbalance of regional income distribution (F22). This influences migration flows, higher qualified work force is endangered to move out (F24 branch b) whereas low skilled farm workers are more likely to immigrate to rural regions (F24 branch a).

Summing up the logical chains concludes that 17 out of 41 fields are affected by this Directive. The highest positive effects can be expected on human health (F28) but also on the environment, especially on the quality of water (F5) and soil (F2). Employment in the secondary sector (F18) is the one field affected highly negatively in both branches.

Figure C 12: Logical chain of the directive



The regions affected by the directive

This directive has different affects on regions that are primarily rural (branch a) and those that hold a fair number of chemical industries (branch b). The former dominated by agricultural production and therefore the primary recipient of pesticides. Regions with a high number of chemical plants (defined by above EU average) are more likely to be affected by changes in the pesticide production.

Rural regions cover almost all of Scandinavia, Romania, Greece, Hungary, Slovenia and Austria. Also affected are Highlands and Islands in the UK, Border, Midlands and Western in Ireland, Alentejo in Portugal, Castilla-la Mancha and Extremadura in Spain as well as Corse, Sardinia and Guayane. As are scattered Regions in Poland, Italy, mainland France (Poitou-Charentes, Limousin) and south eastern Germany

(Oberpfalz and Oberfranken).In Belgium and Bulgaria only one region is considered rural.

As regards regions with a rather high number of chemical industries, they can be best described as those regions that are not considered rural. There are only a few exception to the rule, being considered rural and at a the same time having many chemical plants. These are Denmark, Länsi-Suomi in Finland, Malopolskie in Poland, Észak-Alföld in Hungary, Molise in Italy, Niederösterreich in Austria and Poitou-Charentes in France. Regions not affected by this directive are scattered throughout Europe. A map depicting regions affected can be found in A5.

The Territorial impact of the directive

Considering branch a and branch b of this Directive, the impacts on the **environment** is limited but pervasively positive across all affected regions. While impacts on **quality on air** (F6) can be considered minor **in rural regions** and those with **chemical plants** (the exception is Bucharest benefitting highly), the directive bears undifferentiated moderate positive impacts on the **quality of water** and **soil** and minor positive effects on **biodiversity** (F9) in **rural regions**.

The positive effects on the environment are mirrored in the strong to very strong (pervasively in eastern European countries) positive impacts on **health** (F28) and moderate to high positive impacts on **environmental and technological risk** (F27) in the affected regions. It has to be noted that these impacts are a bit less pronounced in rural regions than in those where chemical plants are situated (see Map C 16).

Impacts on the **regional economy** are quite differentiated across affected regions. The **economic growth** (F12) in **rural regions** is generally hampered by minor negative impacts, getting stronger the poorer the affected regions are. Regions in Hungary (Dél-Dunántúl, Észak-Alföld, Dél-Alföld), Poland (Lubelskie, Podkarpackie, Swietokrzyskie, Warminsko-Mazurskie) and Romania (except Sud-Est and Bucaresti) show moderate impacts, whereas Nord-Est in Romania and Severozapaden in Bulgaria are affected strongly (see Map C 15). Similar is the impact (minor negative) **on economic growth** in regions with **chemical production**, although less differentiated. Only Malopolskie, Opolskie, Kujawsko-Pomorskie in Poland and Észak-Alföld in Hungary are affected moderately. Impacts of branch a and b on **agricultural area** (F17) can be compared to those on economic growth although of a greater magnitude, mostly bearing moderately negative impacts. High negative effects are shown in Pays de la Loire in France, East Riding and North Lincolnshire, Leicestershire, Rutland and Northants as well as East Anglia in the UK.

Differently, effects on **employment in the primary sector** (F16) are minor and positive across all affected regions albeit moderate in city regions that have chemical plants like Hamburg, Stockholm, Groningen, Île de France, Brussels, Vienna and strong in Inner London.

Impacts on social disparities differ from branch a (mainly positive) to branch b (mainly negative). Solely the effect on **income distribution** (F22) is negative for both albeit mainly minor and moderate; only Alentejo in Portugal shows a high impact.

Rural regions profit from the generally minor positive impacts on a household's **disposable income** (F21) and on the **employment rate** (F23). Poland (examining employment) and Bulgaria (examining disposable income) stick out as being moderately affected. An exception form Severozapaden in Bulgaria and Nord-Est in Romania, which experience a high impact. A greater magnitude of impacts can be found assessing **migration** (F24), ranging mainly from moderate to high positive impacts, indicating immigration. Itä-Suomi in Finland and Dél-Dunántúl in Hungary, Basilicata in Italy and most regions in Poland and Romania form the exception showing only minor impacts.

Limited und undifferentiated negative impacts on an household's **disposable income** (F21) and on the employment rate (F23) become apparent in **regions with chemical plants**. The impact being mostly minor, some regions in Poland as well as Sachsen-Anhalt in Germany and Brussels show a moderate impact. Similar to rural regions, the impact on **migration** (F24) is of a greater magnitude albeit negative, indicating out-migration. France and the UK are highly differentiated with an impacts range from minor to high.

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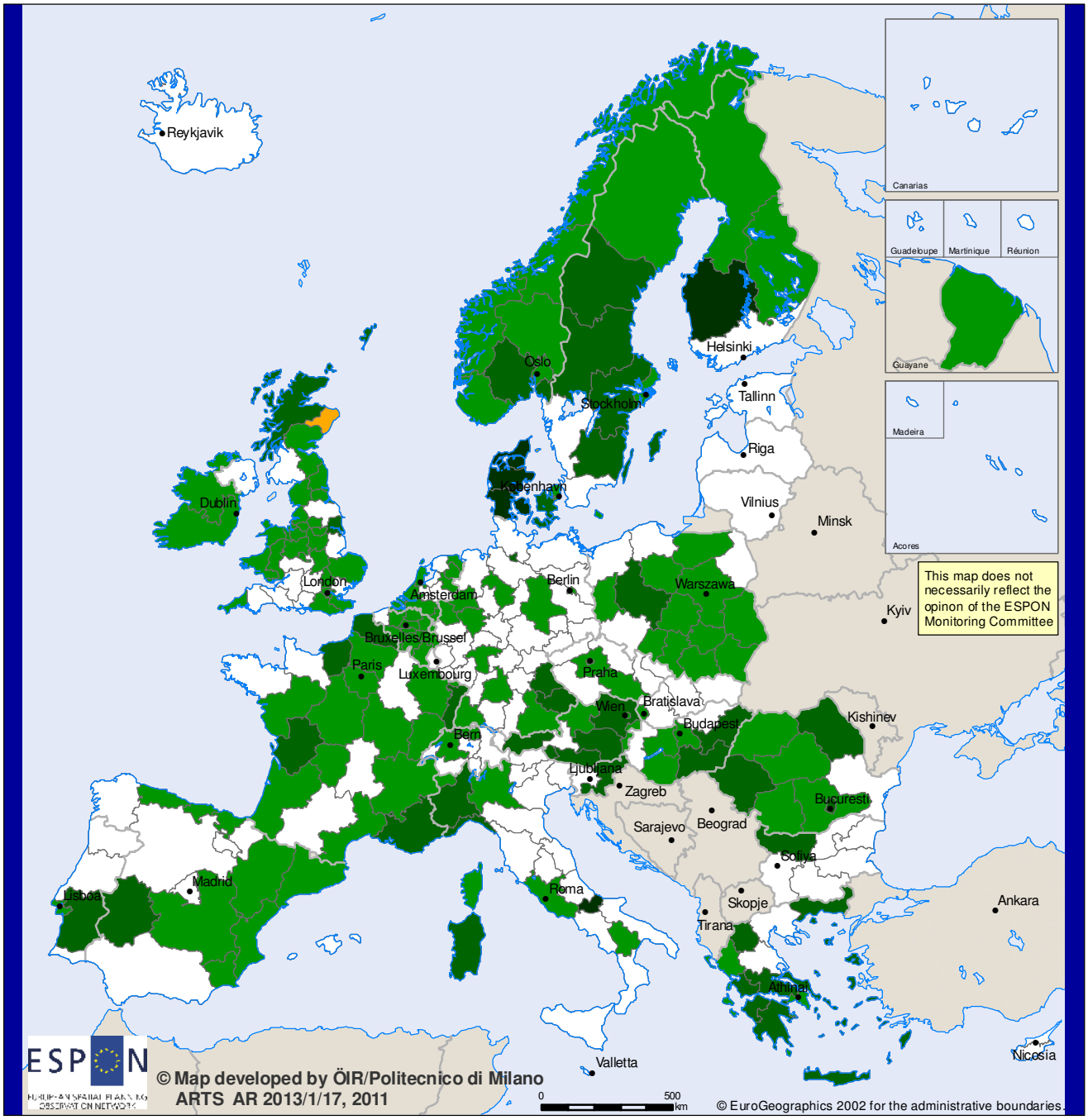


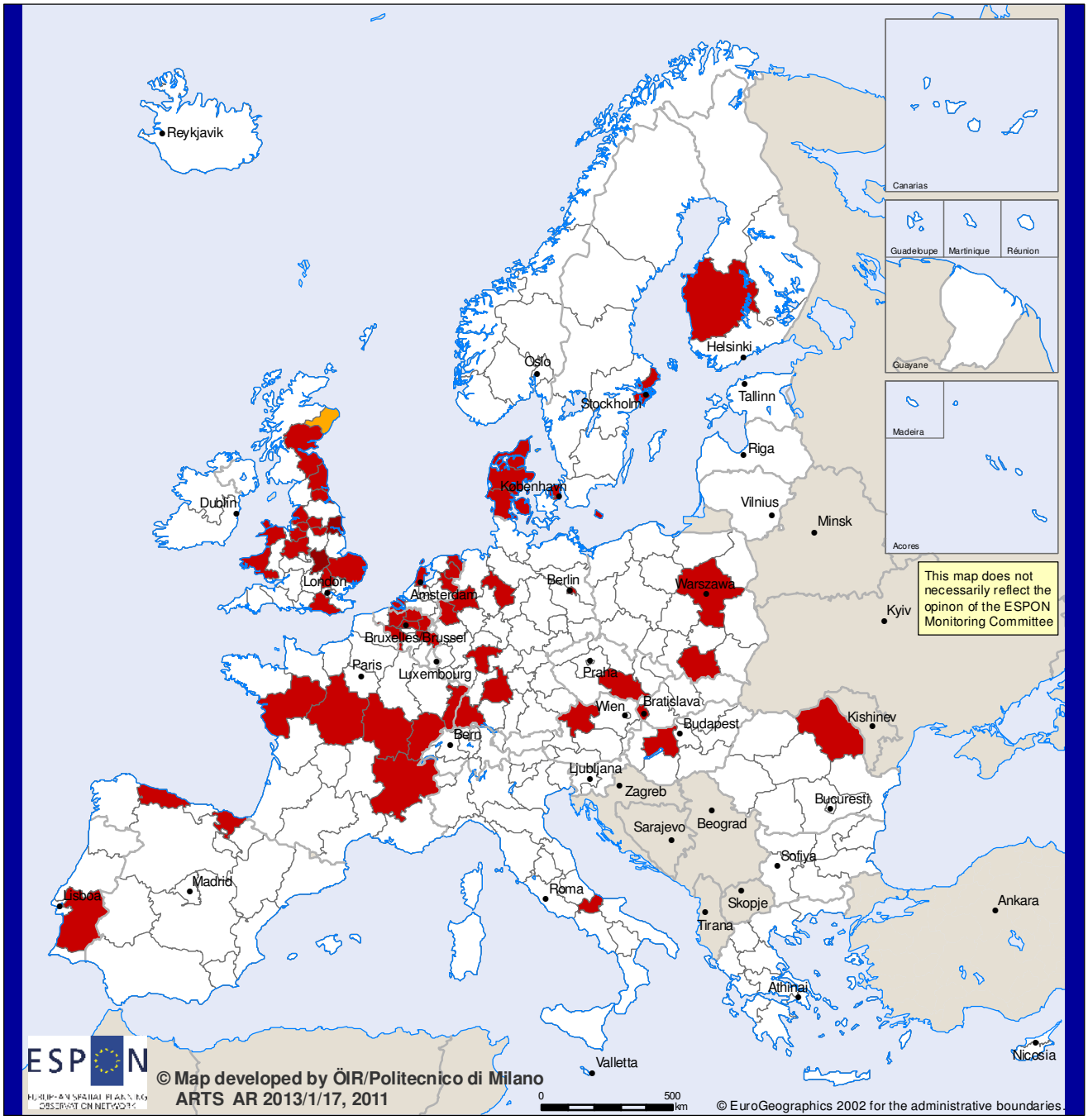
Summative positive impact of Directive on sustainable use of pesticides

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: rural, chemical industries

ESPON ARTS



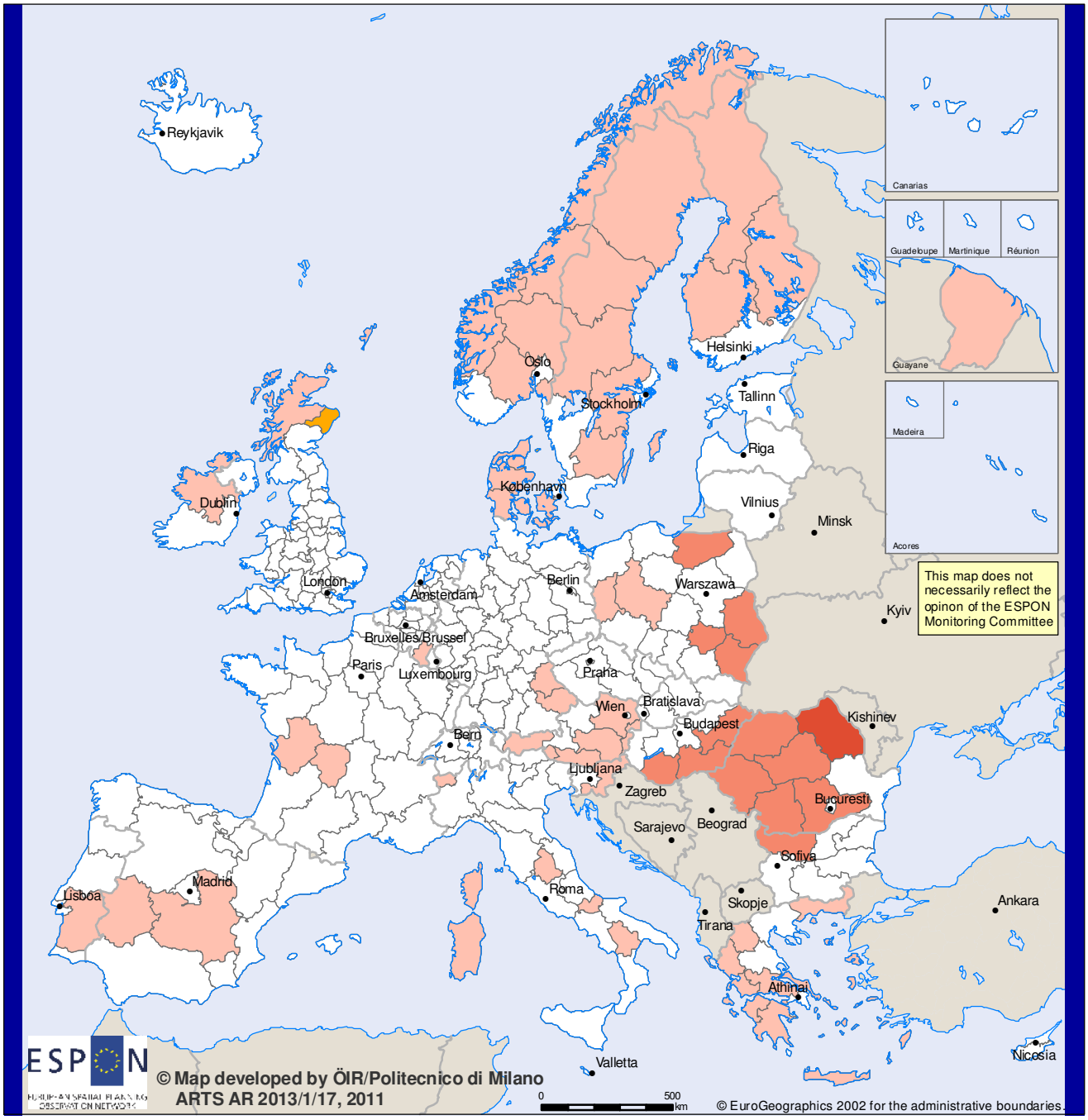
Summative negative impact of Directive on sustainable use of pesticides

Number of indicators with low or very low impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: rural, chemical industries

ESPON ARTS



Territorial Impact of Directive 10 (branch a) on economic growth (GDP/capita)

