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EXECUTIVE SUMMARY

The need to address environmental challenges has become an urgent issue, ranking highly on every national and global political agenda. In light of that, the circular economy paradigm has emerged as a response to the current linear system of production and consumption. Regions, as the most important administrative units in the EU policymaking process, have a leading role in the transition towards the circular economy. Compared to the national level, which is often too secluded and disconnected to successfully mobilise local stakeholders, and the municipal level, which is unable to earmark the required critical mass, the regional level is the optimal prefatory level for circular economy implementation. Nevertheless, despite the importance of regions in the transition, studies addressing this concern remain scarce. To foster the transition towards circular economy on the regional scale, it is crucial to understand what can hinder or intensify this shift. One must identify the barriers — which should be efficiently tackled — and the driving forces — on which the envisioned circular economy strategies and directed efforts can then be based. Hence, the aim of this study is to determine both (1) the major driving forces that can foster circular initiatives in the regional context and (2) the key challenges and barriers that can hinder circular action at the regional level. For this purpose, a review of the literature has been conducted, including both academic and grey literature, to collect and identify the confronted and perceived drivers and barriers. Additionally, regional action plans, strategies, and policy documents calling for circular economy action have been scrutinised to uncover new drivers and challenges, enrich the literature, and contribute to a more informed policymaking process.

1 Level 2 of the EU nomenclature of territorial units for statistics (NUTS 2) is referred to as ‘European regions’ throughout the abstract.
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LIST OF ABBREVIATIONS/ACRONYMS USED

**BRPCE** Brussels Regional Program for a Circular Economy  
**C&D** Construction and Demolition  
**CE** Circular Economy  
**CSR** Corporate Social Responsibility  
**D** Deliverable  
**EEB** European Environmental Bureau  
**EPR** Extended Producer Responsibility  
**ERDF** European Regional Development Fund  
**ESF** European Social Fund  
**EU** European Union  
**SPI** Social Progress Index  
**GDP** Gross Domestic Product  
**GHG** Greenhouse gas  
**ICT** Information and Communications Technology  
**IoT** Internet of Things  
**IS** Industrial Symbiosis  
**MS** Member States  
**NIMBY** Not in my backyard  
**NUTS** Nomenclature of Territorial Units for Statistics  
**OECD** Organisation for Economic Cooperation and Development  
**PESTEL-O** Policy, Economic, Social, Technological, Environmental, Legal, Organisational  
**PLA** Polylactic acid  
**PPS** Purchasing Power Standard  
**QNH** Quintuple Helix  
**R&D** Research and Development  
**R&I** Research and Innovation  
**RCEAF** Regional CE-Centric Assessment Framework  
**SDG** Sustainable Development Goal  
**SMEs** Small and Medium-sized Enterprises  
**UNFCC** United Nations Framework Convention on Climate Change  
**VFG** Vegetable, Fruit and Garden  
**WP** Work Package
1. INTRODUCTION

This report presents the results of a study conducted in the context of the ReTraCE project, within Work Package 4 (WP4). The contribution of WP4 is primarily related to development policies, including the role of international, national, and regional legislation in promoting the transition towards the circular economy (CE), from both the bottom-up (looking at ways to foster entrepreneurial opportunities and innovative business models) and the top-down (looking at required governmental supports and incentives). To that aim, the implementation of the WP4 has been conveyed into six research reports – Deliverables (D), throughout the duration of the project, as presented in Figure 1.

The first deliverable of ReTraCE WP4 (D4.1) was the investigation of the role of policies in enabling an ecosystem that fosters CE transition, with an emphasis on the role of policymaking at the regional level. Existing regional EU policies were considered, covering the concept of regional resilience, various levels of innovation systems, the place-based approach, and the ‘smart specialisation agenda’.

The second deliverable of the ReTRaCE WP4 (D4.2) made the first efforts to adjust existing models for stakeholder mapping in the regional CE scenario. A new model was proposed – namely, the CE-centric quintuple helix (QNH) model, which promotes the emergence and deployment of trilateral networks, hybrid organisations, and development or cooperation platforms. At the core of this model is the academia-industry-government nexus, which has been extended to include the civil society sphere and the natural environment.

The focus of the D4.3 report was on devising and proposing a framework to measure the transition to the CE at a regional level. This conceptual framework – the regional CE-centric assessment framework (RCEAF) – is a multi-criteria and multi-stakeholder framework, encompassing multiple perspectives, conforming with the systemic nature of the CE-paradigm shift.

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3 The level 2 of the EU nomenclature of territorial units for statistics (NUTS 2) is referred to as ‘European regions’ throughout the report.


The current report, D4.4, provides an overview of the identified drivers and barriers to the implementation of regional policies for the transition towards a CE.

Another two reports have been prepared within WP4: D4.5, which concentrates on the consumer perception of the CE transition, and D4.6, presenting the business perspective by covering the innovative CE business models. The arguments for the NUTS 2 level of the regions as the most suitable for implementing and measuring circular change have been presented in all WP4 reports to date.

**Figure 1: Implementation of WP4 deliverables**
1.1 THE ROLE AND STRUCTURE OF THE REPORT

In addition to (1) exploring policies for enabling a suitable ecosystem in which regional CE practices and actions can thrive, (2) developing a model to capture all relevant regional stakeholders and ensure inclusion, and (3) proposing a multi-criteria and multi-stakeholder framework for measuring the transition to the CE at a regional level, it is also important to understand what can hinder or intensify the CE transition. As stated in the previous section, the first three of these points have been addressed in previous reports, and the last is studied in this one.

It is vital to identify the barriers, which should be efficiently tackled, and the drivers, on which the envisioned CE strategies and directed efforts will be based. Hence, the purpose of this report is to determine both (1) the major driving forces that can foster circular initiatives in the regional context and (2) the key challenges and barriers that can hinder circular action at the regional level. For this purpose, the report is organised in two main parts.

The first part reviews the existing literature concerning the two main objectives, including academic contributions and grey literature (e.g., policy reports, think tank reports, strategies, white papers). The analysis of pertinent publications and literature provided background information and a critical understanding of the research conducted so far, gathering both primary (e.g., surveys, interviews, questionnaires) and secondary data (desk-research on reports, strategies, action plans, policies).

The second part of this work presents several EU NUTS2 regions and their regional action plans and strategies for the transition towards CE, scrutinising their content to uncover new drivers and challenges, enrich the literature, and contribute to a more informed policymaking process.
2. EN ROUTE TO REGIONAL CIRCULAR ECONOMY: KEY DRIVERS AND BARRIERS FROM THE LITERATURE

This section provides an overview of the incentives for CE and obstacles to implementation at the regional level, as outlined in the existing academic literature and public reports. The collected resources have been selected for their relevance, thus all are discussing or analysing drivers and barriers encountered at regional level. The first section discusses the factors that could potentially foster the adoption of CE practices and thereby contribute to a greater level of circularity in a specific region. The drivers identified in previous studies are not only pertinent to one stakeholder group — on the contrary, the list of drivers concerns multiple groups of actors, including different levels of government, industry, academia, and civil society. The collected driving forces, presented in Table 1, are more generic, related to general dynamics that can increase the circular activities in a specific region. Two sources were considered the primary contributors on the categorisation of the drivers, and these were the CIRCTER Policy Guide (2019) and the OECD Synthesis Report (2020). Other relevant studies that provided regional drivers were also taken into account (Avdiuschchenko, 2018; Barbero and Pallaro, 2018; Smol et al., 2018; Andretta et al., 2019; Savini, 2019; Scarpellini et al., 2019). The main groups of drivers emerging from the literature review and the respective subgroups have been analysed and the findings are presented in section 2.1.

The transition towards a CE at any level (including the regional) inevitably meets obstacles. Thus, it is crucial to identify the forces that the regions could leverage to potentially accelerate their circularity journeys. However, it is equally important (if not even more so), to identify the key barriers to CE implementation, as well as potential challenges that could arise in the future. Furthermore, it is not sufficient to simply identify them: one must also find a way to effectively address them, using the proper combination of incentives. For this purpose, the challenges faced by multiple regional actors in previous studies were collected and presented in Table 2. Similarly, the collected barriers were also from a broader nature. Again, the CIRCTER Policy Guide (2019) and the OECD Synthesis Report (2020) were the primary sources used for developing these categories, along with the study of Obersteg et al. (2019) on the main governance challenges for urban regions shifting to CE, which used the PESTEL-O framework. Other relevant studies that examine regional barriers were also taken into consideration (Wu et al., 2014; Avdiuschchenko, 2018; Barbero and Pallaro, 2018; Smol et al., 2018; Scarpellini et al., 2019). Barriers known to slow or reverse the adoption of regional CE practices were identified in the literature review, and the respective subgroups are analysed in section 2.2.

In addition to the general studies analysing broader drivers and barriers, numerous studies have been conducted in specific sectors or fields of CE, identifying specific sector-related or field-related driving and/or blocking forces. These include the work of Lombardi (2017), Aranda-Uson et al. (2018), Husgafvel et al. (2018a), Husgafvel et al. (2018b), Vanhamaki et al. (2019), Whicher et al. (2018), Dabrowski et al. (2019), Fleischmann (2019), Paletta et al. (2019), Plastinina et al. (2019), Virtanen et al. (2019), and Volk et al. (2019). These academic contributions were also taken into account, and they are listed in Table 3 and discussed in section 2.3.
2.1 CATALYSTS FOR REGIONAL CIRCULAR PRACTICES

The collected drivers from the desk review were synthesised into eight categories, presented in Figure 2. The categorisation of the drivers was primarily based on the grouping proposed in the CIRCTER Policy Guide (2019) and the OECD Synthesis Report (2020). The driver categories and specific subcategories are elaborated in the following sections.

![Diagram](image)

**Figure 2:** Categories of drivers for regional circular economy implementation

### 2.1.1 Economic/Socio-economic/Financial

The CIRCTER Policy Guide (2019) suggests a number of economic drivers that can help a region to promote CE activities. These include **economic savings**, **profit increases**, **new market or business opportunities**, **high prices for imported or raw materials**, and **attractive prices for circular products and services** (CIRCTER, 2019).

In Smol et al. (2018), most survey respondents (80%) reported long-term prospects for the development of CE in the Malopolska\(^6\) region, if financial support were provided. Hence, **financial support by national and regional governments** is positioned as an incentive for CE action.

The recent OECD Survey (2020) found that more than half (51%) of the surveyed cities and regions considered the **changing economic conditions** to be a major driving force towards the CE. As stated in the report (2020), ‘the COVID-19 crisis has put the world on standby, unlike any other economic, social and climate crisis, resulting in a very significant GDP loss for 2020 (4.5%)’. However, despite

\(^6\)The Polish region of Malopolska is classified as a NUTS2 region.
this, cities remain the apparatus of economic growth, and forecasts project that a group of 600 cities will generate almost 65% of the global economic growth by 2025 (McKinsey Global Institute, 2012).

In addition, as they grow in size, cities tend to create more income per capita (Bettencourt et al., 2007); and while pursuing economic growth, resource efficiency tends to be improved, as denoted by the concept of ‘decoupling’ (OECD, 2020). Nevertheless, the question of decoupling, related to the possibility of green growth, is a matter of intense political deliberation between green growth and post-growth supporters. The recent report from the European Environmental Bureau (EEB) presents a review of the empirical and theoretical literature on the validity of the ‘decoupling hypothesis’, and the conclusions are revealing:

not only is there no empirical evidence supporting the existence of a decoupling of economic growth from environmental pressures on anywhere near the scale needed to deal with environmental breakdown, but also, and perhaps more importantly, such decoupling appears unlikely to happen in the future.

