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European Committee of the Regions

Territorial Impact Assessment

On the Bioeconomy

Disclaimer

This report was produced by the European Committee of the Regions (CoR) secretariat to support the CoR's own-initiative opinion on the *Bioeconomy in Europe*, for which the rapporteur is Jácint Horváth (HU/PES), member of Nagykanizsa Municipal Council.

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This territorial impact assessment report is the outcome of an expert workshop co-hosted by the European Committee of the Regions and ESPON EGTC on 1 April 2019 in Brussels.

The ESPON TIA Tool is designed to support the quantitative assessment of potential territorial impacts according to the Better Regulation guidelines. It is an interactive web application that can be used to support policy-makers and practitioners in identifying ex-ante, potential territorial impacts of new EU legislation, policies and directives (LPDs). This report documents results of the territorial impact assessment expert workshop about a new energy legislative framework, the Clean Energy Package, concerning energy poverty. It serves for information purposes only. This report and the maps represent views and experiences of the participants of the workshop. It is meant to be used for decision support only and does not necessarily reflect the opinion of the members of the ESPON 2020 Monitoring Committee nor of the other institutions involved.

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Acronyms and legend

CoR	European Committee of the Regions
EP	European Parliament
ESPON	European Observation Network for Territorial Development and Cohesion
LRA	Local and Regional Authority
MS	Member State(s)
NUTS	Nomenclature des unités territoriales statistiques Common classification of territorial units for statistical purposes
OIR	Austrian Institute for Spatial Planning (ÖIR)
SDGs	Sustainable Development Goals
TIA	Territorial Impact Assessment

Effects of the directives – colour code

- Positive effects
- Minor positive effects
- Neutral
- Minor negative effects
- Negative effects

Legend – direction of effects

- Increase
- Decrease

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Introduction

The concept of the bioeconomy

"The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. To be successful, the European bioeconomy needs to have sustainability and circularity at its heart. This will drive the renewal of our industries, the modernisation of our primary production systems, and the protection of the environment, and will enhance biodiversity."[1]

A sustainable and circular bioeconomy contributes to addressing global challenges like climate change, and land and ecosystem degradation, coupled with a growing demand for food, feed and energy, which force us to seek new ways of producing and consuming. Thus it helps to fulfil global commitments under the 2030 Agenda and its SDGs, as well as the Paris Agreement.

The EU is seeking to maintain its global leadership in the bioeconomy, which currently has an annual turnover value of around EUR 2 trillion and employs over 18 million people. It delivers added value of EUR 621 billion, and accounts for 4.2% of the EU's GDP and 76% of employment (agriculture, food and drink manufacturing).

The EU's main priorities are threefold:

1. strengthen and scale-up the bio-based sectors, unlock investments and markets;
2. rapidly deploy local bioeconomies across the whole of Europe; and
3. understand the ecological boundaries of the bioeconomy.

Current European policy

The European Commission's 2012 Bioeconomy Strategy was established to look at the complexity of the bioeconomy and help people understand its challenges and potential.

It was successful in putting forward the political message and, as a consequence, most (Western) European countries as well as regions have developed their own bioeconomy strategies.

[1] The EU's bioeconomy strategy and related links: COM(2018) A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment, October 2018.

Another indication of its success is that EU funding for bioeconomy research and development has doubled between FP7 and Horizon2020, enabling the establishment of the bio-based industries public-private partnership, which supports a range of projects.

The current policy context, which involves the Sustainable Development Goals (SDGs), the Paris Agreement, the Energy Union, and the Circular Economy Package, provides further opportunities and sets the bioeconomy in a different context.

The 2018 update of the strategy is underpinned by the idea that the initial five objectives of the 2012 strategy remain valid but that their scope should be adjusted, and that the bioeconomy should be deployed locally in order to create growth and job opportunities at local level.

Achieving sustainability is at the heart of the European Commission's priorities. This can be seen in its strategies across a range of sectors related to the bioeconomy: agriculture, forestry, fisheries, aquaculture, waste, food and nutrition security, energy, and bio-based industries.

The Commission proposal for the next MFF 2021-2027 seeks to boost systemic research and innovation in the areas and sectors covered by the bioeconomy and in particular to earmark EUR 10 billion for the Horizon Europe cluster for "Food and natural resources" (including the bioeconomy).

Political mandate

The workshop, and the report we are now presenting, serve to **support the own-initiative opinion of the Committee of the Regions** on *A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment* (SEDEC-VI/048), for which the **rapporteur will be Jácint Horváth, member of Nagykanizsa Municipal Council**.

The local and regional level plays an important role in promoting cooperation between businesses and research institutions using the "triple helix" model. Local and regional authorities are key to the implementation of EU cohesion policy and a large number of regional smart specialisation strategies, which enable programmes and projects that strengthen the bioeconomy to be co-financed.

Furthermore, the Commission envisages that from 2021 on, the bioeconomy action plans will have to be developed at the most appropriate territorial level – which will involve strengthening the role of local and regional authorities – and that the programmes will have to be managed as directly as possible with the sectors and people concerned, in line with the principles of subsidiarity and multi-level governance. As the regions invest in basic services and capabilities, taking the local and regional approach guarantees a solid link to the specific features and specialisations of individual regions.

1 Methodology: ESPON Quick Check

The concept of territorial impact assessment (TIA) is aimed at showing the regional differentiation of the impact of EU policies. The ESPON TIA Tool[2] is an interactive web application that can be used to support policy-makers and practitioners in identifying ex-ante, potential territorial impacts of new EU legislation, policies and directives (LPDs). The "ESPON TIA Quick Check" approach combines a workshop setting for identifying systemic relations between a policy and its territorial consequences with a set of indicators describing the sensitivity of European regions.

It helps to steer an expert discussion on the potential territorial effects of an EU policy proposal by checking all relevant indicators in a workshop setting. The results of the guided expert discussion are judgments about the potential territorial impact of an EU policy considering different thematic fields (economy, society, environment, governance) for a range of indicators. These results are fed into the ESPON TIA Quick Check web tool.

The web tool translates the combination of the expert judgments on exposure and the different sensitivity of regions into maps showing the potential territorial impact of EU policy at NUTS 3 level. These maps serve as a starting point for further discussion of the different impacts of a specific EU policy on different regions. Consequently, the experts participating in the workshop provide an important input into this quick check on potential territorial effects of an EU policy proposal.

The workshop on the Bioeconomy in Europe was held on 1 April 2019 in Brussels and brought together a number of experts representing different organisations and LRAs.

Two moderators from the OIR, provided by ESPON, prepared and guided the workshop and handled the ESPON TIA tool.

Figure 1 Workshop discussion

Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019, OIR

[2] https://www.espon.eu/main/Menu_ToolsandMaps/TIA/

1.1 Identifying the potential territorial effects, considering economy, society, environment and governance aspects – drafting a conceptual model

In the first step of the TIA workshop, the participating experts discussed the potential effects of developing the European bioeconomy.

This discussion revealed potential territorial impacts of the potential effects of developing the European bioeconomy, considering economy, society, environment and governance-related indicators. The participants identified potential linkages between the development of the bioeconomy in Europe and the effect on territories including interdependencies and feedback loops between different effects (see figure below).

Figure 2 Workshop findings: systemic picture

Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019, OIR

1.2 Depicting the potential territorial effects through indicators

In order to assess the potential effects depicted in the conceptual model, suitable indicators need to be selected related to the parameters that the experts discussed in the fields of economy, environment, society and governance. The availability of data for all NUTS 3 regions poses certain

limitations as to the indicators that can be used. From the available indicators that the ESPON TIA Quick Check web tool offers, the experts chose the following indicators to describe the identified effects.

Assessing potential territorial impacts considering economy-related indicators

- Economic performance (GDP/capita)
- Entrepreneurship (share of private enterprise)
- Employment in agriculture, forestry and fishing
- Employment in sectors affected by the low-carbon economy

Assessing potential territorial impacts considering societal indicators

- Life expectancy at birth
- Disposable income
- Unemployment rate
- Net migration

Assessing potential territorial impacts considering environmental indicators

- Emissions of CO_2 per capita (tonnes)
- Ratio between emissions of CO_2 and GVA
- Land cover: Share of agricultural areas
- Water consumption
- Land use: Share of irrigated land
- Urban wastewater
- Soil fertility
- Municipal waste generated

Furthermore the experts agreed that the following indicators, which are not included in the ESPON TIA Quick Check web tool, would be relevant to describe the identified effects:

- Quality of the sea
- Biodiversity
- GVA/agricultural output (FADN)
- Forest coverage
- Waste processing data
- Coupled products (production success)
- VA/tonne of biomass
- Eco-innovation (Regional innovation scoreboard)

1.3 Judging the intensity of the potential effects

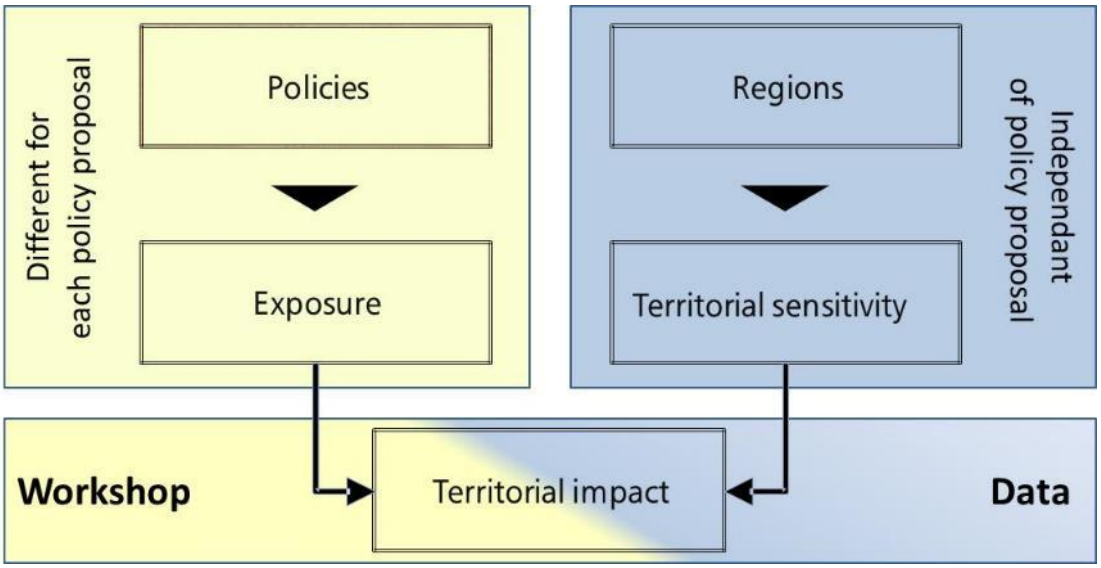
The participants of the workshop were asked to estimate the potential effects deriving from developing the European bioeconomy. They judged the potential effect on territorial welfare along the following scores:

- ++ strong advantageous effect on territorial welfare (strong increase)
- + weak advantageous effect on territorial welfare (increase)
- o no effect/unknown effect/effect cannot be specified
- - weak disadvantageous effect on territorial welfare (decrease)
- -- strong disadvantageous effect on territorial welfare (strong decrease)

1.4 Calculating the potential "regional impact" – combining the expert judgment with the regional sensitivity

The ESPON TIA Quick Check combines the expert judgment on the potential effect deriving from the impact of the potential effects of developing the European bioeconomy (**exposure**) with indicators depicting the sensitivity of regions, resulting in maps showing a territorially differentiated impact. This approach is based on the **vulnerability concept** developed by the Intergovernmental Panel on Climate Change (IPCC). In this case, the effects deriving from a particular policy measure (exposure) are combined with the characteristics of a region (**territorial sensitivity**) to produce potential territorial impacts (see following figure).

Figure 3 Exposure x territorial sensitivity = territorial impact



Source: OIR, 2015.

- "Territorial sensitivity" describes the baseline situation of the region according to its ability to cope with external effects. It is a characteristic of a region that can be described by different indicators independently of the topic analysed.
- "Exposure" describes the intensity of the potential effect caused by the potential effects of developing the European Bioeconomy on a specific indicator. Exposure illustrates the experts' judgment, i.e. the main findings of the expert discussion at the TIA workshop.

1.5 Mapping the potential territorial impact

The result of the territorial impact assessment is presented in maps. The maps displayed below show potential territorial impacts based on a combination of the expert judgment on the exposure with the territorial sensitivity of a region, described by an indicator at NUTS 3 level. Whereas expert judgment is a qualitative judgment (i.e. strong advantageous effect on territorial welfare/weak advantageous effect/no effect/weak disadvantageous effect/strong disadvantageous effect), sensitivity is a quantitative indicator.

2 Preliminary discussion

2.1 Opening remarks

In his opening remarks, the rapporteur, Mr Hórvath, stressed that local and regional authorities are key for implementing strategies towards a sustainable economy. There is strong potential for positive developments in the 2021-2027 period, particularly with the possibility of having mandatory local and national bioeconomy action plans.

Akkos Koos, the expert supporting the rapporteur appointed by the European Committee of the Regions, presented the three main points of the bioeconomy action plan. The first point is upscaling the bio-based sectors, and supporting innovative solutions applied on a small scale, since investments are normally directed only to high value added products. The second point is that local bioeconomies across Europe should be promoted by open innovation spaces integrating the various players. Innovation happens when it is welcome. Finally, we must understand the ecological boundaries of the bioeconomy. Ecosystems form the base of a single system of reporting involving cooperation between regions, in a move away from the linear bioeconomy approach.

Chiara Pocatterra presented the project BIOVOICES, which is aimed at engaging relevant stakeholder groups through a platform with different perspectives, knowledge, and experiences. The project's end goal is to increase the quality, relevance, knowledge about and social acceptability of bio-based products for a prosperous bioeconomy and a sustainable world through: stakeholder-oriented knowledge that can be put into practice, a strategy to address the wider public, awareness-raising on bio-based products, enabling co-creation among stakeholders, and establishing an MML (Mobilisation and Mutual Learning Platform).

2.2 Questions for debate

Prior to the workshop, the participants were also asked to reflect on a series of issues, namely:

- Often, the boundaries of ecological regions do not coincide with those of administrative regions. How might ecological borders and homogenous regions be dealt with from the point of view of biomass production within the framework of a uniform structure rather than current administrative boundaries, with a view to increasing productivity and making efficient use of aid?
- What general and measurable macroeconomic indicators could be used to set indicative targets at EU level for the development of the bioeconomy model at national and regional levels, and what are the appropriate specific indicators for measuring the performance of regions?

- How can secondary vocational education be developed and supported at regional level? How might a system of expert training be set up and supported – starting in primary and secondary education – that is adapted to the bioeconomy model, in order to increase society's awareness and better respond to the needs of the labour market with regard to the bioeconomy?
- Given the lack of skilled workers coming from secondary education and the simultaneous emergence and rapid expansion of industrial automation, how might the EU's job creation targets be achieved through an efficient use of resources aimed at developing a bioeconomy model?
- How could regions be encouraged to improve the quality of the bioeconomy knowledge base (data on biomass production and processing, stakeholders, investors, research results, etc.)?
- How might regions that are lagging behind when it comes to the bioeconomy be encouraged to develop a long-term regional development strategy based on the economic paradigm shift inherent to the bioeconomy model?
- How could communication be facilitated between Member State governments and the European Commission so that the interaction between European, national and regional strategies (top-down process) on the one hand, and business opportunities and activities (bottom-up process) on the other – on the basis of effective mutual complementarity – produces major economic results?
- The European Commission is seeking to close the gap between the degree of maturity of the bioeconomy in the EU-15 and in the "new" Member States (EU-13). What additional financial resources and instruments could be used to promote initiatives already receiving public institutional support?
- The bioeconomy could play a key role in the development of smart specialisation strategies (S3). Could this dynamic play an important role in strengthening the role of the bioeconomy?

2.3 Specific topics to be discussed and tested

Experts were asked to select the most pressing topics concerning the bioeconomy to be tackled by policy-makers.

Gathering strong support among the participants was the fact that the concept is still too vague for regional implementation. A proper framing is needed to allow translation into regional and local policy action. This relates to another topic also connected to the need for better dissemination of knowledge on the topic, which is the collection and dissemination of statistical data. The framing of consistent national and regional strategies for the bioeconomy will require improvements in relation to the existing evidence on issues such as productive capacity and available resources.

Also important was the issue of finance. As noted earlier by Mr Koos, channelling investments that enable the market viability of bio-based products is a challenge and should form a vital part of any bioeconomy strategy.

Finally, among the topics that received most attention was the fact that more attention needs to be paid to multi-sectoral aspects – the so called "hybrid sectors", such as construction and plastics. These are not traditional sectors for the bio-based economy, but precisely because of that, these are also the ones where most of the potential for growth of the bioeconomy can be found.

