

# REGIONAL STRATEGY FOR TRANSITION TO CIRCULAR BIOECONOMY

**PODRAVJE 2023 - 2030**

PODRAVJE REGION - SLOVENIA

## Colophon

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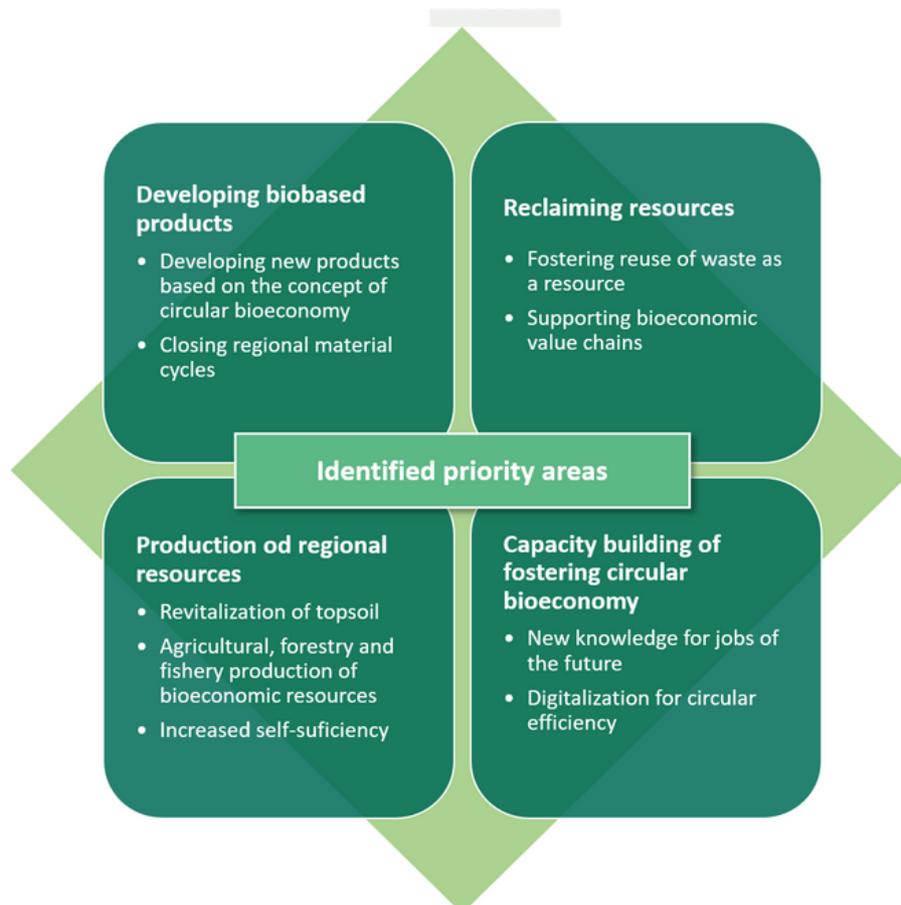
# Executive Summary

In 2022, the Podravje region has become part of the Circular Cities and Regions Initiative and was selected as one of the 12 CCRI Pilots in the CCRI initiative. The region set the goal to prepare the circular bioeconomy strategy and set up the system for circular bioeconomy implementation at regional scale based on developed strategy.

The circular bioeconomy strategy is the key document describing the available regional resources and connecting them with suitable Circular Systemic Solutions (CSSs)<sup>1</sup>.

For the purpose of this strategy, two rounds of consultations with regional stakeholders were organised and 9 key circular systemic solutions have been identified as the key activities within 4 priority areas, to achieve the transition to Circular Bioeconomy in Podravje Region by 2030.

This strategy was presented to the highest body of regional decision-making, the Council of Podravje region, on December 11th, 2023 and the council passed a vote supporting the strategy and its following activities (preparation of action plan).



<sup>1</sup> Definition of CSS: According to the Circular Cities and Regions Initiative (CCRI), a circular systemic solution (CSS) is a demonstration project that aims to deploy a circular and climate-neutral economy at an urban or regional scale. These solutions go beyond individual initiatives and instead focus on addressing the root causes of resource inefficiency and waste generation.

Circular systematic solutions portfolio					
CSS	Description	TRL/Target	Territory	Stakeholders	Financial effort
<b>Closing regional material cycles</b>	Designing joined services (industrial symbiosis), where stakeholders optimise the processes of treatment and reuse of byproducts.	Creation of regional thematic green deals	Region	Municipalities, Public and private companies, and agriculture	**
<b>Circular greenhouse and indoor farming</b>	Greenhouse farming deployment on CE principles and revitalization of available unused large indoor areas, which would be suitable for food production.	8	Localised	Agriculture, Energy providers	*****
<b>Use of sediments in river and lake reservoirs in the region</b>	Sediments from hydropower accumulations and other lakes to be used in construction and agriculture.	8	Localised	Hydro power operators, Municipalities, Research institutions, Construction and agricultural sector	****
<b>Utilization of existing renewable energy sources in the region</b>	Waste heat and geothermal heat sources in Podravje showed high potential utilisation in agriculture (intensive greenhouse farming).	8	Localised	Hydro power plants, Industry, Municipalities, Farmers	*****
<b>Re-use of water and sludge from wastewater treatment plants</b>	Thermal processing of sludge and slurry for phosphorus and energy production, purification of treated wastewater to be used as industrial water (cleaning machinery, cooling processes) or farming (watering plants, animals drinking water).	8	Localised	Wastewater treatment plants, Industry, Research institutions, Agriculture	****
<b>Processing and circular use of communal and industrial bio waste</b>	Increasing the capacity for processing biowaste and processing it into circular fertilizer for topsoil regeneration and potential new products (bio-packaging etc.)	3 demo projects TLR 6-8	Localised	Regional SMEs and industry, Waste management utilities, Research institutions, Agriculture	***
<b>Circular use of low-quality wooden biomass</b>	Collecting low-quality wooden biomass from woods, management of riverbanks and green spaces, floating wood and processing it through pyrolysis for its use at topsoil regeneration and for bio-packaging.	2 demo projects TLR 6-8	Region	Forestry service, Green spaces and riverbank management companies, Hydropower operator, Waste management utilities	***
<b>Regional data collection as base for CSS</b>	A regional data for circular bioeconomy (water, wastewater, waste, remains of production, etc.) will be collected and linked to the regional policy lab.	8	Region	Research organisations, Municipal and national administration, utility services.	**
<b>Assessing circular potential of individual specific material flows</b>	Enhanced use of byproducts from different activities (agriculture, food production etc.) for circular biobased products.	6	Region		***
<b>Regional platform for bioeconomy</b>	Organisation of regular platform meetings (e.g. conferences) for exchange of good practices and new knowledge.	1 event / year	Region	Research institutions, Municipal administration, utility services	**
<b>Competency building</b>	Preparation of learning programmes for fostering circular bioeconomy	1 programme developed	Region	Regional VET providers, Academia	**
<b>Awareness raising</b>	Press releases containing information on circular bioeconomy sent to regional media.	2 press releases /year	Region	Regional media, general public	*

# 1 Introduction

The basic idea of the regional Transition to Circular Bioeconomy is to establish a regional model for a wholistic managing of all available resources within the Region.

The model is based on the cooperation of different stakeholders who represent each group included in the Quintuple Helix approach (academia, business, government, civil society, and environment).

The main focus is predominantly on the publicly owned companies, because they are already involved in relevant areas in which they provide public services to the general population, while respecting the legislation and preserving the natural habitats.

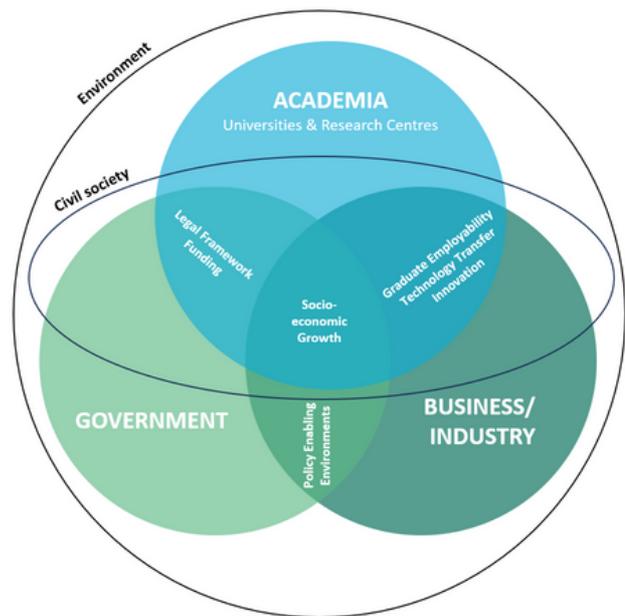


Image 1: Quintuple Helix system

Source: <https://www.paeradigms.org/post/education-for-sustainable-development>

Further close cooperation between public utilities, citizens, industry and local government is crucial to create a successful ecosystem that optimises resources and outcomes - economic, environmental and social. This is a long-term project that ensures development-oriented efficient management of resource flows in local and regional environment.