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

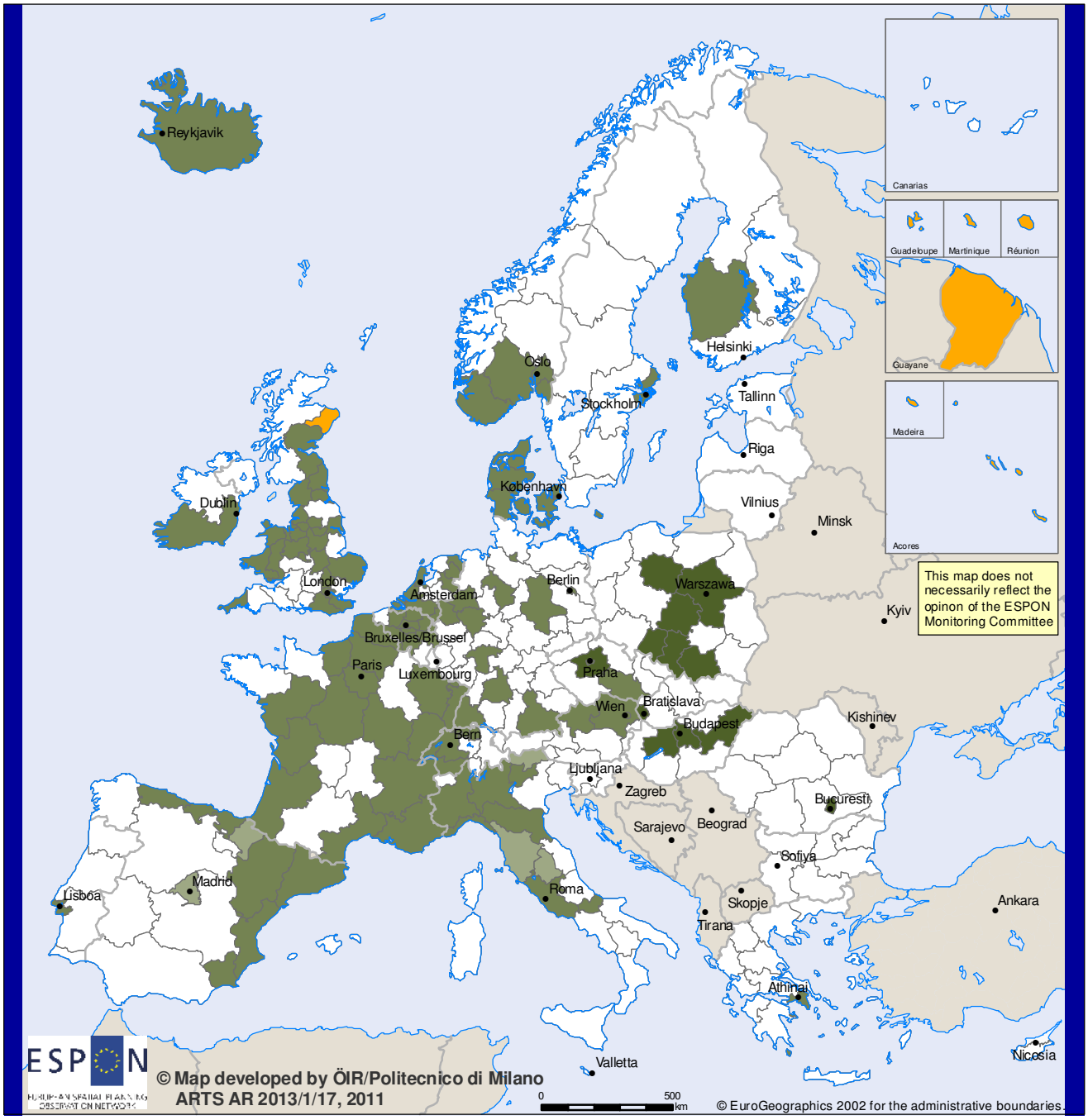
Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: rural

ESPON ARTS



Territorial Impact of Directive 10 (branch b) on healthy life expectancy at birth

Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: chemical industries

4.9 Directive on the energy performance of buildings

The directive promotes the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. Local planners are directly addressed by the directive, to properly consider the optimal combination of improvements in energy efficiency, use of energy from renewable sources and use of district heating and cooling when planning, designing, building and renovating industrial or residential areas.

Logical chain and exposure

The four key points of the Directive are:

- a common methodology for calculating the integrated energy performance of buildings;
- minimum standards on the energy performance of new buildings and existing buildings that are subject to major renovation;
- systems for the energy certification of new and existing buildings and, for public buildings, prominent display of this certification and other relevant information. Certificates must be less than five years old;
- regular inspection of boilers and central air-conditioning systems in buildings and in addition an assessment of heating installations in which the boilers are more than 15 years old.

The common calculation methodology should include all the aspects which determine energy efficiency and not just the quality of the building's insulation. This integrated approach should take account of aspects such as heating and cooling installations, lighting installations, the position and orientation of the building, heat recovery, etc.

The Directive concerns the residential sector and the tertiary sector (offices, public buildings, etc.).

Energy performance certificates should be made available when buildings are constructed, sold or rented out. The Directive specifically mentions rented buildings with the aim of ensuring that the owner, who does not normally pay the charges for energy expenditure, should take the necessary action. Furthermore, the Directive states that occupants of buildings should be enabled to regulate their own consumption of heat and hot water, in so far as such measures are cost effective. The Member States are responsible for drawing up the minimum standards. They will also ensure that the certification and inspection of buildings are carried out by qualified and independent personnel.

The Directive forms part of the Community initiatives on climate change (commitments under the Kyoto Protocol) and security of supply (the Green Paper on security of supply). Firstly, the Community is increasingly dependent on external

energy sources and, secondly, greenhouse gas emissions are on the increase. The Community can have little influence on energy supply but can influence energy demand. One possible solution to both the above problems is to reduce energy consumption by improving energy efficiency. Energy consumption for buildings-related services accounts for approximately one third of total EU energy consumption.

This directive operates within the context of some very dynamic markets such as the fossil energy market, the highly innovative sector of renewable energy production, the heat and cold storage and exchange sector, and the construction sector. In particular the prices of (fossil) energy are hard to predict, but may have serious consequences in relation to this directive and its territorial impact. Depending on the development of cheap means (solar, wind, tidal) for renewable energy production the territorial impact of this directive can work out in different directions. The same counts for the developments in the heat and cold storage sector. Because it is not possible to take all contextual parameters into account the outcomes should be understood in terms of relative continuity of the existing situation. In order to factor in various possible developments the same exercise could be repeated, but under different scenario's, with different contextual parameters.

All areas with buildings could be potentially affected by this directive. It requires member states that all new buildings comply with 'near zero-energy buildings' standards by 31 December 2020 (and 31 December 2018 in case of public buildings). This means that new buildings (or buildings undergoing major renovation) have a very high performance on energy efficiency and that the low amount of energy used comes from renewable sources. This should result in a significantly lower consumption of fossil energy (F34).

Most effects will be on the level of individual new or renovated buildings, which need to be zero-energy buildings by 2018, in the case of public buildings, or 2020 in the case of private buildings. The main impacts will be within the buildings and their installations, with the latter becoming more efficient. From an architectural perspective buildings will be designed in different ways in order to make maximum use of natural climatologically conditions (orientation and angle to the sun, shading etc.), to use different construction materials, to integrate renewable energy production (solar panels, wind turbines, geothermal heat etc.) and may come in adjusted shape, for example with thicker walls.

In terms of physical territorial impact effects are mainly to be expected at the level of a building block or neighborhood in terms of adjusted urban design. In particular in cities where the temperature can be significantly higher due to the dense urban fabric certain urban design provisions can be expected to facilitate the penetration of water and cool air from outside the city. This includes also measures such as lowering the amount of soil sealing, i.e. pavements, roads, at a district level. The overall effect could be a lowering of the amount of buildings per hectare and in effect a more inefficient use of land (F35). On the other hand, it could at the same time lead to a

higher degree of mixed land use (F36) precisely due to the fact that the direct building print will be decreased.

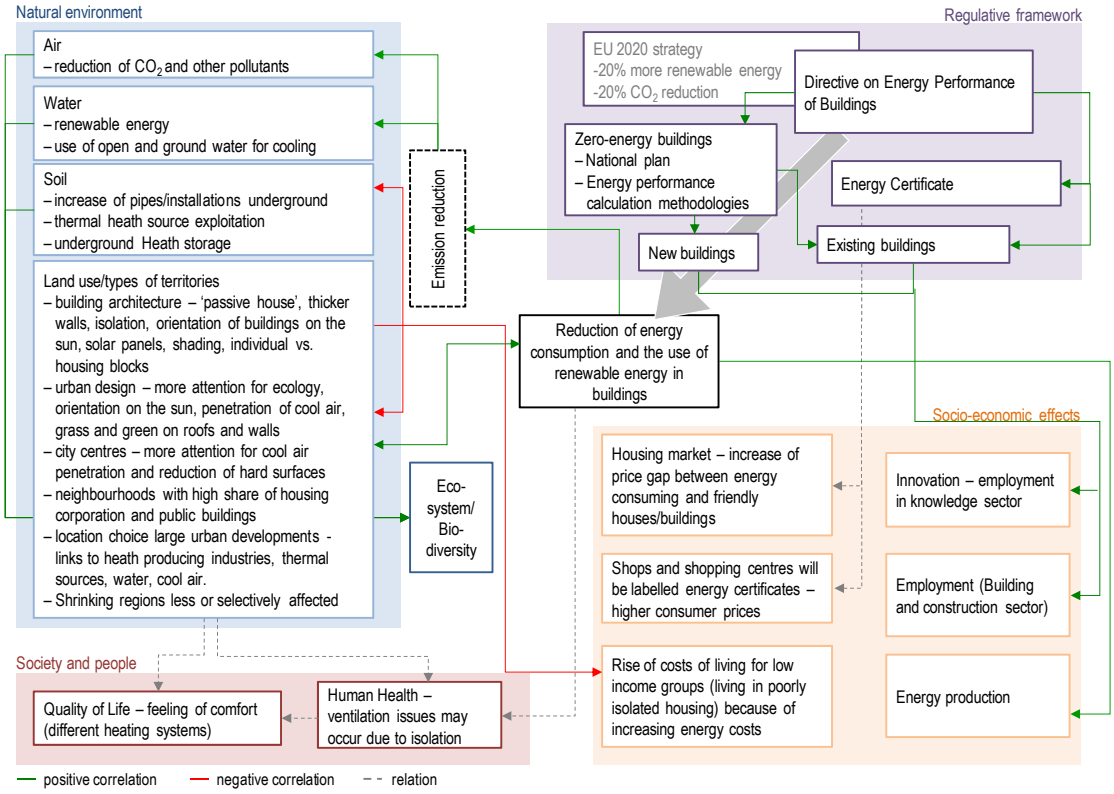
Also there will be increasing attention in urban and neighborhood design for the integration of heat and cold storage and exchange systems, including water as a cooling device (F4). The implementation of such systems involve new underground infrastructure (mainly tubes). Depending on the local situation it can this may also influence decisions on land use and locations for new urban development.

Socially or economically the directive will cause impact too. One field of impact will be the building sector, which needs to become more innovative. In particular in urbanized regions, where there is much building activity, this will lead to more innovation (F13) and new small middle sized consultant and advisory companies in the tertiary sector (F14).

Another social effect, which is more negative, could be further segregation and uneven income distribution in terms of disposable income (F21). Because significant costs involved in making buildings energy neutral it will be difficult for individual owners or landlords to adapt their houses/buildings to the new standards. In particular lower income households will be hesitant to either adapt their own house or move to a new zero energy rent house, which will be more expensive on the short term (but will be compensated on the long term due to lower energy costs). Rather than moving they will stay in poorly isolated and energy inefficient houses. If energy prices raise the effect will multiply and lead to increased income differentiation. In spatial terms it may lead to further segregation within cities.

Indirectly the directive will further stimulate the production of renewable energy (wind, solar, water, biomass etc.) which will have important territorial impact too. The directive foresees in establishing monitoring systems including energy performance certificates for several building categories, national plans to achieve targets, policies and incentives. This will mainly affect the efficiency of government (F37) in terms of additional tasks. The complexity of the planning procedure (F38) may also increase to a limited extent due to an additional national plan which will influence other plans and the certificate system that may play a role in issuing permits.

Figure C 13: Logical chain of the directive



The regions affected by the directive

The main type of regions that will be affected concern those regions where many buildings can be found and are being built. This concerns mainly densely populated, urbanized and growth regions. A map depicting regions affected can be found in A5.

The Territorial impact of the directive

Two more specific types of regions can be identified where effects may be relatively large. This concerns first regions with a high share of **cultural heritage** (F11) in terms of historic buildings (see Map C 17). This concerns regions such as Prague, Cataluña, Cyprus, but also and in particular many Italian regions. A better indicator would have been 'percentage of old buildings as share total amount of buildings', but the indicator cultural heritage comes close and gives a decent indication. Another type of region that will be more strongly affected are regions where **income distribution** (E22) is unbalanced (see Map C 18). This unbalance will be increasing rather than decreasing because of this directive. Regions that are concerned include Andalucia along with a number of other Spanish regions, Thessaly, Malta, almost all Portuguese regions and a number of Italian regions.

A very indirectly affected type of region, concern regions that are vulnerable to climate change. Because of less **fossil fuel consumption** (F34) (see Map C 19) there will be less **CO_2 emission** (F7) which reduces the speed of climate change.

Map C 17: Territorial Impact of Directive 12 on conservation of cultural heritage

Map C 18: Territorial Impact of Directive 12 on equal income distribution

Map C 19: Territorial Impact of Directive 12 on fossil fuel consumption

Map C 20: Summative positive impact of Directive on the energy performance of buildings

Map C 21: Summative negative impact of Directive on the energy performance of buildings

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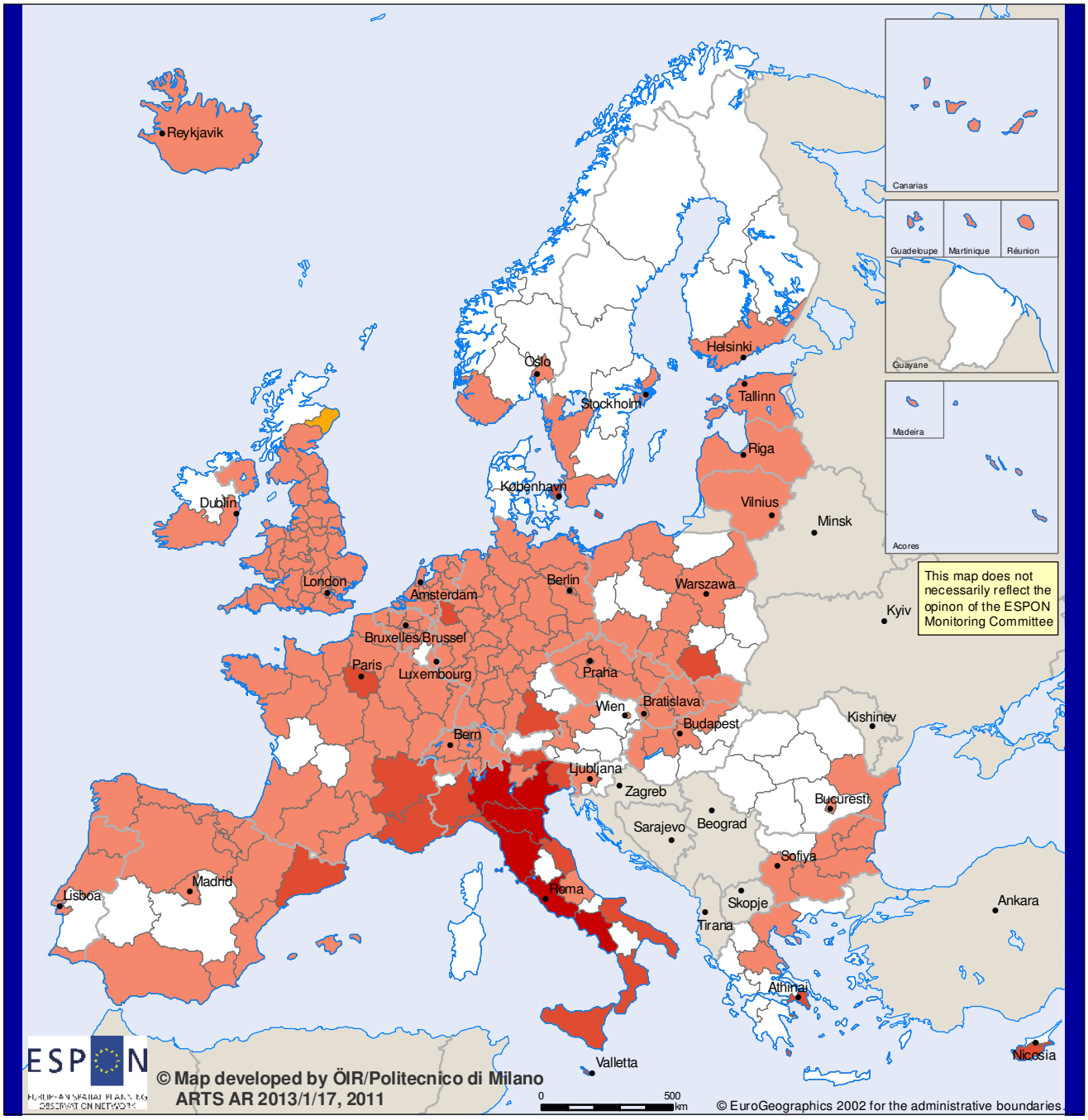