Taking these decisive findings into consideration, policymakers must accept that tackling environmental issues necessitates a ‘direct downscaling of economic production and consumption in the wealthiest countries’. Therefore, the report proposes complementing efficiency-oriented policies with sufficiency policies, with a priority shift and accent from the former to the latter, while acknowledging that both policies are instrumental (Parrique et al., 2019).

Recent evidence has shown a positive relationship between city size and income distribution, with income inequality tending to increase with city size. When cities are small, growth in size is desirable because it enables better economic performance. However, excessive growth of already large cities has negative consequences (Castells-Quintana et al., 2020). Excessive city size can result in congestion diseconomies, which ultimately reduces economic performance (Frick and Rodriguez-Pose, 2018), and equally important, it can contribute to increased inequality and the threat of less cohesive societies (Castells-Quintana et al., 2020).

Another important driver emphasized by the surveyed cities and regions is job creation (47%) (OECD, 2020). During the period of 2012 to 2018, the number of CE-related jobs in the EU increased by 5% to 4 million (EC, 2020). According to the ECa (2020), circularity is estimated to have a positive net effect on job creation, assuming that staff are trained accordingly and possess the specific skills needed for the green transition. Additional jobs emerge because the CE supports repair, maintenance, upgrading, remanufacturing, reuse, recycling of materials, and product-life extension, which are more labour-intensive than the mining and manufacturing of a linear economy (Wijkman and Skånberg, 2017). However, the transition must also consider the wellbeing of society, life quality, and equity (OECD, 2020).

### 2.1.2 Regulatory

Regulatory drivers are very closely linked to economic incentives and taxation systems. The CIRCTER Policy Guide (2019) suggests a number of regulatory drivers that can help a region to
encourage CE activities. These include the existence of charges, taxes on unsustainable and harmful activities, high charges for waste and high landfill taxes, tax benefits for green activities, and bans of specific products (e.g., single-use plastic; CIRCTER, 2019).

Similarly, Andretta et al. (2019) propose regulatory incentives, such as environmental taxes for promoting the EU CE strategy. The authors argue that the taxation of waste-production or discarding – or of any environmental concerns generally – can be a powerful stimulus for CE objectives, being instrumental in building environmental knowledge and raising awareness. These regulatory incentives include taxes on energy, carbon and transport, urban waste-management and disposal, electrical electronic waste, and air pollutants; charges on packaging (plastic bags and bottles); and taxes on environmental damage or for environmental protection. Waste-management environmental taxes can be at the regional and even local level, with high regulatory dispersion; a heterogeneous condition that can result in market fragmentation and economic inefficiencies. Therefore, tax reform is required to harmonise regional taxes for waste-management – within the country and also within the EU (Andretta et al., 2019).

Scarpellini et al. (2019) identified the following regulatory drivers to be considered in regional environmental policy to promote CE among businesses in the region of Aragon: subsidies and bonuses to promote the CE in business, subsidised training plans for employees, certification of products and companies, and the creation of regional waste-interchange systems. The experts interviewed in the study ranked the organisation of a waste-exchange system among the most important incentives for the CE transition in the region, followed by subsidised training. Additionally, subsidies for companies to implement new CE production processes and incentive systems or fiscal bonuses linked to improvements in environmental terms were also perceived as effective. More specifically, tax raises for the most polluting companies were suggested as a regulatory incentive for CE acceptance, as well as increased tax rates contingent on the quantity and type of waste disposed of, with the goal of supporting ‘zero landfill’ (Scarpellini et al., 2019).

### 2.1.3 Institutional

More than half (52%) of surveyed cities and regions cited global agendas as propelling forces of CE implementation (OECD Survey, 2020). The CE approach contributes to the attainment of the 2030 Agenda for Sustainable Development, directly associated with SDG12 (Sustainable and responsible consumption and production patterns), while other SDGs (6, 7, 15) are also deemed important for increasing sustainability in cities (SDG 11). Moreover, the CE supports the Paris Agreement under the UNFCCC, as circular practices not only reduce greenhouse-gas (GHG) emissions but also tackle issues related to natural-resources extraction and exploitation. Finally, the CE contributes to the implementation of the New Urban Agenda (2016), the EU Green Deal, and the G20 initiatives on resource efficiency (OECD, 2020).

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7 The Spanish region of Aragon is classified as a NUTS2 region.

Additionally, civil society circular initiatives (31%) and private-sector circular initiatives (46%) stimulate the transition in the regions (OECD, 2020). Numerous international organisations, umbrella organisations, and foundations encourage cities and regions in their CE journeys, with business and citizen initiatives such as the Ellen MacArthur Foundation, C40, Climate KIC, ICLEI, and the European Investment Bank. Several bottom-up initiatives motivate governmental actions in the surveyed regions. For instance, in the region of Lapland,8 CE practices commenced as a business-sector initiative in 2012. The industrial sector (bio-forest, forestry, mining, and steel) requested support from the public authorities related to the reuse of by-products and residues to promote the competitiveness of the industry associated to the regions’ resilience. Local authorities welcomed the appeal, opening a dialogue about CE, providing technical assistance, and promoting collaborations (OECD, 2020).

The development of CE policies has also been mentioned as a stimulus of a region to increase its circularity (Avdiuschchenko, 2018; Barbero and Pallaro, 2018). Avdiuschchenko (2018) alludes to the vital responsibilities that policymakers have to devise carefully considered CE-related policies that balance the numerous benefits of the CE model with the need to reduce transitional costs as much as possible. Like any transition instigating considerable changes in regional development, CE inevitably has both positive and negative impacts for stakeholders in the given region. The sectors that face the largest transitional costs include the industries extracting virgin materials or non-durable consumer goods. Furthermore, the transition not only entails economic costs, but also social costs, due to changes in employment rates in the industries at the forefront of the competition with the CE-based substitutes (Avdiuschchenko, 2018).

2.1.4 Environmental

The OECD report on CE in cities and regions reveals that climate change is perceived as a CE driver by 73% of the surveyed cities and regions (OECD Survey, 2020). To achieve the objectives of the Paris Agreement and limit global warming to less than 2 °C and 1.5°C by 2030, emissions

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8 The Finish region of Lapland is classified as a NUTS3 region.
must be 25% and 55% lower than in 2018, respectively (UNEP, 2019). In light of that, the EU Green Deal framework sets the goal of achieving a climate neutral economy by 2050. Moreover, with the 2030 Climate and Energy Framework, the EU aims for 32% usage of renewable energy and 32.5% improvement in energy efficiency for the period of 2021 to 2030 (ECb, 2020). Cities and regions are a large part of the resolution, as most environmental and climate-related spending occurs at the subnational level. The transition towards a CE is growing in importance in connotation with investments outlooks and necessary infrastructure. More than 50% of the urban infrastructure that will exist in 2050 is yet to be constructed, and the manner in which this infrastructure is planned and built will affect how people travel, buildings are constructed, and materials are repurposed, with the ultimate goal of decreasing the use of fossil fuels (OECD, 2020).

In the period of 2000 to 2016, subnational governments in 30 OECD countries were accountable for an average of 55% of environmental and climate-related spending (OECD, 2019). Nonetheless, climate-related investment accounted for only 0.4% of their gross domestic product (GDP) within the same period (OECD, 2020).

To achieve low-carbon economies, governments must encourage more efficient use of resources, taking into account natural-resources availability, sustainable consumption, and production trends, while supporting CE to retain the highest possible value of goods and products, avert waste generation, and reuse and convert waste into resources (OECDa, 2020).

### 2.1.5 Behavioural/Socio-cultural

High consumer awareness, a strong CSR culture, and strong entrepreneurial culture are some of the suggested behavioural and socio-cultural drivers that can help a region to foster its CE transition (CIRCTER, 2019). Scarpellini et al. (2019), in their study of the region of Aragon, highlight awareness-raising campaigns and the dissemination of good practices and green procurement as potential incentives to be considered for regional environmental policy to promote CE among businesses.

Increased awareness among wider society and policymakers regarding the vital function of CE in delivering smart, sustainable, and inclusive growth, as stressed in the Europe 2020 Strategy (COM no. 130, 2014), is a primary driving force of the CE shift. All stakeholders (government, academic, industry, and citizens) partaking in CE activities (Carayannis and Campbell, 2012), plus citizens and their awareness and conduct, all have a vital role in putting CE notions into practice (Smol et al., 2018). According to Elia et al. (2017), CE is a novel concept in Europe, therefore it is vital to observe and assess public awareness because a profound ecological culture and societal awareness are essential for creating a responsible CE society (Smol et al., 2018). Specifically, efforts should be directed towards awareness among the youth, as their knowledge, attitudes, and consumption

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9 The Spanish region of Aragon is classified as a NUTS2 region.
behaviours are instrumental for building a CE-oriented society with long-term benefits (Kanchanapibul et al., 2014).

Today, most research on CE awareness is conducted in China (e.g., Xue et al., 2010; Liu et al., 2009; Liu and Bai, 2014; and Guo et al., 2017), where CE has been a national development strategy since 2009. Zeng et al. (2017) report increasing public and business awareness of CE, compared to 2008, when the first study of CE awareness was conducted. In the EU, the EC began to conduct CE-oriented research to explore CE-related industry enticements (Flash Eurobarometer, 2016), but few studies have investigated public awareness of the CE on the EU scale (Lakatos et al., 2016), and no research has been dedicated to youth awareness (Smol et al., 2018).

In light of this, Smol et al. (2018) position public awareness as a major driver of the transition to CE. The authors conducted an evaluation of public awareness and attitudes to CE in the Malopolska10 region of southern Poland. A large proportion of the participants were aged 18-30 years (33%). The results of the study show that the region’s inhabitants are open to the transition and most believe that a CE strategy could be adopted in the region. However, time is needed to change people’s ways of thinking and acting, and funding should be channelled by national and regional governmental bodies for this purpose. To raise awareness of CE among the community, the Ministry of Environment organised targeted educational activities for all stakeholders (children, young people, students, communities, entrepreneurs, and officials), with the goal of informing consumer attitudes and developing optimal behavioural patterns in the marketplace (Smol et al., 2018).

2.1.6 Population

A growing population and higher living standards increase waste-production levels and the consumption of natural resources. It is forecasted that the global population will reach 9 million by 2050, and more than half (55%) will be living in cities (OECD/EC, 2020). This projected demographic change and urbanisation will entail a substantial enlargement of existing cities, as well as the construction of new ones (UNEP, 2018). The consequences will include increased use of biomass, metals, non-metallic materials, and fossil fuels to meet the food, housing, energy, and infrastructure needs (OECD, 2020). Crucial areas of the CE – such as waste-management, energy, and material consumption – are conditional on population density, since more densely populated countries consume fewer materials.

Regarding local and regional arrangements, carbon emissions are closely linked to urban density and structure, as more compact cities and regions can contribute to reducing GHG emissions by reducing the need for construction of new roads, sewers, water lines, and other infrastructure (Ellen MacArthur Foundation, 2019; UNEP, 2018). In this context, Morikawa (2012) established a positive relationship between energy-consumption efficiency and population density. Urban density, moreover, has an important role in the waste sector, because low population density can

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10 The Polish region of Malopolska is classified as a NUTS2 region.
be a restraining factor on recycling rates, due to the higher costs of waste-collection and transportation in less populated areas (OECD, 2020). Nevertheless, high population density can be a ‘double-edged sword’, since it requires a more efficient waste-management system due to sanitation problems and the scarcity and cost of land (Montevecchi and Reisinger, 2014; Matsunaga and Themelis, 2002).