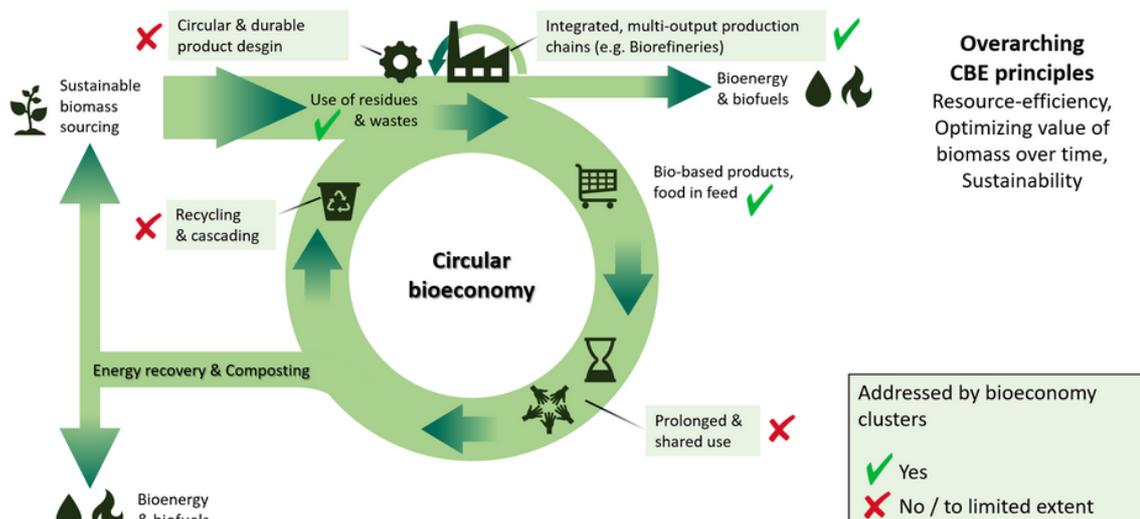


Image 2: Circular Bioeconomy

Source: <https://ars.els-cdn.com/content/image/1-s2.0-S2590289X1930026X-ga1.jpg>

# 2 About the region

The region of Podravje is one of 12 Slovenian statistical regions (NUTS3 = SKTE3) that were created in 2000 for the legal and statistical purposes.

The territorial distribution of the regions is based on the model from 1970s, where gravitational zones were defined for the purpose of regional planning, but it was only in the year 2000 that the government of Slovenia passed the Decree on Standard Classification of Territorial Units, with NUTS3 regions corresponding to statistical regions.

According to the Promotion of Balanced Regional Development Act from 2011 the decision-making bodies for Podravje were established:

- Council of Podravje Region;
- Development Council of the Podravje region;
- Regional Development Network.

## 2.1 Region in numbers

The statistical region of Podravje covers the area of 2.170 km<sup>2</sup> (10,7% of Slovenian territory) and has 327.577 people (15,55% of Slovenian population), with the population density of 151 (145% of the national average). It is the fifth largest and the second most populated region.

It consists of 41 municipalities, which are independent local level self-governing bodies, with their general tasks and obligations defined in the Local Self-Government Act. Most municipal tasks fall into the areas of public administration which include **spatial planning** and **local public services for environmental protection**.

The region has a lot of potential for agriculture, however it is not homogenous, with the size of territory, population and density, as well as land use being varied. In total 794,9 km<sup>2</sup> (36,63%) of the regional territory is used as agricultural land, with up to 69% designated for farming.



Image 3: Region of Slovenia

# 2.2 Regional bioeconomy resources

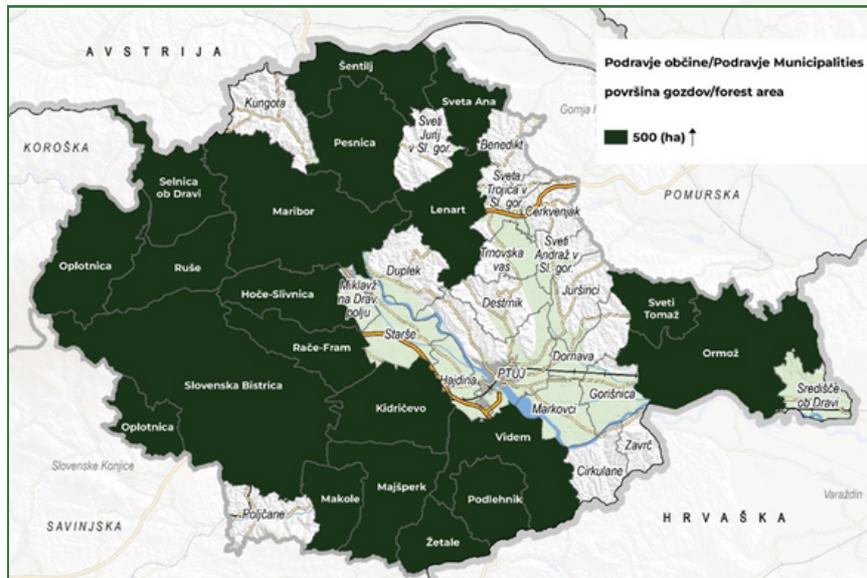


Image 4: Forest area

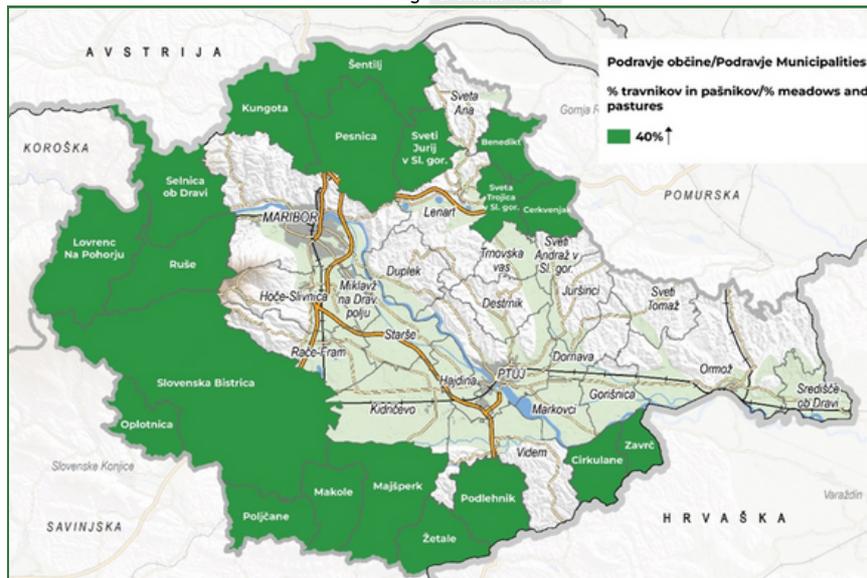


Image 5: Meadows and pastures

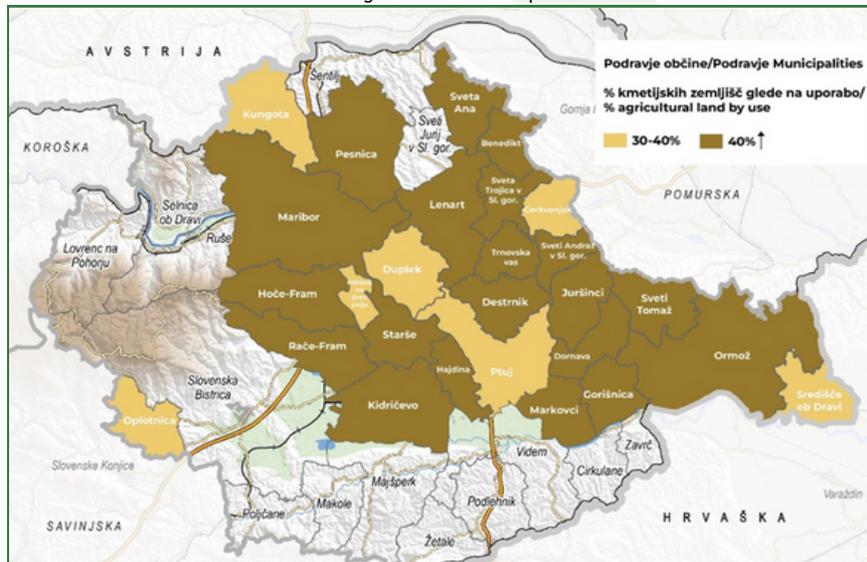


Image 6: Agricultural land

Keeping this diversity in mind, it is not strange that the region has various levels of land use, including forests, meadows and agricultural land.

According to the Regional Innovation Scoreboard 2023<sup>2</sup> (Regional profiles Slovenia) the eastern part of Slovenia (with Podravje) has the innovation index of 84,9, which places it as a moderate innovator, lagging behind the national average of 95,1, but most importantly, behind Western Slovenia, which is a strong innovator, with RRI of 105,4. This is closely linked to investments and employment in the research and innovation sector (Image 7).