Territorial Impact of Directive 12 on conservation of cultural heritage

Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: urban, agglomerated

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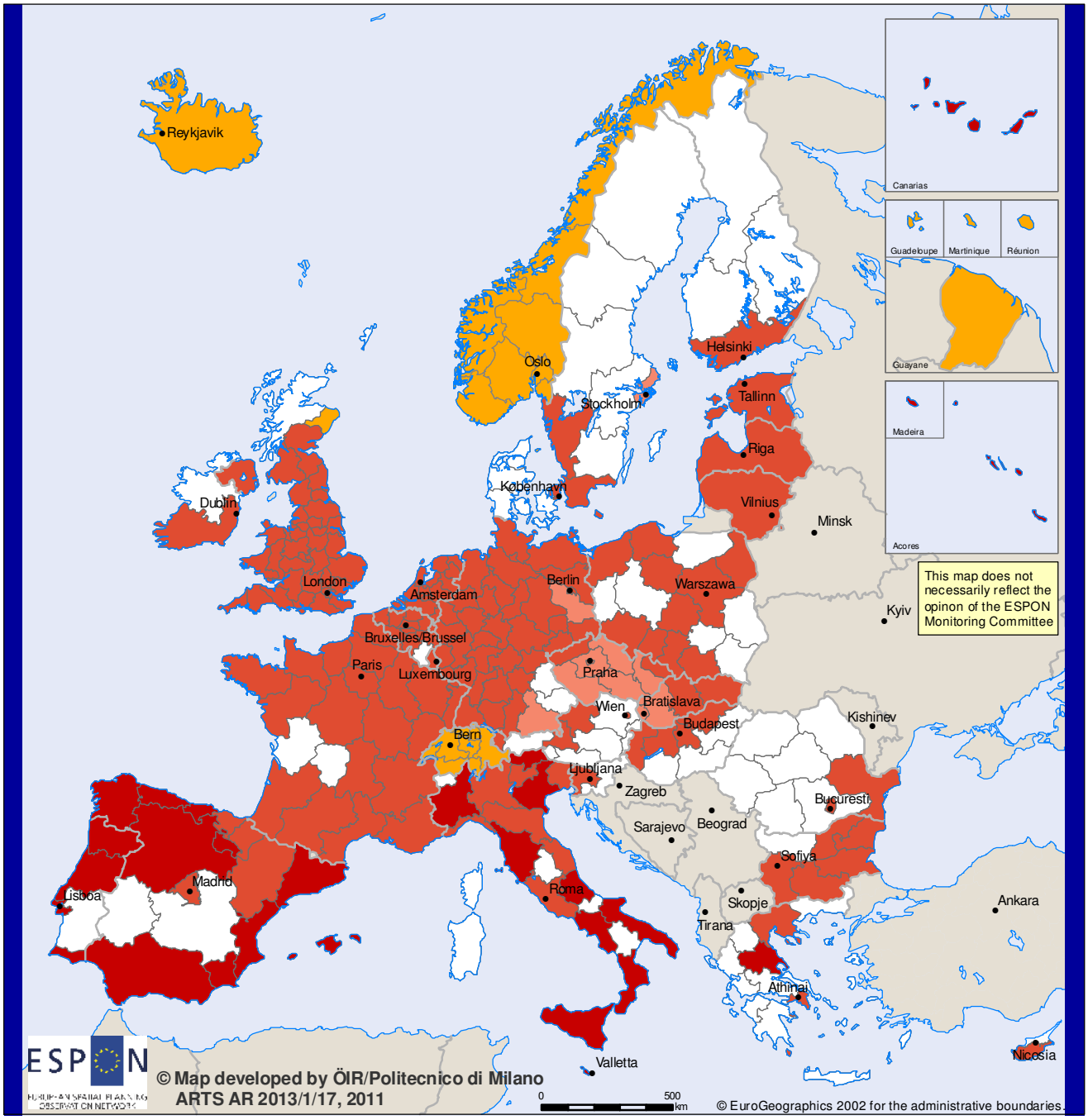

Territorial Impact of Directive 12 on equal income distribution

Negative Impact	Positive Impact	
Very high impact	Minor impact	No Data
High impact	Moderate impact	Neighbourhood Countries
Moderate impact	High impact	
Minor impact	Very high impact	
Not affected		

Types of regions affected: urban, agglomerated

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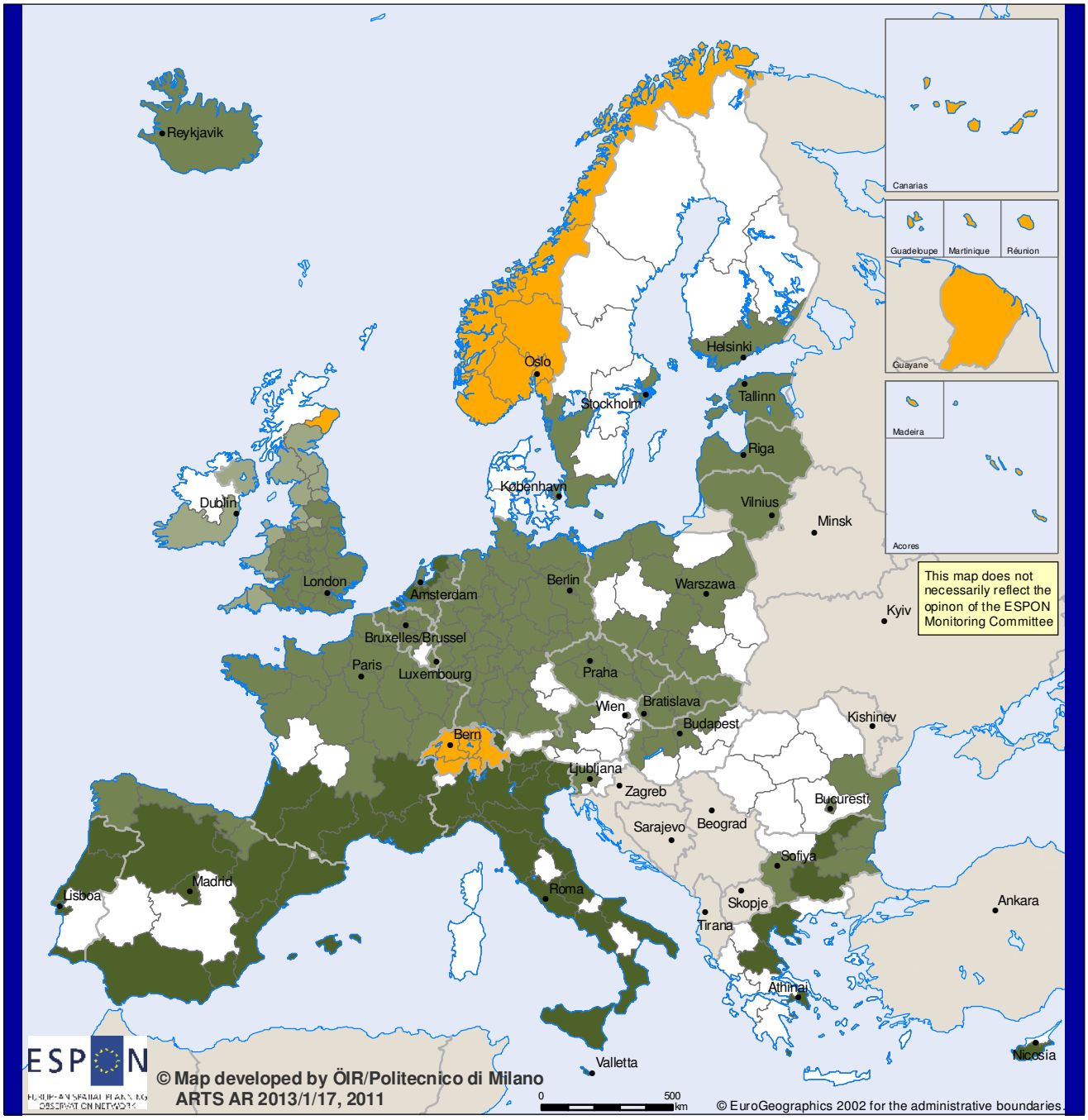


Territorial Impact of Directive 12 on fossil fuel consumption

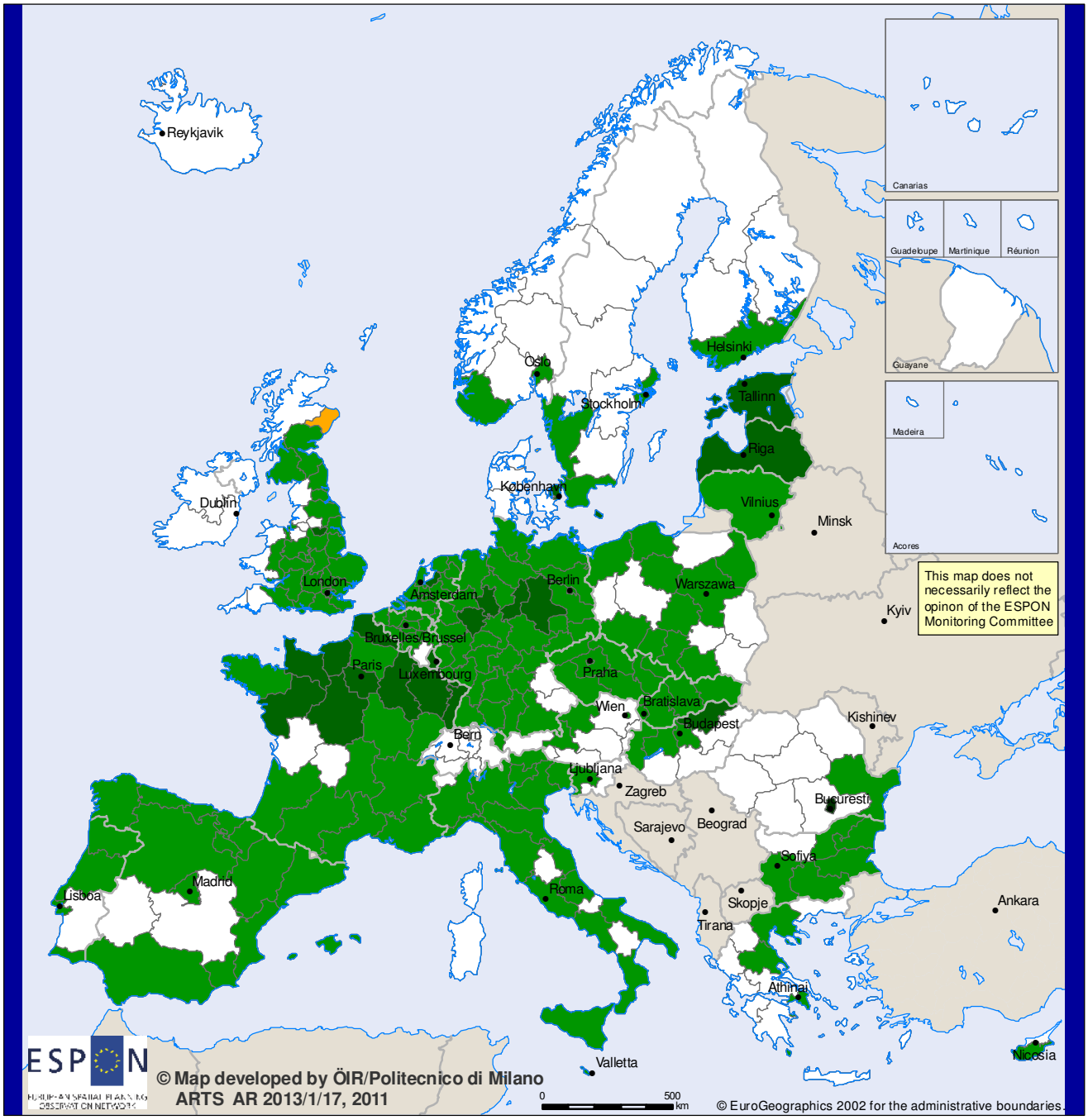
Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: urban, agglomerated

ESPON ARTS



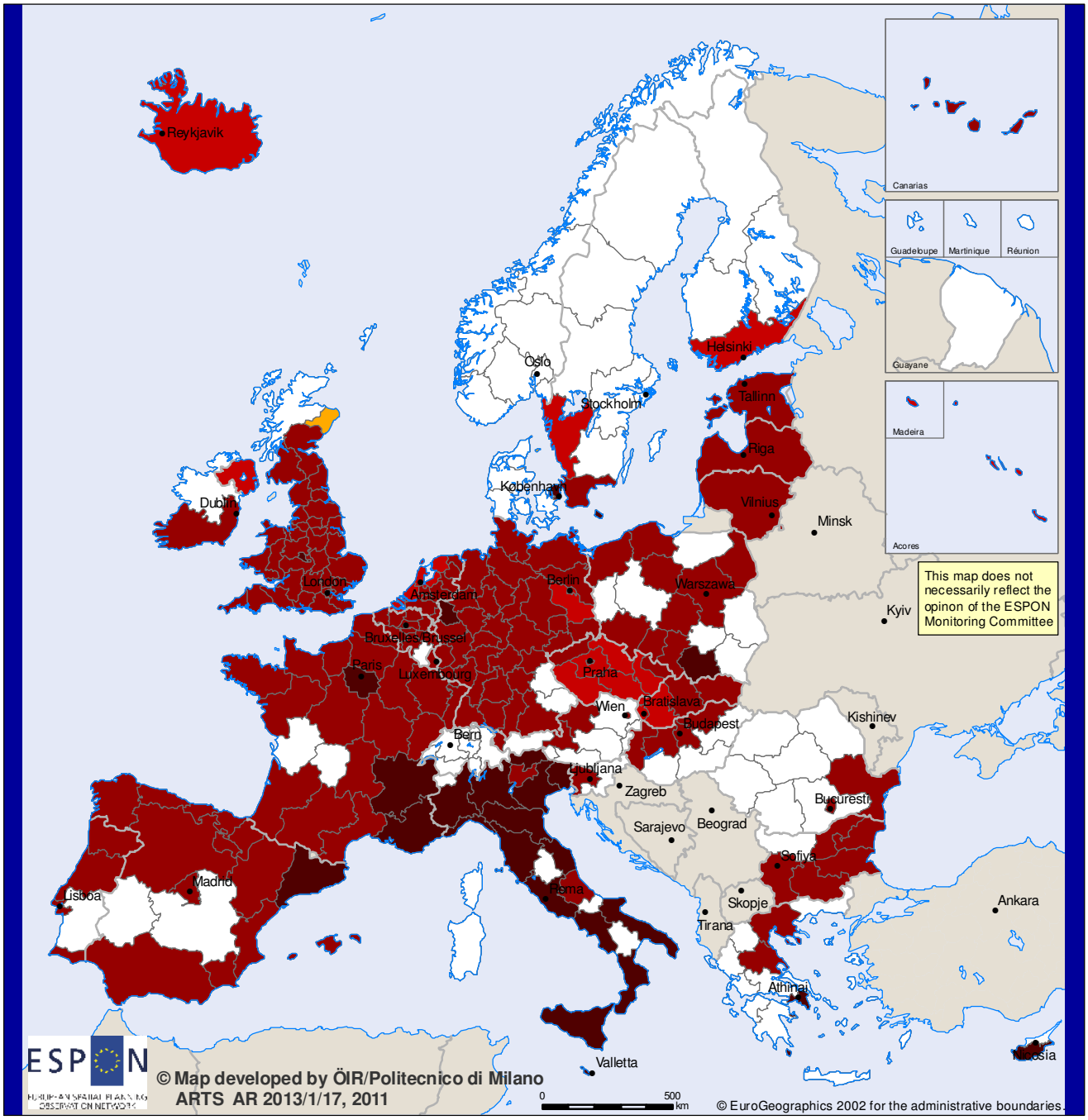
Summative positive impact of Directive on the energy performance of buildings

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: urban, agglomerated

ESPON ARTS



Summative negative impact of Directive on the energy performance of buildings

Number of indicators with low or very low impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: urban, agglomerated

5 Detailed results of three Case Study Directives including their in-depth analysis

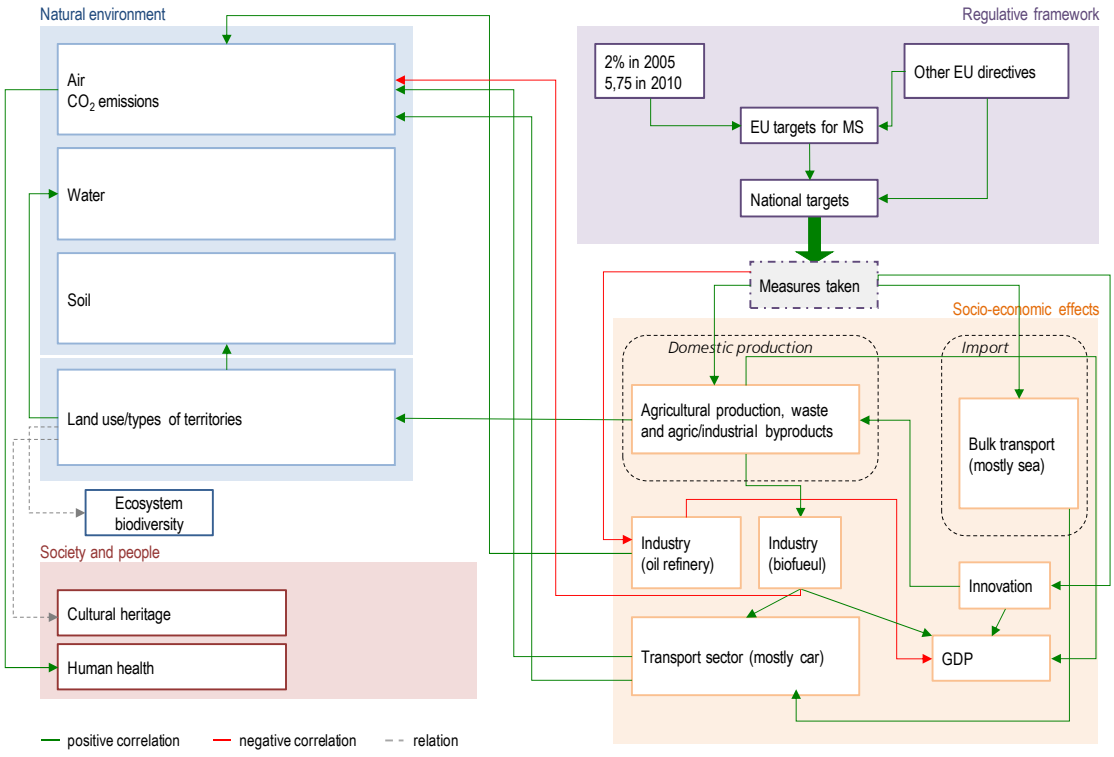
5.1 Directive on the promotion of the use of biofuels or other renewable fuels for transport

This directive does no more than set minimum percentages for renewables in transport fuels. Member states have to determine for themselves how they will meet these targets. Since fuel types are mixed at the petrol station, the directive mainly affects the process of conversion of raw materials into diesel or petrol, not the transport from refinery to petrol station or the use of the fuel in vehicles.

5.1.1 Logical chain and exposure

The logical chain has different branches.

Figure C 14: Logical chain of the directive



Branch a implies large-scale import of raw materials from overseas. These are then industrially converted into fuels. Large-scale transport generally occurs over water, both over sea as well as over inland waterways. Raw materials have to be off-loaded, stored and processed, which means the occupation of space in industrial areas, situated next to waterways. The conversion itself demands industrial installations on a more (in the case of second generation bio diesel) or less (in the case first generation bio diesel and gasoline) big scale.