2.1.7 Technological trends/Knowledge/Capacity

Qualified staff and research and innovation (R&I) capabilities, along with availability of and access to innovation and testing facilities are among the technology-related drivers that can aid a region’s transition toward CE (CIRCTER, 2019). Additionally, the OECD survey revealed that new business models (43%), technical developments (43%), and research and development (R&D; 41%) are regarded as driving forces by more than 40% of the surveyed cities and regions (OECD, 2020). New business models – ranging from reverse logistics, reuse, leasing, and sharing – are thriving, alongside an increase in practices related to green infrastructure and decoupling alternatives, such as electric vehicles, solar panels, smart grids, retrofitting of buildings, and recycling facilities. Furthermore, cities and regions are increasingly hosting industrial symbiosis processes and clusters, on the understanding that the waste of one is input for another (OECD, 2020).

2.1.8 Other

Some drivers were difficult to classify into the set categories, hence a final category of ‘Other’ was created. Savini (2019) explains the importance of the logistics sector, describing it as both a target and driver for CE policymaking. Barbero and Pallaro (2018) argue that systemic design promotes the concept of a CE in which cross-sectoral flows of materials and energy create a network that imitates nature, presenting the Piedmont11 region as a case study. Finally, in the conceptual paper of Avdiuschchenko (2018), which proposes NUTS2 regions as the optimal level for CE implementation, it is concluded that circular cities are the main drivers of CE-model adoption in their surrounding regions.

Table 1: Drivers of circular economy (CE) implementation at the regional level

11 The Italian region of Piedmont is classified as a NUTS2 region.
### Drivers

<table>
<thead>
<tr>
<th>Economic savings</th>
<th>Profit increase</th>
<th>New market/business opportunities</th>
<th>High prices for imported or raw materials</th>
<th>Attractive prices for circular products/services</th>
<th>Economic change</th>
<th>Job creation</th>
<th>Financial support by national/regional governments</th>
<th>Subsidies/bonuses to promote CE in business</th>
<th>Subsidised training plans for employees</th>
<th>Charges/taxes on unsustainable/harmful activities</th>
<th>High charges for waste/high landfill taxes</th>
<th>Tax benefits for green activities</th>
<th>Ban on specific products (e.g., single-use plastic)</th>
<th>Certification of products/companies</th>
<th>Creation of a regional waste-interchange systems</th>
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<td>Economic/socio-economic/financial</td>
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### Studies

- CIRICTER (2019)
- OECD (2020)
- Scarpellini et al. (2019)
- Savini (2019)
- Andretta et al. (2019)
- Barbero and Pallaro (2018)
- Andretta et al. (2018)
- Avdiuschchenko (2018)

### Other

- Logistics sector
- System design
- Circular cities (to adopt CE in surrounding regions)

### Other

- Qualification staff & research and innovation capabilities
- Availability/access to innovation & testing facilities
- New business models
- Technological developments
- Research and development

### Technological trends/knowledge

### Behavioural/socio-cultural

### Institutional

- Global agendas
- National legal frameworks
- Supranational legal frameworks
- Civil society initiatives
- Private-sector initiatives
- CE policies

### Environmental

- Climate change
- Natural resources availability change

### Regulatory

- Charges/taxes on unsustainable/harmful activities
- High charges for waste/high landfill taxes
- Tax benefits for green activities
- Ban on specific products (e.g., single-use plastic)
- Certification of products/companies
- Creation of a regional waste-interchange systems

### Population

- High public awareness
- Corporate social responsibility culture in companies
- Strong entrepreneurship culture
- Dissemination of good practices/green procurement

### Demographic change

- Urbanisation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie Innovative Training Networks (H2020-MSCA-TTN-2018) scheme, grant agreement number 814247 (ReTraCE).
2.2 INHIBITORS OF REGIONAL CIRCULAR PRACTICES

The barriers collected from the desk review were synthesised into eight categories, presented in Figure 3. The categorisation of the drivers was largely taken from the grouping proposed in the two reports, the CIRCTER Policy Guide (2019) and the OECD Synthesis Report (2020). The barrier categories and specific subcategories are elaborated in the following subsections.

2.2.1 Economic/Financial/Funding

The economic/financial/funding category of barriers is the widest and more frequently mentioned. CIRCTER (2019) provides examples of economic challenges that regions can face, such as limited or the absence of returns from investment, limited markets for recycled products, and a lack of funding and investment sources for CE businesses and initiatives. This lack of funding and investment is also observed by Scarpellini et al. (2019) and Wu et al. (2014).

In light of this, the OECD (2020) claims that the CE shift necessitates investment and appropriate incentives to support the economic and financial case for the CE. The surveyed cities and regions responded that they face constraints as a result of the funding gaps, including insufficient financial resources (73%), financial risk (69%), lack of critical scale for business and investment (59%), and lack of private-sector engagement (43%). Moving towards an economy that is more circular will entail a substantial amount of investment, but investment gaps are reported and typically bridged by public funds, such as taxes and subsidies (OECD, 2020). Circular initiatives and pilot projects are recorded, but scaling them up is usually complex because of the restricted
access to additional financial resources. Additionally, the shift towards a CE creates financial risks for the economic actors, partly due to the scale of the activities taking place in cities of different sizes, due to market size, population, material flow, and so on (OECD, 2020). Moreover, the inclusion of well-known, big industry players as accelerating agents for the transition is needed. The NUTS1 region of Flanders, for instance, emphasises the need for funding projects that cover the entire product or value chain (OECD, 2020).

Scarpellini et al. (2019) argue that price increases are often not appreciated by consumers and it is difficult to meet the volume and standards requirements for recycling materials. On the other hand, Barbero and Pallaro (2018) include unaccounted externalities and market failure as potential economic barriers, while Avdiuschchenko (2018) notes the transactional costs (economic and social) that some industries face.

Finally, Obersteg et al. (2019) list a number of economic and financial barriers that emerged from their study of several urban European regions. Some of these hindrances include banks being reluctant to finance CE ventures, higher waste taxes in the region than nationally, financing or up-scaling CE initiatives in the linear economy, dual-waste systems (households/industrial) hinder waste-management optimisation, local service fees not used to refinance new sectoral investments, the development of the circular business model, recently centralised secondary raw-material market being inaccessible to local service-providers, slow market development for eco-innovative solutions, complex application process for additional funding for developing innovative solutions, and unclear or insubstantial incentives for waste separation.

Current researchers question the core of the CE, asking whether closing material and product loops actually prevents primary production. Zink and Geyer (2017) claim that the economic element of the CE has been overlooked, and CE activities ultimately increase overall production, which can partly or entirely counterbalance their benefits. Circular economy rebound then occurs, when CE activities either fail to compete effectively with primary production or reduce prices, hence increasing shifting consumption patterns (Zink and Geyer, 2017). Following this, managerial efforts should not be directed to simply closing material and product loops, but rather to causing the displacement of primary production. Likewise, a priority shift is required to maximise the ‘utility’ of the product or material to maximise the displacement potential of end-of-life goods (Zink et al., 2014). In conclusion, the environmental outcome of the CE is vague, since closing the material loops is not sufficient to ensure environmental improvement.

### 2.2.2 Regulatory/Legal

A substantial number of the collected barriers belong in the regulatory or legal category, affirming the vital role of regulation in the transition. CIRCTER (2019) lists, as regulatory barriers faced by some regions, the subsidies for traditional polluting or inefficient activities (e.g., coal, water, and energy costs) and rigid ‘end-of-waste’ criteria to prevent repurposing of waste streams for recycling, reuse, remanufacturing; while Barbero and Pallaro (2018) give regulations hindering exchange of waste as an example of a regulatory barrier.
Scarpellini et al. (2019), as well as measuring the degree of penetration of CE activities in the region, analysed the main barriers to and incentives for the CE at a reginal level. They point to the general administrative and regulatory barriers, the lack of standards for action, and the lack of a stable regulatory framework favouring the long-term investments required by the CE. Another barrier mentioned by the experts during the interviews is the current ‘end-of-pipe’ environmental management model for the treatment of waste at the end of the process. These principles are not fully considered during the design of the product (Scarpellini et al., 2019).

In the regulatory category of challenges faced by regions and cities, the OECD (2020) notes the inadequate regulatory framework (73%) and incoherent regulation across levels of government (55%). The surveyed cities and regions argue that the regulatory framework needs to be established and adapted to unlock the full potential of the region for the circularity journey. Uncertainty regarding waste-stream classification was reported by numerous stakeholders, along with the need to clarify how materials can be reintegrated into the manufacture process when they are still reusable but qualified by law as waste. In that respect, they claim that one of the largest hindrances to the implementation of the CE is the current definition of ‘waste’ in national legislation. The existing EU directive for eco-design concentrates on areas linked to energy and partially disregards the materials and typology of products in a wider outlook (OECD, 2020).

The final major source of regulatory and legal barriers in the literature is the study of Obersteg et al. (2019), which records the following challenges in the surveyed regions: unclear legislation on waste ownership, legal control by the EU on regional waste-management, poor measures for implementing CE processes, redundancy of authorisation for implementing waste plants, lack of space to manoeuvre for local (government) stakeholders, privatised collection, and conflict between waste-management and other uses of public spaces.

2.2.3 Behavioural/Socio-cultural/Awareness

The concept of CE is becoming more widely recognised across Europe and globally, owing to the promotional activities taking place in the EU, China, Japan, and other developed countries, with the involvement of international organisations (Smol et al., 2018). The emphasis of exploration on CE-related public awareness differs, depending on the implemented approach in the given territorial area. For instance, comparative evaluation of CE policy in China (Geng et al., 2012; Jiao and Boons, 2017) and Europe (Ghisellini et al., 2016) has revealed contrasting focuses formulated by diverse barriers. McDowall et al. (2017) state that China’s focal point tends to be general environmental issues and pollution, while Europe is directing its efforts towards materials, resource efficiency, waste, new business models, new jobs, eco-innovations, social innovations, information and communications technology (ICT), in addition to wider implementation (Smol et al., 2018).

In this context, lack of awareness is one of the most frequently encountered barriers to the regional advance in the circular direction, as shown by the analysed contributions in this report. More than half of respondents (63%) of the OECD survey cited lack of awareness as a challenge they are facing (OECD, 2020). Additionally, the CIRCTER (2019), Obersteg et al. (2019),
Avdiuschchenko (2018), Smol et al. (2018), and Wu et al. (2014) all note the same barrier. The CIRCTER (2019) points to an *old-fashioned mindset in companies and among leadership* and a *lack of entrepreneurial spirit*, describing these as additional challenges for transitioning regions.

Other awareness gaps indicated by the OECD Survey (2020) include *cultural barriers* (67%) and *inadequate information* (55%); and this inhibits the ability of policymakers to make decisions, businesses to innovate, and citizens to embrace sustainable consumption practices. Some CE-related behaviours – such as reuse – are rarely regarded as valuable alternatives for reducing consumption and waste generation. The persisting acceptance issue is partly due to a lack of awareness, as well as a lack of trust in the quality of the reused products. To that end, many cities and regions have developed systems of quality certification, such as the ‘Revolve Re-use’ programme from Zero Waste Scotland that establishes reuse quality standards for reuse shops, awarding a specific logo distinguishable by consumers (OECD, 2020).