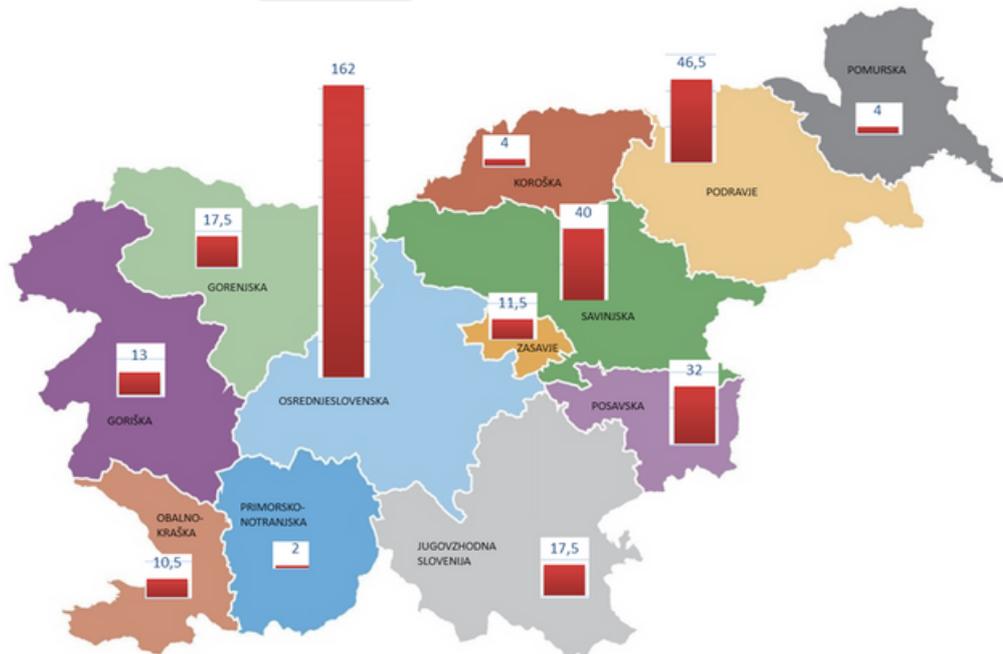


Image 7: Investments in environment

The region also presents a combination of urban and rural areas. Combining a lower innovation index with low investments for “non-specific investments” (as classified by Slovenian Statistic Office) in nature preservation, it is obvious the region is **underdeveloped**, **underfinanced** and thus **underperforming**. This is also obvious from the Sustainable Development Goal Mapper (SDG Mapper: <https://knowsdgs.jrc.ec.europa.eu/sdgmapper>), where the region is performing rather well when it comes to the strategic level (SDG10 - reduction of inequality; SDG12 - sustainable production; SDG16 - institutions, peace & justice), however there is a low impact on industry (SDG9 - industry, innovation & infrastructure).

Therefore, there is some doubt about successful implementation of various strategies in practice, especially since innovation is the main driver of transition.

<sup>2</sup> [https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/regional-innovation-scoreboard\\_en](https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/regional-innovation-scoreboard_en)

## 2.3 Regional challenges

Following the regional overview, the most pressing identified issue is **the lack of networks and support structures** which need to **enhance the regional innovation system and foster regional development towards sustainability**. According to the Slovenian Smart Specialization Strategy, there is a **lack of knowledge-intensive activity** in the region, as well as the **lack of big companies, development networks and clusters**, which all results in the **lack of critical mass**. This in fact causes brain-drain which counteracts many potential benefits the region could have by having the University of Maribor attracting students to the region.

The region is also facing **fragmentation**, due to lack of systemic cooperation between the municipalities. The **administrative fragmentation among municipalities negatively effects the implementation of regional strategic documents**. The fragmentation is also carried over into the institutional fragmentation (e.g. Chambers of Crafts and Small Business), with sectoral localized branches covering sporadically dispersed areas and fragmenting the resources.

Apart from the identified systematic difficulties which the business support ecosystem is noticing, the regional population also feels these negative effects of fragmentation. This is evident in the analysis of housing conditions which showed that 18% (national average 15%) of households experiences problems of proportion of households that have problems with pollution, grime or other environmental problems caused by traffic or industry.<sup>3</sup>

<sup>3</sup> <https://www.stat.si/statweb/File/DocSysFile/8108> (Methodological explanations of Living Conditions; Republic of Slovenia Statistical Office).

The following challenges are hindering the transition to a Circular Bioeconomy in Podravje-Maribor:

- In terms of economic activity, the region is below average, as its GDP per capita is only 82% of an average Slovenian GDP, placing Podravje the 8th place (out of 12) within Slovenian's regions<sup>4</sup>.
- The Podravje region is considered an underdeveloped region according to the Development Threat Index (Slovenia, 2019) - on the 10th place out of 12.
- Low investments in fixed assets. Gross fixed capital formation relative to regional GDP has been the lowest among Slovenian regions for many years.
- Compared to other regions and the Slovenian average, the share of funds for research and development is also low, with Podravje region being 6th (out of 12) regions according to the amount of EUR devoted to Research and Development<sup>5</sup>.
- Lack of jobs in the market, with additional migration (daily and permanent) of skilled workers, with over 18% of work active population employed outside the region<sup>6</sup>.
- High unemployment (especially among young people) and accelerated aging population, with Podravje being the region with 3rd highest unemployment rate (out of 12 Slovenian regions)<sup>7</sup>.
- Lack of political support and a systemic approach to CE in the region to develop encompassing regional CE policies, regulation and funding schemes.

More specifically, the following challenges to circular bioeconomy transition, which directly influence the design and implementation of the Circular Systemic Solutions (CSSs), are present:

- Low local self-sufficiency level (especially in the field of fruits and vegetables).
- Lack of knowledge of natural resource potential in the region and how it could be used.
- Poor state/quality of agricultural soil due to the intensive farming including the use of artificial fertilizers, pesticides etc. on the agricultural land in the past. Due to this, several locations in the region (in Ptuj) have to deal with the issue of ground water contamination on a regular basis.
- Poor management of organic waste, mainly wastewater treatment sludge, but also lower quality wooden biomass and waste from agriculture.
- Poor waste-heat utilisation (industry, hydropower, organic materials).
- Pressing challenge of water sediments management (hydropower accumulations, lakes and water reservoirs).
- Lack of awareness and knowledge about CE in general and circular bioeconomy more specifically across stakeholder groups (incl. public sector, private sector and among citizens).
- Lack of knowledge on how to set up financial instruments to support the implementation of circular actions and activities on the ground.
- Lack of knowledge about Green Public Procurement and how it can be used by public sector to promote circular products and services in general and in the bioeconomy sector specifically.

<sup>4</sup> <https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/0309250S.px/table/tableViewLayout2/> (SURS)

<sup>5</sup> <https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/2364245S.px/table/tableViewLayout2/> (SURS)

<sup>6</sup> <https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/0723405S.px/table/tableViewLayout2/> (SURS)

<sup>7</sup> <https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/0762115S.px> (SURS)

## 2.4 Regional resources

Considering the challenges outlined above, the objectives of Podravje-Maribor is to set up a regional programme for circular bioeconomy targeting 41 municipalities. This includes:

- Development of a regional strategy for circular bioeconomy to set up a policy framework.
- Development of an action plan - a list of concrete projects reflecting the priority areas of the region in relation to bioeconomy. Each concrete project will focus on implementing a specific CSS aiming to overcome one or several challenges mentioned above.
- Development of support mechanisms to enable implementation (incl. setting up funding schemes and developing an awareness raising campaign).

The main goal of the Podravje region is to support the development of climate resilient and circular regional bioeconomy through the utilisation of endogenous regional bio-economy potentials and to initiate the formation of value-chains derived from available bio-degradable materials.

### 2.4.1 Agricultural land and irrigation (including residues)

The total area of farmland in Podravje is 80.648ha, which represents 37,2% of regional territory. Only 2.416ha is ready for irrigation (36,74% of all Slovenian farmland ready for irrigation). Before 2020, the area of irrigated land has been about 1/3 of the currently irrigated farmland. Although the area for irrigation has increased between 2017 and 2021, the quantity of water for irrigation has stayed the same. In the Podravje region, the irrigated area still represents only 2/3 of the total farmland area prepared for irrigation.

Table 1: Area of irrigated farmland and water (by source) used for irrigation in 2017 and 2021

	2017	2021
<b>Actual area of farmland for irrigation (ha)</b>	504	1.597
<b>Quantity of water used for irrigation (1.000m<sup>3</sup>)</b>	287	289
<b>Underground water (1.000m<sup>3</sup>)</b>	32	29
<b>Surface flowing water (1.000m<sup>3</sup>)</b>	82	115
<b>Surface still water (lakes, accumulations, water supply system) (1.000m<sup>3</sup>)</b>	174	145

<https://pxweb.stat.si/SiStat/>

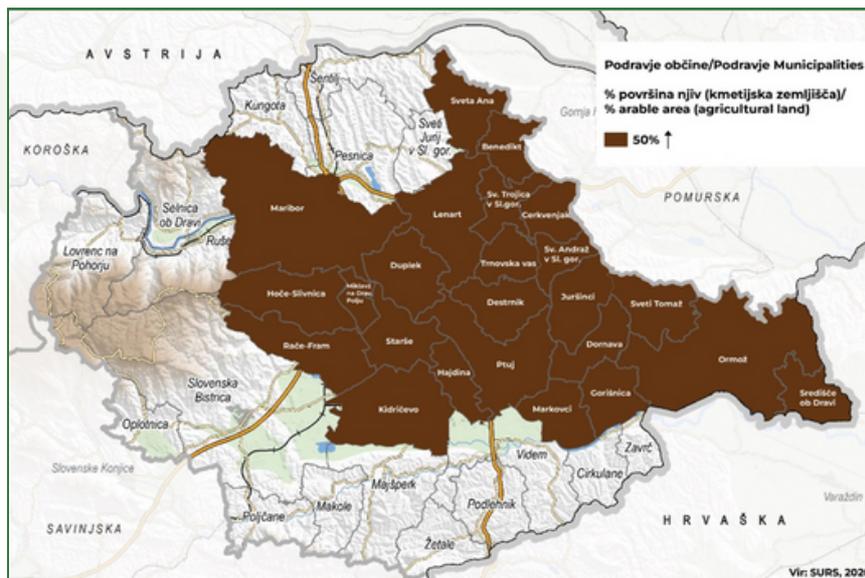


Image 8: Arable land in Podravje

Podravje is predominantly agricultural region with more than 70% of territory devoted to agricultural activities consisting mostly of crop farming and cattle for meat and dairy product. As most of the region is a flatland, the majority of farmlands are under intensive grain growing, which in combination with strong winds and droughts caused by climate change has caused deterioration of the soil quality in the past several decades.