Among other topics that were touched on by the participants was the fact that the primary sector cannot, in any case, be forgotten: land and sea biomass constitute the basis of the resources needed for a successful bioeconomy.

The question of resources must also be understood from several angles. One important issue is that a typical industry using bio-resources is the food industry. But competition will naturally come if more land and sea bio-resources are required for the above mentioned hybrid sectors. The competition between sectors to access biomass will lead to its further development.

The other issue directly related to the use of resources is not the competition for the new production of resources, but the "green" aspect of the bioeconomy: the recycling and reuse of resources that form the backbone of a circular economy.

3 Expected economic effects

3.1 Experts' discussion

At the economic level, the highlights of the discussion were the need to provide the proper tools for the development of the bioeconomy; multilevel and cross-sectoral governance; and, consequently, the mainstreaming of the bioeconomy.

Among the tools on which the bioeconomy is based, is the creation of new value chains where the primary sector can find higher potential for a stable income. This is reflected in potential gains in terms of jobs, and both jobs with a lower and higher level of qualifications.

The production of bio-based fuels faces challenges of different sorts – but certainly a big one is the fact that policies regarding fossil fuels are often unclear. Governments have to juggle between competing demands for the taxation of fossil fuels and the demands of citizens and business to not over-tax what is still the backbone of energy production and fuel consumption all over Europe. Clearer policy options would help the market to move either towards the mainstreaming of, or away from, biofuels.

This creation of a level playing field in terms of regulation and taxation was recognised by several participants as a pre-condition for the success of the whole sector, which could also benefit from the recognition of labels and standards for the bioeconomy. In this sense, cross-sectoral cooperation both at political level (national and local and regional authorities) and at social level (private companies, research institutions) is crucial for a conscious decision-making process and a positive economic symbiosis between industries and biomass producers.

Another reality that also needs to be properly dealt with as regards taxation and at the legal level is the emergence of prosumers – meaning, consumers that are also producers of the goods they consume. Clear rules and fewer obstacles are needed to enable individuals and communities to engage in such activities, as this can greatly benefit local economies, especially in rural areas.

Finally, and with a view to fostering the development of bioeconomy capabilities at regional and national levels, is the need to create biohubs. Such centres would facilitate a smoother and scaled-up collection and transformation of biomass and its provision to the relevant industrial clients.

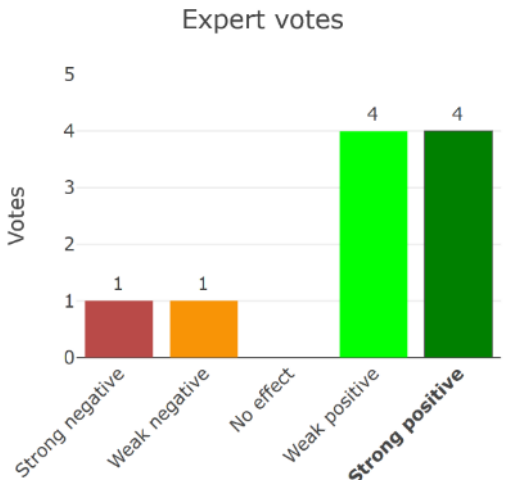
On the basis of this discussion, the following statistical indicators were tested.

3.2 Economic performance (GDP/capita)

The experts concluded that the development of the bioeconomy in Europe would promote economic development, e.g. new value chains would emerge. Thus, economic performance (GDP/capita) could

be affected positively. Four experts judged the effect as strongly positive and four experts as weakly positive. On the other hand, one expert voted for weakly negative and one for strongly negative.

Figure 4 Result of the expert judgment: economic performance (GDP/capita) affected by the development of the European bioeconomy

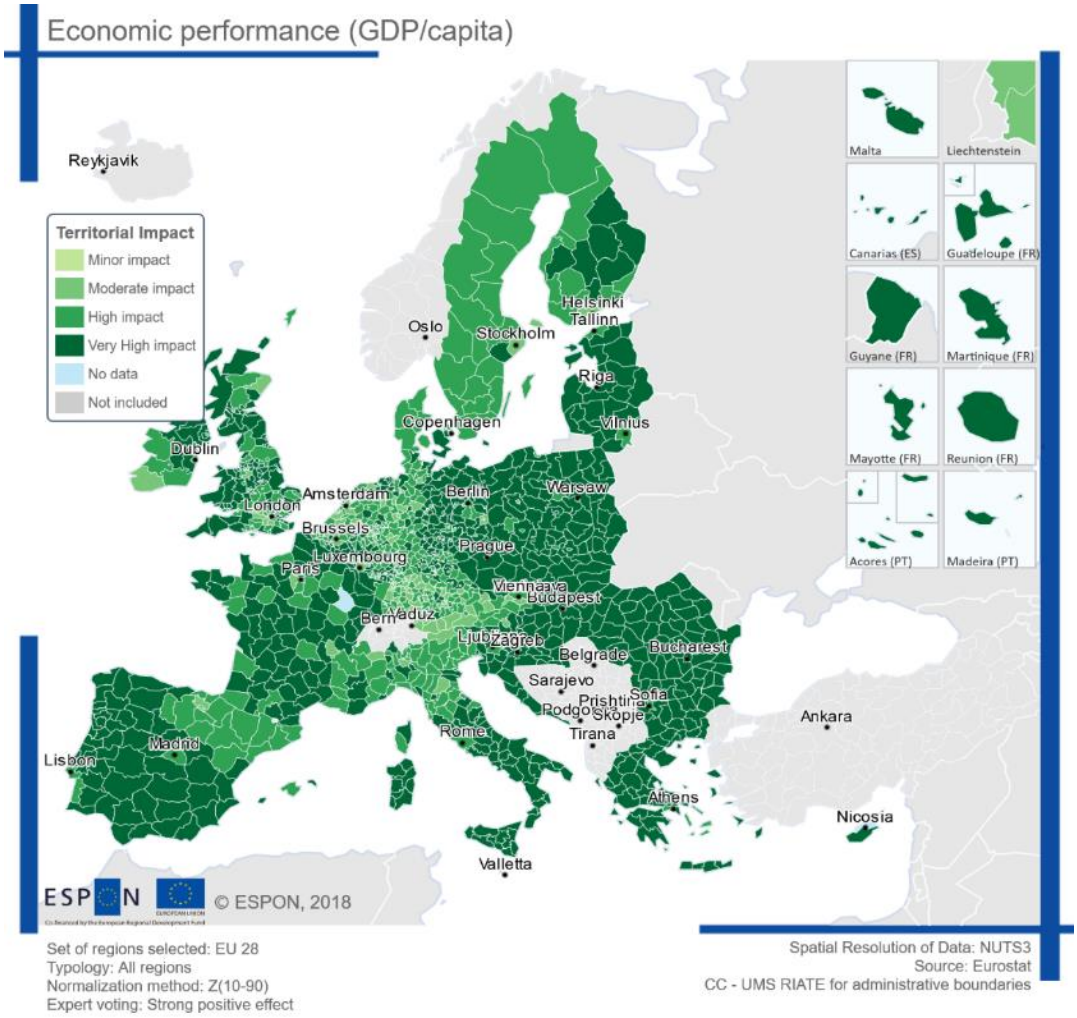


The indicator GDP/capita measures the gross domestic product (GDP) at current market prices (Purchasing Power Standard per inhabitant). Regions with lower GDP per capita are expected to benefit more from the development of the European bioeconomy. Sensitivity is thus inversely proportional to the level of GDP per capita.

The following maps show the potential territorial impact from the development of the European bioeconomy on economic performance (GDP/capita). The first map combines the expert judgement of a strongly positive effect with the given sensitivity of regions. Some 56% of the regions would benefit from a very highly positive impact and 31% a highly positive impact; 13% of the regions are expected to face a moderately positive impact.

The map shows that development of the bioeconomy in Europe could result in a kind of "catching-up effect". Regions with lower GDP could benefit more than regions with an already higher GDP/capita due to the lower marginal benefit for already economically highly performing regions. Thus, the regions gaining a very high and high positive impact are located in the eastern part of Europe (east Finland, Estonia, Latvia, Lithuania, Poland, east Germany, the eastern part of Slovakia, Hungary, Croatia, Bulgaria, Romania) and in the south (Greece, south of Italy, Sardinia, Cyprus, south of Spain, Portugal. Furthermore, regions in the west and north of Britain, the north-east of Ireland and in the centre of France could potentially benefit more from an EU industrial policy strategy.

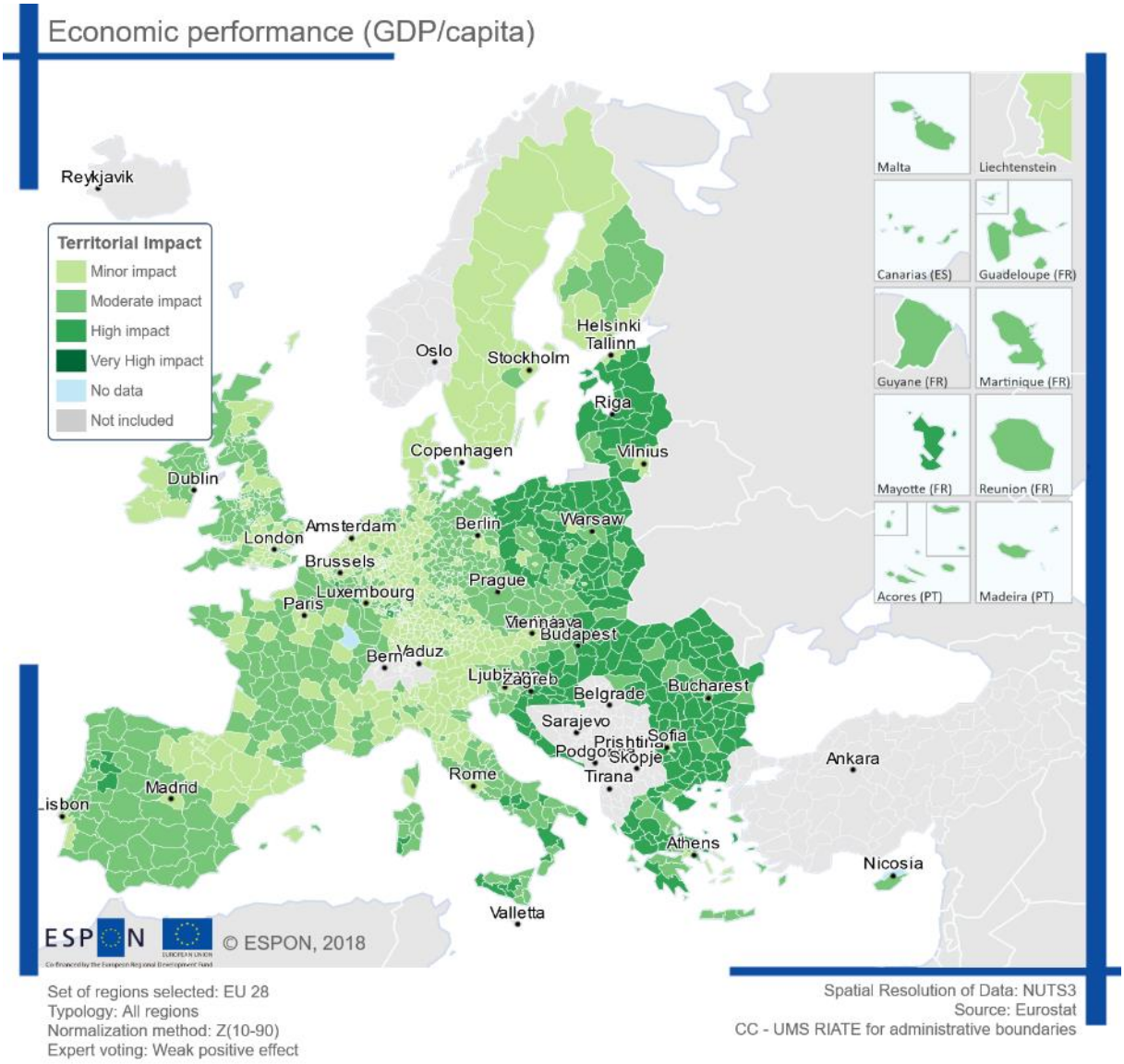
Map 1 Result of the expert judgment: economic performance (GDP/capita) affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

The second map shows the potential impact of the development of the European bioeconomy on economic performance (GDP/capita), based on a weak positive effect. Some 16% of the regions could gain a highly positive impact, 40% a moderately positive impact and 44% only a minor positive impact. Due to the aforementioned "catching-up" effect, it is expected that many regions in eastern and south-eastern Europe, as well as some regions in Italy and Portugal, would benefit the most from the development of the bioeconomy in Europe.

Map 2 Result of the expert judgment: economic performance (GDP/capita) affected by the development of the European bioeconomy – expert judgment: weakly positive effect

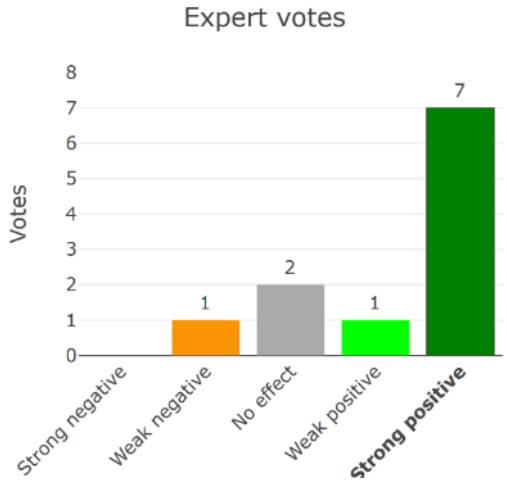


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

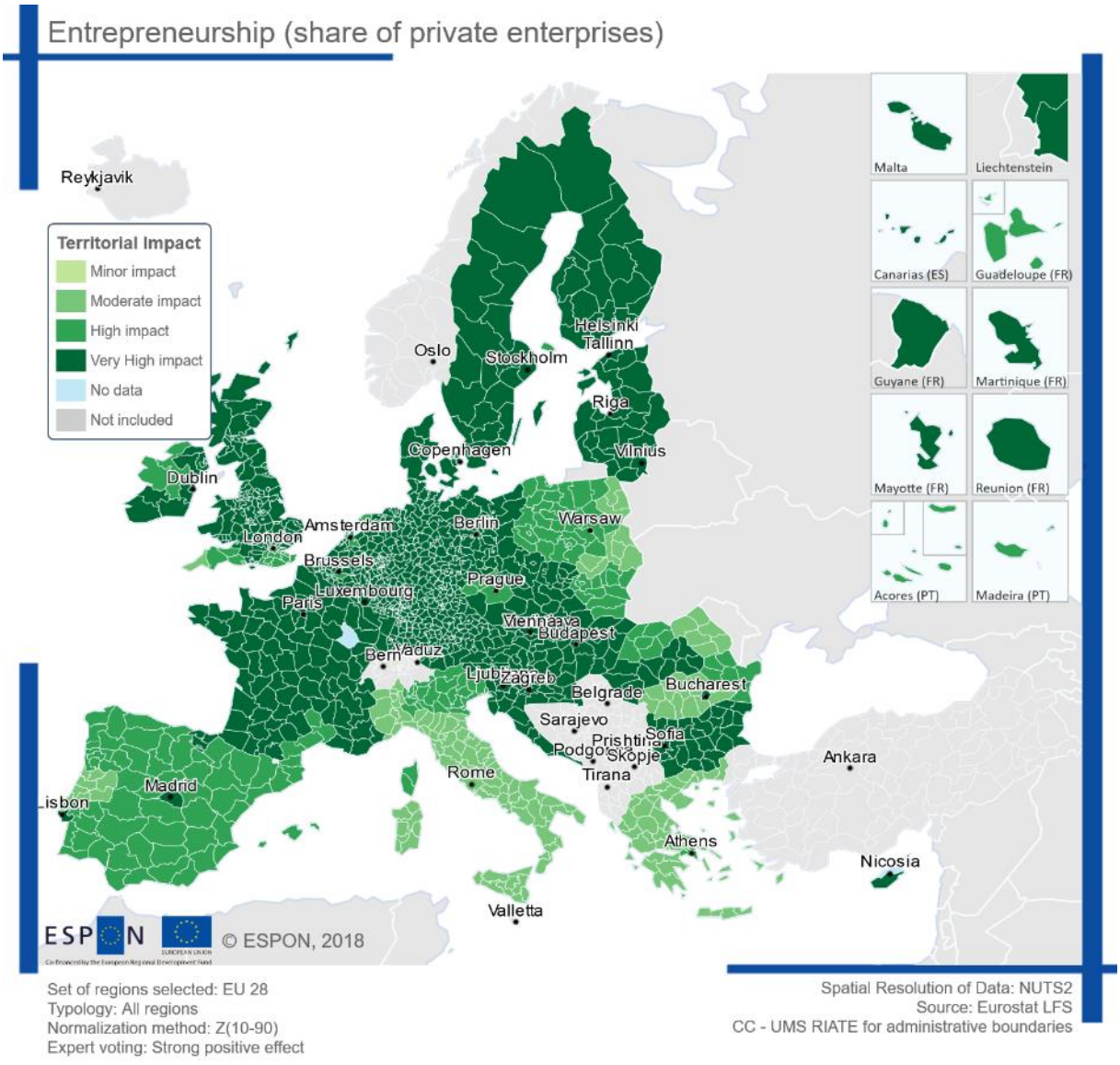
3.3 Entrepreneurship (share of private enterprises)

The experts assumed that the development of the bioeconomy in Europe would create a climate that would promote the development of start-ups and other entrepreneurial initiatives. These companies are more likely to foster activities in the field of sustainable innovation. Therefore the experts saw positive effects on entrepreneurship. Seven experts judged the effect as strongly positive and one judged it as weakly positive. One expert considered this effect as weakly negative. Two experts did not consider this indicator as relevant.