*Informational barriers* are also highlighted by Avdiuschchenko (2018) as a potential obstacle. Moreover, Scarpellini et al. (2019) list the *resistance to change* and *lack of interest from shareholders and stakeholders* as other barriers. Similarly, Barbero and Pallaro (2018) argue that *lack of experience in identifying opportunities* could be a hindrance for the transition.

Finally, the study of Oberstege et al. (2019) is a source of numerous other behavioural barriers, including the following: *consumer readiness to pay premiums for circular products, reliance on business leaders to make the CE transition, citizens’ distrust of institutions, suspicions about the quality of organic and C&D waste products, and the topic of waste not being adequately covered in the school curricula.*

### 2.2.4 Technological/Knowledge/Capacity

Several barriers related to technology and knowledge are also acknowledged in the CIRCTER Policy Guide (2019), such as a *lack of experts in areas related to regional CE*, *limited R&I capabilities in companies and universities*, and *poor-quality or lack of research, testing, and piloting infrastructure*. Scarpellini et al. (2019) also cite the *lack of trained specialised personnel* as a key barrier. Two capacity gaps were identified by the OECD (2020), with the *lack of human resources* and of *technical solutions* posing a challenge for 61% and 39%, respectively, of the surveyed cities and regions. There are certain capacities that are essential for a region that wishes to progress towards a more CE (OECD, 2020).

### 2.2.5 Policy

The systemic nature of the CE is due to the variety of stakeholders, sectors, and goals involved in the process. This entails a wide policy focus through policy integration of silo strategies (OECD, 2020). As stated by the OECD (2020), ‘*when interactions and complementarities are overlooked, the lack of a systemic approach might lead to the implementation of fragmented projects in the short to medium run, rather than sustainable policies in the long run*’.
In many instances, the CE debate is concerned with enabling niche, tecno-economic experimentation, while discussions around more socio-economic agendas are less frequent (Genovese and Pansera, 2020). These fragmented efforts and silo policy approaches can be somewhat avoided by adopting a more holistic view. However, one barrier highlighted by the surveyed regions and cities is a lack of holistic vision (cited by 67% of the respondents), which in turn could be the result of poor leadership and coordination (OECD, 2020). The responsibility for devising CE strategies and putting them into practice amongst the city administration is sometimes unclear, which leads to fragmented initiatives and weak accountability. On many occasions, the specific mandate for setting and executing long-term CE visions has been assigned to waste-management or environmental departments, another time circumventing the multi-dimensional aspect of the CE. Numerous sections partake in CE-related undertakings, hence stronger coordination is required. Other policy gap identified was around the lack of political will (39%; OECD, 2020).

Wu et al. (2014) claim that insufficient funding and rigorous environmental restraints have left local governments facing difficulties in balancing and coordinating economic development and environmental regulation.

In addition, a number of policy challenges are listed by Obersteg et al. (2019), including a lack of consistency in municipal sustainability policies, a lack of regional CE policy formulation and coordination, a silo-mentality within governments and businesses regarding CE, competition among municipalities for leadership of waste management, a lack of policies on problems going beyond administrative boundaries, regional policies not being calibrated to local contexts, long-term and solid cooperation being difficult to build, the integration of CE in urban-planning policies, the balance of general regulations with tailor-made solutions, a lack of real participation by stakeholders, a lack of decentralisation of decision-making, insufficient horizontal municipal cooperation, and challenges to cooperation between local authorities and the private sector.

2.2.6 Infrastructure

Many barriers identified by the surveyed stakeholders from urban regions in the study of Obersteg et al. (2019) were related to inadequate infrastructure. These include a lack of recycling points in the peri-urban area, improve valorisation of food surpluses from the distribution chain, insufficient solutions for special-waste collection and treatment, the limited number of companies with innovation potential, the limited capacity for bulky-waste storage and waste containers in public spaces, the persistence of existing waste-technology preventing innovation, and the long distances between waste generation and treatment.
2.2.7 Environmental
Obersteg et al. (2019) present the results of a governance analysis of six urban regions in Europe. The scholars applied the PESTEL-O framework to identify governance challenges for urban regions moving towards CE. Numerous barriers of an environmental nature were identified by the interviewed stakeholders and said to be undermining the circular practices in the regions. These include points for separated waste-collection frequently becoming wasted areas, the need to enhance the efficiency of waste-collection-system management to reduce mixed waste, the location of new waste-treatment plants, suburbanization significantly increasing waste-management costs, peri-urban assemblages of wastelands, and abandonment and illegal deposit of waste along peri-urban streets.

2.2.8 Other
Some barriers were difficult to classify into the set categories; hence, a category of ‘Other’ was created. Scarpellini et al. (2019), in addition to measuring the degree of penetration of CE activities in the region, also analysed the main barriers to and incentives for the CE at a reginal level. One barrier identified was difficulties with supplying recycled products. Avdiuschchenko (2018) argues that the absence of CE-monitoring instruments for EU regions poses a challenge to the successful adoption of the policies, potentially hindering the realisation of the processes and strategies.
Table 2: Barriers to circular economy (CE) implementation at the regional level

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Studies</th>
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<tbody>
<tr>
<td>Limited or lack of returns from investment</td>
<td>CIRCTER (2019)</td>
</tr>
<tr>
<td>Limited market for recycled products</td>
<td>OECD (2020)</td>
</tr>
<tr>
<td>Lack of funding/investment sources</td>
<td>Scarpellini et al. (2019)</td>
</tr>
<tr>
<td>Price increase not appreciated by consumers</td>
<td>Barbero and Pallaro (2018)</td>
</tr>
<tr>
<td>Difficulties in meeting volume &amp; standard requirements for recycled materials</td>
<td>Smol et al. (2018)</td>
</tr>
<tr>
<td>Market failure</td>
<td>Avdulchev (2018)</td>
</tr>
<tr>
<td>Unaccounted externalities</td>
<td>Wu et al. (2014)</td>
</tr>
<tr>
<td>Transactional costs (economic &amp; social)</td>
<td>Obersteg et al. (2019)</td>
</tr>
<tr>
<td>Financial risks</td>
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<tr>
<td>Lack of critical scale for business &amp; investment</td>
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<tr>
<td>Lack of private-sector engagement</td>
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<tr>
<td>Banks reluctant in financing CE ventures</td>
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<tr>
<td>Limited awareness of successful CE business models in resource management and planning projects</td>
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<tr>
<td>European waste management sanctions to be paid</td>
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<tr>
<td>Tendering not respondent to CE processes</td>
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<tr>
<td>Highest waste tax in the region compared to national</td>
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<tr>
<td>Financing/up-scaling CE initiatives in linear economy</td>
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<tr>
<td>Developing circular business model</td>
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<tr>
<td>Dual-waste system (household/industrial) hinders waste-management optimisation</td>
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<tr>
<td>Local service fees not purposed for refinancing new sectoral investments</td>
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<tr>
<td>Recently centralised secondary raw material market inaccessible to local service-providers</td>
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<tr>
<td>Many non-re-cultivated wasted areas needing major investments</td>
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<tr>
<td>Slow market development for eco-innovative solutions</td>
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<tr>
<td>Lack of business models for improving waste-management processes</td>
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<tr>
<td>Difficult process of applying for additional funding to develop innovative solutions</td>
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<tr>
<td>Unclear or insufficient incentives for waste separation</td>
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<tr>
<td>Subsidies for traditional polluting/inefficient activities</td>
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<tr>
<td>Rigid ‘end-of-waste’ criteria</td>
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<tr>
<td>Inadequate regulation frameworks</td>
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<tr>
<td>Incoherent regulation across levels of government</td>
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<td>Lack of standards for actions</td>
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<tr>
<td>Administrative/regulatory</td>
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<tr>
<td>End-of-pipe principle (product design)</td>
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<tr>
<td>Regulations that hinder exchange of waste</td>
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<tr>
<td>Construction tender procedures not adequately adapting CE principles</td>
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<tr>
<td>Unclear legislation on waste ownership</td>
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<tr>
<td>No tax disincentives for companies and households producing waste</td>
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<tr>
<td>Legal control by EU on regional waste management</td>
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<tr>
<td>Poor measures for implementing CE processes</td>
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<tr>
<td>Redundancy of authorisations for implementing waste plants</td>
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<tr>
<td>Lack of room to manoeuvre for local (government) stakeholders</td>
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<tr>
<td>Privatised collection</td>
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<tr>
<td>Disrespect of environmental protection and waste-management legislation</td>
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<tr>
<td>Lack of a well-functioning effective flow monitoring system</td>
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<tr>
<td>Conflict between waste management and other uses in public spaces</td>
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<tr>
<td>Low public awareness</td>
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<tr>
<td>Old-fashioned mindset in companies/among leadership</td>
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<tr>
<td>Lack of entrepreneurial spirit</td>
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<tr>
<td>Cultural barriers</td>
<td></td>
</tr>
<tr>
<td>Inadequate information/informational barriers</td>
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</tbody>
</table>
Lack of interest
Resistance to change
Lack of experience in identifying opportunities
Consumer readiness to pay premiums for circular products
Reliance on business leaders to make the CE transition
Citizens’ distrust of institutions
Suspicion of the quality of organic and construction and demolition (C&D) waste products
‘NIMBY’ syndrome in local communities
Engaging households in fighting food waste
Participation (quantity and quality) in separate collection vegetable, fruit, and garden (VFG) waste
Excessive (mainly landfilled, food, plastic) waste
Residual/garden waste burning practice of households
Waste topic not included sufficiently in school curricula
Little interest in waste from either landlords or tenants

Lack of experts/human resources in a region
Lack of research & innovation capabilities in companies/universities
Poor-quality or absence of research, testing, piloting infrastructure
Lack of technical solutions

Lack of holistic vision and political will
Balance and coordinate economic development and environmental regulation
Lack of consistency in municipal sustainability policies
Lack of regional CE policy formulation and coordination
Silo-mentality within governments and businesses regarding CE
Competition among municipalities for leadership on waste management
Lack of policies for facing problems beyond administrative boundaries
Regional policies not calibrated to local contexts
Long-term and solid cooperation are difficult to build
Integrate CE in urban-planning policies
Balancing general regulations with tailor-made solutions
| Lack of real participation of stakeholders |                         |
| Lack of decentralisation of decision-making |                         |
| Not enough horizontal municipal cooperation |                         |
| Difficult cooperation between local authorities and private sector |                         |
| High percentage of organic-waste displacement |                         |
| Disposal of eco bales |                         |
| Lack of recycling points in the peri-urban area |                         |
| Improve valorisation of food surpluses from distribution chain |                         |
| Nuisance related to storage and collection of VFG-waste |                         |
| Path dependency of waste-management system and planning practice |                         |
| Low density of waste-collection points |                         |
| Insufficient solutions for special waste-collection and treatment and waste separation infrastructure |                         |
| Small number of companies with innovative potential |                         |
| Limited capacity for bulky-waste storage and waste containers in public spaces |                         |
| Persistence of existing waste-technology preventing innovation |                         |
| Long distances between waste generation and treatment |                         |
| Presence of polluted or noise-restricted peri-urban wastescapes in port and airport areas |                         |
| Abandonment and illegal deposit of waste along peri-urban streets |                         |
| Deposit of eco bales in peri-urban areas |                         |
| Peri-urban assemblages of wastelands |                         |
| Environmental impact of waste transport |                         |
| Points for separated waste-collection frequently becoming wasted areas |                         |
| No solutions for polylactic acid (PLA) collection and treatment and low level of distribution |                         |
| Efficiency of waste-collection-system management for reducing mixed waste |                         |
| Locations of new waste-treatment plants |                         |
| Suburbanisation significantly increasing waste-management costs |                         |
| Biowaste potential not fully used for bio-gas production |                         |
| Difficulties supplying recycled products |                         |
| Lack of CE-monitoring instruments for regions |                         |

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2.3 SECTOR-SPECIFIC CATALYSTS AND INHIBITORS

While some studies identify generic drivers of and barriers to CE introduction, development, and implementation, others focus on specific sectors (e.g., forest, waste, design, plastics). A summary of these, including the granular and sector-specific incentives and challenges, is presented in Table 3 and Table 4. These academic contributions highlight sector-specific drivers and barriers identified in different regional contexts.