## 2.4.2 Water and wastewater (including sediments)

The region of Podravje has a higher share of treated sewage - in 2022 **81,4% of wastewater from sewage is treated** compared to the national average of 69,1%. However, in comparison to the data from 2019 the situation is deteriorating, as there was 90,2% of wastewater treated in Podravje, while there was only 68,5% treated nationally on average.

Considering the source of pollution of water, 43% of all wastewaters originates from households.

Based on these data we can conclude that there is a high percentage of water, which could be reused, however the national statistics show that almost all the water used by industry is fresh technological water, with less than 1% of water in recirculation or reuse.

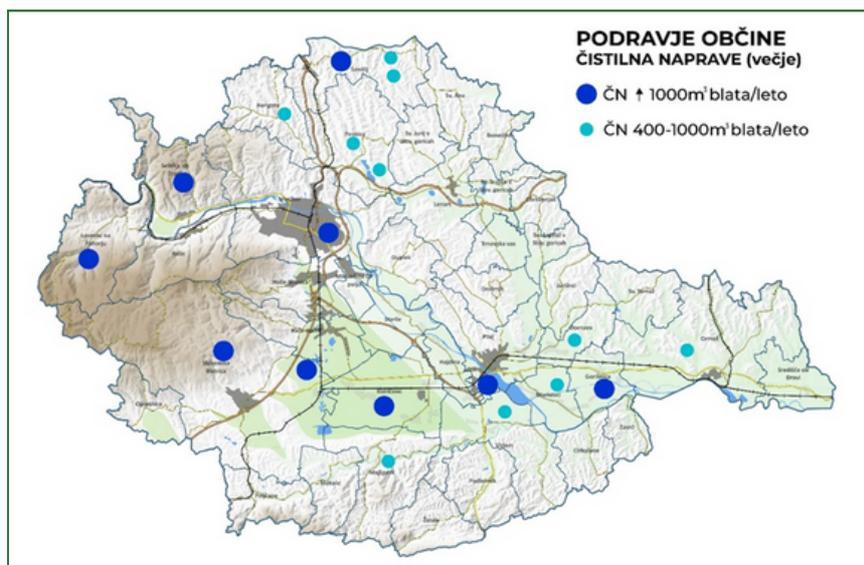


Image 9: Larger wastewater treatment plants of Podravje

Another challenge is river sediments, piling up in hydroaccumulation lakes and other water bodies of the region. Only from hydropower accumulations around 50.000 m<sup>3</sup> should be removed yearly to maintain the normal operation of hydropower plants. Sediments are consisted of clay and organic substances which could be utilized in agriculture and construction sector.

## 2.4.3 Waste / biowaste

Podravje region is just below the national average when it comes to production of municipal waste<sup>8</sup>(kg/person), with 508 kg/person of waste annually (the national average is 518). However, looking at various municipalities, it is obvious that there is a huge (over 5x) difference between them: the largest waste producer is the municipality that generates 992 kg/person/year while the lowest waste producer is the municipality that generates 186 kg/person/year. Further problem is the use of biowaste, which is a resource that the region has not tapped into yet. At the same time, the region has a diminished quality of topsoil quality. The biowaste could be used as a resource for improving the soil quality, thus raising the potential for achieving self-sufficient production of certain key food sources.

<sup>8</sup> Municipal waste is waste from households and similar waste from trading, manufacturing, business services and other activities and also from the public sector.

## 2.4.4 Regional biomass

With 39,1% of the regional territory (84.739ha) covered with forests, of which 73,3% are in private ownership<sup>9</sup> and 37,2% of regional territory (80.648ha) of agricultural land, the region has a very high potential for production of biomass from biowaste as byproduct of forestry and agricultural activity.

With upkeep of the waterways of the major river Drava and its tributaries also generating (mostly low quality) biowaste, and the biowaste produced through upkeep of green areas (non-forest or farmland) such as parks, or green elements in residential areas, the regional biomass of various quality represents a substantial regional resource.

## 2.4.5 Prospects

With the needs and challenges the region is facing, the Circular Bioeconomy presents an opportunity, as it can become a generating force to start creating the critical mass and avoiding institutional fragmentation (as mentioned in Regional Challenges). The Circular Bioeconomy has a clear potential for closing material cycles within the region and support in overcoming the institutional and administrative fragmentation within the Podravje. The use of local materials will support local economy and boost the regional economic growth while at the same time overcome the fragmentation because it will connect stakeholders from various municipalities to cooperate.

There is a need for a systemic solution in four major areas:

- Bioeconomic production
- Reclaiming resources
- Production of regional resources, and
- Capacity building for fostering circular bioeconomy.

<sup>9</sup> [http://www.zgs.si/delovna\\_podrocja/lesna\\_biomasa/potenciali\\_po\\_obcinah/index.html](http://www.zgs.si/delovna_podrocja/lesna_biomasa/potenciali_po_obcinah/index.html)

# 3 Transition to a Circular Bioeconomy

In the last 50 years, the biosphere upon which humanity depends has been altered to an unparalleled degree. The current linear economic model, which relies on fossil resources and is addicted to “growth at all costs”, is putting at risk not only life on our planet, but also the world’s economy. A circular bioeconomy offers a conceptual framework for using renewable natural capital to holistically transform and manage our land, food, health, and industrial systems as well as our cities.

In simpler words, **the transition to circular bioeconomy will enable the highest possible quality of life, with lowest possible drainage of the natural resources.**

In addition, to major potentials circular economy hold for the environment, it also presents a great potential for improvement of competitiveness of enterprises, both in the regional (Podravje) and national (Slovenia) contexts, as well as within the European context.

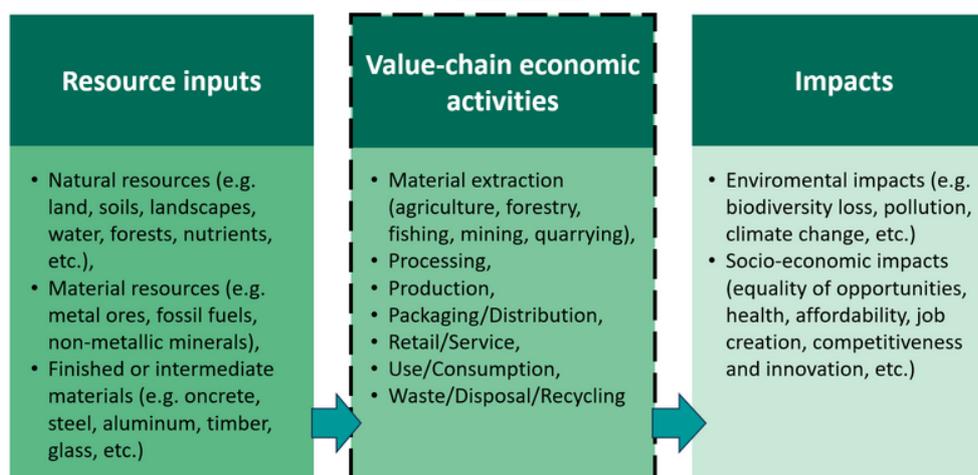


Image 10: Economic activities of production and consumption in relation to natural resources and environmental and socio-economic impacts

## 3.1 Designing Circular Bioeconomy

A circular bioeconomy relies on healthy, biodiverse and resilient ecosystems. It aims to provide sustainable wellbeing through the provision of ecosystem services and the sustainable management of biological resources (plants, animals, micro-organisms and derived biomass, including organic waste). These are transformed in a circular manner into food, feed, energy and biomaterials - within the ecological boundaries of the ecosystems that it relies on.<sup>10</sup>

<sup>10</sup> [http://www.zgs.si/delovna\\_podrocja/lesna\\_biomasa/potenciali\\_po\\_obcinah/index.html](http://www.zgs.si/delovna_podrocja/lesna_biomasa/potenciali_po_obcinah/index.html)