As opposed to branch a, production of raw material for biofuel takes place in the European territory itself. The European norm leads to an increased demand, that prompts farmers to switch from food to biofuel crops. This decision depends on the price of biofuels, the price of alternative crops and local specificities. In many areas of Europe, biofuels cannot compete with other crops. Only in areas where current crop production is very unprofitable, is there a chance that farmers will switch to biofuel production (both first generation (sugar, starch, vegetable oil) as second generation (cellulose)) (Rutz & Janssen, 2007). The impact of this branch on ecological factors like biodiversity, is mainly dependent on what the land use before conversion.

Two further branches (c and d) relate to the use of waste material from food crops for producing biofuels; and to a different management of nature areas, in which can rest products of forest or park management is utilized.

Within the logic of branch c, farmers use the waste material from their crops for producing biofuels (this implies second generation biofuels where fuel can be produced from any organic material such as inedible parts of food crops, wood, straw, etc). Because it is the rest product that is being used, branch c will not impact land use, but it may have impacts on the conservation of traditional landscape (because of the industrial-like installations that are being build next to the farms), and, more in general, it will affect the profitability of farming in the region and with that its social-economic prospects for the population.

Management of natural areas, but also forests in general, produce waste material such as wood (or reeds, in the case of wetlands), which can be used for second-generation biofuels. This is the fourth branch (d) in the logical chain. Although this will not lead to a different land use directly, in can have an important indirect impact. The extra income that is generated in addition to their ecological and recreational value, implies that it will be easier to preserve these areas. Biofuel production supports in this retaining natural areas which would otherwise have been converted into agriculture or urbanized area.

The raw materials in branches b,c, and d are brought by road to the nearest conversion plant. These can be the same as in branch a, or more small-scale local facilities. As the raw materials in these branches often have a relative low energy content (e.g. wood or reed), only transportation over small distances can stay efficient, both from a economical standpoint, as well as form the perspective of efficient energy use, as the transportation vehicles use fossil fuel themselves.

Branches c and d are not being taken into account in the Territorial Impact Matrix, because the two first branches are expected to show the most impact. Branch c will not change land use, only contributing a little to the margin on farming (although this can mean the difference for the survival of the farm). Branch d is an interesting, but relatively indirect possible impact of the directive.

5.1.2 Type of regions affected by the directive

In parallel with the description of impacts of the other directives, only for two of the branches the types of regions have been identified and impacts haven been estimated. For branch a, harbours (both sea and inland ports) have been selected (ESPON indicator: accessibility of sea harbours within 30 min). For branch b, regions with a low agricultural profitability (a proxy indicator of farm size was used). A map depicting regions affected can be found in A5.

5.1.3 The Territorial impact of the directive

For the production of biofuels – whether imported or from domestic origin – industrial areas need to be expanded, plants built and put into operation. This can have various impacts, of rather local nature. The NUTS-2 classification used on the maps render in this case a relatively crude picture.

The directive is expected to affect the **natural environment** in a number of ways. As regards **soil sealing** (F3), the model results show the greatest (negative) impacts in already heavily urbanized regions such as Inner London, Wien and Berlin. Regarding **biodiversity** (F9) the picture is different: the two most affected regions are both in Spain: Canarias and Comunidad Valenciana. Other areas which show negative impacts on this indicator are Slovenia, Abruzzo (IT), Yugoiztochen (BG) and Algarve (PT). Finally, as regards land-use, the major negative impacts can be found in the largest cities, which is most likely the product of the sensitivity measure used, rather than an expectation that these areas will experience the most **urban sprawl** as a result of the biofuels directive.

The extra harbour activity resulting from the directive is also expected to have a negative impact on air quality, specifically that **pollution in the air** (F6) and **CO_2 emissions** (F7) are expected to increase. The areas with the most impact are: Sud (RO), Mazowieckie (PL), Düsseldorf (DE), the Dutch regions of Limburg and Noord-Brabant, and the Paris region Île de France. The CO_2 emissions is expected to produce the most impact in harbour regions where there are is already a high level of vehicular traffic (sensitivity) such as Bremen (DE), Greater Manchester and Merseyside (UK) and Hamburg (DE).

Regarding the economic impact of importing biofuels via harbours, the most significant positive results on **economic production** (F12) can be found in relatively poor regions, which also indicate the effect of the sensitivity adjustment. The top five regions profiting are all in Bulgaria and Romania, with Severozapaden and Severen tsentralen (BG) and Sud-Vest and Sud (RO) topping the list. A similar situation is apparent as regards the impact on **employment** (F23) – areas with high unemployment are more sensitive and thus stand more to gain from the benefits from the directive. Interestingly, the top three regions are all French peripheral island regions (Reunion, Guadeloupe and Guyane). These are followed by Zachodniopomorskie (PL) and three eastern German regions.

In a different way, the directive can also have economic impact on harbours in richer regions. An example is the harbour of Harlingen in Friesland, the Netherlands, which welcomes biomass based energy factories to support the small regional harbour in its competition with other harbours (Van Hoorn, Tennekes & van Wijngaarden, 2010). Biofuel plants can contribute to an image of a 'green harbour', which may attract other activities as well.

The impacts of the directive along branch b are particularly of interest in those areas where normal crop production is relatively unprofitable. As crops for biofuel compete with normal crop production (unlike branch c, where rest products of agricultural production are being used), in these areas it is more likely that farmers will switch than in others. Still, very local circumstances such as the disposition of the soil, the availability of specialist knowledge, or the vicinity of a conversion plant are crucial. Conversely, also in areas with more profitable farming in general, bad market circumstances can prompt farmers to switch to first generation biofuel crops for a limited period. As can the introduction of subsidies for biofuel production on EU or national level.

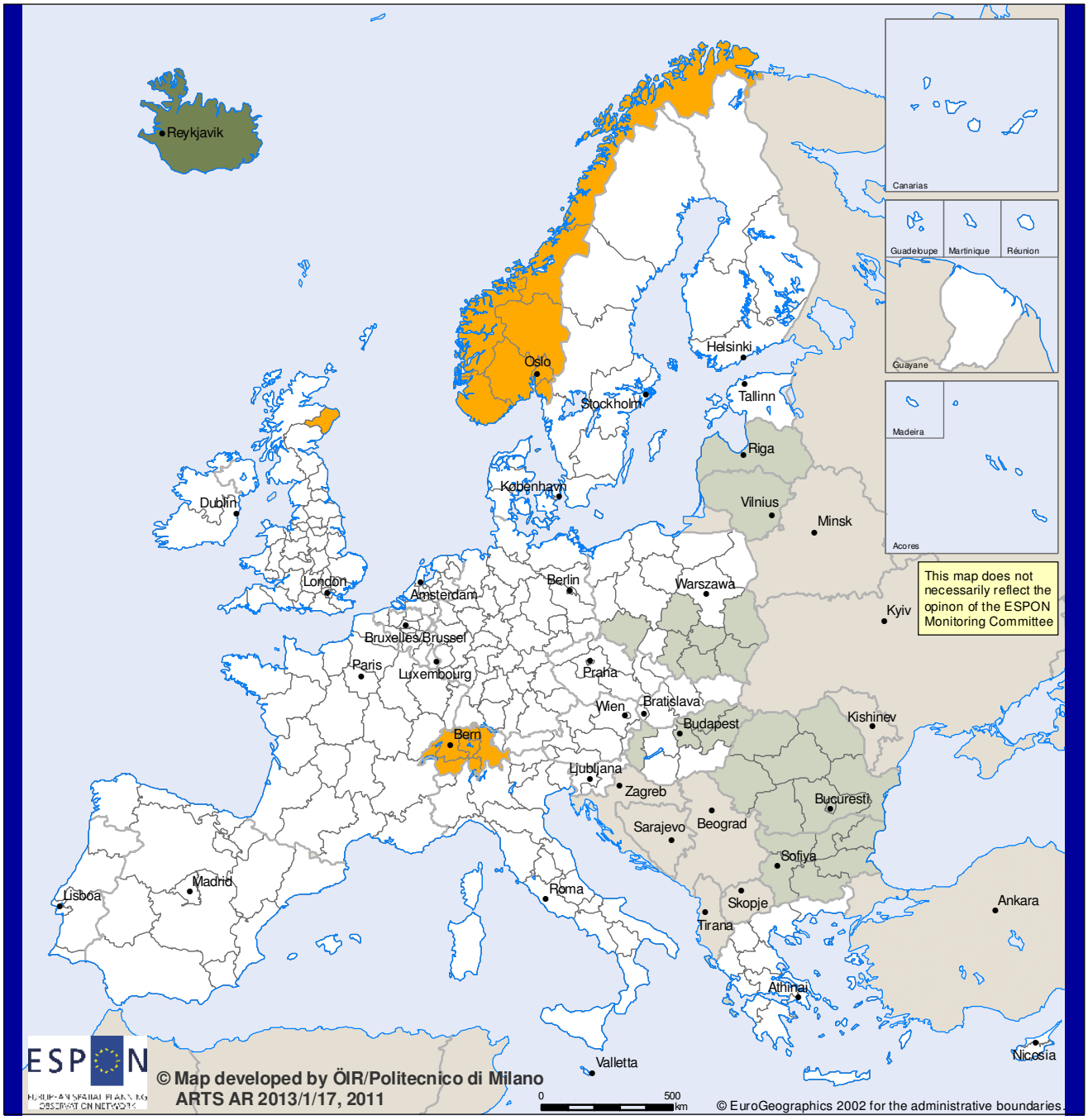
Impacts on the regional economy are generally seen as positive, due to the promise of another source of income in disadvantaged rural areas. The impact on **economic growth** (F12) is most significant in areas where the regional sensitivity is highest, namely the poorer regions (see Map C 23). In fact, the top ten most affected regions are all in Romania and Bulgaria, with Nord-Est in Romania topping the list. The variable **employment in the primary sector** (F16) is also positive in Eastern Europe, but is much more spread out than GDP (see Map C 22). The main beneficiaries (in order) are: Közép-Magyarország (HU), Bucaresti (RO), Ionia Nisia (GR), Nyugat-Dunántúl (HU) Slaskie (PL) and Lithuania.

Map C 22: Territorial Impact of Directive 5 (branch a) on employment of primary sector

Map C 23: Territorial Impact of Directive 5 (branch b) on economic growth (GDP/capita)

[following pages]

ESPON ARTS



Territorial Impact of Directive 5 (branch a) on employment of primary sector

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

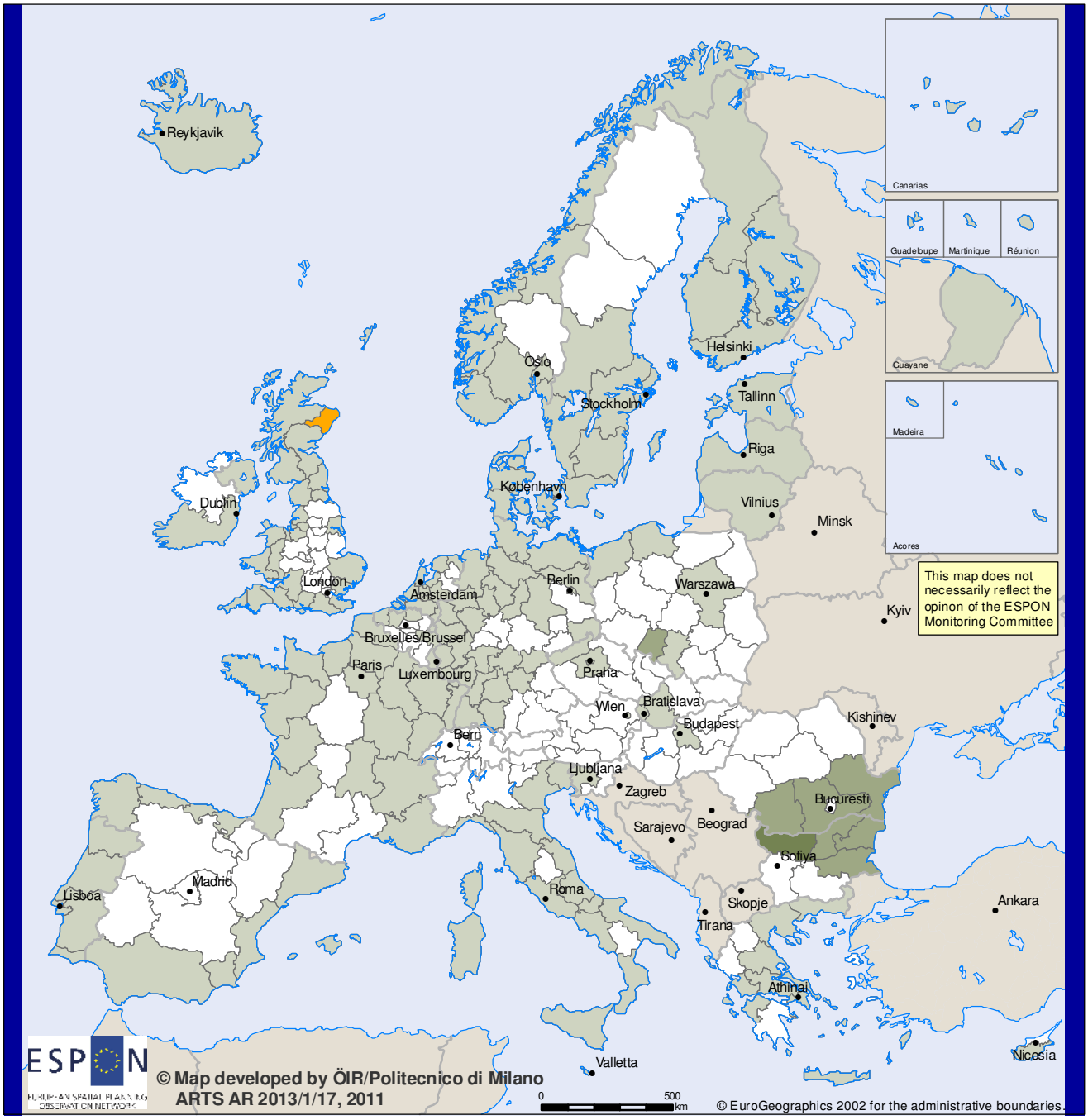
Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: rural, unprofitable farming, natural areas, forest

ESPON ARTS



Territorial Impact of Directive 5 (branch b) on economic growth (GDP/capita)

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: harbour regions

5.2 Directive on the recognition of professional qualifications

This Directive establishes a framework one the recognition of professional qualifications within the EU. It aims to clarify and consolidate the current rules in place and to facilitate free movement of qualified professionals between Member States.

5.2.1 Logical chain and exposure

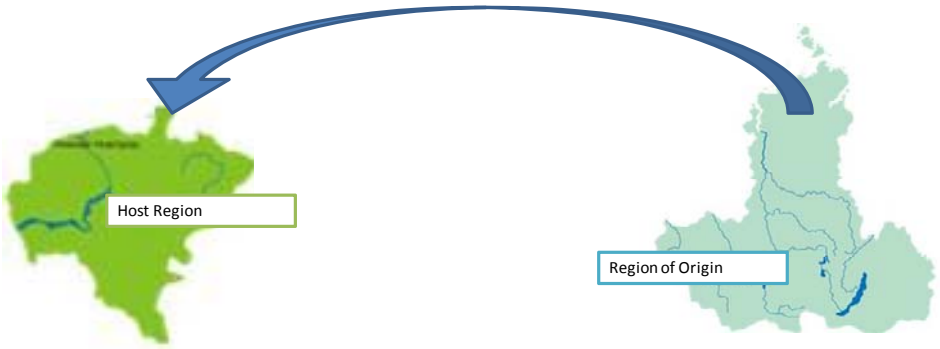
The simplification and harmonisation of recognising professional qualifications benefit governance mechanism across all regions. When considering the effects of this Directive it becomes apparent, that urban and wealthy regions (branch a) are affected differently than shrinking regions (branch b). Mobile professionals are inclined to leave 'unattractive' regions and migrate to urban and wealthy regions where working conditions (especially wage levels) are more promising. The access to labour markets facilitates freedom of movement and service provision and also enables citizens to profit from cultural exchange

The recognition of professional qualifications triggers regional development in all sectors of economy in wealthy regions through creating a favourable environment for the movement of workers thus creating additional supply of labour and in due course prepares the ground for the establishment of service enterprises. For shrinking regions the effect can be opposite: jobs are lost in the secondary and tertiary sector which has negative effects on economic growth in the short run. In the long run rebound effects are expected due to relocation of production to regions with lower production costs.

The primary sectors being bound to land face competitive disadvantages opposite the high attractiveness of jobs in all other sectors in both, wealthy and shrinking regions.