Aranda-Uson et al. (2018) provide an overview of the favourable conditions that can accelerate the transition towards circular models, as well as noting some of the challenges faced in Chinese settings that hinder the introduction of CE. Paletta et al. (2019) investigated a sample of 364 plastics-converting companies in the Emilia Romagna region of Italy and identified four categories of barriers in the plastic valorisation sector: technical-technological, legislative, economic, and socio-cultural. The pioneering work of Dabrowski et al. (2019) sought to investigate the barriers to knowledge transfer in the field of CE. For this purpose, the paper focused on novel empirical material: namely, the knowledge-transfer process for spatial solutions encouraging CE between two EU metropolitan regions (the Amsterdam metropolitan area and the Naples metropolitan areas), focusing on eco-innovative solutions for circular resource management. Design is a vital instrument for the movement to more CE-friendly policies and regulations; and, in their study conducted in Scotland, Whicher et al. (2018) identified the presence or absence of supportive policies and regulation to be a key driver of or hindrance, respectively.

Husgafvel et al. (2018a) conducted two studies: a regional study of sustainability and competitive advantage in the forestry sector companies in the Kymenlaakso region (Finland), and a second case study concerning the potential for cascading recovered solid wood in wood products. An attempt was made in a second paper to detect the CE challenges in the seafaring sector in the Kainuu region of Finland (Husgafvel et al., 2018b). Several studies have analysed the incentives and challenges found in the waste sector (Fleischmann, 2019; Vanhamaki et al., 2019), including construction and demolition (C&D) waste management (Volk et al., 2019), regional solid municipal waste management (Plastinina et al., 2019), and obstacles to closing the loop of regional material flows (Virtanen et al., 2019).

Industrial symbiosis (IS) is increasingly employed as a strategic instrument to help deliver the CE at all levels in Europe – local, regional, national, and European (Lombardi, 2017). With this in mind, Lombardi (2017) conducted 65 surveys of companies in the resource-intensive-process industry sectors (cement, ceramics, chemicals, engineering, minerals, non-ferrous metals, steel, and water). The results revealed various non-technical barriers to the adoption of IS, with regulation, organisational and governance challenges, and a lack of information being the most vital (Lombardi, 2017).
<table>
<thead>
<tr>
<th>Drivers</th>
<th>Table 3: Drivers identified in specific sectors and fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favourable conditions that can accelerate the transition towards circular models</td>
<td>Aranda-Uson et al. (2018)</td>
</tr>
<tr>
<td>- Regulation and public support</td>
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<tr>
<td>- Geographic proximity</td>
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<td>- Local and regional authorities, policymakers</td>
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<tr>
<td>- Introduction of industry-driven and/or collaborative models (self-regulation)</td>
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<tr>
<td>- Establishment of voluntary standards</td>
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<tr>
<td>- Promotion of eco-design and manufacturing standards that stimulate closing of materials loops</td>
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<tr>
<td>Waste sector</td>
<td>Fleischmann (2019)</td>
</tr>
<tr>
<td>- Better governmental waste-management and incentives</td>
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<tr>
<td>- Design-led innovation</td>
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<tr>
<td>Construction and demolition (C&amp;D) waste management</td>
<td>Volk et al. (2019)</td>
</tr>
<tr>
<td>- Financial incentives</td>
<td></td>
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<tr>
<td>- Education</td>
<td></td>
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<tr>
<td>- Interlocking policy system</td>
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</tr>
<tr>
<td>Regional solid municipal waste management</td>
<td>Plastinina et al. (2019)</td>
</tr>
<tr>
<td>Economic efficiency of economic activity as main incentive for CE implementation:</td>
<td></td>
</tr>
<tr>
<td>- Development of sorting facilities</td>
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<tr>
<td>- Provision of incentives for separate municipal solid-waste collection</td>
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<tr>
<td>- Introduction of proper tariff system</td>
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<tr>
<td>- Favourable conditions for business development</td>
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<tr>
<td>Waste</td>
<td>Vanhamaki et al. (2019)</td>
</tr>
<tr>
<td>Waste (biowaste) management</td>
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<tr>
<td>Forest sector</td>
<td>Heggstad et al (2018)</td>
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<tr>
<td>- Technological innovation</td>
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<tr>
<td>- Supportive regulatory environment</td>
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<tr>
<td>- Extended producer responsibility (EPR) schemes could be one option for promoting the recovery and use of wood in new products and helping to direct more attention to design processes that would ease the dismantling of products.</td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>Whicher et al. (2018)</td>
</tr>
<tr>
<td>- Policy and regulation</td>
<td></td>
</tr>
<tr>
<td>Industrial symbiosis</td>
<td>Lombardi (2017)</td>
</tr>
<tr>
<td>Benefits of industrial symbiosis implementation from the survey results:</td>
<td></td>
</tr>
<tr>
<td>- Improved environmental performance of the company</td>
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<tr>
<td>- Reduced costs of waste disposal</td>
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<tr>
<td>- Improved environmental performance of the community</td>
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<tr>
<td>- Revenue generation and reduced cost of input</td>
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<tr>
<td>- Adherence to regulatory requirements and satisfaction of CSR requirements</td>
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<tr>
<td>- Opportunity to implement similar process in other areas of business</td>
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<tr>
<td>- Improved links with other businesses and quality of inputs</td>
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</tbody>
</table>

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Table 4: Barriers identified in specific sectors and fields

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<tbody>
<tr>
<td>Challenges to improving the introduction of the circular economy (CE) in China</td>
<td>- Lack of reliable information &lt;br&gt;- Shortage of advanced technology &lt;br&gt;- Poorly enforced legislation &lt;br&gt;- Weak economic incentives &lt;br&gt;- Poor leadership and management &lt;br&gt;- Lack of public awareness</td>
<td>- Technical-technological &lt;br&gt;- Legislative &lt;br&gt;- Economic &lt;br&gt;- Socio-cultural</td>
<td>- Lack of incentives &lt;br&gt;- Lack of funding</td>
<td>Knowledge-transfer process for spatial solutions to promote CE, focusing on eco-innovative solutions for circular resource management</td>
<td>- Language &lt;br&gt;- Disciplinary background &lt;br&gt;- Geography (of metabolic flows) &lt;br&gt;- Socio-cultural &lt;br&gt;- Socio-economic differences &lt;br&gt;- Other socio-political phenomena &lt;br&gt;- Legal aspects &lt;br&gt;- Governance and decision-making &lt;br&gt;- Technological aspects</td>
<td>- Regulatory and incentive environment &lt;br&gt;- Lack of waste-processing facilities &lt;br&gt;- Poor communication among involved parties &lt;br&gt;- Lack of awareness and poor behaviour among project stakeholders &lt;br&gt;- Lack of awareness of environmental implications of waste disposal &lt;br&gt;- Cultural resistance and poor project processes</td>
<td>- State management failures: &lt;br&gt;- Legal requirements for waste recovery (Russian targets for waste recovery are far below EU targets) &lt;br&gt;- Legally underdeveloped financial state support to waste-processing enterprises (and lack of details in subordinate legislation for specific regulations)</td>
</tr>
<tr>
<td>Plastic valorisation</td>
<td></td>
<td></td>
<td>Waste sector</td>
<td>Knowledge-transfer process for spatial solutions to promote CE, focusing on eco-innovative solutions for circular resource management</td>
<td></td>
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<td></td>
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</tbody>
</table>
- Lack of internalisation of externalities, such as reduced waste volume, reduced environmental damage, and virgin resource consumption having social value in the form of environmental taxes or fees
- Environmental fees and pollution payments are a formality
- Irregular waste fraction recycling

<table>
<thead>
<tr>
<th>Forest sector – 1. Barriers in the woodworking industry field, potential for cascading recovered solid wood; 2. Barriers to the use of recovered wood</th>
</tr>
</thead>
</table>
| 1. Scale and profitability (processes optimised for logs, strength grading in load bearing structures, possible humidity requirement, quality requirements, moisture content, origin of the recovered wood, cleanliness, humidity requirements in bendings, availability of recovered hardwoods, sorting, energy use)  
2. Price/cost effectiveness (industrial scale, quality, cleanliness, logistics, availability, requirement for moisture, origin, authorisation, strength grading, separation of wood species, length, appearance) |

<table>
<thead>
<tr>
<th>Challenges to the CE in the seafaring sector</th>
</tr>
</thead>
</table>
| - Clever products and services  
- Development of cooperation and logistics  
- Energy and material efficiency  
- Evaluating the developing of supply/value chain  
- Creating value added  
- Increase of sectoral cooperation and interaction  
- Increase of recycling and reuse and minimisation of waste  
- Intelligent production and processes  
- Local or regional resource banks  
- New symbiosis products and utilisation of by-products and side flows  
- Developing of international guidelines and best practices  
- Development of harbour operations and management  
- Development of operational environment of EU  
- International vocational education |

<table>
<thead>
<tr>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Policy and regulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industrial symbiosis – 1. Selected group of non-technical barriers to the CE through industrial symbiosis; 2. Challenges to implementing industrial symbiosis, highlighted in the survey results</th>
</tr>
</thead>
</table>
| 1. Informational (regulatory and policy, commercial, organisational/governance)  
2. Process barriers (regulatory barriers, financial barriers, transport barriers, lack of information regarding alternative feedstock/inputs, lack of time to implement solutions, long timeframe for implementation of solutions, coordination barriers, concerns about confidentiality, gaining approval from relevant authorities, contractual barriers, logistical barriers) |

### 3. EN ROUTE TO THE REGIONAL CIRCULAR ECONOMY: KEY DRIVERS OF AND BARRIERS TO THE REGIONAL STRATEGIES

Chapter 2 provided an overview of the drivers and barriers associated with implementation of CE at the regional level, as presented in the academic literature and relevant grey literature. To verify and complement these findings, a preliminary secondary data analysis was conducted for selected...
EU regional strategies and action plans for CE transition. The analytical results are presented in this chapter.

3.1 SELECTION STRATEGY AND PROCESS

To define the term ‘region’ as used throughout WP4, the NUTS classification was presented in the first deliverable (D4.1) of this WP. All EU member states (MSs) – along with their NUTS 1, NUTS 2, and NUTS 3 regions – are compiled in a comprehensive set of tables presented in Appendix A (‘NUTS classification’), provided as supplementary material for this technical report. As the NUTS2 regions have been proposed as the optimal level for CE implementation, the 281 NUTS 2 EU regions were the starting point for selection of the regional strategies analysed in the following sections. The flow chart presented in Figure 4 illustrates the selection strategy and process of the regions and their CE strategies.