# CIRCULAR BIOECONOMY OF WELLBEING

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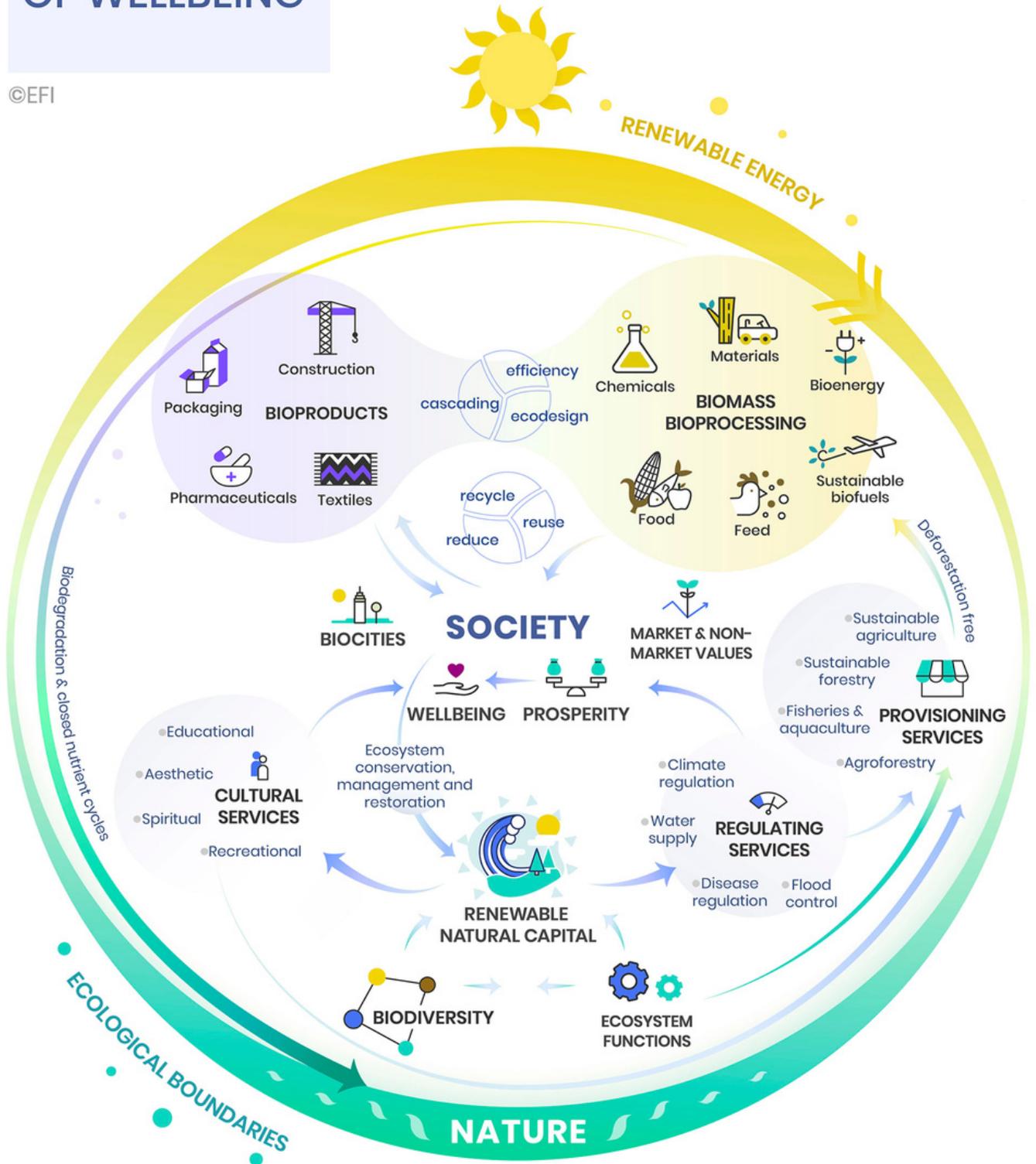


Image 11: Circular Bioeconomy of Wellbeing

<https://www.researchgate.net/publication/342333586/figure/fig1/AS:904474986041345@1592655049805/Flows-in-the-circular-bioeconomy-of-wellbeing-Source-European-Forest-Institute-The.pptm>

## 3.1.1 Circular Systemic Solution (CSS)

The concept of Circular Systemic Solution (CSS) was firstly introduced in the European Green Deal programme as: ‘a cross-sectoral demonstration project for the territorial deployment of a circular and climate-neutral economy,’ which involves ‘several relevant actors’ and is ‘linked to a geographically cohesive territory.’

Being the main objective of the CCRI to support and help cities and regions to implement their respective CSSs, the CSO has further elaborated the CSS concept by providing the following notions that a CSS should take into account different territorial stakeholders to allow for collaboration throughout value-chains.

A CSS should consider several territorial stakeholders such as:

- public administrations and utilities;
- private sector services and industries, including SMEs;
- scientific and innovating communities;
- financial intermediaries;
- and civil society, including citizens and non-governmental organisations and philanthropy.

It is crucial that a critical mass of actors, including decision makers on multiple levels is engaged in each territory and adapted to the needs to implement a CSS (in cities, regions and territorial clusters). This is the grounds for creation of new and sustainable circular value chains based on local/regional bioeconomy. Hence the CSS have the potential to address and provide answers to major challenges beyond just resource management and recovery of waste and water.

To achieve Circular Bioeconomy in the Podravje region, a ten-step approach broken into three main phases was selected:

- Mapping of the region and its potentials,
- Designing measures for circular solutions and projects,
- Implementation of measures fostering circular bioeconomy.

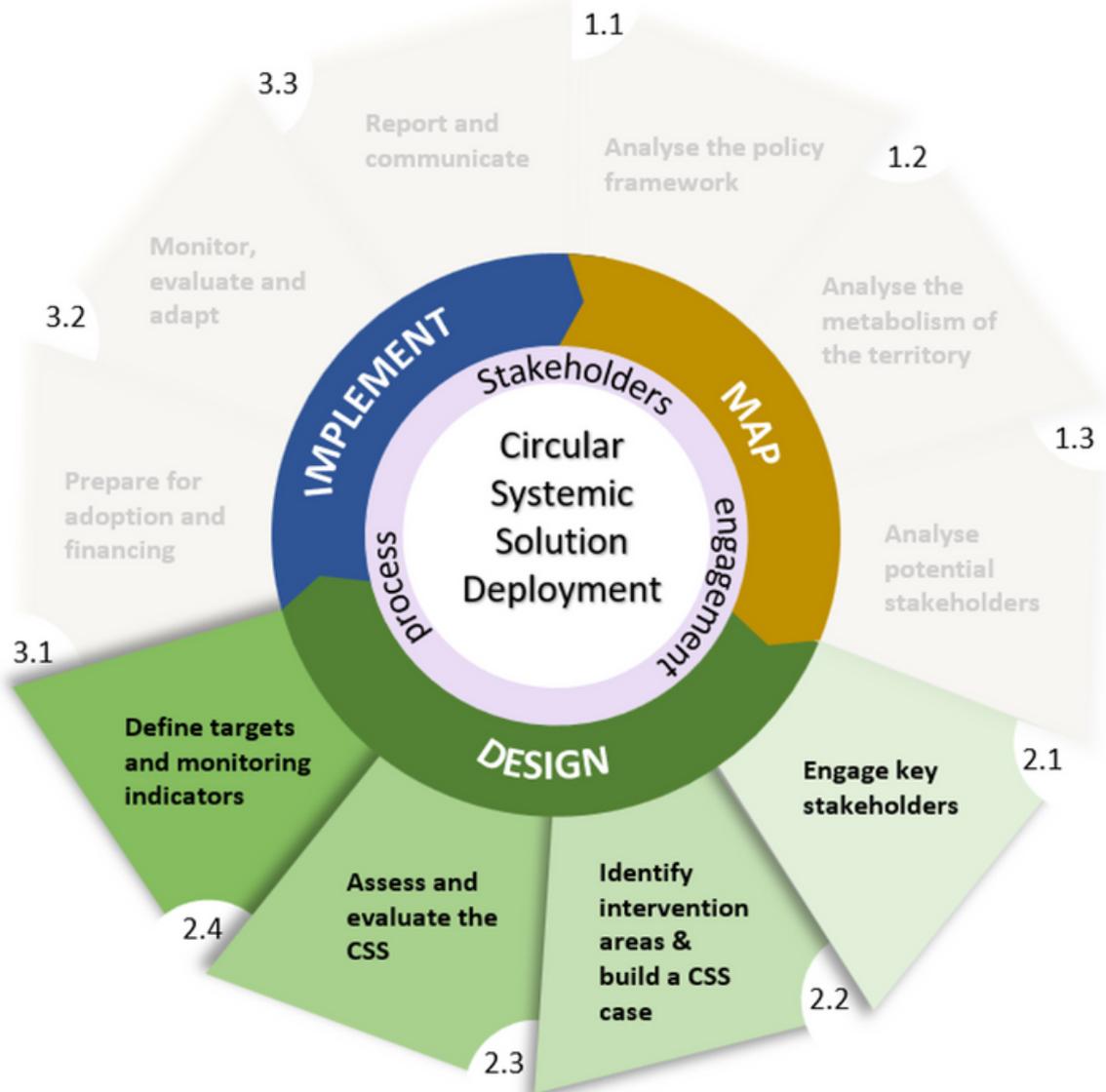


Image 12: Circular Systemic Solution Deployment

The preparation of the strategy is the second of the three steps of Deployment of Circular Systemic Solution.

## 3.2 Enabling transition

In a circular economy materials and products are recirculated, their value is fully utilised, and wastage is minimised. Buildings and products are designed for reuse, repair, and recycling instead of for being discarded. It is easy to share and get access to products and services without owning them. All in all, a more circular approach in our production and consumption can ease the pressure on our natural resources and improve the environment for the benefit of future generations. A circular approach may open up for an accelerated transition to new business models aimed at a rapidly growing global market for green technologies and services. In order for this to happen a strategic approach is needed.