Figure 5 Result of the expert judgment: entrepreneurship (share of private enterprises) affected by the development of the European bioeconomy



Map 3 Result of the expert judgment: entrepreneurship (share of private enterprises) affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

The indicator entrepreneurship (share of private enterprises) depicts the share of self-employed persons among total employed persons. Regions showing lower levels of self-employment are expected to benefit more from measures aimed at its promotion, or which inhibit it unintentionally. Sensitivity is thus inversely proportional to the share of self-employment.

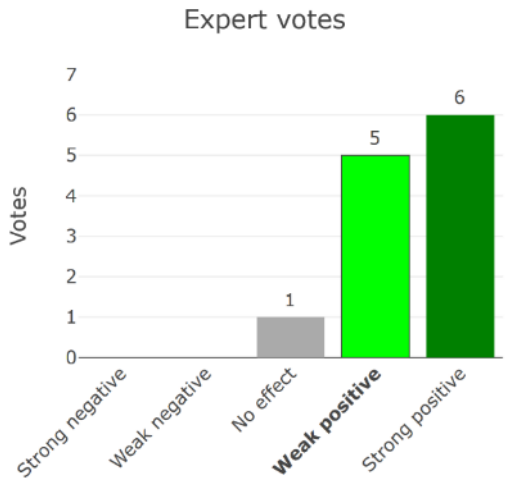
The above map shows the potential territorial impact from the development of the European bioeconomy on the share of self-employed persons. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 72% of the regions could gain a very highly positive impact and 16% a highly positive impact; for 12% of the regions there would be a moderately positive impact.

It is assumed that in regions with a high share of self-employed persons the entrepreneurial spirit is higher, serving as a basis for additional start-ups etc. These regions are especially located in the European centre, in Scandinavia, the Baltic countries, Bulgaria, Croatia and the UK.

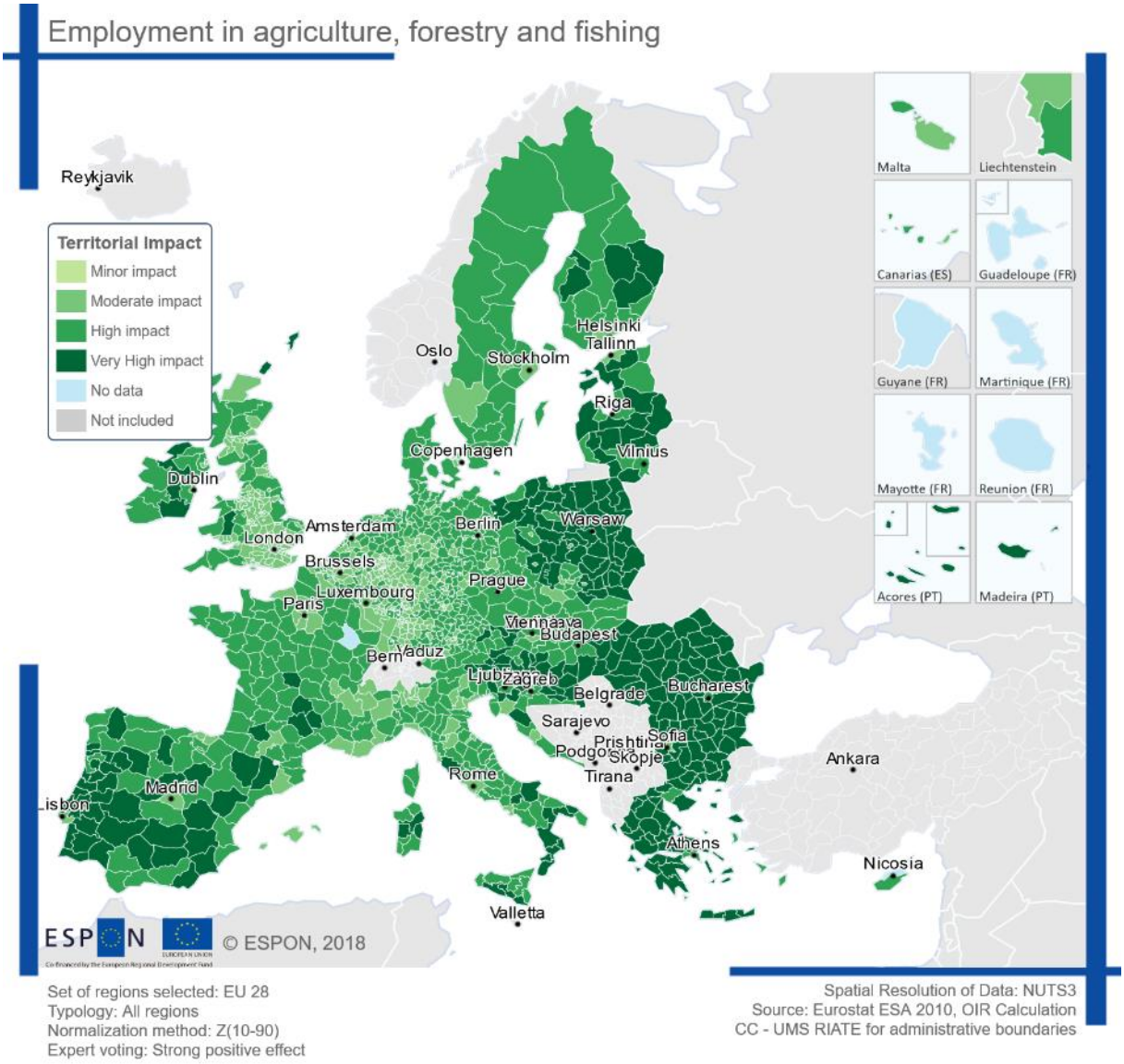
3.4 Employment in agriculture, forestry and fishing

As mentioned in the introduction, agriculture, forestry and fishing are a main source for the development of the bioeconomy. The majority of the experts agreed that a suitable indicator to depict the importance of these sectors in a region is the share of employment in agriculture, forestry and fishing. Six experts voted for strongly positive and five for weakly positive. One expert did not expect a relevant effect, since a change in this indicator is hard to interpret. An increase in employment could mean returning to manual labour in agriculture. A decrease could mean that the population has aged, migrated or has other options – not necessarily being a result from an advance in IT and innovations in agriculture. Since it is not possible to directly replace this indicator with regional gross value added in agriculture or value added at factor costs we introduce the following indicators that enable us to approach this issue – namely, national GVA, and average economic size of farm holdings by NUTS 2 region.

Figure 6 Result of the expert judgment: employment in agriculture, forestry and fishing affected by the development of the European bioeconomy

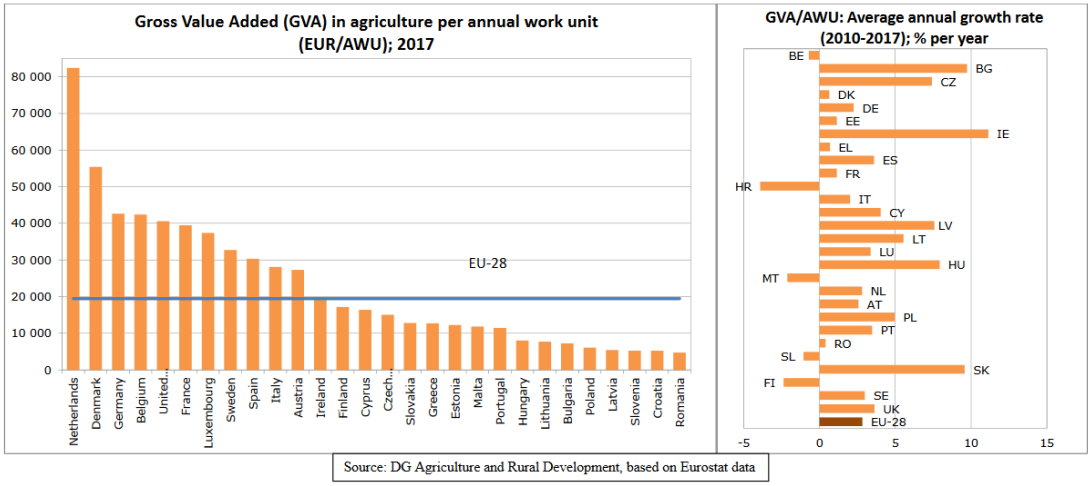


Map 4 Result of the expert judgment: employment in agriculture, forestry and fishing affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

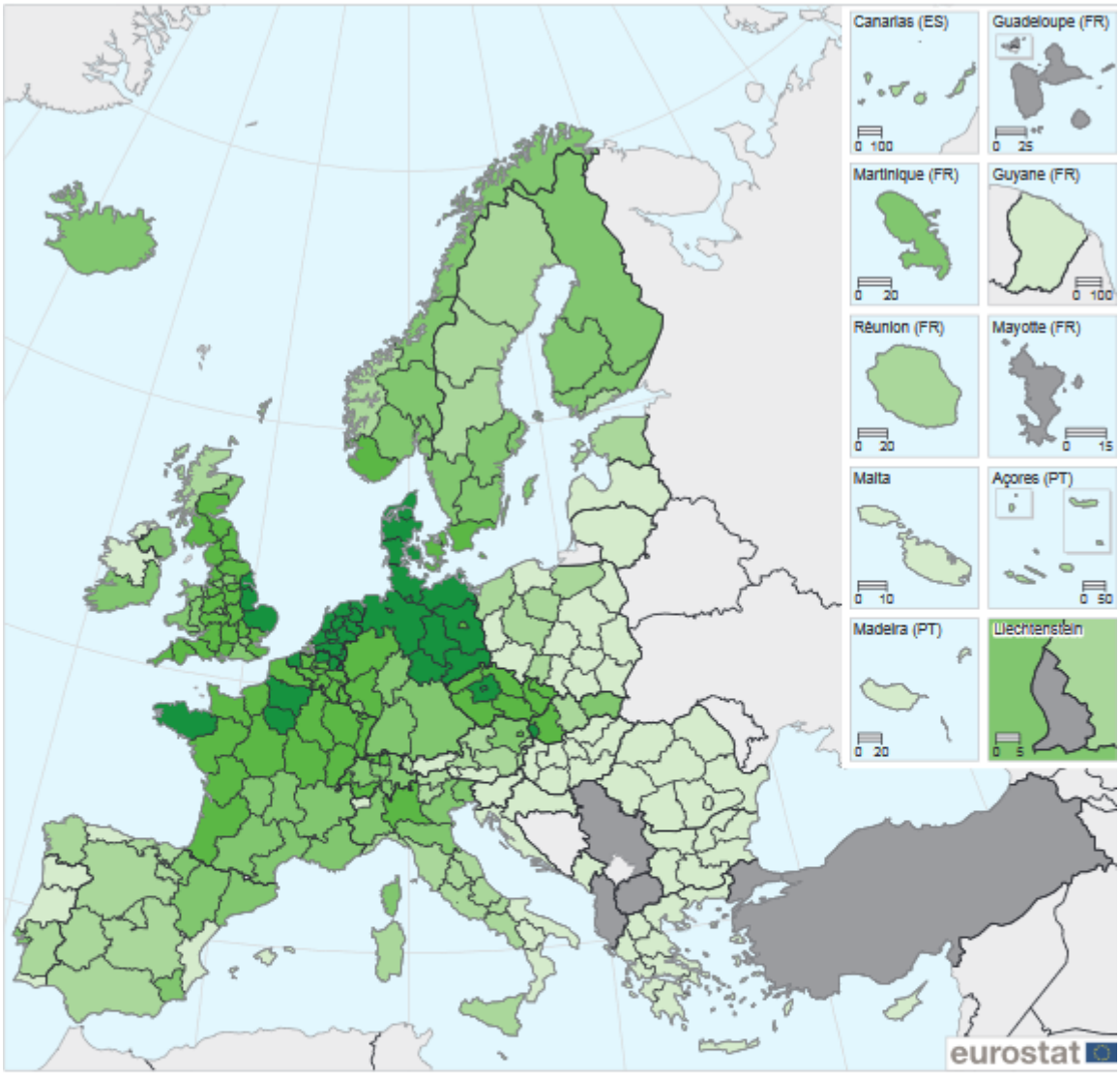
Figure 7 Gross value added in agriculture per annual work unit



Source: DG Agriculture and Rural Development, based on Eurostat data

Map 5 Average economic size of farm holdings (NUTS 2)

Average economic size of farm holdings, by NUTS 2 regions, 2013
(thousand EUR)



(thousand EUR)

EU-28 = 30.5

- < 25
- 25 - < 50
- 50 - < 100
- 100 - < 200
- ≥ 200
- Data not available

Administrative boundaries: © EuroGeographics © UN-FAO © Turksta
Cartography: Eurostat — GISCO, 04/2018

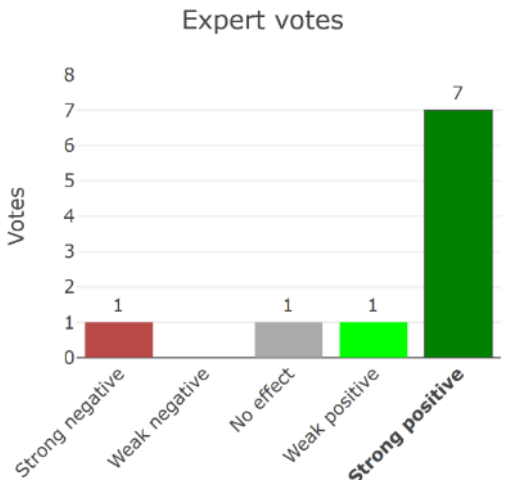
0 200 400 600 800 km

Note: Germany and London (UKI): NUTS level 1. Slovenia: national data. Iceland, Switzerland and Montenegro: 2010.
Source: Eurostat (online data code: ef_kvecsleg)

3.5 Employment in sectors affected by the low-carbon economy

The experts agreed that the development of the bioeconomy in Europe would have a positive impact on sectors affected by the low-carbon economy such as transport, energy, the building and construction sector, water and waste management etc. Seven experts voted the effect strongly positive and one voted it as weakly positive. One expert considered this effect as strongly negative and one expert did not see this indicator as relevant.