As explained in Box 1, the NUTS 2 regions belong to three development categories. The first selection criterion was to include regions from all categories to ensure representativeness and minimise the possibility of presenting biased and distorted representations of the status of the CE efforts across the EU regions. Additionally, an attempt was made to delve into an intercountry case and select regions with CE strategies from the three development categories and compare them. For that purpose, three Spanish regions were included in the analysis, having been chosen on the basis of the online availability of data and the authors’ knowledge of the Spanish language.

**Figure 4:** Selection strategy and process (regions according to NUTS 2016 classification)

- **Selection criteria:**
  - Representation of the three development stages (within EU and within country)
  - Existence and online availability of regional CE strategy/action plan (in English or Spanish)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Innovative Training Networks (H2020-MSCA-ITN-2018) scheme, grant agreement number 814247 (ReTraCE).
Box 1: The NUTS 2 regions

The NUTS classification provides the basis for regional boundaries and geographic eligibility, as statistics from regional accounts are used for the allocation of EU funds. During the period of 2014-2020, eligibility for the European Regional Development Fund (ERDF) and the European Social Fund (ESF) was calculated on the basis of regional GDP per inhabitant in purchasing power standard (PPS), as averaged for the period of 2007-2009. NUTS level 2 regions were ranked and split into three groups:

- **less-developed regions**, where GDP per inhabitant was **less than 75%** of the EU-27 average;
- **transition regions**, where GDP per inhabitant was **75%-90%** of the EU-27 average; and
- **more developed regions**, where GDP per inhabitant was **more than 90%** of the EU-27 average.

Eligibility for the cohesion fund – which was established to strengthen the economic, social, and territorial unity of the EU in the interests of promoting sustainable development – is assessed on the basis of the NUTS 2 level regions. Hence, a large proportion of the cohesion policy budget has been allocated to regions whose development lags behind the EU average; more specifically, more than 50% of the total budget was distributed to less-developed regions, primarily located in the south or the east of the EU, the Baltic Member States, and several of the outermost regions (Eurostat Regional Yearbook, 2019).

The next step of the selection process was to identify regions that had CE strategies in place that are available online and written in English or Spanish. Regions in the more developed regions category had the greatest representation, as a large proportion had strategies and action plans in place. Difficulties arose, however, when trying to identify less developed and transitioning regions that had a strategy for CE implementation available online. These regions tended to lack a national policy framework or action plan for the CE, as was the case for Bulgaria,12 Cyprus,13 Estonia,14 and Hungary.15 On the other hand, Nordic countries ranked highly for their pro-environmental initiatives and seem to be focusing their efforts on achieving circularity in their smaller territories, more particularly their NUTS 3 regions. As reported in the OECD Synthesis report (2020), the regions of North Karelia, South Karelia, and Southwest Finland have developed actions plans for the NUTS 3 level regions, but they were excluded from the analysis in this report. The regional strategies analysed in the following chapter – on the NUTS 2 level only – are shown in Table 5.

Table 5: Selected NUTS 2 regions with regional initiatives for analysis

---

<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>PPS per capita</th>
<th>Strategy/Action Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>More developed regions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luxembourg</td>
<td>253%</td>
<td>The Data-Driven Innovation Strategy for the Development of a Trusted and Sustainable Economy in Luxembourg (2019)</td>
</tr>
<tr>
<td></td>
<td>Brussels Capital Region</td>
<td>196%</td>
<td>Brussels Regional Program for a Circular Economy 2016 – 2020 (BRPCE)</td>
</tr>
<tr>
<td></td>
<td>Catalonia</td>
<td>110%</td>
<td>Estratègia d’Impuls a l’economia verda i a l’economia circular (2015)</td>
</tr>
<tr>
<td><strong>Transition regions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Friesland</td>
<td>88%</td>
<td>Circulair Fryslân: De Economie Van De Toekomst (2015)</td>
</tr>
<tr>
<td></td>
<td>Galicia</td>
<td>82%</td>
<td>Estratègia Gallega de Economía Circular 2019-2030</td>
</tr>
<tr>
<td><strong>Less-developed regions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extremadura</td>
<td>64%</td>
<td>EXTREMADURA 2030 Estratègia de economia verde y circular (2017)</td>
</tr>
</tbody>
</table>

3.2 REGIONAL BLUEPRINTS

This section presents the so-called blueprint of the selected regions, showing the profile of the region and its respective CE policy documents. The name of the region and its NUTS code is given first, followed by its population and stage of development; all the information has been extracted from the European Social Progress Index 2020 (2020 EU-SPI) Scorecards. In Table 5, the PPS per capita economic measure is introduced; and based on this, the regions are categorised as more developed, transitional, or less developed. As such, no other economic indicator is presented in this section. An effort was made to identify NUTS 2 regional indicators and measures to represent a broader perspective of the regions’ status, giving an overview of the social and environmental dimensions. For that purpose, two sources were included in the Regions’ Blueprints.

First, the European Social Progress Index 2020 (2020 EU-SPI) is incorporated as a measure of societal development and quality of life at the regional level, going beyond GDP. The index measures social progress in European regions, at the NUTS-2 level, using 12 components described by a total number of 55 comparable social and environmental indicators, excluding economic aspects. The components are further aggregated into three broader dimensions of basic human needs (necessary enablers of societal development), foundations of wellbeing (intermediate factors of social and environmental progress), and opportunities (the most advanced component of a cohesive and tolerant society). The higher the score of the region, the better its rank within the 240 EU NUTS-2 regions.

The OECD Regional Wellbeing measure is then presented. Each OECD region is measured on 11 scales important for wellbeing – including the environment. The values of the indicators are expressed as a score between 0 and 10. A high score indicates better performance relative to the other regions.

To further complement the picture of the institutional and fiscal decentralisation of EU countries, the Division of Powers was added to the Regions’ Blueprints, showing the legal bases for the various governance structures in the respective countries, the responsibilities and powers of the regions, and their respective regional authorities.

Finally, the national and regional frameworks are presented, along with the specific CE action plans or strategies for the regions. Relevant information has been extracted from the policy documents, focusing primarily on the cited or implied drivers, incentives, and challenges and barriers faced by the region in its journey towards the CE.

18 https://www.oecdregionalwellbeing.org/
19 https://portal.cor.europa.eu/divisionpowers/Pages/default.aspx
LUXEMBOURG (LU00)

Population: 602,000
Stage of development (1=Lowest; 5=Highest): 5

2020 EU-Social Progress Index (SPI)
Score (0-100): 74.6
Rank: 42/240
EU score (0-100): 66.7

OECD Regional Wellbeing (0-10)
Education: 7.3
Jobs: 7.0
Income: 6.8
Safety: 9.4
Health: 8.5
Environment: 6.0
Civic engagement: 10.0
Accessibility: 9.9
Housing: 6.1
Community: 6.2
Life satisfaction: 6.7

Division of powers – Luxembourg
Member state without legislative powers at the sub-national level – unitary state.

Representing NUTS 1, NUTS 2, and NUTS 3 regions.

Central level (state responsibilities): Exclusive legislative and administrative powers in all fields related to national interest.

Regional level: District commissioners ensured compliance with laws and general and municipal regulation.

Regional CE Strategy: ‘The Data-Driven Innovation Strategy for the Development of a Trusted and Sustainable Economy in Luxembourg’ (2019) – a national and regional strategy, as the state of Luxembourg is equivalent to NUTS 1, 2, and 3 regions.

Responsible institution: The Government of the Grand Duchy of Luxembourg – Ministry of Economy, integrated the CE in its data-driven innovation strategy as a key-sector for innovation. The data-driven innovation strategy has seven priority sectors, including ‘eco-technologies’, which is comprised of CE and smart mobility focus areas, coordinated by the Ministry of Energy and Spatial Planning and the Ministry of Mobility and Public Works.

Aim (within the CE focus area): To become an honest broker for Europe’s CE and develop data-driven performance-based services.

Drivers: Including CE principles in the masterplans of large urban development projects; integrating the CE into the municipalities’ climate pacts, encouraging circular procurement; developing material passports in the construction sector, including all relevant information on how to turn buildings into material banks; creating a data hub for CE to provide data, knowledge, and services to circular stakeholders and complete integrated value chains; adapting the financial, regulatory, fiscal, and accounting systems to the CE; creating attractive ecosystems and developing a new specific sector by addressing issues and developing new services related to accounting, financing, insurance, liability, tax, contracting, testing, regulation, standards, value propositions, and qualified intermediaries such as consultants and entrepreneurs.

Challenges: A need for an ecosystem that supports company efforts to performance-based business models; the development of further domestic test markets; lack of data available on products and components, as well as a lack of precision on materials grouped in generic categories (e.g., plastics); financing of the transition costs for circular business models; and internal change management (for companies).
BRUSSELS CAPITAL REGION (BE10)

<table>
<thead>
<tr>
<th>Population</th>
<th>Stage of development (1=Lowest; 5=Highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 207 000</td>
<td>5</td>
</tr>
</tbody>
</table>

2020 EU-Social Progress Index (SPI)  Division of powers – Belgium

<table>
<thead>
<tr>
<th>Score (0-100)</th>
<th>Rank</th>
<th>EU score (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.5</td>
<td>123/240</td>
<td>66.7</td>
</tr>
</tbody>
</table>

OECD Regional Wellbeing (0-10)

<table>
<thead>
<tr>
<th>Education</th>
<th>Jobs</th>
<th>Income</th>
<th>Safety</th>
<th>Health</th>
<th>Environment</th>
<th>Civic engagement</th>
<th>Accessibility</th>
<th>Housing</th>
<th>Community</th>
<th>Life satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>2.9</td>
<td>3.8</td>
<td>7.8</td>
<td>6.9</td>
<td>5.1</td>
<td>10.0</td>
<td>7.8</td>
<td>6.7</td>
<td>7.3</td>
<td>6.3</td>
</tr>
</tbody>
</table>

Member state with legislative powers at the sub-national level – complex federal state.

Regional level: Has legislative and executive organs known as the regional parliament and the regional government. Regions have legislative powers in fields connected to their territory and, therefore, may issue regional decrees that have the force of law.

No hierarchical relationship between the regions and the federal authority, and their powers have shared responsibilities in some areas (i.e., environment, taxation, energy, etc.).

Responsible ministries/bodies in the policy area of environment & the fight against climate change include the following: The Health, Food Chain Safety and Environment FPS/FOD, the Flemish Department for Living Environment, Nature and Energy, Environment Wallonie, Brussels Environment.

Regional CE strategy: Brussels Regional Program for a CE (BRPCE) 2016-2020 (2016).

General objectives: (i) To transform environmental objectives into economic opportunities; (ii) to relocate the economy to Brussels to produce locally whenever possible, reduce travel, optimise land use, and create added value for Brussels inhabitants; and (iii) to help create employment.

Steering of the BRPCE: Three Ministers (Minister for Housing, Quality of Life, the Environment and Energy; Minister for the Economy, Employment and Vocational Training; Secretary of State Responsible for Public Cleanliness, the Collection and Treatment of Waste, and Scientific Research), four regional administrative bodies (Impulse – the Brussels Enterprise Agency, Brussels Environment – the Brussels administration for the Environment and Energy, Bruxelles-Propreté Agency – the Brussels Agency for Urban Cleaning, and the Collection and Treatment of Household Waste, Innoviris – the Brussels administration for the promotion and support of innovation) and other stakeholders.