### 3.2.1 EU and global context

The strategy at hand is built on a wider transnational concept of circular economy, and it is in line with the following EU level documents:

- European Union Green Deal;
- Bioeconomy strategy;
- New Circular Economy Action Plan (2020).

The key EU proposals about environment sustainability however are covered in the European Green deal and its four most rudimentary set goals (Image 13).



Image 13: Set goals of EU Green Deal

At the same time the strategy at hand is fully in line with the UN goals for sustainable development.



Image 14: Sustainable development goals of the United Nations

Out of 17. UN goals, the ones most relevant within the scope of this strategy are:



## 3.2.2 National context

The Slovenian Development Strategy 2030<sup>11</sup> represents the state’s core development framework as set out in the Chapter 2 of the strategy - Vision of Slovenia, and a review of the current situation and global trends and challenges.

Slovenia is foremost well aware that it is strongly dependent on its ability to respond and adapt to global trends and challenges, which include demographic challenges, pressure on the ecosystem and competition for global resources.

As a result, Slovenia has set the Slovenian development planning model (as shown in Image 15).

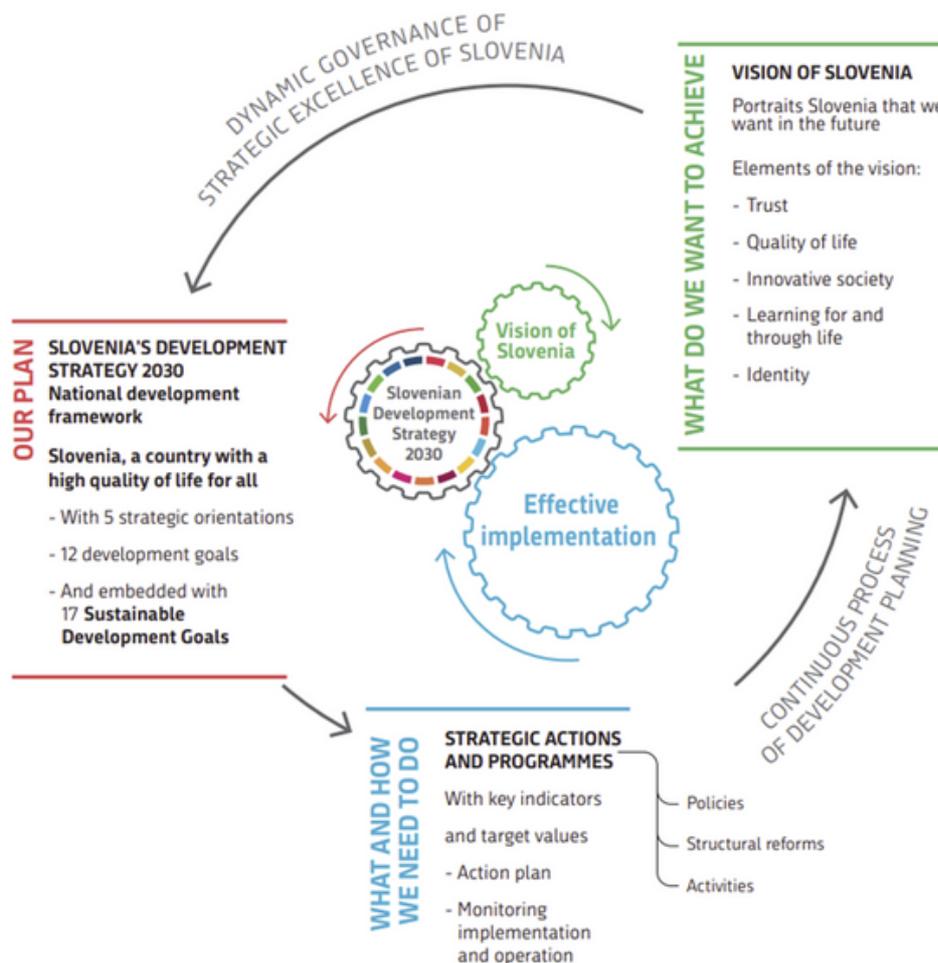


Image 15: Slovenian development planning model (Slovenian Development Strategy 2030)

<sup>11</sup> <https://www.gov.si/assets/ministrstva/MKRR/Strategija-razvoja-Slovenije-2030/Slovenian-Development-Strategy-2030.pdf>

The primary objective of the Slovenian Development Strategy 2030 is to provide a high quality of life for all. This can be achieved through balanced economic, social and environmental development which takes account of the planet’s limitations and creates conditions and opportunities for present and future generations.

Looking at Image 16 (below) we can see how different development goals link with strategic orientations. It can also be observed that each of the 12 goals of the national strategy include at least one strategic sustainable development goals as set by the UN.

In respect to the Circular Bioeconomy, the two most important goals, however, are the **Low-carbon circular economy** and **Sustainable natural resource management**.

A high quality of life for all	Inclusive, healthy, safe and responsible society	Highly productive economy that creates added value for all	Learning for and through life	Well-preserved natural environment	High level of cooperation, competence and governance efficiency
Goal 1: Healthy and active life	●		●	●	
Goal 2: Knowledge and skills for a high quality of life and work	●	●	●		
Goal 3: Decent life for all	●				●
Goal 4: Culture and language as main factors of national identity	●		●		
Goal 5: Economic stability		●			●
Goal 6: Competitive and socially responsible entrepreneurial and research sector		●	●		●
Goal 7: Inclusive labour market and high-quality jobs	●	●	●		
Goal 8: Low-carbon circular economy	●	●	●	●	
Goal 9: Sustainable natural resource management	●	●		●	
Goal 10: Trustworthy legal system	●	●			●
Goal 11: Safe and globally responsible Slovenia	●	●		●	●
Goal 12: Effective governance and high-quality public service		●	●		●

Image 16: Linking of development goals and strategic orientations (Slovenian Development Strategy 2030)

However, even though the Strategy itself mentions that the *insufficient implementation of strategic documents indicates a need for changes to the management and harmonisation of internal policies, and to the monitoring of their implementation and the achieving of the goals*. It is exactly this lack of multilevel cooperation that is hindering the development of the Podravje region. This is one of the key issues that the strategy at hand needs to address.

### 3.2.3 Regional context

Within the region of Podravje the first strategy for circular economy was prepared back in 2018: Strategy for the transition to circular economy in the Municipality of Maribor<sup>12</sup> (May 2018). It is also the first circular economy strategy on a city level in the broader territory of the Southeast EU.

The region will follow the lead of the regional capital (Maribor) through the strategy at hand, adopted by the regional council. This way many initiatives the region is involved in, such as EU funded projects, will become part of a systemic and systematic approach to the transition to a circular bioeconomy.

## 3.3 Regional Stakeholders

In the process of the preparation of this strategy, the key regional stakeholders were identified. These stakeholders are presented in Table 2 below.

<sup>12</sup> [https://circulareconomy.europa.eu/platform/sites/default/files/strategy\\_wcycle\\_final.pdf](https://circulareconomy.europa.eu/platform/sites/default/files/strategy_wcycle_final.pdf)

Table 2: Key regional stakeholders for implementation of circular bioeconomy in Podravje

Type of stakeholder	Name of stakeholder	Role of stakeholder
<b>Regional authority</b>	Regional Council of Podravje	Key decision making body on the level of the Podravje region, consisting of mayors of all 41 municipalities of Podravje region
	Development Council of Podravje Region	Consisting of 28 members from local self-governments, industry representatives, NGOs and development programmes it is the key stakeholder coordinating developmental initiatives and interests in the region.
	Regional Development Agency for Podravje - Maribor	Key provider of service for municipalities in the field of regional development, networking, attracting investors, smart specialisation, and coordinator of CCRI, fostering transition to Circular Bioeconomy.
<b>Territorial authorities</b>	Development agencies covering several municipalities	Development agencies covering specific territories within the region (ZRC Bistra, RASG, JARA, RIC Slovenska Bistrica).
<b>Local authority</b>	41 municipalities of Podravje	Local self-government responsible for spatial planning and local public services for environmental protection.
<b>Research institute</b>	E-Institute	Expert research institution, co-coordinator and expert partner in the CCRI project.
	University of Maribor	Key regional scientific institution, disseminating and enriching knowledge, developing, testing, and implementing new study methods.
	Agricultural Institute of Slovenia	Key national research organisation in the field of agriculture, landowner, laboratory testing of quality and safety of agricultural products.
	Private colleges and research institutions	Private colleges and other providers of tertiary education in the region (Academia, Doba, Alma Mater, etc.).
<b>Knowledge providers</b>	Chamber of Agriculture and Forestry of Slovenia	Umbrella interest organization of natural and legal persons in the Republic of Slovenia engaged in agriculture, forestry and fishery (local branches in Maribor and Ptuj).
	Vocational school offering agricultural and/or environment protection	There are established knowledge providers (vocational schools and others) which cover the key topics involving agriculture and/or environment protection (Biotehniška šola Maribor, Izobraževalni center Piramida Maribor, Lesarska šola Maribor, Šolski center Ptuj).
<b>Utility Service</b>	Javni holding Maribor	A holding connecting companies providing public utility services for the City of Maribor (such as water supply, waste management, sewage and wastewater treatment).
	Public Utility Company Ptuj	Waste collection and treatment, also provider of heating.
	Ptuj municipal utility company	Landfill infrastructure owner and operator, operator of wastewater treatment plant.
	Komunala Slovenska Bistrica	Landfill infrastructure owner and operator, operator of wastewater treatment plant.
	Saubermacher	Provider of complete solution to waste treatment.
	Komunalno podjetje Ormož	Provider of municipal solutions in three municipalities.
<b>Business support network</b>	Chamber of Commerce and Industry of Štajerska	Key stakeholder connecting regional businesses and owner of Strategic Research and Innovation Partnership of Networks for transition to circular economy.
	Chambers of Craft and Small Businesses	In Podravje there are 7 active Chambers of Craft and Small Businesses, representing interests and performing services for their members (small businesses).
<b>Industry</b>	Drava Hydropower Maribor	Owner of hydropower plants, river sediments, low-quality biomass.