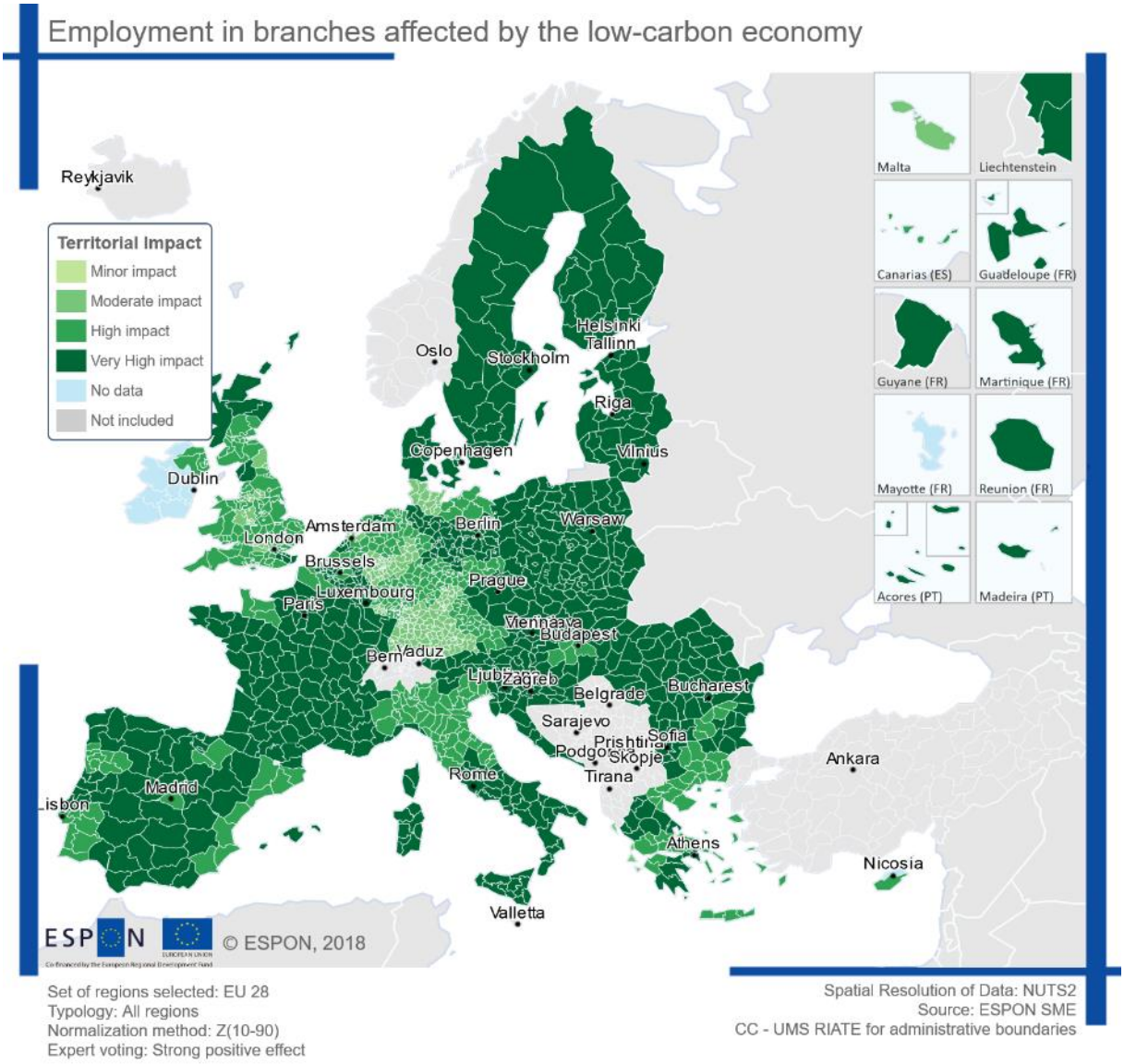
Figure 8 Result of the expert judgment: employment in sectors affected by the low-carbon economy affected by the development of the European bioeconomy



The indicator "employment in sectors affected by the low-carbon economy" depicts the share of persons employed in industries that will be affected by the low-carbon economy (e.g. transport, energy, the building and construction sector, water and waste management etc.) out of total employment (excluding agriculture). Regions with a higher share of employment in these industries are expected to be influenced more by the development of the European bioeconomy. Sensitivity is thus directly proportional to the share of employment in these sectors.

The following map shows the potential territorial impact from the development of the European bioeconomy based on employment in sectors affected by the low-carbon economy. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Almost half of the regions (48%) would get a very highly positive impact and 35% a highly positive impact. Regions facing a moderately positive impact (17%) can only be found in Germany, the Netherlands and the UK.

Map 6 Result of the expert judgment: employment in sectors affected by the low-carbon economy affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

4 Expected societal effects

4.1 Experts' discussion

The previously mentioned discussion on the mainstreaming of the bioeconomy is echoed also in the societal impacts of a successful strategy for the sector. This depends on a transformation towards lifecycle thinking, as in mindfulness of every aspect of our actions on the environment. Consumer awareness of a sustainable way of living can be reflected at least two levels: better health standards and better living standards.

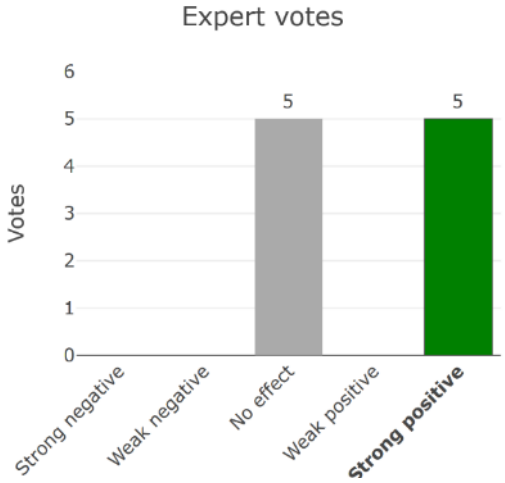
The bioeconomy has the potential to foster the repopulation of rural areas, as major providers of biomass. In cities, it has the potential to foster cleaner cities where the use of urban bio-waste can also have a positive economic role.

Experts agreed on a series of relevant statistical indicators to measure the potential impact of cleaner cities and more sustainable living with better economic opportunities for regions that have suffered from out-migration, including life expectancy, employment, and available income.

4.2 Life expectancy at birth

Some experts concluded that the development of the bioeconomy in Europe could have a positive impact on life expectancy. As the consumption of fossil energy sources would be minimised, the emission of pollutants would also be reduced. Therefore life expectancy would be higher. Five experts expected a strongly positive effect. However, five experts did not see a relevant effect.

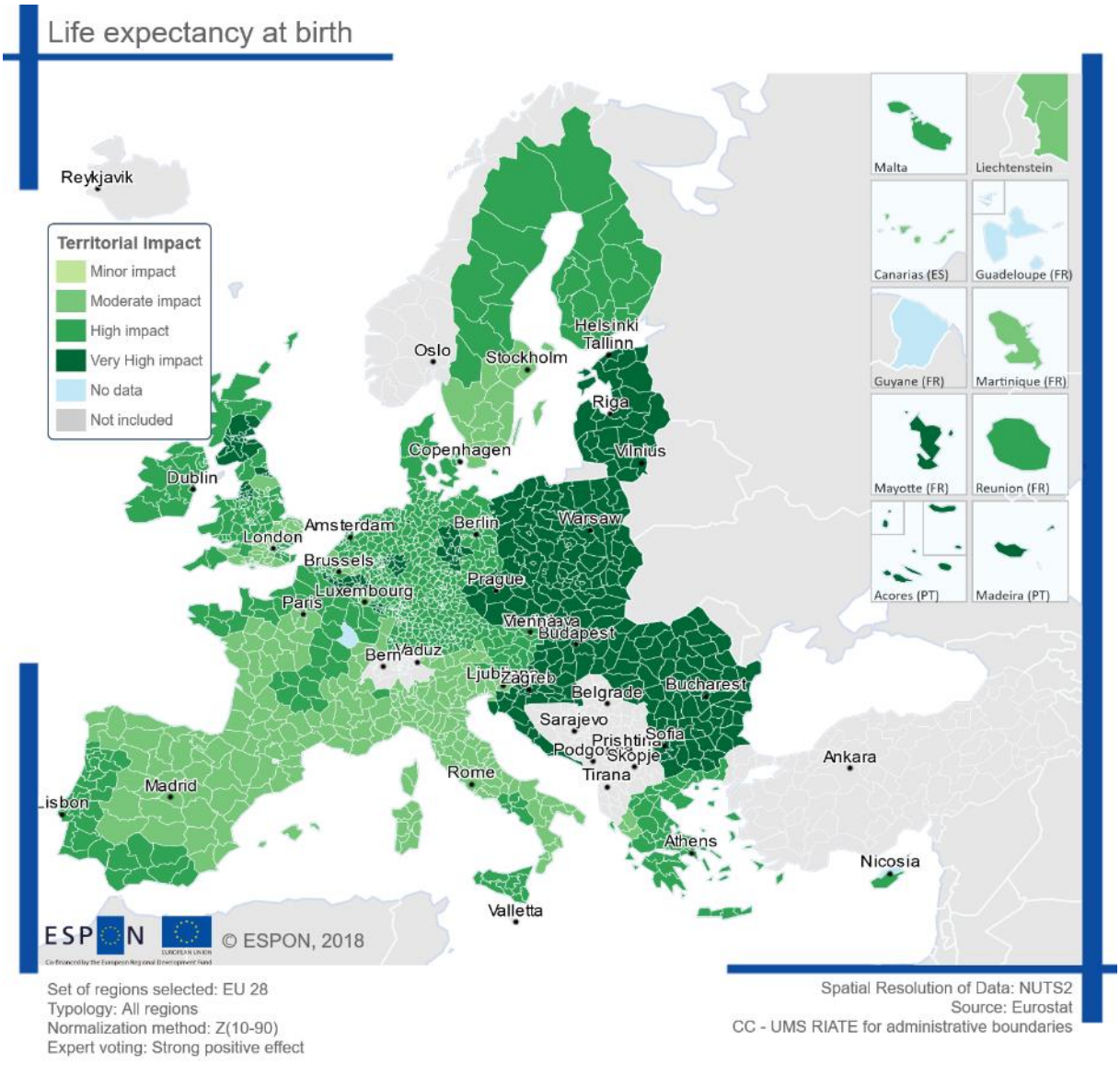
Figure 9 Result of the expert judgment: life expectancy at birth affected by the development of the European bioeconomy



This indicator depicts life expectancy at a given exact age. Regions in which life expectancy is lower are assumed to benefit more from the development of the bioeconomy in Europe. Sensitivity is thus inversely proportional to life expectancy at birth.

The following map shows the potential territorial impact from the development of the European bioeconomy on life expectancy at birth. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 24% of the regions could gain a very highly positive impact. The regions with the potential highest benefits would be mainly located in the eastern and south-eastern parts of Europe; 54% would get a highly positive impact and 22% a moderately positive impact.

Map 7 Result of the expert judgment: Life expectancy at birth affected by the development of the European bioeconomy – expert judgment: strongly positive effect

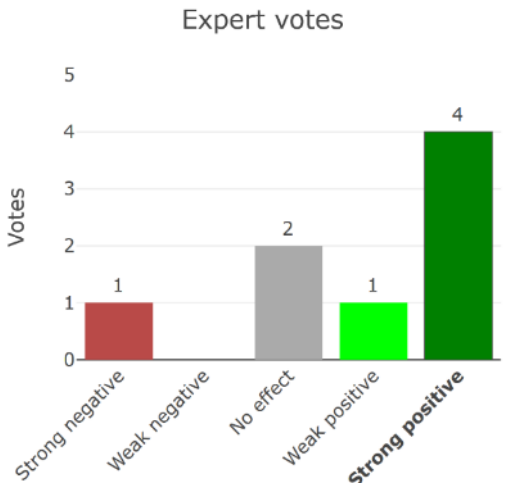


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

4.3 Disposable income

Due to the expected positive effect of the bioeconomy on economic development, the experts assumed that this would positively influence the disposable income of people, especially when they are gaining their income from the primary sector. Four experts voted the indicator "disposable income" as strongly positive and one as weakly positive. One expert judged the effect as strongly negative and two experts did not consider this indicator as relevant.

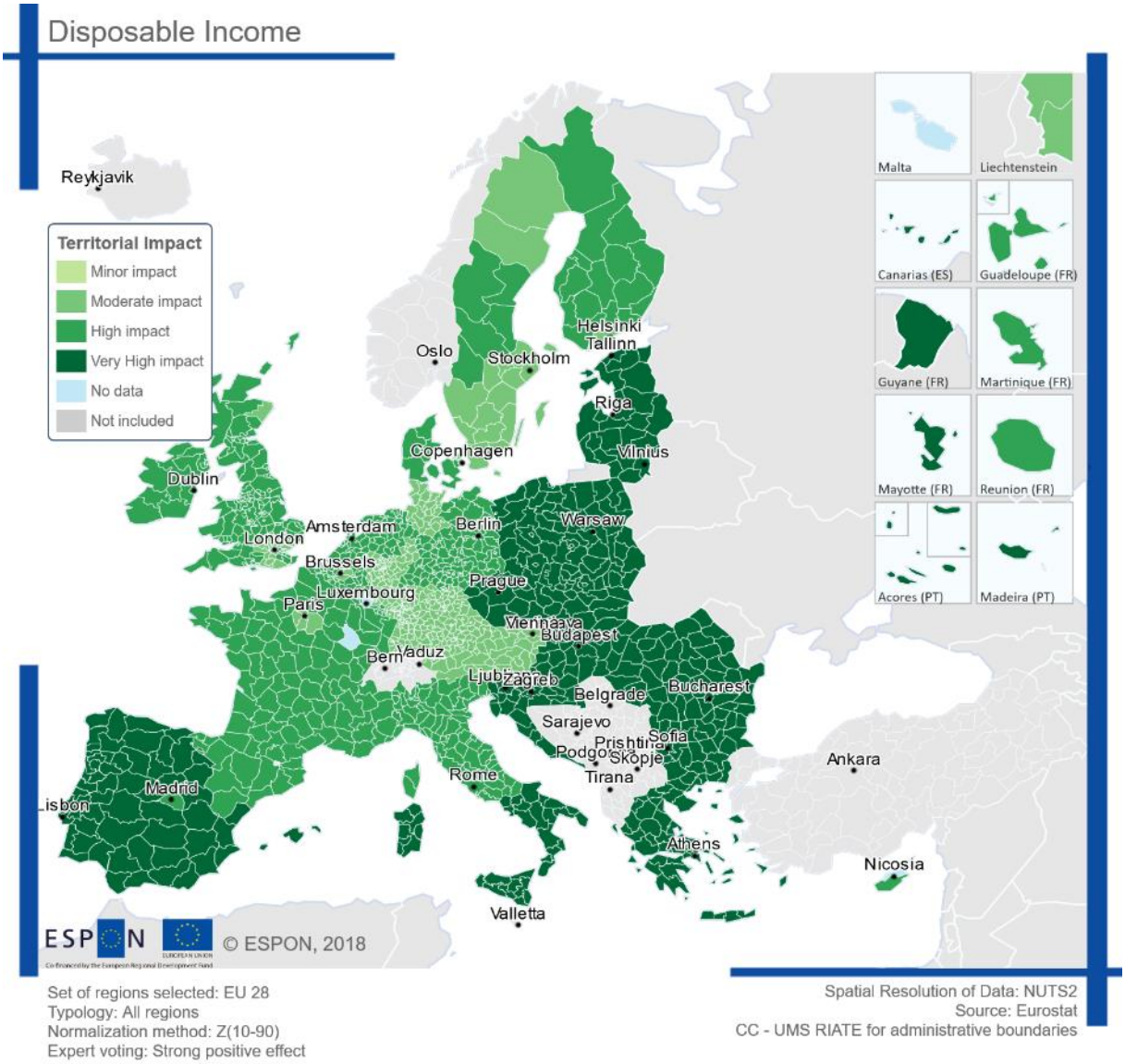
Figure 10 Result of the expert judgment: disposable income affected by the development of the European bioeconomy



The indicator "disposable income" is stated in euro per inhabitant expressed in purchasing power standard. Regions with lower disposable income per capita are expected to benefit more from the development of the European bioeconomy. Sensitivity is thus inversely proportional to the level of disposable income per capita in PPS.

The following map shows the potential territorial impact from the development of the bioeconomy in Europe based on disposable income. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 30% of the regions would get a very highly positive impact. These regions are economically less developed (e.g. eastern and south-eastern Europe, southern Italy, Portugal and parts of Spain). Some 43% of the regions are expected to benefit from a highly positive impact and 27% a moderately positive impact.