Drivers: Combining bottom-up and top-down approaches – involving multiple public and private stakeholders in the origination, operation, and reporting of the measures; cross-functional measures (favourable regulatory framework); sector-based measures (target construction, resources and waste logistics, trade and food sectors); territorial measures (integrating the CE at the local level); governance measures (strengthening coordination between authorities); BRPCE, designed as a ‘living strategy’ and being revised every 18 months;

Challenges: Incorporation of bottom-up and top-down approaches creates the greatest challenges; working efficiently in a multi-administration and co-creative manner, with production facilities located outside the region.
CATALONIA (ES51)

Population: 7,499,000
Stage of development (1=Lowest; 5=Highest): 4

2020 EU-Social Progress Index (SPI)

<table>
<thead>
<tr>
<th>Score (0-100)</th>
<th>67.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>135/240</td>
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<tr>
<td>EU score (0-100)</td>
<td>66.7</td>
</tr>
</tbody>
</table>

OECD Regional Wellbeing (0-10)

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>4.7</td>
</tr>
<tr>
<td>Jobs</td>
<td>5.2</td>
</tr>
<tr>
<td>Income</td>
<td>4.0</td>
</tr>
<tr>
<td>Safety</td>
<td>9.6</td>
</tr>
<tr>
<td>Health</td>
<td>9.7</td>
</tr>
<tr>
<td>Environment</td>
<td>5.5</td>
</tr>
<tr>
<td>Civic engagement</td>
<td>4.4</td>
</tr>
<tr>
<td>Accessibility</td>
<td>7.6</td>
</tr>
<tr>
<td>Housing</td>
<td>5.6</td>
</tr>
<tr>
<td>Community</td>
<td>7.9</td>
</tr>
<tr>
<td>Life satisfaction</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Division of powers – Spain

Member state with legislative powers at the sub-national level – unitary state organised on a decentralised basis.

Regional level: Autonomous communities enjoy important autonomy and have legislative powers, with the right to self-govern.

Policy area: Environment & the fight against climate change is governed centrally by the Ministry for the Ecological Transition and the Demographic Challenge.

Regional CE strategy: Strategy for the promotion of the green economy and the circular economy (approved by governmental agreement GOV/73/2015 on 26 May 2015).

Responsible institution: The Regional Government of Catalonia (Territorial and sustainability department).

Main objective(s): (1) To align, in competitiveness matters, to the standards of smart, sustainable, and inclusive growth of the EU and leading surrounding countries; (2) to provide coherence and visibility to the different plans towards green/CE of the different governmental departments; (3) to establish priorities for future governmental action; and (4) to boost corporate leadership and the capacity to transition to circular/green economy, also for society as a whole.

Drivers: Interreg Europe CircE Project (‘European Regions Toward Circular Economy’) involves eight partners and representatives of different European social and economic scenarios. It seeks to enhance the ability of the involved regions’ policy instruments to drive the transition towards more circular economies through the exchange of knowledge and experience, as well as broad stakeholder involvement. In the specific case of Catalonia, the ‘Action plan to promote circular economy in the textile and beverage sectors 2019-2021’ is in place as part of the project. ‘Catalunya Circular’ (Circular Catalonia) is an innovation hub and meeting point for companies and institutions that offer solutions for a more circular Catalonia.

Challenges: It envisages the key areas of action in terms of generating demand and creating market structures, improving access to funding, promoting R&D, and boosting internationalisation.

International frameworks: UN’s Global Green New Deal (as supported by UNEP’s Green Economy Report, 2011); the OECD’s Green Growth Strategy; the UN’s Rio+20, ‘The Future We Want’ (2012).


Regional frameworks: RIS3CAT – ‘Strategy for research and innovation for smart specialisation of Catalonia’, integrating the green economy into leading sectors, emerging activities, facilitating technologies, and context that facilitates innovation.
Division of powers – The Netherlands

Member state without legislative powers at the sub-national level – unitary state organised on a decentralised basis.

Central level (state responsibilities): National issues; legislative and administrative power, but provinces and municipalities may issue provincial and municipal regulations, as long as they are in compliance with national law.

Regional level: The representative governing body at the provincial level is the Provincial Council (Provinciale Staten), while the executive body is the Board (College) of the King’s Commissioner (Commissaris van de Koning) and the Provincial Aldermen (Gedeputeerde Staten).

Responsible Ministry in the policy area environment & the fight against climate change is the Ministry of Infrastructure and Water Management, with the Regional Authorities for the provincial levels.

National framework: Grondstoffenakkoord – national agreement outlining the country’s commitment to a CE by 2050.


Responsible institutions: Province of Friesland, Municipality of Leeuwarden, Circular Friesland Association, Metabolic, Urgenda.

Drivers: General joint activities outlined for each sector (setting up a platform, organising roundtable discussions); inspiring flagship projects and overarching activities; stimulating cooperation between different sectors, incubators, and accelerators; a platform to collect knowledge and attract companies that will supply the new circular products in the construction sector; the establishment of the Frisian Salt Institute to gather knowledge via projects in various test locations and related research; circular experts – catalysts and theme specialists; the promotion of industrial symbiosis; a focus on cultural diversity and extension of added value to CE; system thinking approach where the circular consumer is at the centre; changes in behaviour and mentality; circular business models and entrepreneurship; circular procurement; integral approach to education, including CE and sustainable development in education programmes, from primary-school to university level; circular construction; circular design.

Challenges: An initial need for opportunity analysis and correct stakeholder involvement.
GALICIA (ES11)

<table>
<thead>
<tr>
<th>Population</th>
<th>Stage of development (1=Lowest; 5=Highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 705 000</td>
<td>3</td>
</tr>
</tbody>
</table>

2020 EU-Social Progress Index (SPI)

<table>
<thead>
<tr>
<th>Score (0-100)</th>
<th>68.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>120/240</td>
</tr>
<tr>
<td>EU score (0-100)</td>
<td>66.7</td>
</tr>
</tbody>
</table>

OECD Regional Wellbeing (0-10)

| Education | 4.2 |
| Jobs      | 3.5 |
| Income    | 3.1 |
| Safety    | 10.0 |
| Health    | 9.0 |
| Environment | 8.0 |
| Civic engagement | 3.5 |
| Accessibility | 6.8 |
| Housing    | 7.2 |
| Community  | 8.2 |
| Life satisfaction | 4.4 |

Division of powers – Spain

Member state with legislative powers at the sub-national level – unitary state organised on a decentralised basis.

Regional level: Autonomous communities enjoy substantial autonomy and have legislative powers, with the right to self-govern.

Policy area: Environment & the fight against climate change is governed centrally by the Ministry for the Ecological Transition and the Demographic Challenge.

International frameworks: UN’s Sustainable Development Goals (2016).


Regional CE strategy: Galician circular economy strategy.

Responsible institution: The Regional Government of Galicia.

Main objective(s): (1) To promote a knowledge-based economy; (2) to drive a life cycle and eco-design philosophy in the corporate/market culture; (3) to promote a CE information platform; (4) to drive new business models based on use/utility (rather than product ownership); (5) to employ CE as a demographic engine, highlighting the riches of local resources (human or natural); (6) to implement eco-efficient urbanism; (7) to implement eco-efficient water-cycle management; and (8) to prioritise circularity in waste management, including a hierarchy of waste-recovery strategies (favouring regeneration of primary materials).

Drivers: The main drivers are envisaged in terms of the general application of systematic eco-design practices, creation of new activities and business model innovation, clear promotion of R&D for the generation of scientific and technical knowledge, together with increased resource efficiency and extended management of materials along their life cycle, as well as increased education and information exposure for all relevant stakeholders. In this sense, Galicia has a clear advantage with respect to its already built (knowledge) capacity in the agricultural and fishing sectors. Economic advantages are viewed as facilitating the implementation of circular strategies.

Challenges: Stakeholder collaboration, led by the government, is necessary and challenging. Incorporation of systematic strategies (as drivers) and the alignment of the Spanish government with these are necessary. In particular, the Spanish government should build coherence between the actions of different regions in Spain to ensure their success (most importantly, in terms of the changes to market incentives and structure necessary for a real transition).
EXTRAMADURA (ES43)

<table>
<thead>
<tr>
<th>Population</th>
<th>Stage of development (1=Lowest; 5=Highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,071,000</td>
<td>2</td>
</tr>
</tbody>
</table>

2020 EU-Social Progress Index (SPI)

| Score (0-100) | 64.3 |
|---------------------------------------------|
| Rank | 151/240 |
| EU score (0-100) | 66.7 |

Division of powers – Spain

Member state with legislative powers at the sub-national level – unitary state organised on a decentralised basis.

Regional level: Autonomous communities enjoy substantial autonomy and have legislative powers, with the right to self-govern.

Policy area: Environment & the fight against climate change is governed centrally by the Ministry for the Ecological Transition and the Demographic Challenge.


EU frameworks: Europe 2020 strategy (2010); Closing the loop – An EU action plan for the Circular Economy (2015); Europe 2030 project (2010); Europe 2020 strategy; Horizon 2020 programme.


Regional CE strategy: Green and circular economy strategy EXTREMADURA 2030.

Responsible institution: The Regional Government of Extremadura.

Policy instruments addressed: Social concentration commission; directive committee Extremadura 2030; regional strategy coordination commission; territorial commission; technical office Extremadura 2030; thematic commission; Extremadura 2030 Forum.

Main objective(s): (1) To build a sustainable development model based on green and circular economies; (2) to design a stakeholder involvement process in the governance model; (3) to enable a social transformation based on mass capacity building of citizens; (4) to make Extremadura into an internationally recognised laboratory for green and circular economy matters (in terms of R&I); and (5) to identify and valorise stakeholder interactions with respect to the green and circular economies.

Drivers: Stakeholder involvement and knowledge-sharing as a new form of governance are seen as the key enabler of the transition. Monitoring framework inspired by the UN’s SDGs is proposed to aid the transition.

Challenges: Achieving compromise between decision-makers to enable the governance process; understanding the thematic and territorial context, the structures, and governance frameworks for a proper application of the governance model; ensuring a proper resource allocation to boost trust and stakeholder participation; as well as enabling proper comprehension of the multi-level governance model.
CENTRAL MACEDONIA (EL52)

<table>
<thead>
<tr>
<th>Population</th>
<th>Stage of development (1=Lowest; 5=Highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 877 000</td>
<td>2</td>
</tr>
</tbody>
</table>

**2020 EU-Social Progress Index (SPI)**

<table>
<thead>
<tr>
<th>Score (0-100)</th>
<th>55.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>211/240</td>
</tr>
<tr>
<td>EU score (0-100)</td>
<td>66.7</td>
</tr>
</tbody>
</table>

**OECD Regional Wellbeing (0-10)**

| Education | 6.6 |
| Jobs | 0.6 |
| Income | 2.3 |
| Safety | 10.0 |
| Health | 7.2 |
| Environment | 4.7 |
| Civic engagement | 5.1 |
| Accessibility | 4.2 |
| Housing | 3.3 |
| Community | 4.1 |
| Life satisfaction | 0.4 |

**Division of powers – Greece**

Member state without legislative powers at the sub-national level – unitary state organised on a decentralised basis.

Central level (state responsibilities): general powers for designing and implementing national policies.

Regions are responsible for the administration of affairs of their district. They shape, plan, and implement regional-level policies, under the principles of sustainable development and the social cohesion of the country, taking into account both national and European policies.

Responsible actors in the policy area of environment & the fight against climate change are the Ministry of Environment and Energy, the special standing committee of the Hellenic Parliament for the protection of the environment on the state level and regional authorities on the regional level.