The following table provides an overview of the short and long term effects for labour markets and income for both the host regions and the regions of origin:

Host Region	Region of Origin

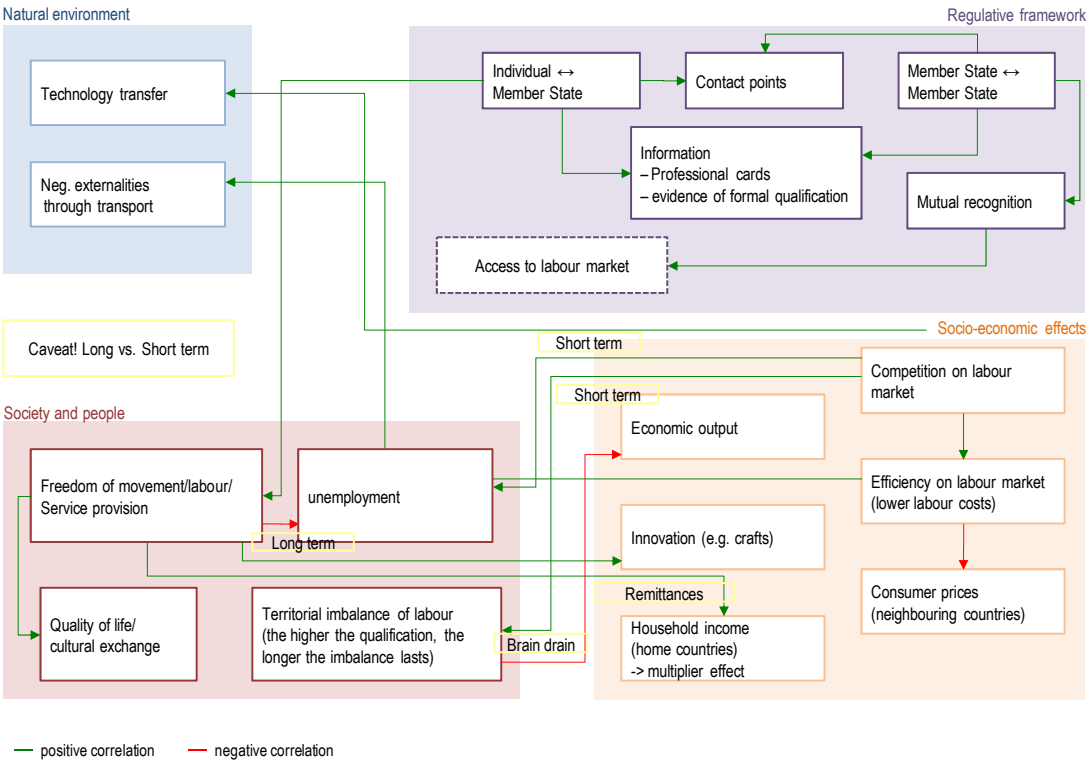


Original condition	
High labour demand ⇨ relatively high wages due to underuse of resources/demand surplus in goods and services together with relatively higher cost levels	Relatively low wage levels ⇨ due to sufficient labour supply or supply surplus together with relatively lower cost levels
Consequence: short term movement of labour	
Labour market effects	
Labour market equilibrium on a relatively lower wage level compared to the original condition If the in-migration of labour continues until the marginal wage gains are more than compensated by the costs (transaction costs and additional cost levels to be borne in the host region) ⇨ stop of movement	Labour shortage and rising wage levels ⇨ increasing attractiveness of the region for in-migration of labour ⇨ possible counter movement of work force or in-migration of labour from other regions
Income equality effects	
Declining household income due to increased competition on the labour market for the economic sector concerned (e.g. health care). ⇨ generally increase in income inequalities (ceteris paribus)	Increasing household income due to labour demand over time ⇨ generally increase in income inequalities although in the long run closing of this gap if countermovement of the work force sets in.
Disposable Income	
In the economic sectors concerned the disposable income will go down on average with an overall increase of the work force. However this will not affect the general income levels on the macro scale significantly	In the long run the income level in the sectors concerned will rise – however with limited overall effect on the macro scale.

Generally in the short run this development increases income inequalities due to labour surplus in the host countries whereas in the long run labour market equilibrium establishes a more equal income distribution.

The general increase of economic activities and transport cause the CO_2 emission to go up. Furthermore population growth in the host regions increases the demand for housing, water and energy. The opposite can be expected for the regions of origin. This also has effects on the landscape diversity: Population growth and urban sprawl entails a loss of characteristics in growing regions.

Figure C 15: Logical chain of the directive



5.2.2 The regions affected by the directive

The Directive is expected to effects agglomerated, urban and wealthy regions (branch a) differently than shrinking regions (branch b). The rationale behind this is that urban and wealthy regions are attractive to mobile professionals who seek better working conditions. While these regions attract further population, regions with less promising job prospects are left behind.

Hence effects stemming from branch b of the directive touch regions that can be found mainly on the eastern side of the ESPON space. The Baltics as well as Bulgaria, most of Romania, Hungary and eastern Germany belong to the regions affected. Great parts of Slovenia, Czech Republic, Poland and Greece also are touched by the implementation of that Directive. As are the sparsely populated regions in northern Sweden and eastern Finland.

In the case of branch a agglomerated and prosperous areas stick out. They encompass vast parts of Europe. Germany, Czech Republic, Slovakia, Switzerland, the Netherlands the Baltics, Lichtenstein, Luxembourg, Cyprus, Iceland and Malta belong consistently to that category. In the UK this branch impacts all but Highlands and Islands, in Ireland all but Border, Midlands and Western, in Portugal Alentejo, in Spain Castilla-la Mancha and Extremaura, in France Corse, Poitou-Charentes, Guayane and Limousin, in Belgium Prov. Luxembourg (B), in Bulgaria Severozapaden and in Germany all but Oberpfalz and Niederbayern. In Scandinavia only the most southern regions, including the capital regions are affected. Similar are

the effects in Denmark (only Hovedstaden) and in Romania (Bucharesti and Sud-Est). In Poland, Austrian, Italy, Hungary, Greece, France and Slovenia the situation is more differentiated.

A map depicting regions affected can be found in A5.

5.2.3 The Territorial impact of the directive

The Directive bears diverse impacts on **regional economy**. All in all the **economy** (F12) in wealthy regions will growth further whereas economy in shrinking region is impacted negatively. However, in both branches this impact will be mostly minor. Only in already poor regions in Bulgaria, Romania, Hungary and Poland the impact will be stronger (moderate). The greatest magnitude of positive effects can be found in regions in terms of **entrepreneurship** (F14) for both wealthy and shrinking regions. In both, the regions are mainly affected very highly positive, an exception being Peloponnisos (GR) where the impact is only moderate. Considering **employment in agriculture** (F16) both branches bear minor negative effects for all regions. More pronounced is this in city regions, like e.g. Vienna, Brussels, Hamburg, Munich in Oberbayern, Île de France, Luxemburg, Groningen (NL), Stockholm and London, were already there is only a small share of farming. Positive effects on **Tourism** (F20) in all affected are minor, except shrinking regions in Poland, Bulgaria and Romania which benefit more than others.

Harmonising the recognition of professional qualifications within the EU has very high positive impact on **income distribution** (F22) in shrinking regions. Within the agglomerated and wealthy regions those in southern Europe, especially in Portugal and Malta benefit in that regard although not to the same extent. This ameliorated social situation has strong positive effects on **health** (F28) in eastern European regions and the Baltics.

More differentiated are the impacts on **employment** (F23) and **migration** balance (F24). Shrinking regions will suffer in both regards a negative impact. While the effect on employment is negative but mostly minor (exception for some parts in Germany and Poland, where it is moderate), the negative impact on migration is on a greater scale and more differentiated, ranging from moderate to very high.

In agglomerated regions, the effects are the opposite. Attracting new residents, the impact on **migration** is strong and positive. More so in regard to the job market. Increased economic activity provides workplaces, which shows on the consistently high to very high positive impacts on the **employment** rate (F23). Most pronounced are these effects in European periphery, where agglomerated or wealthy areas stand out even more as centres for economic activities.

Following **branch a**, **wealthy regions** attract population, leading to the construction of housing, which has negative impacts on the share of **soil sealing** (F3), leads to **urban sprawl** (F35), accompanied by negative impacts on the level of **CO_2 Emissions** (F7) These effects are generally minor, although big urban

agglomerations, already being more sensitive, show a moderate negative impact. These include regions like Brussels, Praha, Vienna, many cities in Germany (Bremen, Berlin, Hamburg) and the UK (London, West Midlands, Greater Manchester, Merseyside) and Ciudad Autónoma de Melilla (ES). Increased **fuel consumption** (F34) follows minor to moderate negative impacts on the regions, most affected are regions in southern Europe. The top 20 are found in Spain, Portugal, Greece and Italy. To a lesser dimension the stated impacts also affect the region's **landscape diversity** (F10) negatively, the Canaries (ES) being affected the most.

The impact on the environment in **shrinking regions** is very limited and undifferentiated minor: slightly negative on the level of **CO_2 Emissions** (F7) and slightly positive on **landscape diversity** (F10), most so in Greece. The decrease in **fuel consumption** (F34) mainly profits (to a moderate extent) shrinking regions vulnerable to climate change, especially in Bulgaria, Hungary and Greece and Alentejo in Portugal.

Interpreting the territorial impact as analysis of negative unintended effects it becomes clear that the effect on shrinking regions is problematic.

In general the trade off between two carrying principles of the EU becomes visible by the analysis of intended and unintended effects of this directive:

Principle of freedom of movement of factors of production (labour)/goods and services

The European Union's Internal Market seeks to guarantee the free movement of goods, capital, services, and people – the EU's four freedoms – within the EU's 27 member states.

The Internal Market is intended to be conducive to increased competition, increased specialisation, larger economies of scale, allows goods and factors of production to move to the area where they are most valued, thus improving the efficiency of the allocation of resources.

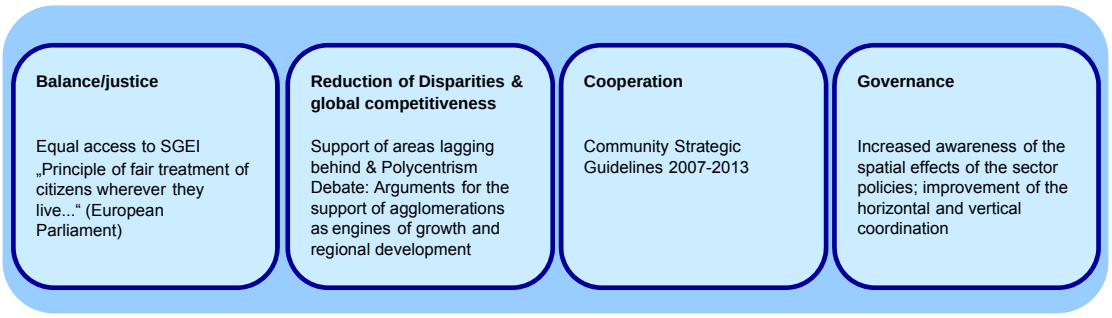
It is also intended to drive economic integration whereby the once separate economies of the member states become integrated within a single EU wide economy. Half the trade in the EU is covered by legislation harmonised by the EU.

The free movement of persons, which is also touched by this directive, is a fundamental right guaranteed to European Union (EU) citizens by the Treaties. It is realised through the area of freedom, security and justice without internal borders. Lifting internal borders requires strengthened management of the Union's external borders as well as regulated entry and residence of non-EU nationals, including through a common asylum and immigration policy.

Principle of Territorial Cohesion

Since the Treaty of Amsterdam (1997) the term has been embedded in EU constitutional law – esp. in connection with Services of General Economic Interest – SGEI. It is often seen as "synonym" for the encouragement of regional development within the EU and still shows a certain vagueness of its concrete meaning.

However in principle there are four dimensions to be distinguished:



Balance/Justice

With territorial cohesion access to services of general economic interest (SGEIs) will be ensured even in peripheral, disadvantaged areas. These efforts are aimed against complete market liberalization, with the understanding of the existence of market failures in certain fields as an argument for constraining market forces[21]. In this context services of general economic interest are regarded as precondition for the use of the territorial capital, and thus the improvement of competitiveness.

This aspect is also connected to the notion of "social justice and equity" and adds a spatial dimension[22]. It is to be understood as under the pretext that social and economic inequalities, such as differences in health or power, are only justified if they lead to benefits for all, especially the weaker parts of society.

Reduction of disparities and global competitiveness

Territorial cohesion is also used to influence the direction of EU regional policy, with arguments for the continued support of the less-favored and peripheral regions on the one hand. On the other hand – in conjunction with the polycentricism debate – arguments in support of cities as engines of regional development to fully exploit their potential are raised. Both approaches have the aim to allocate economic activity more evenly over the territory of the EU and to enhance competitiveness.

Thus "a paradigm shift" in Europe's spatial development policy was initiated. While the traditional spatial development strategy of the European regional policy has been oriented upon the regional structural weaknesses and disadvantages, the new

[21] Faludi, A. (2003) Unfinished business: European spatial planning in the 2000s, in: A. Faludi (ed) Special Issue on the Application of the European Spatial Development Perspective, Town Planning Review, 74(1), 121-140

[22] see Rawls, J. (1979) Eine Theorie der Gerechtigkeit, Frankfurt/Main

approach focuses more on the development potential of regions and exploiting their development potential. At the same time transnational and cross-border co-operations are more emphasized. The term "territorial capital" plays a central role in this debate. It means that each region has its own specific territorial capital (social, human or technical) and this has to use it in terms of endogenous development in an optimal way.

Cooperation

In order to use the regional potential as mentioned above optimally, it is necessary to establish partnerships and networks. This is reflected in the Community Strategic Guidelines[23] (CEC, 2005b) where continued co-operation programs on the cross-border, transnational and interregional level for the future structural funds period has been established.

Governance

Furthermore, it is clearly to be seen that under the concept of territorial cohesion increased attention to the spatial dimension of sector policies is paid. This consciousness of the spatial dimension of EU sector policies has increased and could be shown in various examples. First is the White Paper on European governance (which explicitly emphasizes the need for increased spatial coherent governance), moreover the Fifth Report on Economic, Social and Territorial Cohesion, but also other EU publications[24] establish reference to the spatial dimension of sector policies and their interconnections. Several efforts were made to identify the spatial effects of sector policies (see ESPON) but also the costs of non-coordination of different policies at different levels (European, national and regional) were demonstrated and therefore an improvement of the horizontal (between sector policies) and vertical (between levels) was deemed necessary. This leads to the issue of multi-level governance, which recognizes that hierarchical, clear decisions are not enough any longer in a complex world, which is constantly changing like ours.

Based on our assessment this **directive** impedes economic growth in already shrinking regions by supporting emigration of professionals that leave these regions in search for a more favourable economic environment. In this sense favouring the goal of freedom of service provision and movement, the Directive hampers the objective of European cohesion at least in the short run. More specifically the aspects of “reduction of disparities” and “balance” are clearly contradicting the primacy of the free market logic underlying the free movement principle. The negative effects on the regional scale are neglected in favour of the expansion of the global/EU development

[23] CEC (2005) Cohesion policy in support of growth and Jobs: Community strategic Guidelines, 2007-2013, communication from the Commission, COM(2005) 0299, 5th of July, Brussels.

[24] see e.g. F. Barca (2009): An Agenda for a Reformed Cohesion Policy: a place based approach to meeting European Union challenges and expectations; Independent Report; Brussels

path. Following this train of thoughts we can conclude that policy alternatives should focus on mitigating negative effects due to brain drain.

Map C 24: Territorial Impact of Directive 8 (branch a) on entrepreneurship

Map C 25: Territorial Impact of Directive 8 (branch a) on employment rate

Map C 26: Territorial Impact of Directive 8 (branch b) on entrepreneurship

Map C 27: Territorial Impact of Directive 8 (branch b) on out-migration/brain drain

Map C 28: Summative positive impact of Directive on recognition of qualifications

Map C 29: Summative negative impact of Directive on recognition of qualifications

[following pages]

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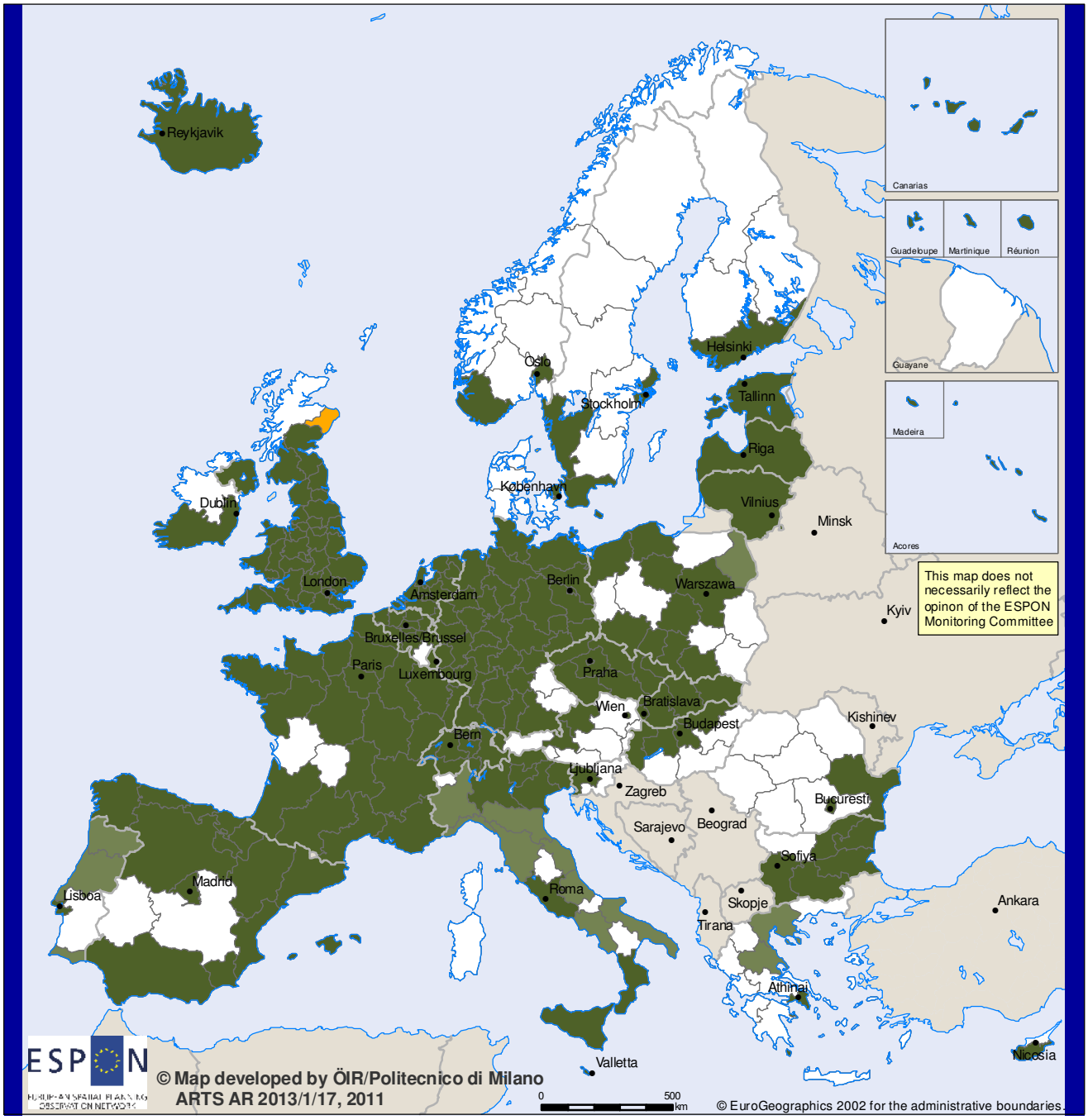