# 4 Strategy for Circular Bioeconomy

The main purpose for preparing the strategy for the transition to a Circular Bioeconomy in Podravje is to align Regional Development and Economy to the Agenda 2030 of the United Nations, European Green Deal, New Circular Economy Action Plan, and Slovenian Development Strategy which are setting new goals of sustainable development.

The strategy will define how the region will foster the implementation of Circular Systemic Solutions defined in the previous chapter of this document.

## 4.1 Implementation methodology

As the transition to circular bioeconomy is a complex multi-stakeholder process, various stakeholders who are responsible for each of the cornerstones of circular bioeconomy defined in this strategy (see Image 18, Chapter 6: Designing Circular Systemic Solutions), the stakeholders addressing each of the four areas, will form a territorial alliance. This alliance will form a Thematic Green Deal (TGD) and will be dedicated to achieving the objectives further outlined in Section 6 on the level of the Podravje Region.

Each TGD will be an agreement of stakeholders forming a thematic specific cluster, which will contribute to the achieving the general goals of the region. The TGD will form consortia (including legal entities and physical persons) that will apply to the calls set out as the implementing mechanisms of this strategy, according to the developed implementation action plan, and work on implementing the activities outlined in the action plan.

The TGD are expected to be linked based on the geographical and topic related challenges.

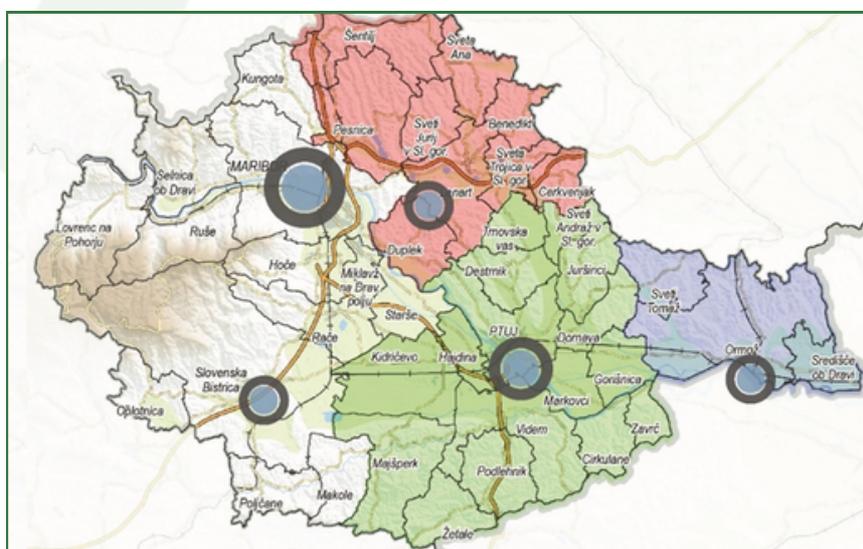


Image 17: Key centres of development in the region (Maribor, Ptuj, Slovenska Bistrica, Ormož, and Lenart)

## 4.1.1 Monitoring

RDA Podravje-Maribor, as the coordinator of the Podravje-Maribor CCRI Pilot, and the E-Institute, as co-coordinator and expert partner in CCRI, are responsible for preparation and monitoring of the strategy for circular bioeconomy, development of the action plan and measures for the implementation and achievement of the strategic goals. They will be responsible for annual reporting on achieving the strategic goals of transition to circular bioeconomy to the Regional Council.

A monitoring board will be set up consisting of the representatives of all 5 groups of the quintuple helix model, managed by the Regional Development Agency for Podravje - Maribor. This monitoring board will monitor the implementation of the policy measures and their achieved impact in accordance with the set indicators as defined within CCRI:

Key Area	Circular bioeconomy state of implementation
<b>Awareness/ Information campaigns /events</b>	Awareness raising campaigns for motivating stakeholders to take up circular bioeconomy measures
	Number of economic operations sensitised on circular bioeconomy
	Citizen involvement
<b>Capacity building</b>	Number of people with increased capacity circular bioeconomy implementation
	Number of decision makers involved in monitoring circular bioeconomy data
	Number of circular bioeconomy businesses offered business support
<b>Regulation</b>	Number of legislative and normative barriers identified and resolved
	Number of legislative and normative incentives created
<b>Funding and taxation</b>	Budget for projects on circular bioeconomy and number of beneficiary companies
<b>Policy</b>	Strategies for waste management
	Roadmap for resource management
	Municipality level strategies on circular bioeconomy
<b>Industrial Symbiosis</b>	Number of pilot demonstration projects
	Number of companies involved in industrial symbiosis
	Investments in symbiosis
	Tonnes of materials recovered and reused
	Annual CO <sub>2</sub> savings
<b>Eco-design</b>	Tonnes of waste / biproducts reused
	Activities to encourage the implementation of eco-design measures

## 4.1.2 Evaluation

Based on the annual monitoring report, the Regional Council will evaluate the implementation of the strategy and achievements of the strategic goals.

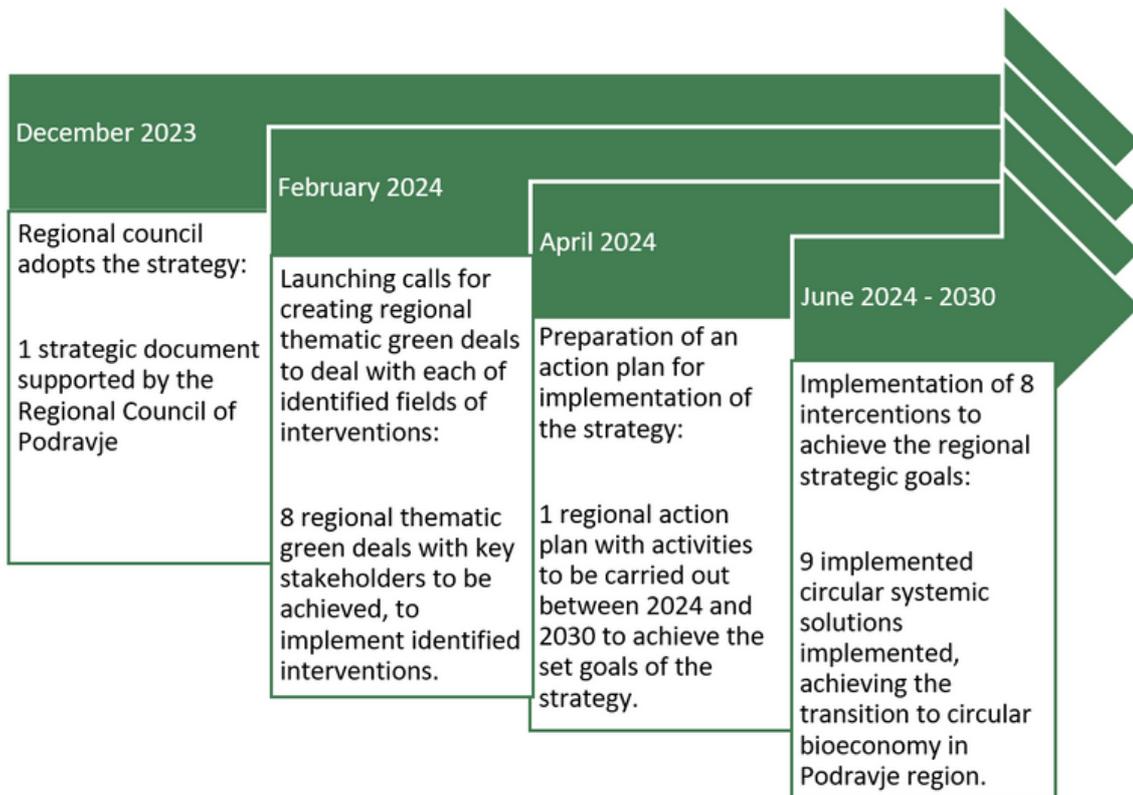
In case of deviation from the set goals in the action plan, the monitoring board will prepare a contingency plan with the CSS cluster which is in charge of implementing the activities to achieve the goals of a certain cornerstone area of the strategy.

## 4.1.3 Reporting

The monitoring board will present annual reports to the Regional Council and the Development council of the region, and will communicate with the interested and general public, presenting the implementation of the strategy and its action plan, along with the impacts the implementation has both on the region and the environment in accordance to the KPIs defined in this Strategy and the following Action plan for implementation of the strategy.

## 4.2 Action plan

The current strategic document provides the analysis of the regional situation, gaps, and opportunities for fostering the transition to circular bioeconomy. Based on the strategy and its support by the regional council, the further steps will be prepared. The following steps will result in the prepared action plan for the implementation of the strategy. The purpose of the action plan is to co-create specific Circular Systemic Solutions and value-chains to the extent that they become investment ready, including supporting financial mechanisms.