Regional frameworks: Regional Waste Management Plan.


Responsible institution: Regional Development Fund of Central Macedonia – on behalf of the Region of Central Macedonia.


Main objective: To strengthen cooperation in the energy utilisation of biowaste.

Drivers: 17 bio-gas plants active in the region – significant potential; knowledge transfer from the participation in the BIOREGIO (INTERREG) project; advisory and support for innovation and knowledge transfer from research results to industrial partners; facilitation and creation of communication channels for information exchange and coordination among administration, scientific community, and economic and societal actors; innovation vouchers for SMEs for funding actions based on waste management and waste as an energy form.

Challenges: The need to utilise additional biowaste streams, the need to cooperate with research organisations for further R&D in the production of biomass energy, information exchange, the need to strengthen the value chain on biowaste and create contacts and synergies among bio-gas plant operators and producers of other forms of biowaste and bring together bio-gas plant operators to exchange information and pursue common goals for anaerobic digestion technologies.
3.3 DISCUSSION OF RESULTS

From the Regions’ Blueprints presented in the previous section, seven visions and action plans for regional efforts to transition towards a CE can be identified. The differences between these visions reflect the unique characteristics of the respective regions’ cultures, histories, economic and industrial structures, political reality, and institutional arrangements. Some regions base their CE strategies on their predominant sectors and place-based capabilities. For instance, Central Macedonia is focusing on biowaste from its agricultural and food sector; Luxembourg’s incorporation of the CE is a strategic priority of the region’s data-driven strategy, due to its well-developed ‘internet of things’ (IoT) capacities and facilities; and the region of Friesland is anchoring its strategy on five emerging sectors that are crucial for the CE and for the region: namely, agriculture, plastic, construction, organic-waste streams, and saline agriculture. In the case of the Brussels Capital region – a large consumption node with limited production activities, capacities, and resources – the focus should be on sustainable consumption, as the urban policies have a partial impact on the production located outside its boundaries (Christis et al., 2019). Accordingly, one of the main aims of the BRPCE is to relocate the economy to Brussels to produce locally whenever possible and create added value for Brussels inhabitants. In the three Spanish cases, the standalone CE strategies have a broader focus.

Taking into account the division of power within the country, some regions have legislative powers that provide more diverse and powerful instruments and mechanisms for implementing the transition towards the CE. The Spanish and Belgian regions, for example, have more complex institutional arrangements. In the case of Luxembourg, which is a unitary state with a smaller population, the country simultaneously represents all three NUTS levels, thus reducing the complexity of multi-level governance.

The analysis of the regional strategic documents to extract the drivers and barriers was a challenging task, as these elements were not explicitly mentioned. However, the actions and initiatives presented in the strategies were established on the basis of the challenges the regions are facing, as well as the driving forces of the transitions. Therefore, the underlying drivers and barriers could be identified for each region, and these are presented in the respective Region’s Blueprint.

Luxembourg is adapting its financial, regulatory, fiscal, and accounting systems to foster the transition to the CE, as well as developing a new specific sector by addressing issues and developing new services related to accounting, financing, insurance, liability, tax, contracting, testing, regulation, standards, value propositions, and qualified intermediaries, such as consultants and entrepreneurs. For instance, they are investigating how local SMEs can provide performance and products as a service-based model for hotel interiors. This supportive ecosystem is being built by integrated public and private stakeholders, through the continuous development of pilot projects that invite dedicated working groups to learn and to co-create a circular ecosystem. Additionally, the Ministry of Economy is positioning the region as a CE data hub that offers data, knowledge, and services to CE stakeholders and completes integrated value chains in the years to come, though
the issue of product- and component-data availability – as well as the lack of precision for certain material groups – is underlined.

The 2016 BRPCE was developed as a broader and more holistic programme, as the region had gained valuable experience from its employment-environment alliance, which had mobilised diverse actors to develop environment-related industries. This corroborated, once again, the constructiveness of uniting the public, private, and non-profit sectors under the umbrella of a shared objective. As clearly stated in one of their reports, this balanced approach was a major success factor, with the top-down approach by the government decision-makers having a clear trajectory and the bottom-up initiatives coming from local and sectoral stakeholders who know what is needed and how to put this into practice on the ground. This multi-level, cross-sectoral collaboration was also identified as the largest challenge for the implementation of the strategy. The BRPCE programme is designed as a ‘living strategy’, being revised every 18 months as an incorporated mechanism to challenge results, revise measures, and involve more sectors and stakeholders.

The region of Catalonia was one of the first to design a CE strategy. This appeared in 2015 and the new strategy will be published mid-2021. With its participation in an Interreg project, the region is aspiring to enhance the policy instruments at their disposal to foster the transition. Another interesting driver is the focus on the innovation hub, which brings together stakeholders to exchange knowledge and experiences and provide circular solutions.

A wide range of stakeholders in the region of Friesland have been well aware of the CE concept and its practical benefits since 2015, and they have been able to identify opportunities for broad cooperation to create new jobs and ensure environmentally sustainable economic growth. Initially, a regional metabolism analysis for Friesland was conducted by Metabolic, and the regional context was mapped, along with the commodity flows and needs of local stakeholders. The presentation of this report marked the birth of the Circular Friesland Association, founded by 25 companies and organisations in a major step towards a circular Friesland. The system thinking approach was adopted for the CE transition in the region, emphasising different segments of society whose needs must be considered throughout the transition – from circular procurement, circular design, integral education on CE, focus on the consumer and changes in behaviour and mentality, to specific measures in specific industrial sectors and circular experts acting as a driving force of the CE.

The focus of the CE strategy in the region of Galicia is primarily R&D solutions for generating scientific and technical knowledge, building capacity, and increasing education and information exposure for all relevant stakeholders. The latter of these is also identified as one of the main challenges, requiring collaboration between different stakeholders and coherence between regional actions in different Spanish regions.

The region of Extremadura, except the main objectives of the CE strategy, provided main governance objectives by stakeholders. For the public sector, the following were identified: initial leadership co-leadership boosting, process development and coordination, resource provision, consensual decision guarantee, governance management, and evaluation coordination. For civil
society and individual citizens, the contribution to needs and problems identification contribution to solution development, knowledge from experience, closeness and proximity boosting, propositions for betterment, and participatory evaluation were cited. The governance objectives for academia were as follows: diagnosis of needs and problems, innovation in solutions, knowledge transfer, and participatory evaluation. Finally, for corporations, the following governance objectives were acknowledged: contribution to the identification of needs and problems, investment in productive activities, project development, experience sharing, propositions for improvement, and participatory evaluation. The primary driving forces of the CE transition were reported as stakeholder involvement and knowledge-sharing, along with the establishment of a monitoring framework to monitor the process. At the same time, the multi-level governance model and broad stakeholder participation were observed as the largest challenges.

The region of Central Macedonia developed its CE strategy as part of the BIOREGIO Interreg project, advocating for a shift from the focus on circular bioeconomy in the Regional Operational Programme of Central Macedonia 2014-2020. This was an attempt to encourage and streamline interventions that promote the transition to a business model built around CE principles. Except the integration of the CE activities in the 2014-2020 programming period, the integration in the next programming period 2021-2027 will be reflected at the regions’ financial priority axes. The final pillar of the strategy is the establishment of the targeted strategic actions of RIS3 in the Central Macedonia region to enforce the CE. The key policy changes in this respect concern the introduction of waste management as a priority, as well as the reuse of waste as an energy form. The need for cooperation with all relevant stakeholders – including research organisations for R&D purposes – was highlighted as a challenge, alongside issues regarding information and knowledge exchange, highlighting the need for a platform or hub to act as a meeting point for various stakeholders.

The overall picture is rich and diverse, even with only seven regions included in the analysis; and this mirrors the multifaceted nature of the CE transition, which is influencing many aspects of our society.
4. CONCLUSIONS AND RECOMMENDATIONS

This report has given an account of the drivers of and barriers to CE implementation encountered at the regional level. A literature review was conducted, including both academic and grey literature, to identify the confronted and perceived drivers and barriers. In addition, regional strategies and action plans were analysed to uncover new drivers and barriers, enrich the literature, and contribute to a more informed policymaking process.

The findings suggest several courses of action for regions that are leading the transition towards a CE, as well as regions that have just begun their journeys. The first implication is that a place-based approach is needed, and regions should identify strategic sectors of existing or potential competitive advantage in which they can innovate, specialise, and create capabilities, thereby distinguishing themselves from other regions. Economic, social, environmental, political, and geographical factors should be considered, alongside the institutional settings and industrial profile of the region. Differences in territorial contexts create different sets of needs and opportunities, which the CE strategies must acknowledge.

A balanced approach to implementation is required. On one hand, top-down efforts are needed to set the general vision and direction, establish the framework conditions, and direct the flow of funds and regulatory mechanisms. On the other hand, bottom-up initiatives that emerge from society itself are equally essential, as these include grassroots movements, the engine of entrepreneurship, green entrepreneurship, and circular business models.

These efforts in both directions must be coordinated, and the silo-mentality must be avoided. For that purpose, a functional and effective multi-level governance mechanism should be put in place, enabling effective channels of communication, implementation, and reporting – both vertically (e.g., from local governments, through regional, national, and international governments, and vice versa) and horizontally (e.g., regional governments within a country).

The creation of so-called ‘circular hubs’ or multi-stakeholder platforms for communication and knowledge transfer would contribute to the acceleration of the transition, bringing together actors from the government, industry, academia, and society. These initiatives can be established nationally or internationally, and they can have different forms (virtual versus physical), with different responsibilities and power given by the state according to the needs of the project.

Participation in cross-disciplinary international projects (such as the Interreg projects) also contributes to sharing of best practices, solutions, and policy learning, with the ultimate goal of helping regional and local governments to develop and deliver better policy.

Finally, the creation of the regional CE strategies as ‘living strategies’, with a reasonable revision mechanism to account for the latest developments and adjust the policy and its instruments of implementation accordingly is also recommended. This, in turn, will require a monitoring mechanism in place to track the progress towards a more circular economy, having AN integrated and sustainable impact on people and places.
BIBLIOGRAPHY


Brussels Regional Program for a Circular Economy 2016 – 2020 (BRPCE). Available at: https://www.circulareconomy.brussels/a-propos/le-prec/?lang=en


Circulair Fryslân: De Economie Van De Toekomst (2015). Available at: https://www.metabolic.nl/projects/circular-friesland/

Circular Friesland. Available at: https://circulairfriesland.frl/en/circular-economy/


Division of Powers. Available at: https://portal.cor.europa.eu/divisionpowers/Pages/default.aspx


ECa (2020), Impact of Shift to Circular Economy, European Commission


Estratègia d'Impuls a l'economia verda i a l'economia circular (2015). Available at: http://mediambient.gencat.cat/ca/05_ambits_dactuacio/empresa_i_produccio_sostenible/economia_verda/impuls_economia_verda/


Lakatos, E.S., Dan, V., Cioca, L.I., Bacali, L., Ciobanu, A.M., (2016), How supportive are Romanian consumers of the circular economy concept: a survey. Sustainability 8 (8), 789.


Matsunaga, K. and N. Themelis (2002), Effects of affluence and population density on waste generation and disposal of municipal solid wastes. Available at:


OECD Regional Well-Being. Available at: https://www.oecdregionalwellbeing.org/


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**ANNEX A: NUTS Classification**

This Annex is provided as an individual file, due to its size and format (Excel file).