Territorial Impact of Directive 8 (branch a) on entrepreneurship

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: wealthy, urban, agglomerated

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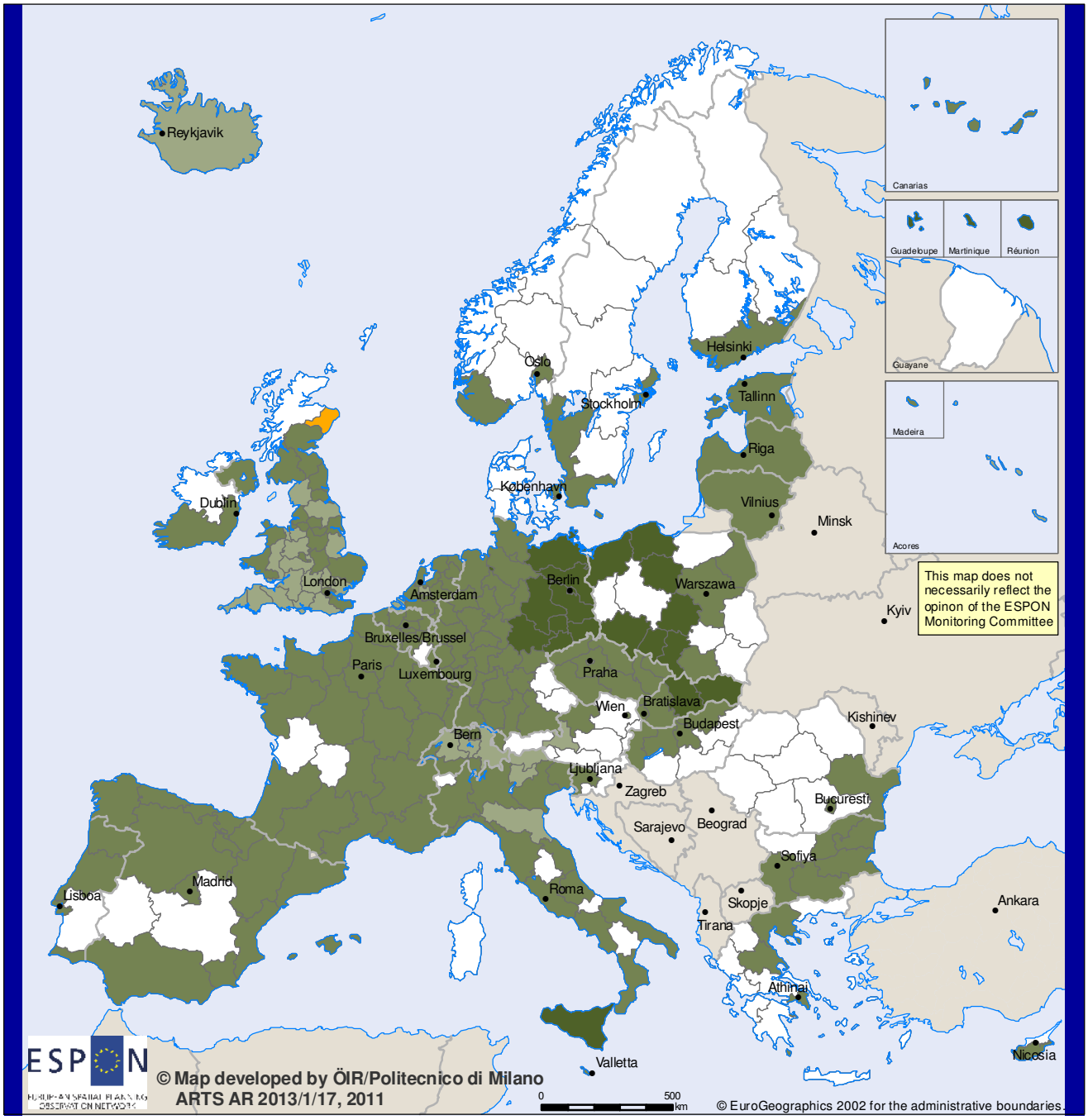

Territorial Impact of Directive 8 (branch a) on employment rate

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: wealthy regoins, urban, agglomerated

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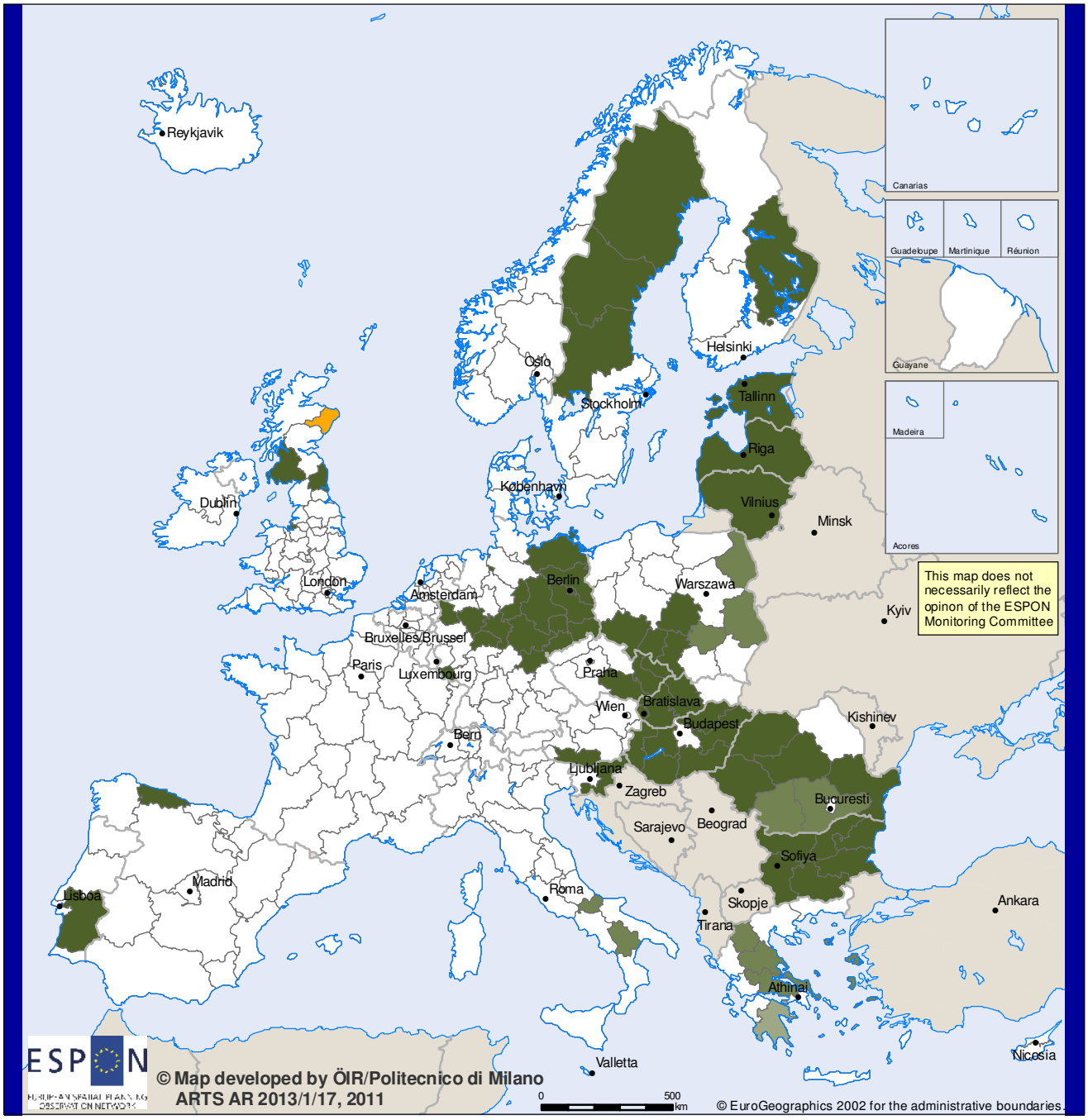

Territorial Impact of Directive 8 (branch b) on entrepreneurship

Negative Impact	Positive Impact	
Very high impact	Minor impact	No Data
High impact	Moderate impact	Neighbourhood Countries
Moderate impact	High impact	
Minor impact	Very high impact	
Not affected		

Types of regions affected: shrinking regions

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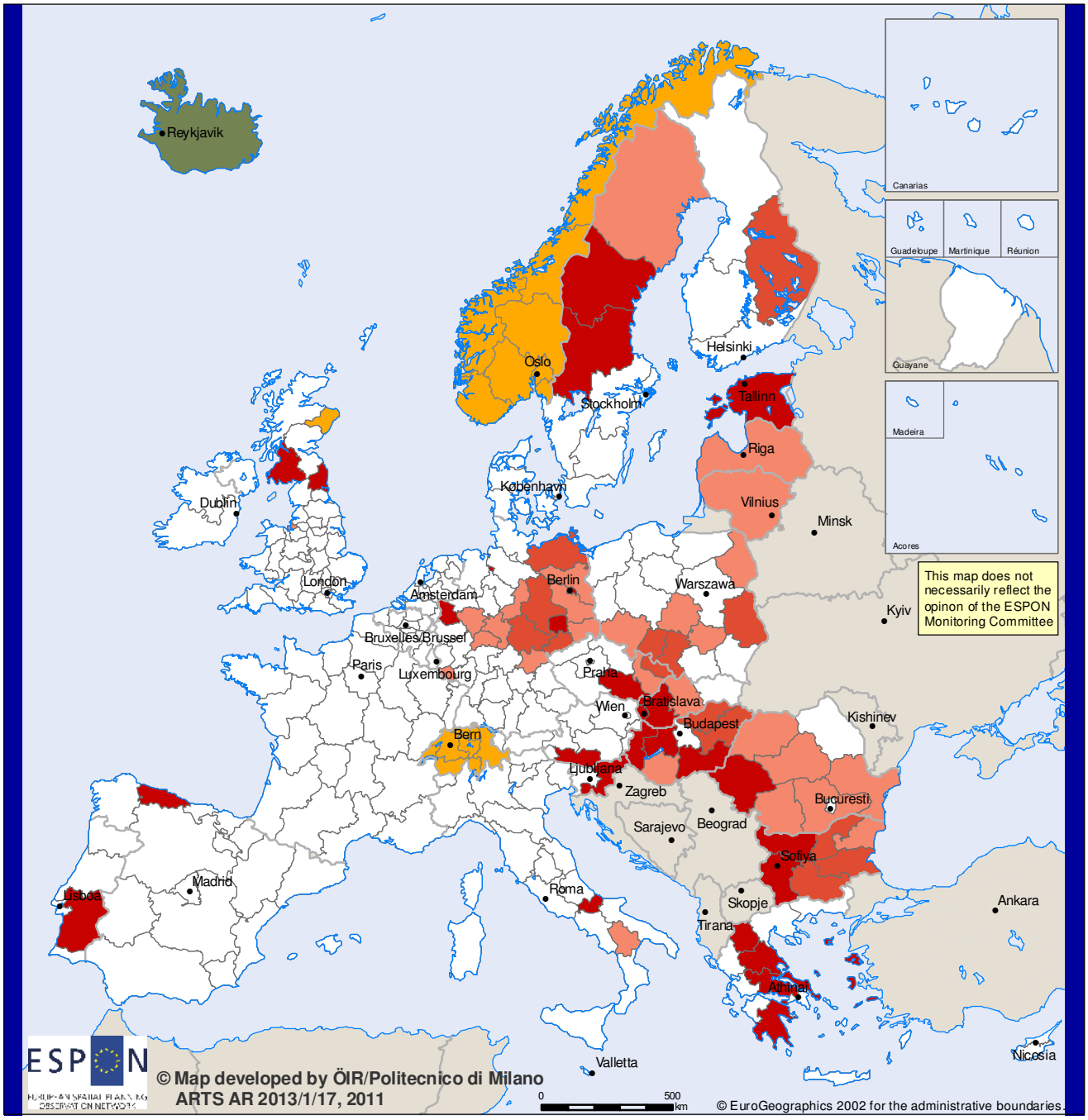


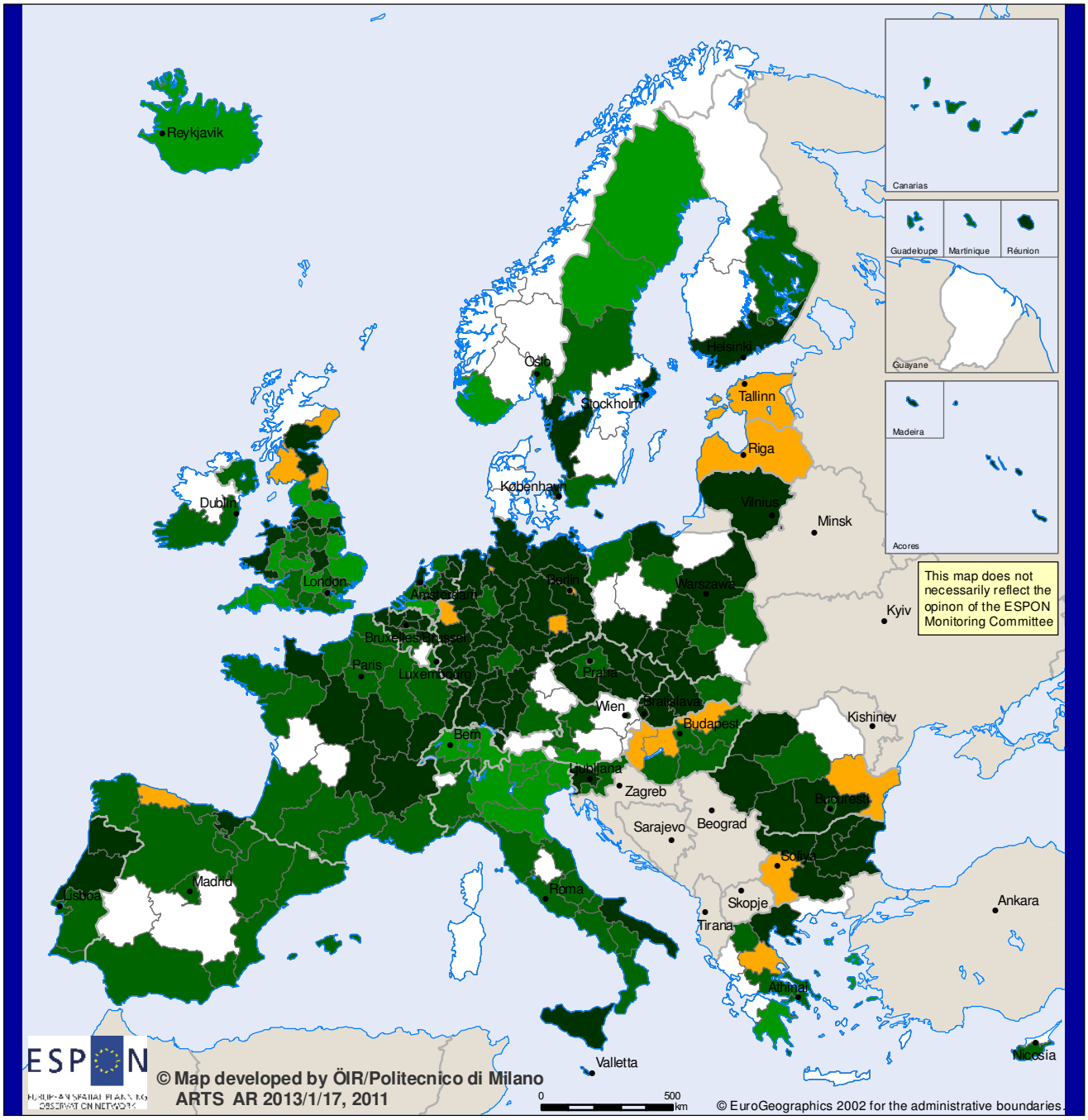
Territorial Impact of Directive 8 (branch b) on out-migration / brain drain

Negative Impact
- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact
- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: shrinking regions



Summative positive impact of Directive on recognition of qualifications

Number of indicators with high or very high impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: wealthy regions, urban, agglomerated, shrinking regions