Map 8 Result of the expert judgment: disposable income affected by the development of the European bioeconomy – expert judgment: strongly positive effect

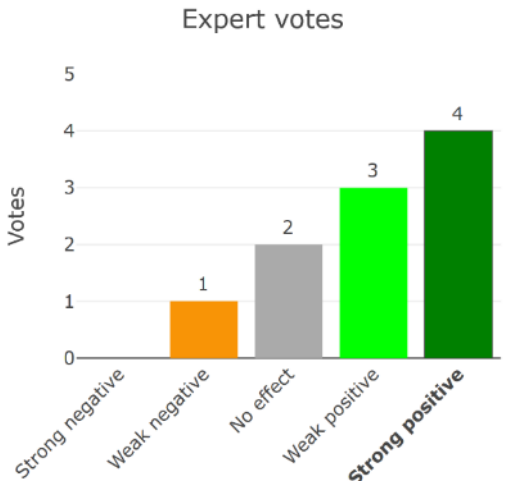


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

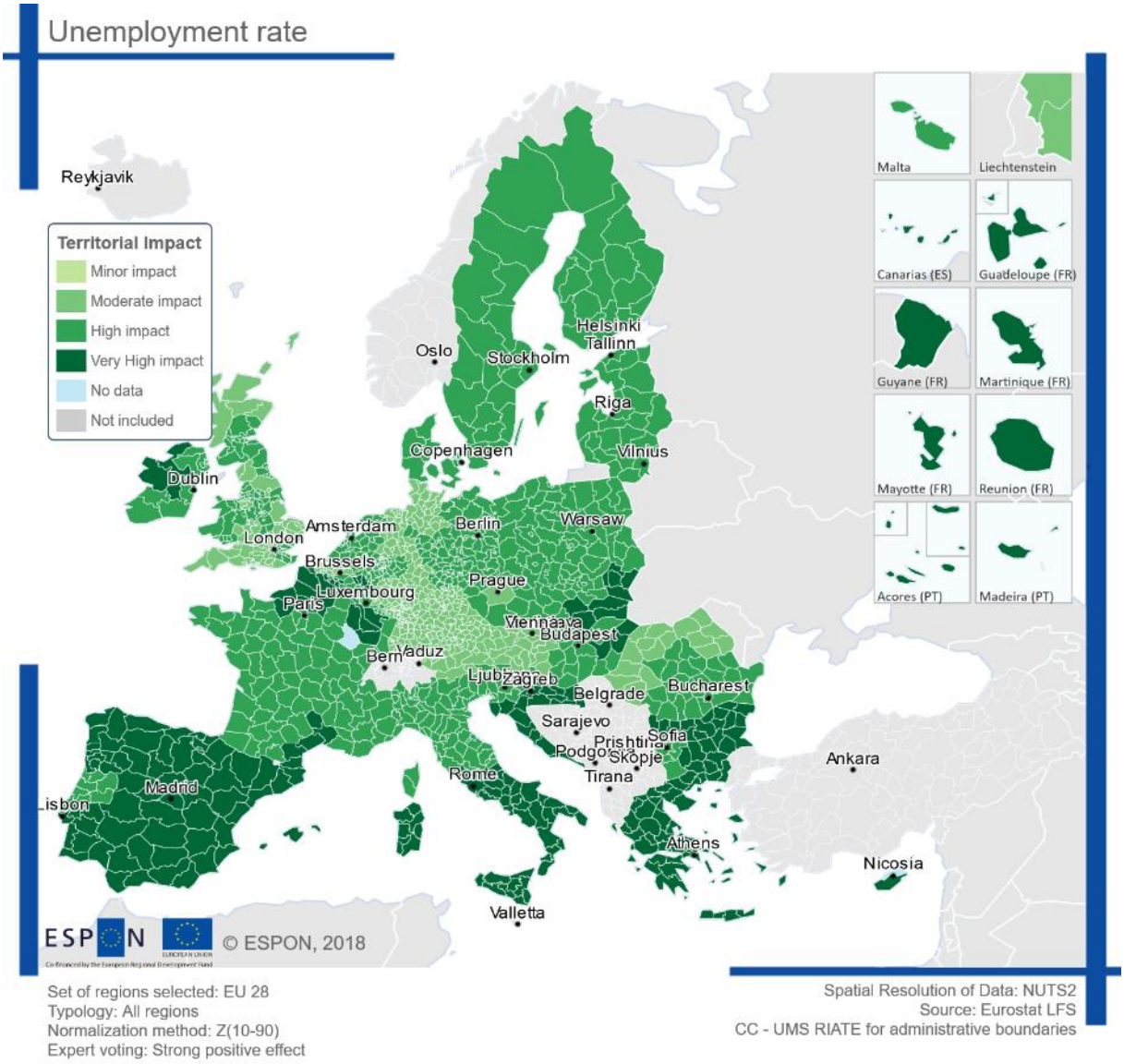
4.4 Unemployment rate

Due to the positive effects of the development of the bioeconomy in Europe on economic performance, the experts agreed that the unemployment rate could be reduced. Four experts voted for strongly positive and three for weakly positive. One expert judged the effect as weakly negative. Two experts did not consider this indicator as relevant. It was noted that it would be better to focus on the employment rate, rather than on unemployment. Regions thrive on people having access to jobs, both in terms of income spending and tax base. Unemployment can be decreased due to non-economic activities such as migration or an ageing population, both being a common occurrence in the EU.

Figure 11 Result of the expert judgment: unemployment rate affected by the development of the European bioeconomy



Map 9 Result of the expert judgment: unemployment rate affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

The indicator "unemployment rate" depicts the sensitivity of a region according to the unemployment rate. It is calculated by dividing the number of unemployed people by the economically active population. Regions experiencing higher levels of unemployment are likely to benefit more from a reduction in unemployment and are more harmed by increases thereof. Sensitivity is thus directly proportional to the unemployment rate.

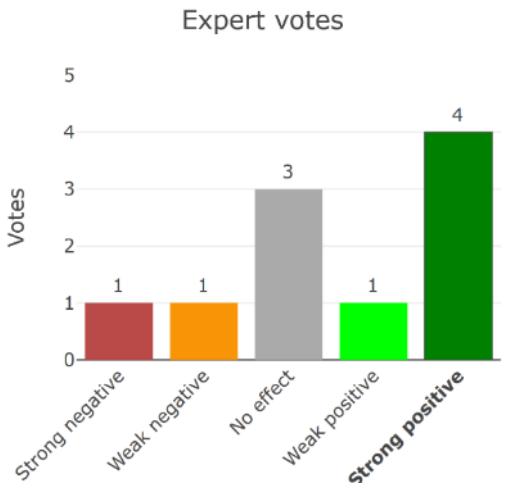
The above map shows the potential territorial impact from the development of the European bioeconomy based on the unemployment rate. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 20% of the regions could gain a very highly positive impact. Half of the regions (51%) would benefit from a highly positive (51%) impact; 29% of the regions would get a moderately positive impact. The indicator supposes that regions with a high unemployment rate would benefit most, when initiatives are taken to reduce unemployment. Those

regions can be found throughout Spain, Croatia and Greece and in the southern parts of Portugal and Italy, as well as in parts of France, Belgium, Ireland, Poland, Slovakia, Hungary, Bulgaria and in Cyprus.

4.5 Net migration

The positive effects of the bioeconomy on economic development, job opportunities and income options are linked to agriculture, fisheries and forestry. As these sectors are mainly located in rural areas, the experts saw a positive effect on net migration in rural areas. They assumed that the bioeconomy could help to increase the economic attractiveness of rural areas and reduce out-migration or even trigger a new wave of "in-migration" to rural regions. These regions could become more attractive as new jobs would be created. Four experts considered this effect as strongly positive, one expert as weakly positive. On the other hand, one expert voted for weakly negative and one for strongly negative. Three experts did not expect a relevant effect.

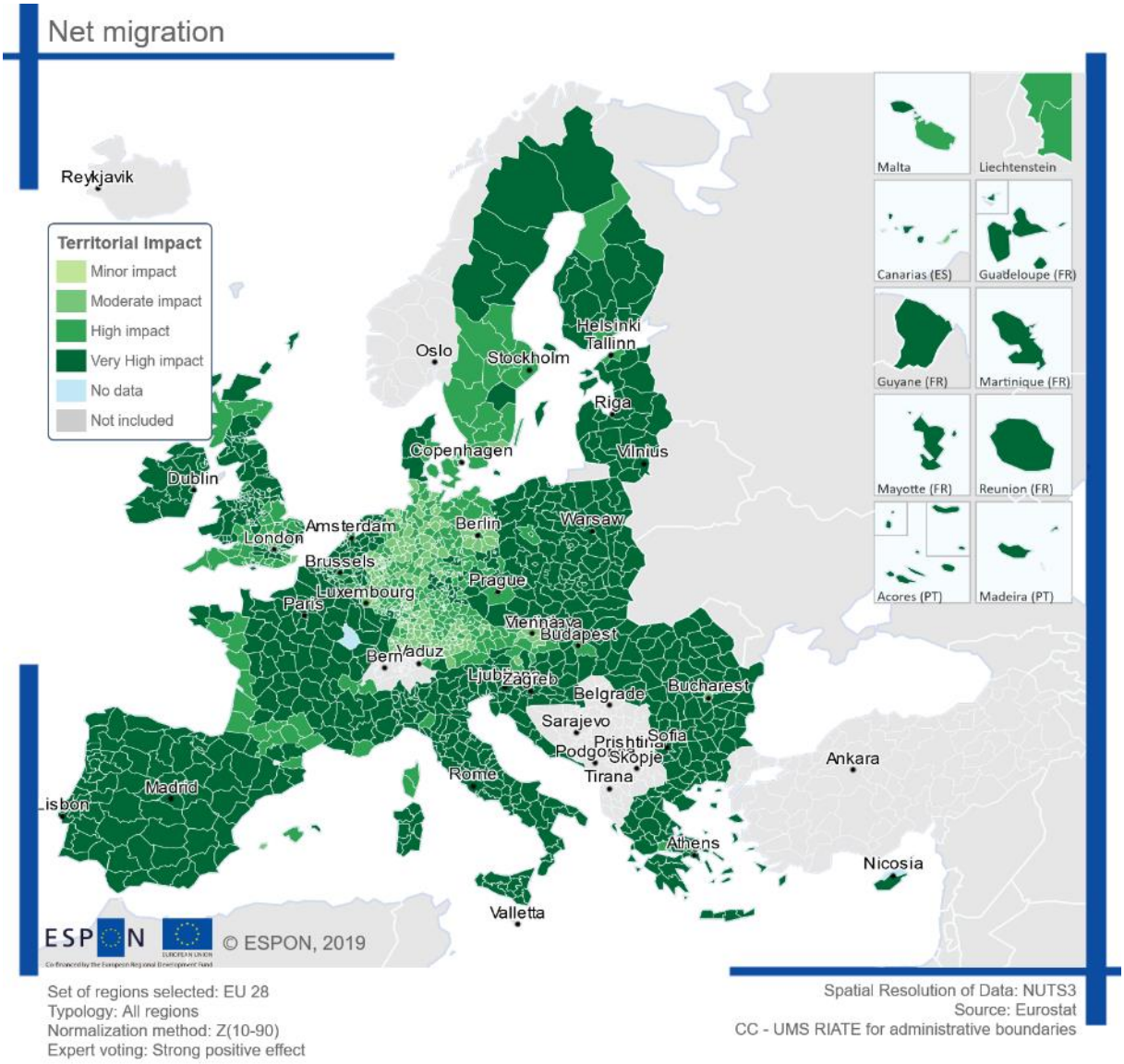
Figure 12 Result of the expert judgment: net migration affected by the development of the European bioeconomy



The indicator "net migration" is measured by the crude rate of net migration including statistical adjustment per thousand inhabitants. The crude rate of net migration is equal to the difference between the crude rate of population change and the crude rate of natural change. Regions experiencing a brain drain are expected to benefit more from the potential effects of developing the bioeconomy in Europe causing their reduction or suffer most from their exacerbation.

The following map shows the potential territorial impact from the development of the European bioeconomy based on net migration. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 59% of the regions would gain a very highly positive impact and 25% a highly positive impact. These regions are distributed quite equally throughout Europe. The regions facing the least positive impact can be found in Germany, Austria, and a few regions in the UK, Romania, Croatia and Sweden.

Map 10 Result of the expert judgment: net migration affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

5 Expected environmental effects

5.1 Experts' discussion

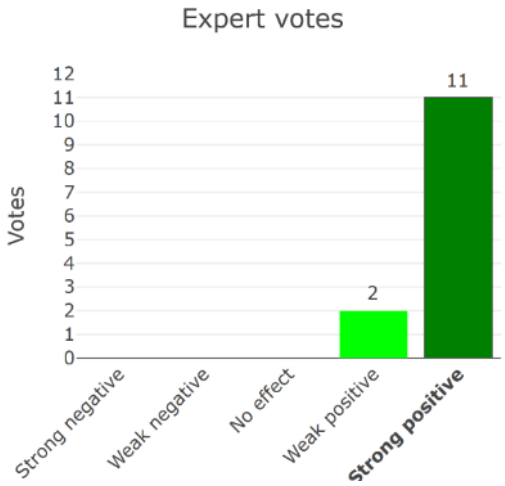
The connection between the bioeconomy and lifecycle thinking implies that a successful bioeconomy strategy will be reflected in increased resource efficiency. The use of fossil-based products is expected to be lower and so is the carbon intensity of the economy as a whole. This is not only because CO_2 production as a whole might be lower, but also because the CO_2 uptake should increase via economic sectors directed at producing more biomass. Better care for soil and water resource conditions is also expected to follow.

Experts agreed on a series of statistical indicators that allow us to depict the possible impact of a successful bioeconomy strategy on the environment, ranging from CO_2 to use of soil and water.

5.1 Emissions of CO_2 per capita

The development of the bioeconomy in Europe will require environmentally friendly methods of production to be adopted with less consumption of fossil energy sources. Consequently, it will contribute to reducing CO_2 emissions per capita. All experts saw a positive effect: eleven experts voted for strongly positive and two for weakly positive.

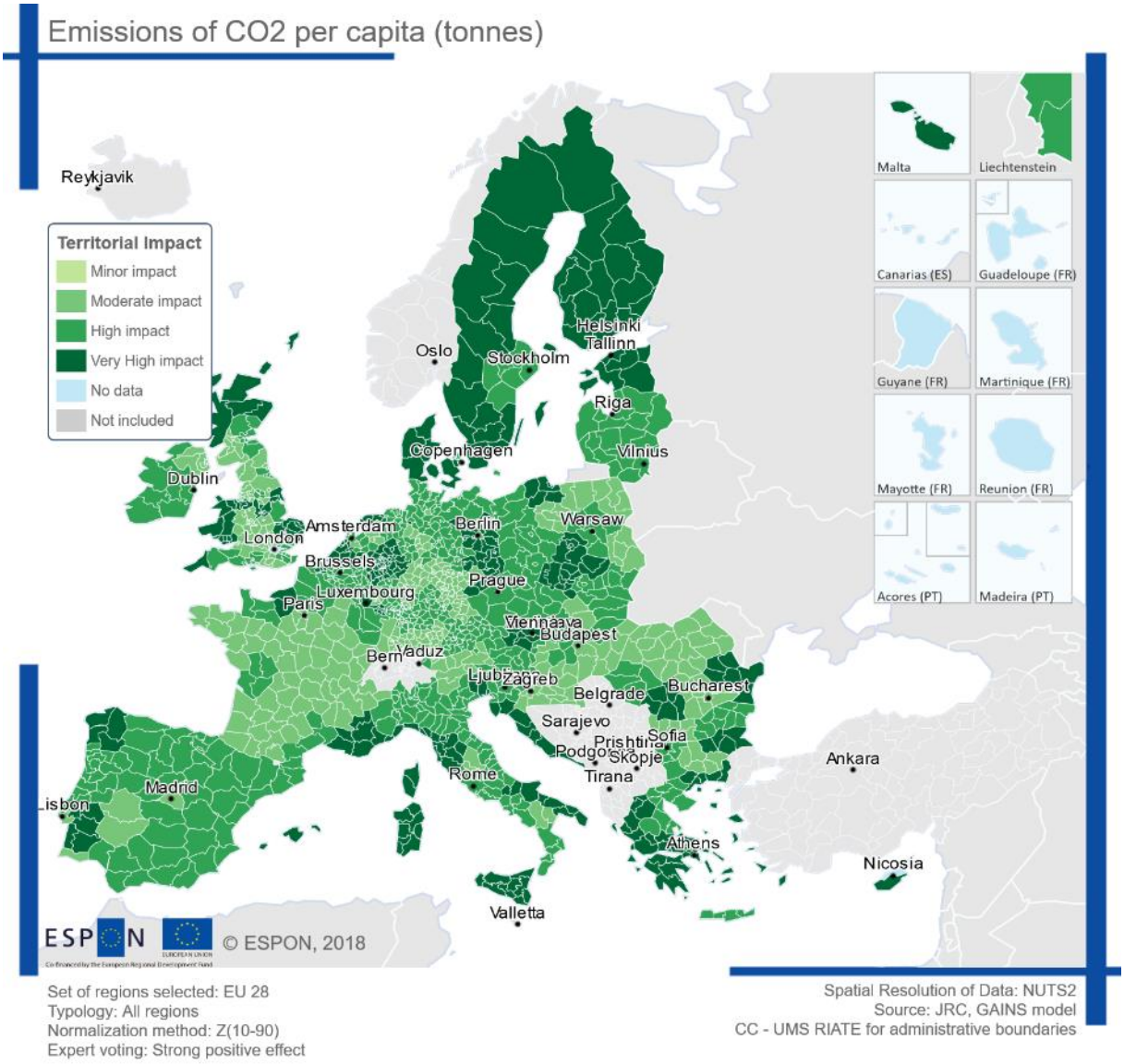
Figure 13 Result of the expert judgment: emissions of CO_2 per capita (tonnes) affected by the development of the European bioeconomy



The indicator "emissions of CO_2 per capita" depicts the sensitivity of a region according to emissions of CO_2 in tonnes per capita. It is measured in tonnes per year. Regions showing higher concentrations of CO_2 per capita are expected to be more sensitive.

The following map shows the potential territorial impact from the development of the European bioeconomy based on emissions of CO_2 per capita. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 27% of the regions could gain a very highly positive impact; 44% would get a highly positive impact and 29% a moderately positive impact.

Map 11 Result of the expert judgment: emissions of CO_2 per capita (tonnes) affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

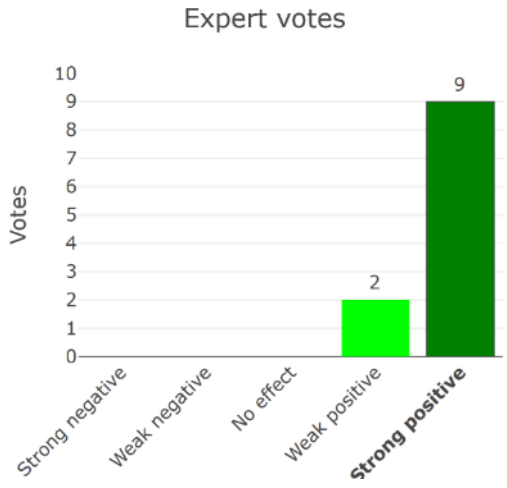
Many of the regions that would gain the highest impact in terms of a reduction of CO_2 emissions are port regions or industrial regions. Sparsely populated regions with high CO_2 emissions per capita in Sweden and Finland show high impacts due to the low population, which results in a high level of CO_2 per capita. It was nevertheless noted that this indicator is biased against less populated regions. For example, a NUTS 3 region with a stable wood processing industry would increase CO_2 emissions in the event of demographic loss. Therefore, it would be important to develop at a regional scale in Europe the indicator of CO_2 emissions per km^2, as used by the United Nations Statistics Division[3].

[3] https://unstats.un.org/unsd/environment/air_co2_emissions.htm .

5.2 Ratio between emissions of CO_2 and GVA

Another suitable indicator to depict CO_2 emissions is the "ratio between emissions of CO_2 and GVA". Compared to the indicator "emissions of CO_2 per capita", this ratio is able to show how "$CO_2$2 efficient" the economic activities of a region are. Therefore, regions with a low ratio between emissions of CO_2 and GVA are supposed to have a sustainable economy. As in the previous indicator, all experts judged the effect as positive: nine experts voted for strongly positive and two for weakly positive.

Figure 14 Result of the expert judgment: ratio between emissions of CO_2 and GVA affected by the development of the European bioeconomy

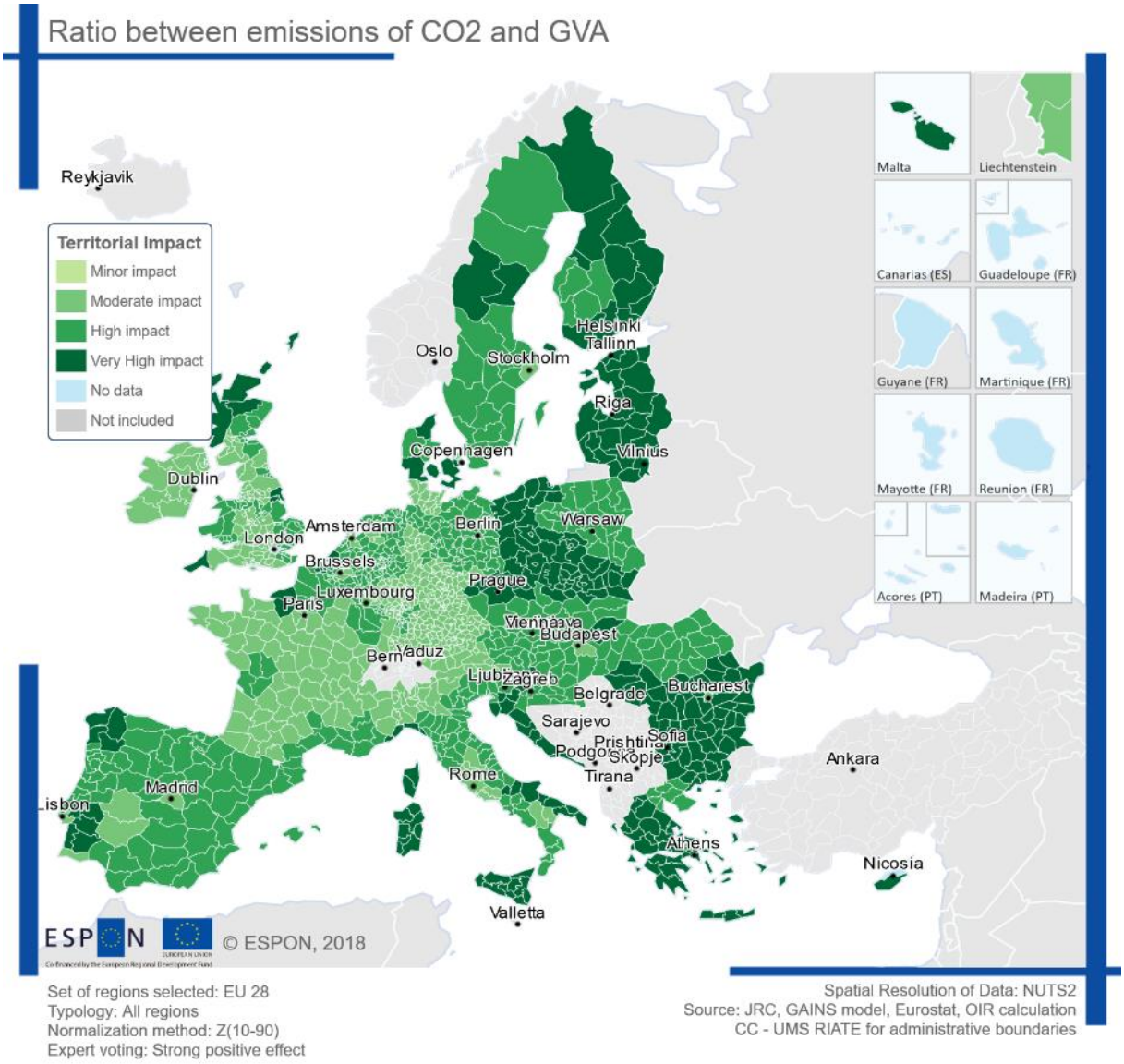


This indicator depicts the ratio between emissions of CO_2 and GVA. It is calculated by dividing emissions of CO_2 (tonnes) by GVA (in millions of euro). Regions showing a higher ratio between emissions of CO_2 and GVA are expected to be more sensitive. Sensitivity is thus directly proportional to the ratio between emissions of CO_2 and GVA.

The following map shows the potential territorial impact from the development of the European bioeconomy based on the ratio between emissions of CO_2 and GVA. It combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 21% of the regions would gain a very highly positive impact and 41% a highly positive impact; 38% of the regions are expected to benefit from a moderately positive impact.

Compared to the previous map, which shows the potential territorial impact based on emissions of CO_2 per capita, now some sparsely populated regions with high CO_2 emissions (e.g. Sweden, Finland, etc.) could expect a lower positive impact, whereas regions in eastern and south-eastern Europe would expect higher positive impacts.

Map 12 Result of the expert judgment: ratio between emissions of CO_2 and GVA affected by the development of the European bioeconomy – expert judgment: strongly positive effect

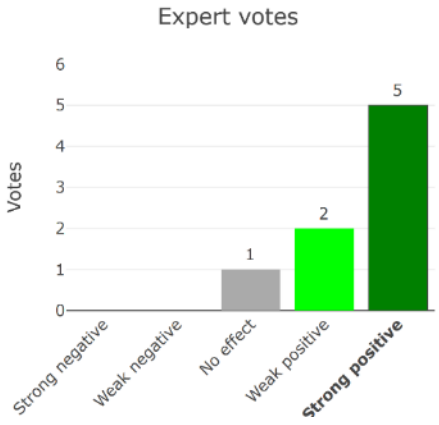


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

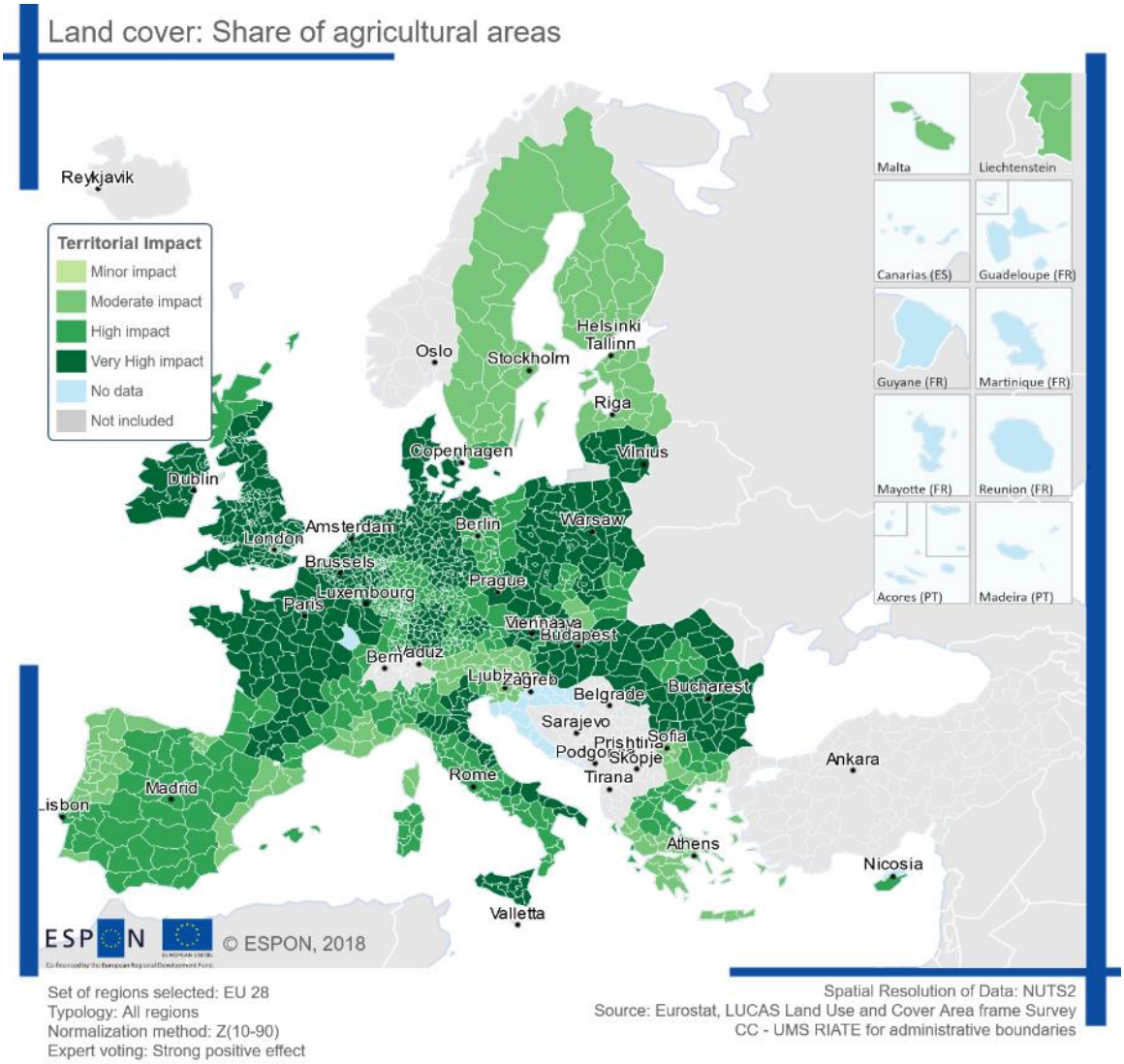
5.3 Land cover: Share of agricultural areas

Similarly to the indicator "Employment in agriculture, forestry and fishing", the experts also decided to choose "Land cover: Share of agricultural areas" as a suitable indicator to describe the effects of the bioeconomy. Five experts expected a strongly positive effect and two a weakly positive effect. One expert did not see a relevant effect.

Figure 15 Result of the expert judgment: land cover: share of agricultural areas affected by the development of the European bioeconomy



Map 13 Result of the expert judgment: land cover: share of agricultural areas affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

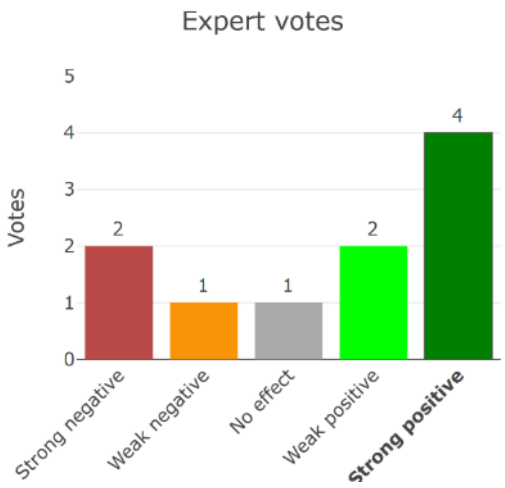
This indicator depicts the sensitivity of a region according to the share of total land area used for agriculture. Regions with a larger share of land used for agriculture are likely to be more sensitive to the development of the bioeconomy in Europe. Sensitivity is thus directly proportional to the share of agricultural areas.

The map above shows the potential territorial impact from the development of the bioeconomy in Europe based on the share of agricultural areas. It combines the expert judgement of a strongly positive effect with the given sensitivity of regions. More than half of the regions (54%) would gain a very highly positive impact and 31% a highly positive impact. Some 15% of the regions are expected to face a moderately positive impact. The regions facing the highest impact can be found in Ireland, the UK, France, the Benelux countries, Germany, Denmark, Italy, Austria and in Eastern Europe.

5.4 Water consumption

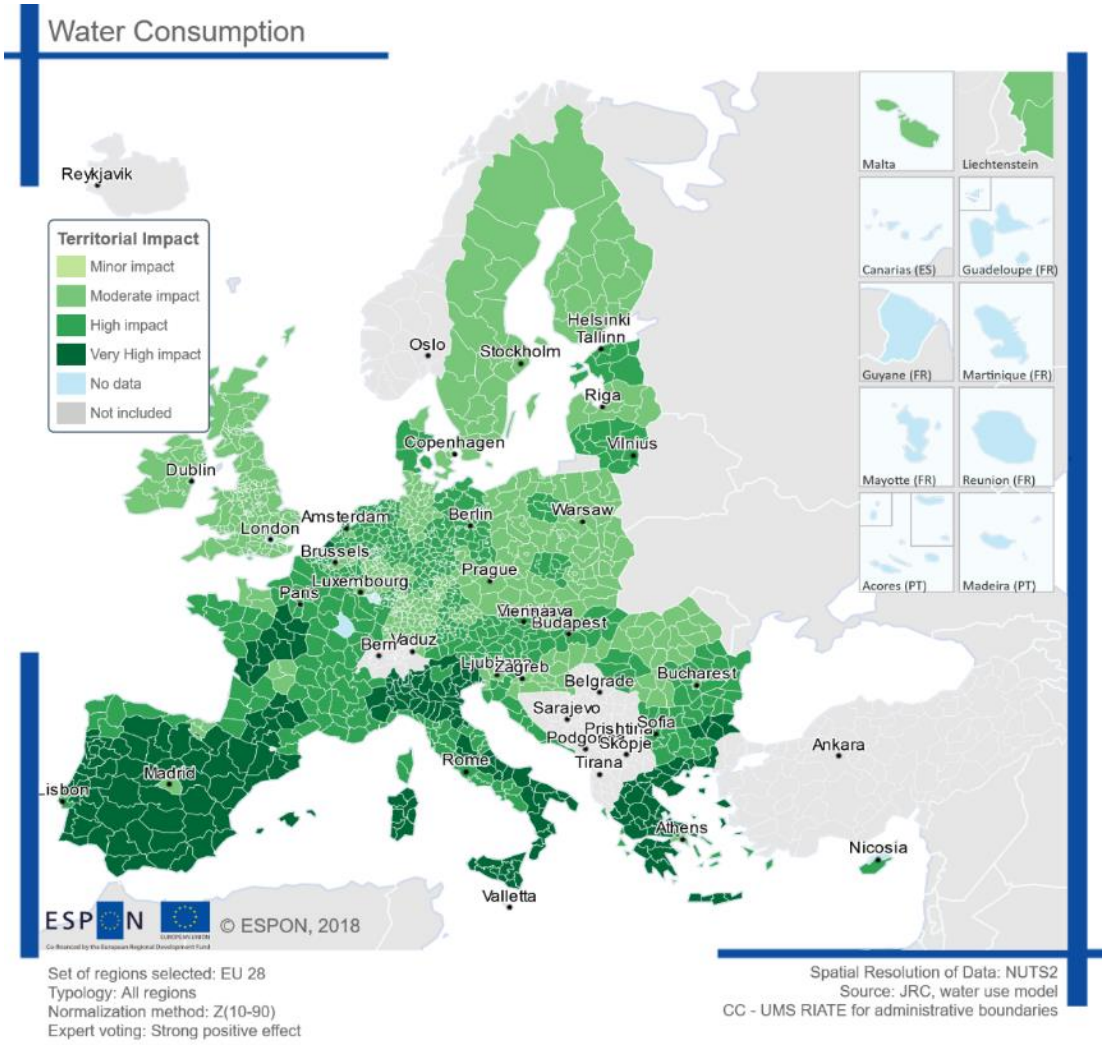
It is expected that the development of the European bioeconomy would foster the reuse of water and consequently reduce water consumption. Therefore, the experts agreed that regions with a higher water consumption could be affected positively. The voting was slightly divided though. Four experts judged the effect as strongly positive and two as weakly positive. One expert voted for weakly negative and two for strongly negative. One expert did not expect a relevant effect.