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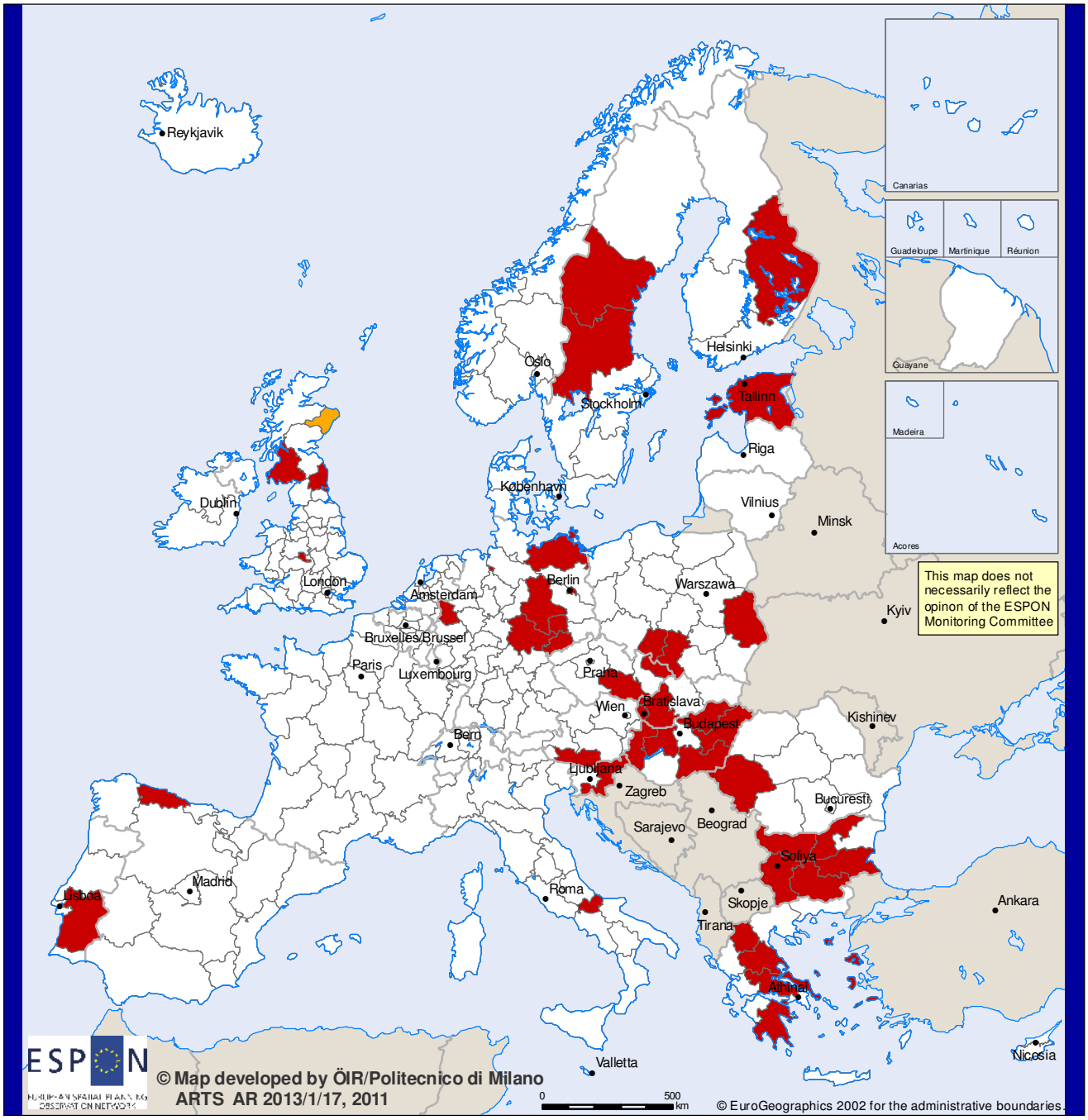


Summative negative impact of Directive on recognition of qualifications

Number of indicators with low or very low impact

- 0
- 1
- 2
- > 2
- No Data
- Neighbourhood Countries

Types of regions affected: wealthy regions, urban, agglomerated, shrinking regions

5.3 Directives on the promotion of clean and energy-efficient road transport vehicles

This directive aims at the introduction of specific measures in the transport sectors to address energy use and greenhouse gas emission with the ultimate goal of a better integration of transport and energy policies. Specifically, this directive aims at stimulating the market for clean and energy-efficient road transport vehicles, namely standardised vehicles produced in large quantities such as passengers cars, coaches and trucks, to sustain the purchase and in turn stimulate further investments in the design and production of clean and energy efficient vehicles. A special attention is recommended on the procurement of public transport services. To this end, the directive entails a list of criteria in terms of lifetime energy and environmental impacts and pollutants to be met by vehicles purchased in accordance to public procurement rules.

5.3.1 The logical chain and exposure

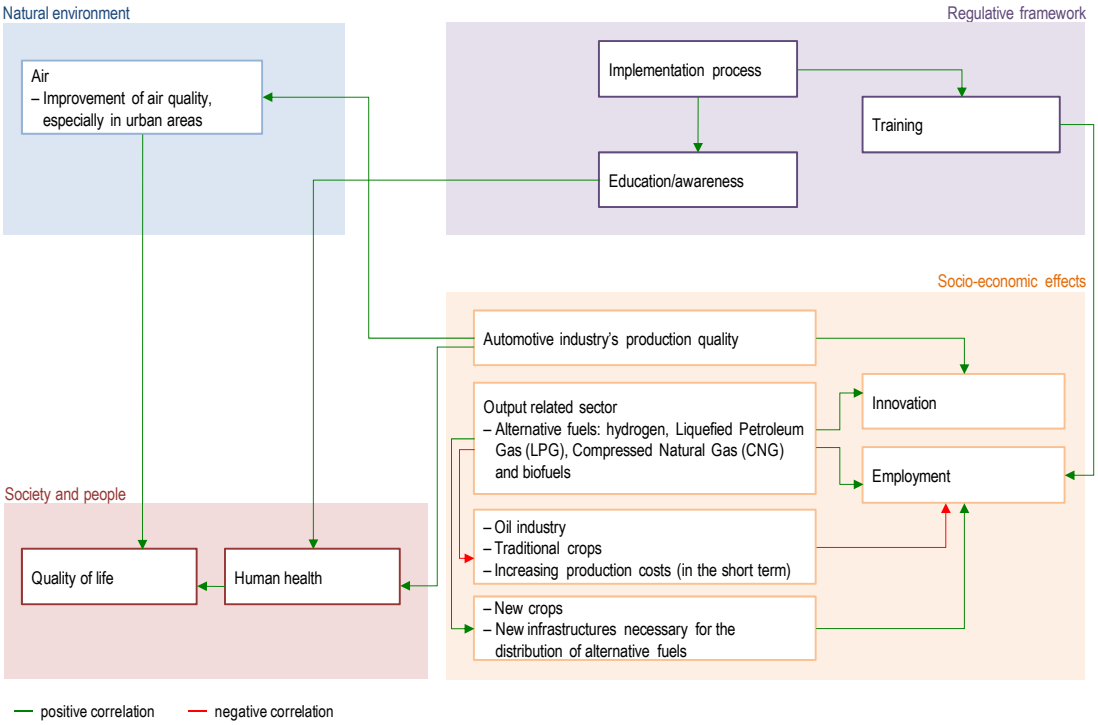
The directive impacts are expected to follow two distinctive channels.

On the one hand, impacts are channelled by the demand side, meaning through the incentives to the adoption of cleaner and more efficient vehicles, leading to positive impacts on the natural environment in terms of lower emissions and pollutants in air as well as reduced fossil fuel consumption (**branch a**).

On the other hand, impacts are channelled by the supply side, meaning through the investment and production of cleaner and more efficient vehicles, leading to some impacts on employment and GDP and generating a push effect on the development of inventions and innovations in cleaner and green technologies (**branch b**).

These linkages are depicted in the following figure.

Figure C 16: Logical chain of the directive



The exposure fields affected in branch a) of this directive refer to the natural environment field, namely a moderate reduction of CO_2 emissions and the level of pollutants in air (PM10). This teams with a moderate reduction on the dependency of fossil fuel consumption. The impact is expected to be moderate since the directive does not aim at a full substitution of vehicles fleet, but basically addresses fleet renewal. Also, vehicles can be considered as a substantial although not exhaustive component of C02 emissions.

On the other hand, the impact via the supply side (i.e. branch b) will bear moderately positive on GDP and employment (namely in manufacturing) since it affects a limited part of the manufacturing sector. Some impact may also be expected on the share of arable area, permanent grass area, permanent crops areas, since the extra production of bio-fuels may require an extension of cultivated areas. The impact on innovation is differently expected to be considerable since car producers may engage in extra investments in alternative and superior vehicles technologies.

5.3.2 The regions affected by the directive

We expect that the regions more hit by this directive are agglomerated regions in the first case and regions with a considerable share of employment in vehicle production (i.e. identified as those regions falling in the top 25 percentile of the distribution of employment in vehicles production over total employment in manufacturing) in the second case.

The rationale behind this expectation is as follows. In the first case, benefits from the directive will be particularly high in regions that are more congested and polluted,

typically agglomerated ones. These regions cover mainly capital cities and highly densely populated regions in Central Europe

Conversely, benefits stemming from the implementation of this directive will touch mainly regions that are highly specialised in vehicles production which may experience an increase in production and employment. These regions concentrates in Central Europe again, with some hotspots in Italy (namely Piemonte, Abruzzo, Molise and Basilicata), Spain (Galicia, Pais Vasco, Aragón, Castilla y León, Cataluña), France (Basse-Normandie, Nord – Pas-de-Calais, Franche-Comté) and British and Swedish regions in Northern Europe. Also several Eastern Europe regions look potentially affected by this directive especially, in Slovakia, Poland, Czech Republic and Hungary. A map depicting regions affected can be found in A5.

5.3.3 The Territorial impact of the directive

Looking at the impacts channeled by the demand side, this directive seems to bear minor positive impact (i.e. a reduction of) on **pollutant in air** (F6) with the exception of Bucaresti that highly benefit from it. Similarly, impacts on the **emission of CO_2** (F7) will be positive albeit minor with the exception of Région de Bruxelles and Ciudad Autónoma de Melilla (moderate) and Inner London (high). Lastly, impact on **fossil fuel consumption** (F36) will be again positive and minor but a larger number of regions seem to be moderately affected in Italy (Liguria, Lombardia, Veneto, Lazio, Campania), Spain (Aragón, Comunidad de Madrid, Cataluña, Comunidad Valenciana),and other Mediterranean regions (Provence-Alpes-Côte d'Azur, Attiki, Malta, Lisboa), as shown in Map C 30 below.

Looking at impact channeled by the supply side, this directive seems to bear minor positive impact on **economic growth** (F12) in all regions with the exception of five regions in Eastern Europe (Észak-Magyarország, Podkarpackie in Poland, Centru, Sud, Vest in Romania) showing moderate impacts, as depicted in Map C 31 below. Differently, impacts on **innovation** (F13) will be positive and high across all European regions affected by this directive. Lastly, impacts on the share of arable area (F17) will be overall positive and minor, being moderate in some German and Czech regions as well as in some Polish, Romanian and Hungarian ones and high in a few regions, i.e. Basse-Normandie, East Riding and North Lincolnshire, Herefordshire, Worcestershire and Warks.

This directive touches a very relevant aspect connected to the green economy (i.e. the shift towards clean and energy-efficient transport vehicles) and highlights two channels along with European directives may eventually show territorial impacts, the supply and production side on the one hand and the demand and adoption side on the other.

This suggests that policy options in this specific field may be conceived and developed in accordance with this double channel of impact.

In particular, at a first stage, policies may be aimed at incentivizing and promoting the production side, namely through the support to investments in research and innovation in order to develop and produce more advanced and efficient (i.e. greener) technologies to be applied in transport vehicles. Next, and perhaps once technologies become sufficiently stable and relatively cheaper, policies may be aimed at incentivizing and promoting the adoption side, either through additional ad-hoc directives or by specifically envisaging policy instruments in the new Structural Funds allocation in the upcoming Financial Perspective which is currently under discussion. Especially in this regard, coordination among MS in support of the adoption of greener technologies in transports looks crucial in order to limit selective and uneven adoption patterns across the European territory.

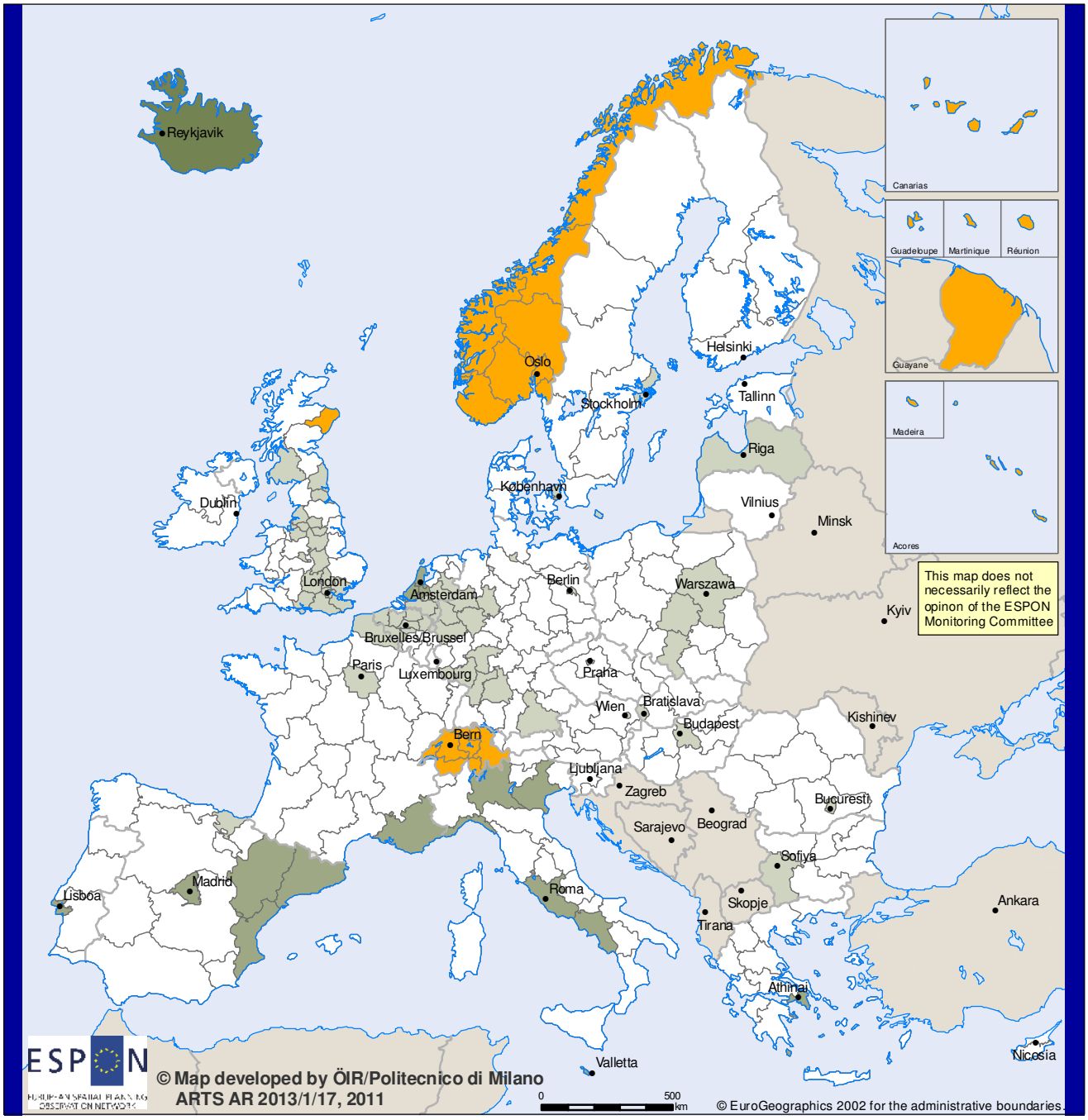
Also, our analysis points to the potential connection and the integration of this directive with other policy measures affecting the production and adoption of other green technologies, especially in the energy sector (e.g. bio-mass, bio-fuels). For example, our TIM approach highlights the link of this directive with agricultural and energy policies since it directly affects the share of agricultural lands and may also introduce a shift in the crops been cultivated in order to meet a potentially increasing demand of bio-fuels.

Map C 30: Territorial Impact of Directive 11 (branch a) on fossil fuel consumption

Map C 31: Territorial Impact of Directive 11 (branch b) on economic growth (GDP/capita)

[following pages]

ESPON ARTS



Territorial Impact of Directive 11 (branch a) on fossil fuel consumption

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

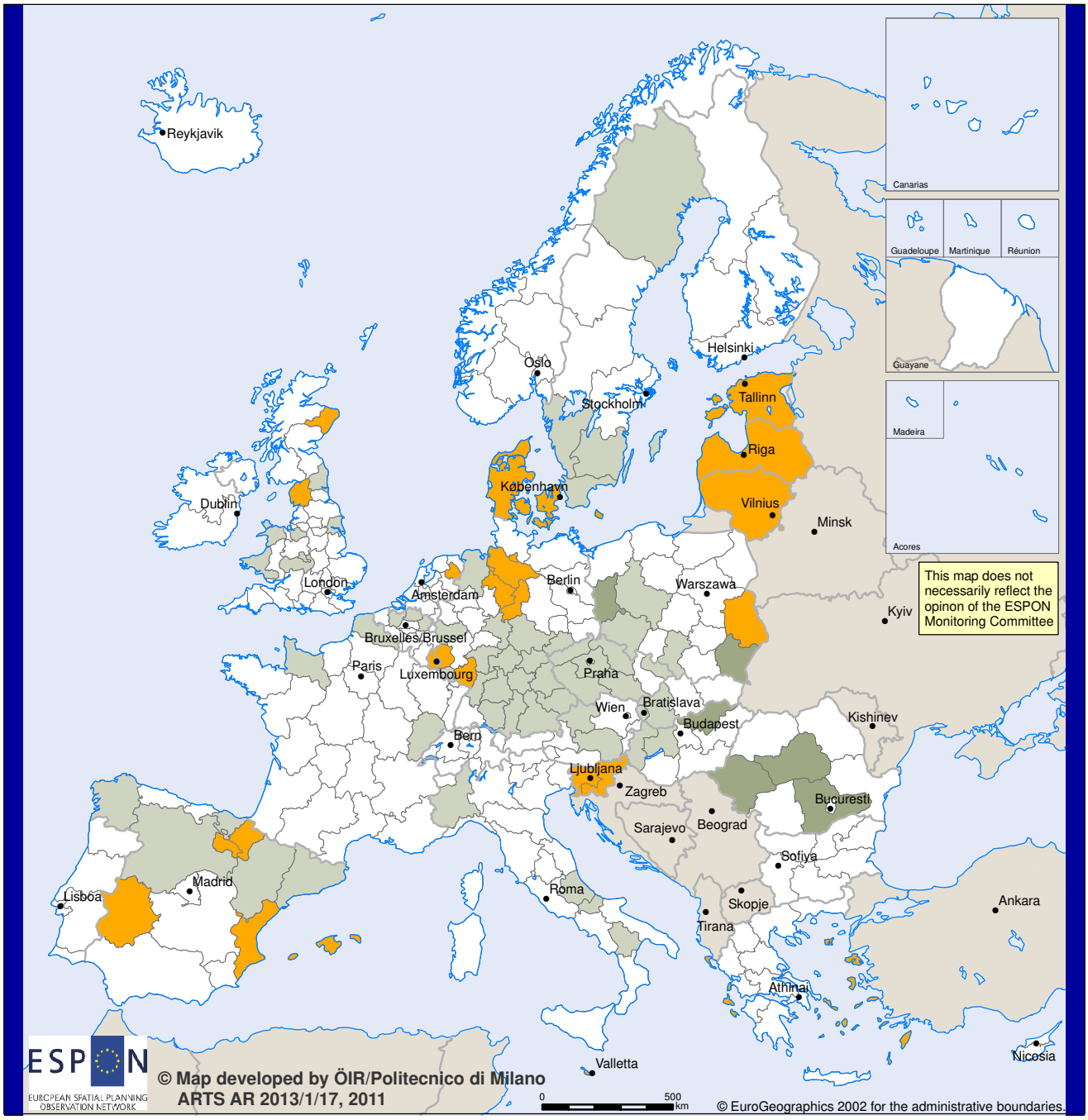
Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: agglomerated

ESPON ARTS



Territorial Impact of Directive 11 (branch b) on economic growth (GDP/capita)

Negative Impact

- Very high impact
- High impact
- Moderate impact
- Minor impact
- Not affected

Positive Impact

- Minor impact
- Moderate impact
- High impact
- Very high impact

- No Data
- Neighbourhood Countries

Types of regions affected: highest share of employment in automotive

6 Governance

6.1 European Commission Impact Assessment

The basic idea of the IA procedure is that ex ante impact evaluation, parallel to the policy making process, will improve the original ideas and result in robust, effective, efficient and widely supported policies. An IA usually takes about a year to one and a half year and is intended as a bottom-up process. In principle each and every stakeholder is invited to be part of the IA process.