Figure 16 - Result of the expert judgment: water consumption affected by the development of the European bioeconomy



The indicator "water consumption" depicts the sensitivity of a region according to daily freshwater consumption in litres per capita. Regions showing higher freshwater consumption per capita are expected to be more sensitive to the development of the European bioeconomy. Sensitivity is thus directly proportional to water consumption.

Map 14 Result of the expert judgment: water consumption affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

It was noted that this indicator, and its implications, need to be considered carefully. Indeed, a reduction in economic activity would likely result in a drop in water consumption – but that would not be for the best reasons. Furthermore, the European Union has set the goal of having a minimum share of at least 14% of fuel for transport purposes coming from renewable sources by 2030[4]. Given that biofuel production involves a very high consumption of water, the positive link between the indicator and the bioeconomy needs to be considered more carefully.

The map shows the potential territorial impact from the development of the European bioeconomy based on water consumption. It combines the expert judgement of a strongly positive effect with the given sensitivity of regions. Some 16% of the regions are expected to face a very highly positive impact. These regions are located in areas with warm climate conditions (Portugal, Spain, Italy, Greece) where

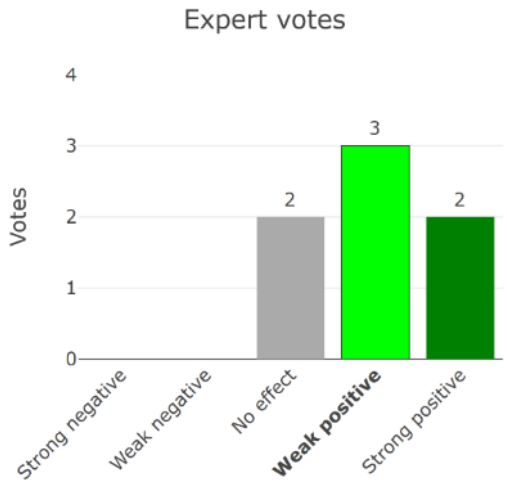
[4] Namely Article 25 of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources. https://eur-lex.europa.eu/eli/dir/2018/2001/oj.

water consumption is high. Some 31% of the regions could still gain a highly positive impact and 43% a moderately positive impact.

5.5 Land use: Share of irrigated land

The experts assumed that the bioeconomy would include re-use of water resources and consequently reduce the need for irrigation for growing crops. They concluded that regions with high shares of irrigated land will be positively affected by the development of the bioeconomy in Europe. Two experts voted the effect strongly positive and three voted it as weakly positive. Two experts did not consider this indicator as relevant.

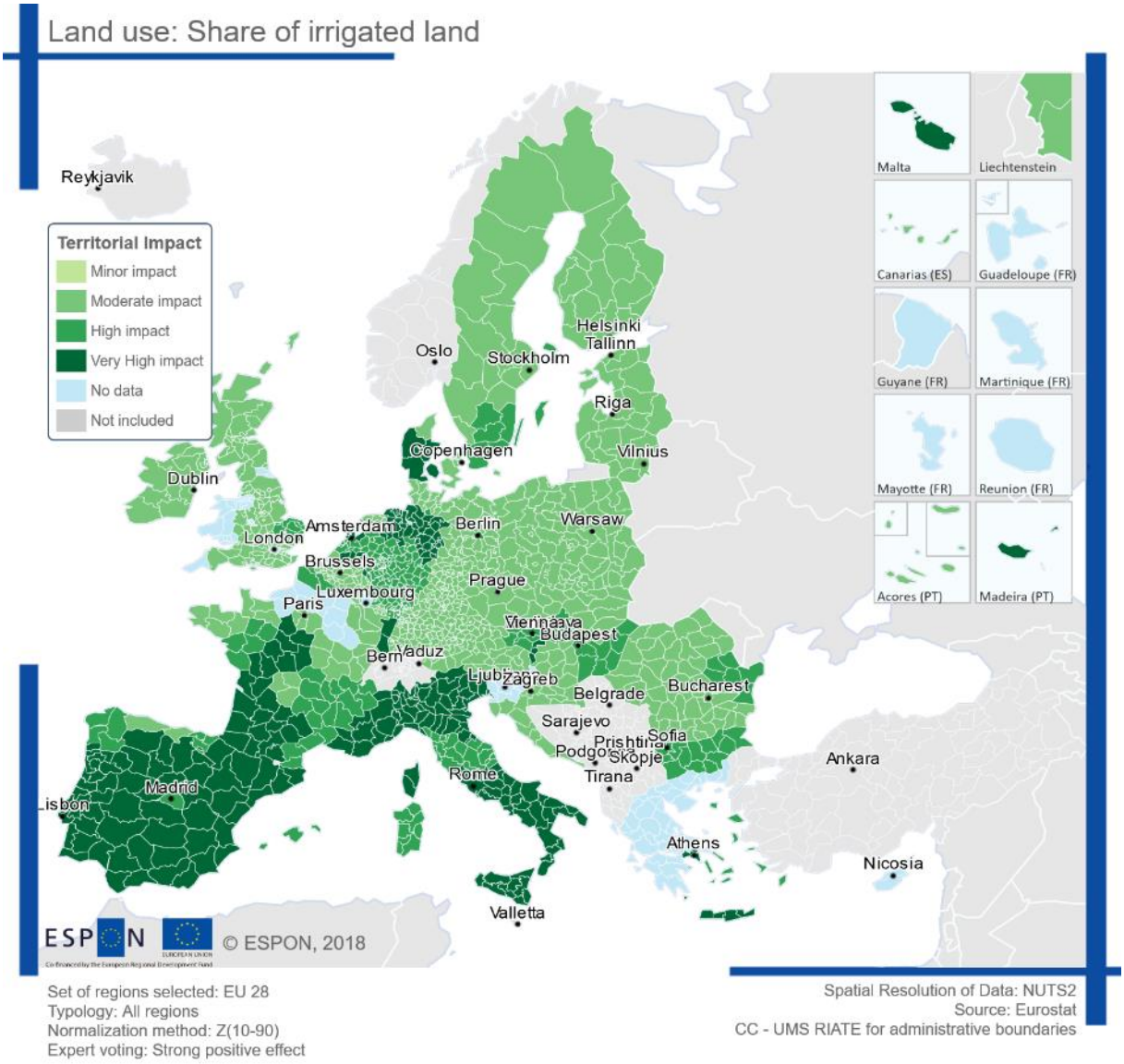
Figure 17 Result of the expert judgment: land use: Share of irrigated land affected by the development of the European bioeconomy



The indicator "Land use: Share of irrigated land" depicts the sensitivity of a region according to the share of irrigated land out of the total utilised agricultural area. Regions with a larger share of irrigated land are likely to be more sensitive. Sensitivity is thus directly proportional to the share of irrigated areas.

The following map shows the potential territorial impact from the development of the European bioeconomy based on the share of irrigated land. It combines the expert judgement of a weakly positive effect with the given sensitivity of regions. Some 11% of the regions are expected to benefit from a highly positive impact and 10% a moderately positive impact. The countries set to gain most as regards the positive effect of the bioeconomy on land irrigation are Italy, Spain and Portugal with a high share of cultivation of fruit and vegetables, France with its vineyard cultivation as well as the Netherlands with the flower-growing regions and Denmark. The majority of the regions (79%) would get a minor positive impact.

Map 15 Result of the expert judgment: land use: Share of irrigated land affected by the development of the European bioeconomy – expert judgment: strongly positive effect

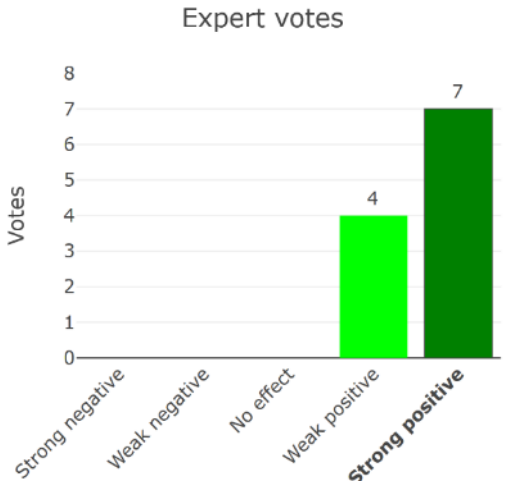


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

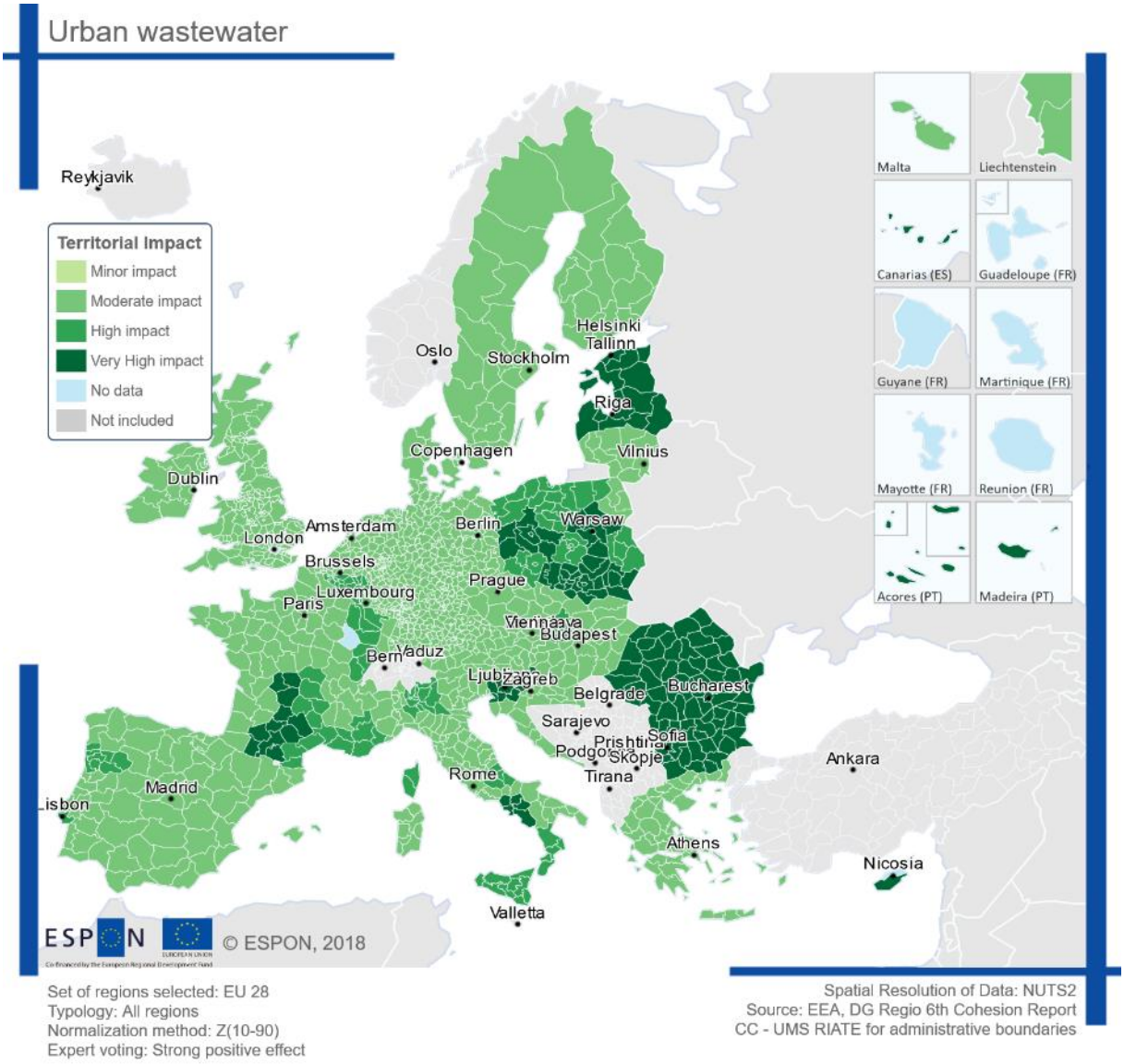
5.6 Urban wastewater

Due to the re-use of water being an important aspect of the bioeconomy, the experts assumed that the bioeconomy would also contribute to reducing the amount of wastewater. All experts expected that the bioeconomy would have an impact on urban wastewater: seven experts voted for strongly positive and four for weakly positive.

Figure 18 Result of the expert judgment: urban wastewater affected by the development of the European bioeconomy



Map 16 Result of the expert judgment: urban wastewater affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

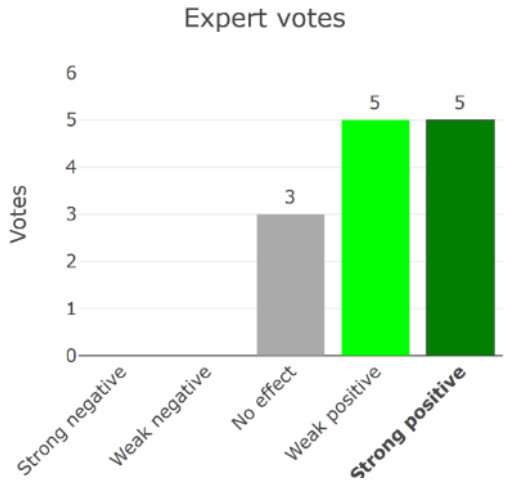
The indicator "urban wastewater" comprises urban wastewater that is not collected by collecting systems nor treated by individual or other appropriate systems as a percentage of the generated load. Regions showing higher amounts of urban wastewater are expected to be more sensitive. Sensitivity is thus directly proportional to share of urban wastewater.

The map shows the potential territorial impact from the development of the European bioeconomy based on urban wastewater. It combines the expert judgement of a strongly positive effect with the given sensitivity of regions. Some 12% of the regions would gain a very highly positive impact and 9% a highly positive impact. These regions can be found in Estonia, Latvia, Poland, Romania, Bulgaria, Slovenia, Cyprus, Italy and France. Some 79% of the regions are expected to face a moderately positive impact.

5.7 Soil fertility

High soil fertility ensures the ability to restore and enhance ecosystem functions. Most of the experts saw a positive effect of the development of a European bioeconomy policy on the development of soil fertility. Five experts voted the effect of the indicator "soil fertility" as strongly positive and five as weakly positive. Three experts did not expect a relevant effect.

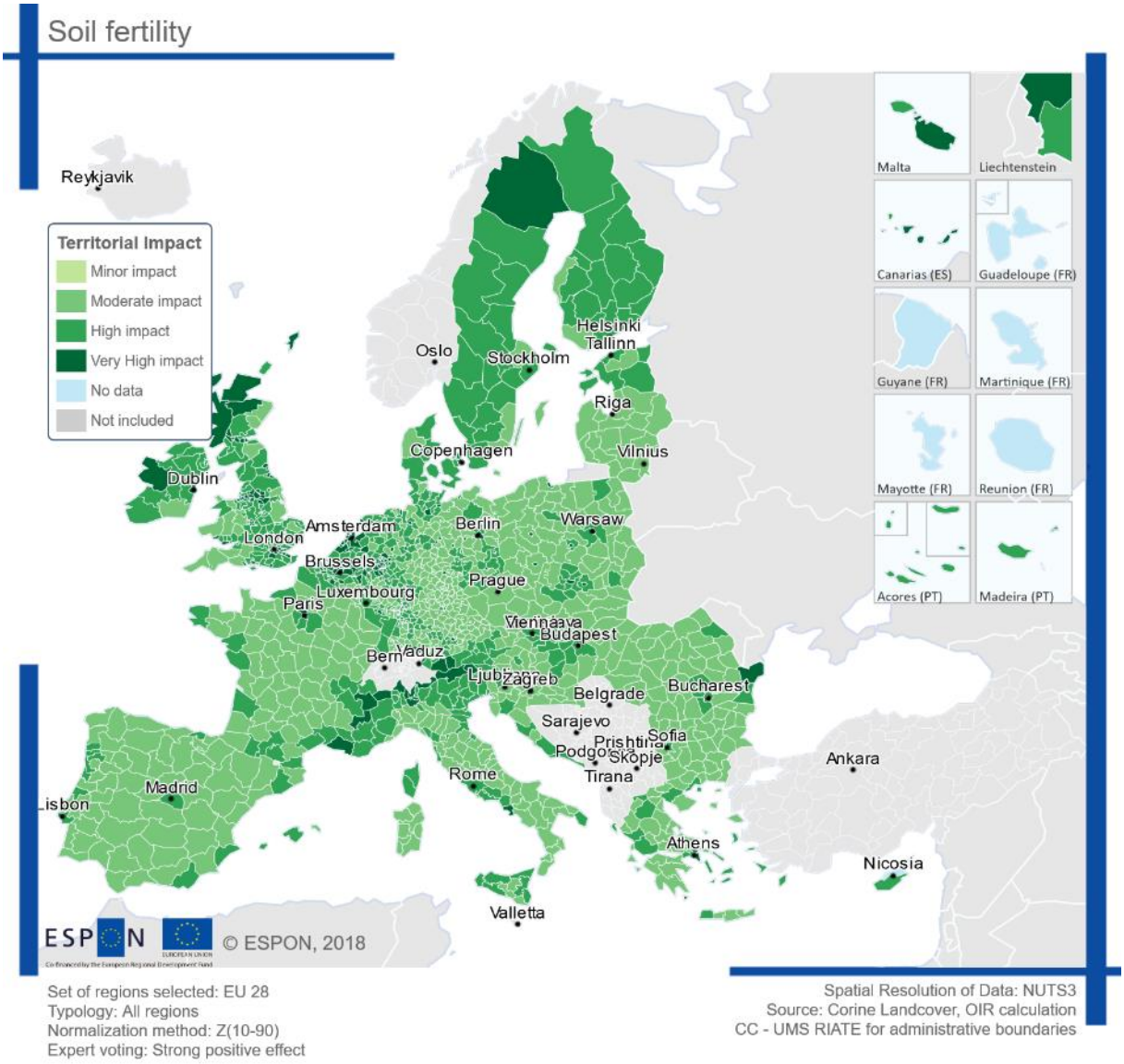
Figure 19 Result of the expert judgment: soil fertility affected by the development of the European bioeconomy



The indicator "soil fertility" depicts the sensitivity of a region according to the share of fertile land out of total area. Regions with a lower share of fertile land are expected to benefit more from measures aimed at increasing the share of fertile land. Sensitivity is thus inversely proportional to the share of fertile areas.

The following maps show the potential territorial impact from the development of the European bioeconomy based on soil fertility. The first map combines the expert judgment of a strongly positive effect with the given sensitivity of regions. Some 21% of the regions would gain a very highly positive impact and 34% a highly positive impact. These regions are located in Scandinavia, Ireland, in the north of the UK, Belgium, the Netherlands and in the Alpine region. Naturally, due to the high share of soil sealing, many larger cities have also higher impacts. Some 46% of the regions are expected to benefit from a moderately positive impact.

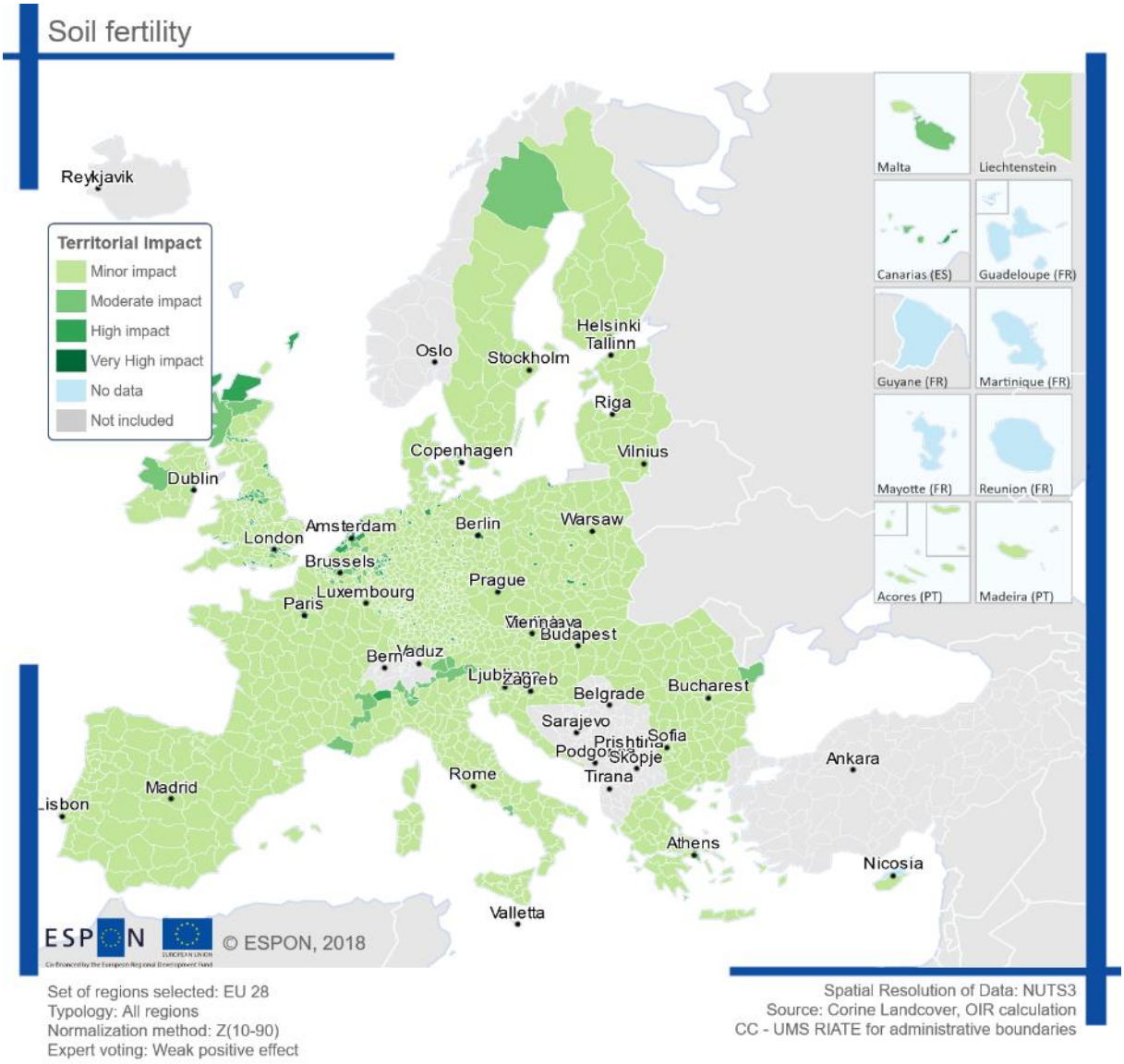
Map 17 Result of the expert judgment: soil fertility affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1st April. 2019

The second map shows the potential territorial impact from the development of the European bioeconomy based on soil fertility combining the expert judgment of a weakly positive effect. Some 11% of the regions are expected to gain a highly positive impact. Compared to the previous map, now large cities, almost exclusively, would experience the highest effect. Some 9% of the regions would benefit from a moderately positive impact and 80% a minor positive impact.

Map 18 Result of the expert judgment: soil fertility affected by the development of the European bioeconomy – expert judgment: weakly positive effect

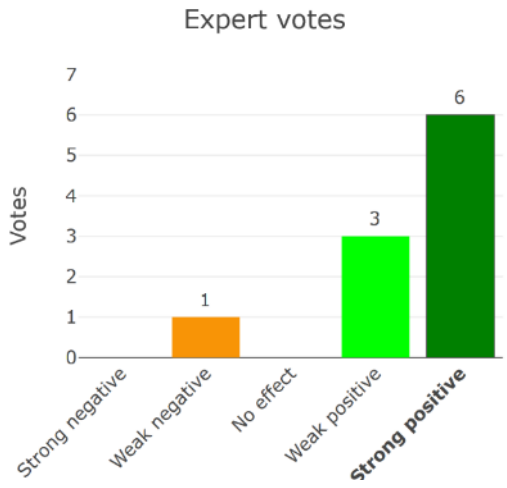


Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

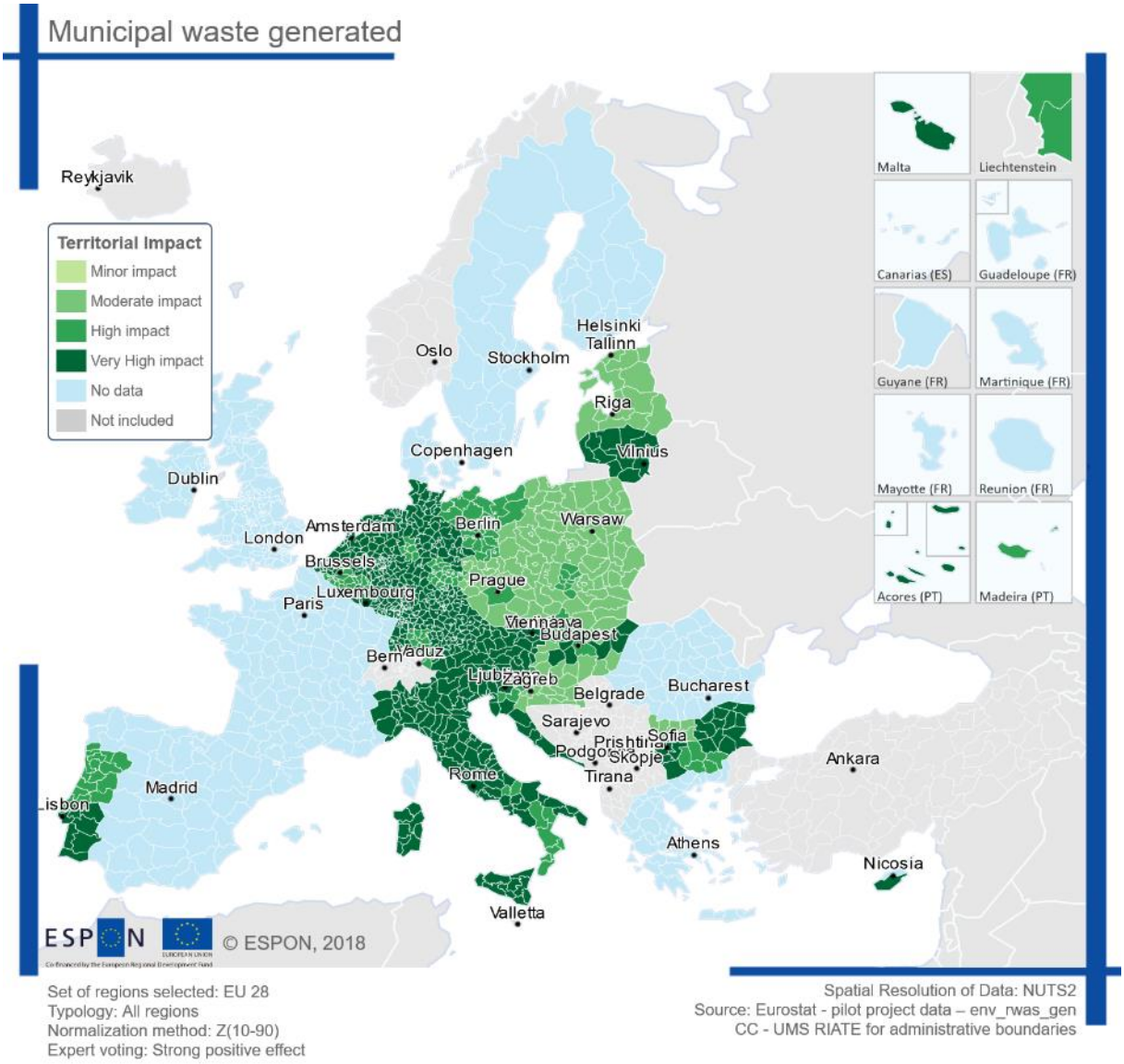
5.8 Municipal waste generated

The bioeconomy promotes circular waste management. The recycling rate should be increased and less waste generated. Consequently, there would be a positive impact on regions with a higher amount of waste generated. Six experts voted for strongly positive and three for weakly positive. One expert judged it as weakly negative.

Figure 20 Result of the expert judgment: municipal waste generated affected by the development of the European bioeconomy



Map 19 Result of the expert judgment: municipal waste generated affected by the development of the European bioeconomy – expert judgment: strongly positive effect



Source: Territorial impact assessment expert workshop, Brussels, 1 April 2019

The indicator depicts the sensitivity of a region according to the municipal waste generated. It is measured in tonnes per capita. Regions showing higher amounts of generated municipal waste per capita are expected to be more sensitive. Sensitivity is therefore directly proportional.

The map shows the potential territorial impact from the development of the European bioeconomy based on municipal waste generated. It combines the expert judgement of a strongly positive effect with the given sensitivity of regions. Some 68% of the regions would gain a very highly positive impact. These regions are in Latvia, Hungary, Bulgaria, Croatia, Germany, Benelux, Austria, Italy and in the southern half of Portugal. Some 17% of the regions are expected to get a highly positive impact and 15% a moderately positive impact. (As data is missing for several countries, the map provides only limited information.)

Experts' policy recommendations

Experts concluded that the mainstreaming of the bioeconomy requires action from decision-makers at multiple levels, depending on the competences of European, national, regional and local authorities, but also, and crucially on the value chains of each activity within the bioeconomy.

Specifically, economic symbiosis, as an economic ecosystem where the unused or residual resources of one company are used by another, results in mutual economic, social and environmental benefits and is vital for the bioeconomy. To that end, we need:

- the European Union to motivate regions to form biomass clusters in order to achieve economies of scale in human resources, research and development;
- the Member States to establish national strategies and position themselves, at least, within the European market;
- the Member States to conduct a concerted policy embracing and prioritising the conflicting goals of sectors that create the bioeconomy: climate action, economy, growth, clean energy etc., as overly narrow policies tend to fail to deliver expected impacts;
- local and regional authorities to become active in linking their economic players to each other and to other European regions where they can achieve a symbiotic relationship, promoting innovative activities and new business models anchored in their local potential.

The creation of biohubs will enable better treatment of the supply of biomass and should be accompanied with measures to generate value-added at local level to guarantee that biomass suppliers are not reduced to that condition. Much of the potential for economic and employment growth in such regions will be lost if the value is instead generated elsewhere (typically, in areas that are already economically more dynamic).

Finally, to boost the market uptake of bio-based products, the experts asserted that public procurement must necessarily be involved. The setting of specific targets for products that originate in the bioeconomy could help in providing a steady demand for some products. This would be crucial to mitigating the short-term high costs that derive from developing an innovative economic activity that will provide long-term benefits.

The bioeconomy is a potential domain for the Smart Specialisation Strategies (S3), and the use of H2020, or of ERDF resources (such as the interregional innovation investments currently in the proposal for a regulation on European Territorial Cooperation) would enable the European Union to unleash the economic potential of many European regions that are rich in biomass but currently lack the financial or political support to use it productively.

Appendix: Workshop agenda

Territorial impact assessment

The bioeconomy

European Committee of the Regions, Rue Belliard 101, Brussels, room JDE 61

1 April 2019

| **Working language:** English |

| Moderator: Bernd Schuh |

09:30 Registrations open

10:00 Welcome coffee *in front of the conference room*

10:30 **Welcome and introduction**

Rapporteur Jácint Horváth (HU/PES), member of Nagykanizsa Municipal Council

Short introduction of the experts

10:50 **Introduction to the topic**

Chiara Pocaterra, Agency for the Promotion of European Research

11:10 **Explanation of the ESPON Quick Scan TIA tool**

Erich Dallhammer, OÏR GmbH

11:20 **Interactive discussion on the topic**

- Developing a common understanding of the policy vision a "sustainable bioeconomy for Europe"

12:30 Lunch break

13:30 **Interactive discussion**

- Dealing with cause/effect chains of a "sustainable bioeconomy for Europe"
- Estimating the intensity of the regional exposure

15:00 Short break

15:15 **Interactive discussion** (Discussion on the findings, results and hypothesis)

16:15 **Policy recommendations**

17:00 End of the workshop