Impact assessments do not follow a run-of-the-mill format. Each IA follows its own logic and uses its own methods and data, depending on the policy proposal at stake. The main challenge of the IA is to translate broad and abstract policy proposals into plausible and concrete expected outcomes. A standard approach is to 'calculate' the impacts of three or more policy alternatives. Depending on the available sources of evidence several techniques are applied such as modelling, expert opinions, inter service consultation, consultation with stakeholders outside the Commission, existing datasets, handbooks, indexes and case studies. IA procedures always make use of existing knowledge and never develop data themselves.

6.2 Governance as a factor explaining territorial impact

The main objective of the ESPON ARTS project is to assess the *territorial sensitivity* of regions to EU directives. A basic assumption underlying the project is that this sensitivity can be explained to a large extent from specific regional territorial characteristics relating to soil, air, water and use of the land. However, it is equally well understood that territorial characteristics alone cannot completely explain the territorial effects of a directive within a region. For example, the air quality directive causes a different impact in similar urban territories in different countries; the explaining element is the factor *governance*.

Under the umbrella of 'Europeanization' several authors have discussed and showed that because of these follow up decisions at domestic level EU policies can have effects that vary considerable across the member states (i.e. Héritier et al. 2001, Börzel 2002, Olsen 2002, 2007, Featherstone 2003, Radaelli 2003, Lenschow 2006).

National contexts differ considerably across the EU and beyond, as has been pointed out by previous ESPON research and other sources (ESPON 2.3.2 2006, Newman & Thornley 1996, CEC 1997, Stead & Nadin 2010). However, it was found that analyzing administrative cultures, spatial planning systems and institutional contexts in general at an EU scale does not provide specific enough information to explain why and in particular how directives will impact.

For a better understanding one needs to look in a more detailed way at the process that directives go through before they are being implemented and applied. Based on a meta-analysis of literature addressing the impact of EU directives and on developing the logical chains and exposure matrices in this project, we discern between four policy stages that directives go through:

(1) Development of the EU directive

(2) Transposition/translation in national legislation

(3) Implementation into existing or new policies

(4) Actual use and jurisprudence.

In each of these four policy stages specific government and governance decisions play a role and can lead to unexpected territorial impact. For example:

Ad1. During the *development* of an EU directive member state delegations have to be sensitive for its possible effects on territory and existing domestic legislation and will very likely use knowledge about this to define negotiation boundaries. Domestic governance aspects that explain the behaviour and defining of boundaries concern amongst others:

- Cross sectoral and multi-level coordination mechanisms within member states. Such mechanisms vary considerably across member states and lead to information imbalances.
- Involvement of territorial experts in development stage, in order to identify in an early stage possible effects of a directive on territorial development.

Ad 2. *Transposing* a directive into domestic legislation can be done in many different ways depending on how a member state interprets the directive in the context of its own legislative system. Some member states act pragmatically and, if possible, copy-paste directives in their domestic legislation, while others add additional objectives (gold plating) or relate the directive to specific legislation in other policy fields. Indicators of different behaviour concern amongst others:

- History of gold plating etc.
- Commission publishes reports on member states that transpose and implement directives too late

Ad 3. The *implementation* of a directive depends on a variety of decisions regarding the question how the objectives of the directive can be best met given the existing domestic policy system and mechanisms. In one case existing policies already cater for meeting the directive's objectives, in other cases existing policies need to be revised or complemented by new policies and instruments. A variety of different decisions can be made as regards:

- Instruments and measures to be used
- A strict or flexible use of thresholds
- The type of assessment model to be used

Ad 4. The *actual use* of a policy depends amongst others on the organization and functioning of the public administration, available governance capacity and resources and on the *legal system* within a member state or region and whether the decision made in the transposition and implementation phases allow certain degrees of flexibility. Here we find amongst others:

- A large variety across member states on the applying thresholds when issuing of building permits
- That access to the legal system in order to file a case differs greatly across member states
- That as a consequence the amount of jurisprudence differs greatly across countries with some countries having dozens of cases dealt with by the highest body and others only a few or even none.
- That in some countries the applicant has to prove that new proposals comply with thresholds, in other countries those who object need to prove that thresholds are being violated.

So a picture emerges that shows a wide variety of implementing directives and ways of doing things. Differences can be explained from incidents, but also from structural elements of the institutional system of a country, such as the legal system. Where there are high barriers to file a case to court there is significantly less jurisprudence to be found, if at all. This then results in entirely different dynamics across member states in planning and project development processes. Whereas in one country this needs to be done very carefully in order to avoid the risk of a legal case (and losing it), in other countries this risk is much lower and puts less pressure on the procedure and contents of a plan. The effect is a different territorial outcome.

6.3 Data gathering

Data gathering as regards governance indicators is a challenge. The original project tender proposed case studies in three countries (I, A, NL) to governance aspects related to three directives. For pragmatic as well as substantive reasons it was decided to follow a different strategy. Pragmatic concerns are that within the limited time available it would be impossible to identify and interview relevant stakeholders in each of the three countries. Substantive concerns are that at the time of developing the project proposal the concept of the four policy stages had not been developed.[25]

In order to collect in a relatively easy way data and expert knowledge a questionnaire has been distributed among ESPON Contact Points at the ESPON seminar in Liege (and later also by e-mail). The questionnaire followed the principle of the four policy stages, which had been translated into four hypotheses (see text box, see A6 for the complete questionnaire) and questions relating to them.

[25] This was part of a project for the Dutch government that started in October 2010.

Although the questionnaire was originally not included in the terms of reference or tender, it seemed a promising way forward. However, for various reasons the response to the questionnaire was disappointing and close to zero. It teaches that the research method of collecting expert knowledge by questionnaire can only be used under the conditions that the project proposal includes them from the start, announces the questionnaire well in advance to the main addressees and foresees in a budget to compensate the addressees for the use of their time.

Text box: Hypotheses in questionnaire

1. EU directives will lead to unexpected territorial impacts when their substance and internal logic do not (closely) match existing policies and instruments at the domestic level. This results from the fact that their transposition into domestic legislation and policies requires many additional decisions.
2. Unexpected territorial impact of EU directives can be avoided if the transposition and implementation of the directive is made subject to sound inter-sectoral coordination and (informal) consultation of important domestic stakeholders which are affected by the directive(s) in question (ngo's, private sector, civic organizations and others).
3. Unexpected territorial impact of EU directives can be avoided when member states start a dialogue with the European Commission.
4. There is a positive correlation between the unexpected territorial impacts of EU directives and the opportunities that the judicial system offers for stakeholders to file a case to the court.

6.4 Meta analysis

Because of the failed attempt a different strategy has been followed: that of a literature review. A literature review from the perspective of governance along the lines of the four policy stages makes sense as it has not been done before. There is an increasing amount of literature (reports, articles, conference papers) available that deals with the impact and implementation of EU directives. However, usually such sources, including previous ESPON research, only address one directive or case with the purpose of showing how a directive impacts within a specific context and what factors are decisive. Until now, little effort has been spend in developing a more general understanding of the impact of EU directives. Nor has there been an exclusive focus on the factor governance. Therefore, a meta-analysis of available literature from the perspective of the four policy stages and governance could mean a major step forward.

The literature review takes into account as many as possible EU member states as well as a selection of directives. As regards the latter the point is not so much on being comprehensive in a sense of addressing all possible directives. The focus will be primarily on mechanisms and procedures applied in countries to transpose directives and on those directives that addressed specific governance questions in certain member states. More in general this concerns directives that caused

significant impact, such as the Air Quality directive, Natura 2000, the Nitrate directive and the Water Framework directive in several countries.

A limiting factor is the availability of accessible sources, i.e. which are written in English language. Already the TPG researchers have collected a considerable amount of relevant literature. What becomes clear right away is that the literature is unbalanced as regards the geographical distribution across Europe with emphasis on countries that have more experiences with unwanted impact of EU directives and countries of which the academic communities are integrated in the English speaking international academic community. Whereas this means that not all ESPON countries will be covered (something that we intended to do with the questionnaire), there is nevertheless sufficient scope and differentiation to allow for drawing authoritative conclusions that could guide future research.

6.5 Constructing a governance filter?

On the basis of the findings in the literature study future research projects could focus on making the factor governance an integrated element of the ARTS methodology, i.e. on introducing a 'governance filter' in the assessment model. Elements that would require further elaboration concern:

(1) detailed analysis of each of the four policy stages and identifying for each step which structural governance aspects, i.e. relating to decision making procedures, amplify or mitigate the impact of EU directives;

(2) collecting specific data regarding these structural governance aspects for each member state.

Obviously, the main challenge is to provide suitable data and indicators. Indicators would not be the problem as they will follow from the meta-analysis. Gathering data may again be very difficult to collect as they are dependent on expert knowledge for each member state. Moreover, governance systems and models are dynamic which puts an additional requirement on data.

Therefore the question should be asked whether the development of a governance filter should be advised as a viable direction. Because of the complexity of the exercise and the temporary usability of its outcomes we tend to conclude that it is not. Also it should be questioned whether the massive efforts that such an exercise requires can be justified by their value in terms of improving the predictive capacity of the ARTS methodology?

Theoretically governance characteristics can be mapped and put into a model, but in practice each directive transposing process has its own key stakeholders, dynamics and written and unwritten rules. This means that whereas we can identify and track down all kinds of decisive governance elements, such as the ones outlined earlier, which tell much about possible follow-up decisions, their explaining capacity will always remain limited in a sense that involved stakeholders suddenly may decide to

do things differently. Also, the crucial step that in the end determines whether a directive causes territorial impact is the choice of measures and instruments that a member state will use to implement the directive. This choice is the result of a complex and context related process the outcomes of which cannot be predicted by any means. In short, there will always remain governance elements that cannot be sufficiently explained by means of indicators and modelling.

7 Roadmap for policy implementation and on the further research avenue to follow

7.1 Options for policy implementation

Implementation of the TIA procedure in the IA of the Commission

The impact assessment (IA) procedure on the Commission level was introduced in 2002 and further developed by means of a gradual process that allowed Commission officials and organization to grow with it. The basic idea of the IA procedure is that ex ante impact evaluation, parallel to the policy making process, will improve the original ideas and result in robust, effective, efficient and widely supported policies.

An IA usually takes about a year to one and a half year and is intended as a bottom-up process. In principle each and every stakeholder is invited to be part of the IA process.

IA procedures always make use of existing knowledge and never develop data themselves. In terms of addressing territorial impact this may have consequences as (apart from ESPON) there is little territorial data available.

Therefore, the Commission's Impact Assessment practice qualifies as one of the best opportunities to get TIA implemented at the EU level (Zonneveld & Waterhout 2009). The TIA as developed in ESPON ARTS could serve as a first pre-check on the expert level of the Commission and add the territorial dimension to the IA procedure. It enables to identify those regions with would benefit intensely and those regions with likely high negative impacts. The result of TIA could feed in into the further stakeholder driven process of the Commission's Impact Assessment.

Another option would be to use the TIA procedure as part of the strategic environmental assessment (SEA). This would put the focus on the impacts of a directive on the environment, whereas the TIA approach developed analysis also economic and societal consequences.

Taking the EU neighbourhood on board

The analysis concentrates on the direct and indirect effects within in a region of the EU27 where the directive is directly implemented. However, each directive will also produce spill over effects towards the neighbouring countries. These effects are not covered by the TIA procedure up to now. Analysing the impacts of EU legislation on the EU neighbourhood could be a new part of the EU neighbourhood policy in order to support the neighbouring to be better prepared.

7.2 Further data requirements and ideas of territorial indicators, concepts and typologies as well as on further developments linked to the database and mapping facilities.

Additional indicators needed to get a more complete picture about the sensitivity of regions

The analysis of the impact of the directives should cover all relevant fields of territorial development: covering natural environment, regional economy as well as society and people. We defined 41 indicators to cover that wide range. However, we found only for 30 indicators values allowing to picture sensitivity of regions. Missing indicators were especially concerning:

- land use
- governance (efficiency of government/governance mechanisms, duration or complexity of planning procedures, participation rate, societal transfers)
- innovation and market barriers
- cultural heritage

Additional indicators would be needed in order to provide the full range of possible impacts of directives.

Due to the indicators used the TIA was conducted on NUTS 2 level. NUTS 2 is quite a large scale for the distinction of effects of some directives e.g. when directives aim at urban areas etc. So, it would be good to get the list of indicators as well as the list of types of regions on NUTS 3. This would lead to more precise results. Due to the necessity to stick at the NUTS 2 level due to the data availability also the Urban-rural typology developed jointly by DG Agri, Eurostat, JRC and DG Regio could not be used in the project, because it is only available on NUTS3.

Additional and more specified types of regions

When setting up the conceptual model for the selected directives, we came often to the conclusion that they induce different effects in very special types of regions (eg. regions with chemical plant, intense agriculture etc.) The existing typologies do by

not cover the types that would be necessary. So it would be very useful to extend the list of pre-selected types of regions of the regional exposure matrix. Only if I can provide a suitable type of region for the analysis, I can do the TIA in the format of the workshop. Otherwise the TIA procedure will last longs, when looking for new typologies.

8 Points for further consideration providing the thoughts of the TPG

A better solution for describing summative effects easy and reliable

At the moment the TIA delivers usable results for each indicator. For policy makers it would be interesting to get also an overview about “summative” impacts of a directive on each region, considering together all impacts on the different fields. At the moment we chose the simplest solution: counting all fields in which the impact on the region was considered “high”. This leads to very simple results.

Additional research would be interesting how to picture this “summative” effects better. One approach would be computing a weighted multi-criteria impact index, in the same way as it was done in the ESPON Tequila Models. This solution implies the definition of a shared system of weights for the single impacts (through experts judgement, policy maker’s priorities, etc.) and of some thresholds beyond which compensation among impacts is excluded (the FLAG methodology in the Tequila 2 model). Another option would be a cluster analysis. Then you would not need weights, but a cluster analysis cannot be standardised for applying it directly in a workshop.

Depicting spill over effects

The analysis focuses an depicting the impact of the EU legislation within a region. Additionally also spill over effects and cross boarder effects could be analysed. However, this requires a different method.

Alternative approach for the TIA analysis on governance issues

Instead of trying to model governance in order to predict where problems might occur, a different approach is to help stakeholders with identifying potential issues in the process of developing, transposing, implementing and using the directive. This could be done by developing a guidance and check-list which provides general and stage specific guidance. Such a check-list should inform policy makers about how to act in specific situations and what the possible options and their likely effects are. A

general guidance, applying to all possible directives, could act as a framework and tool for policy makers.

Going one step further the challenge becomes to adapt the general guidance in such a way that it becomes attuned to a specific directive. Here the ARTS model comes back in. With the outcomes of the ARTS model and the elaborations by means of the logical chains and reports the guidance could become further specified in a qualitative way by taking account of specific territorial characteristics of the directive under consideration.

9 Dissemination activities

As up till now, the focus of the work was lying at the development of the methodology the dissemination was not the focus of our work. Up to now, the methodology was presented at the ESPON Seminar in Liege.

9.1 The dissemination in the scientific community

- Participation to scientific conferences presenting papers related to this project:
  - presentation of methodological aspects at the Annual Conference of the European Regional Science Association (ERSA), to be held at the end of August 2011;
  - presentation of empirical results and achievements at the ERSA Conference in 2012
  - presentation at other conferences as, .g the AESOP (the Association of European Schools of Planning, deeply interested in the impact of European initiatives), meetings of the European Council of Spatial Planners and the biennial Conference of the European Evaluation Society
- Submitting scientific articles to international journals in the fields of Regional Science, Planning, Geography and Public Policy Evaluation as well as other journals
- The possibility of producing a full book with an international publishing company will be considered (the costs of which are not included in the budget, but are generally not prohibitive if the publishing company trusts the work).

9.2 The dissemination in the policy makers' community

In order to stimulate the debate amongst policymakers, the TPG will organize a workshop in cooperation with the ESPON CU, specifically oriented to our project. During this workshop, European policymakers will be invited to discuss the results of the project. This will also provide an occasion to disseminate our methodological approach and interact directly with policymakers about the implementation of IA approach. The workshop is scheduled at May 4th in Brussels.

Single partners could also make presentations of results at national meetings with a comparative goal (results are particularly relevant in an interregional comparative setting), and publish in national scientific or professional journals.

Single partners could also make presentations of results at national meetings. Since the results are particularly interesting when placed in an interregional comparative setting, comparing both international and intra-national contexts will stimulate discussion and enhance learning and understanding. Finally, the partners will consider the possibility of publishing insights gained in these meetings in national journals.