# 5 Designing Circular Systemic Solutions

Based on the analysis and consultations with key stakeholders of the region, the following priority areas have been defined, presented as four cornerstones of circular bioeconomy with goals to be reached in order to achieve the transition to circular bioeconomy in Podravje.

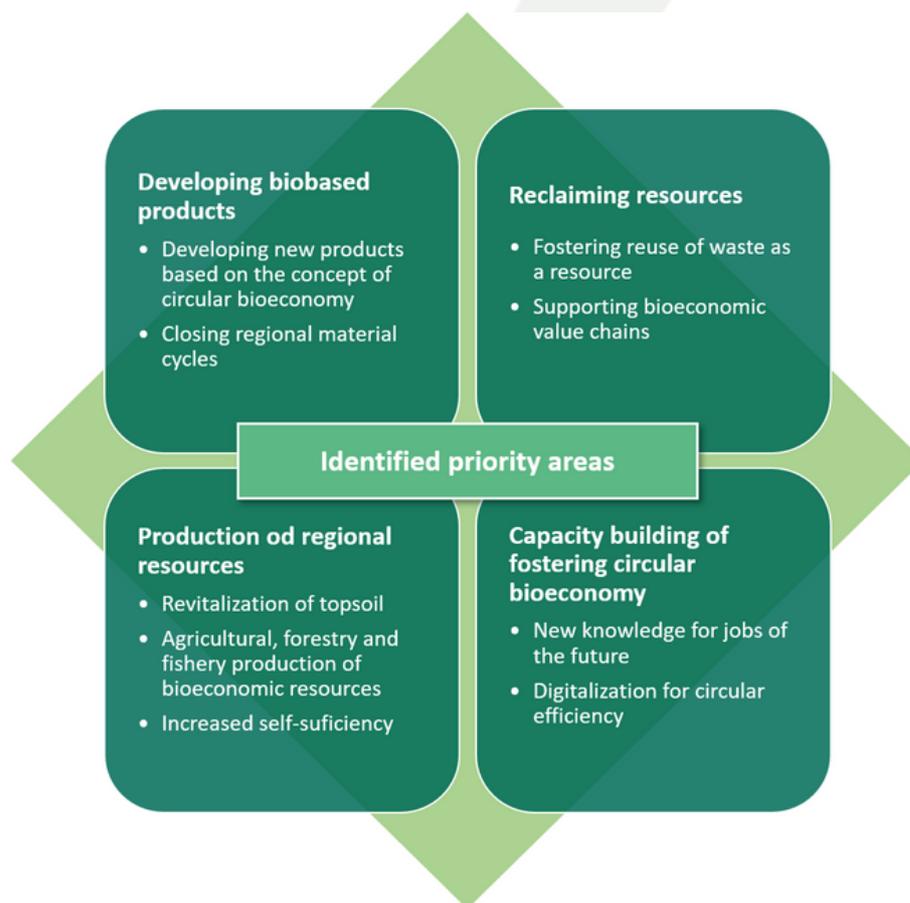


Image 18: Identified priority areas for achieving sustainable circular systemic solutions.

Based on the identified priority areas the process of designing circular systemic solutions was created (see Image 19).

Follow up to this strategic document - the Action plan for the implementation of the Strategy, will include developed regional bio circular production in identified areas, which will create new regional biobased value chains.

As seen in the image, the capacity building is present throughout every phase of the process of transition to circular bioeconomy, as the regional capacity needs to increase to allow for the process of transition to be achieved.

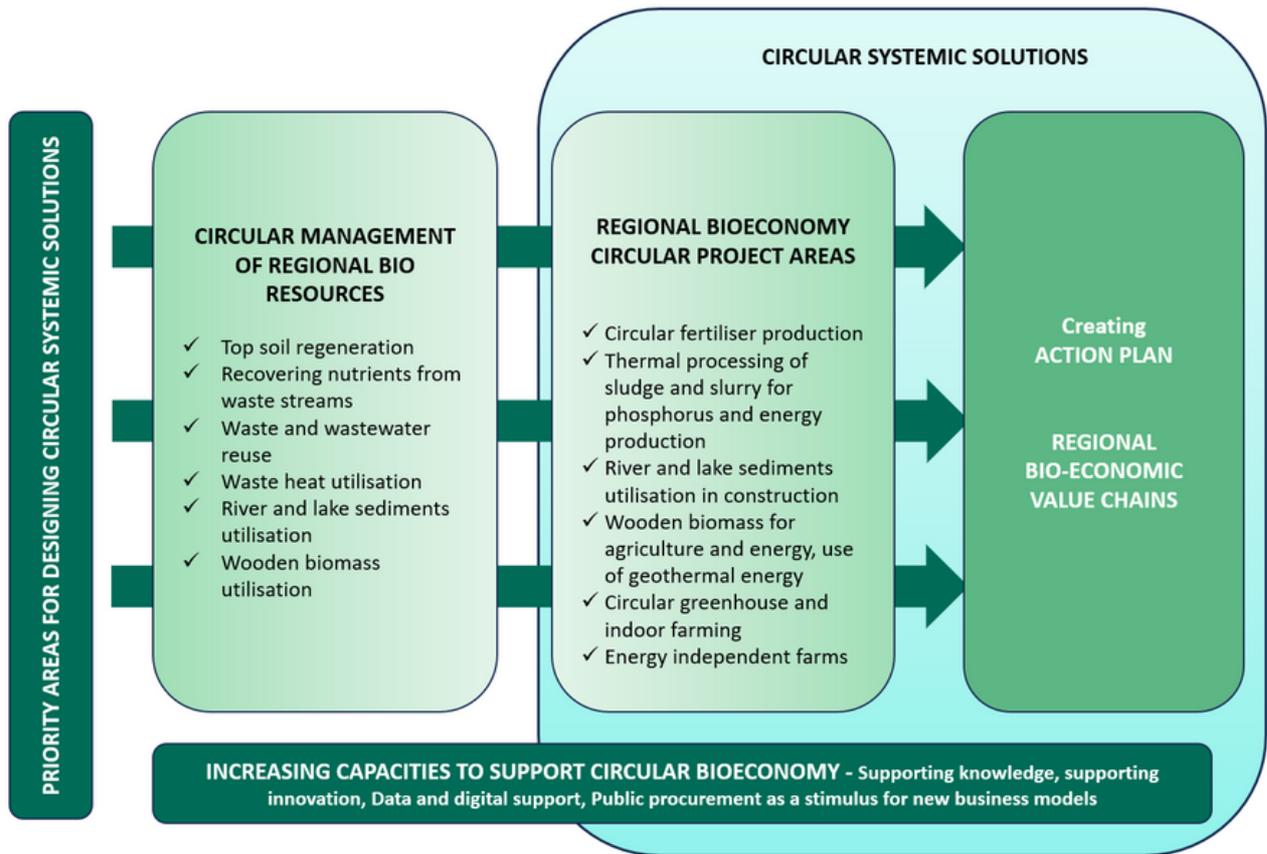


Image 19: Priority areas for designing circular systemic solutions

## 5.1 Circular systematic solutions portfolio

The following portfolio of Circular Systematic Solutions presents the identified activities that are foreseen to take place within the implementation of this Strategy.

Table 3: Portfolio of identified Circular Systemic Solutions

Circular systematic solutions portfolio					
CSS	Description	TRL/Target	Territory	Stakeholders	Financial effort
<b>Closing regional material cycles</b>	Designing joined services (industrial symbiosis), where stakeholders optimise the processes of treatment and reuse of byproducts.	Creation of regional thematic green deals	Region	Municipalities, Public and private companies, and agriculture	**
<b>Circular greenhouse and indoor farming</b>	Greenhouse farming deployment on CE principles and revitalization of available unused large indoor areas, which would be suitable for food production.	8	Localised	Agriculture, Energy providers	*****
<b>Use of sediments in river and lake reservoirs in the region</b>	Sediments from hydropower accumulations and other lakes to be used in construction and agriculture.	8	Localised	Hydro power operators, Municipalities, Research institutions, Construction and agricultural sector	****
<b>Utilization of existing renewable energy sources in the region</b>	Waste heat and geothermal heat sources in Podravje showed high potential utilisation in agriculture (intensive greenhouse farming).	8	Localised	Hydro power plants, Industry, Municipalities, Farmers	*****
<b>Re-use of water and sludge from wastewater treatment plants</b>	Thermal processing of sludge and slurry for phosphorus and energy production, purification of treated wastewater to be used as industrial water (cleaning machinery, cooling processes) or farming (watering plants, animals drinking water).	8	Localised	Wastewater treatment plants, Industry, Research institutions, Agriculture	****
<b>Processing and circular use of communal and industrial bio waste</b>	Increasing the capacity for processing biowaste and processing it into circular fertilizer for topsoil regeneration and potential new products (bio-packaging etc.)	3 demo projects TLR 6-8	Localised	Regional SMEs and industry, Waste management utilities, Research institutions, Agriculture	***
<b>Circular use of low-quality wooden biomass</b>	Collecting low-quality wooden biomass from woods, management of riverbanks and green spaces, floating wood and processing it through pyrolysis for its use at topsoil regeneration and for bio-packaging.	2 demo projects TLR 6-8	Region	Forestry service, Green spaces and riverbank management companies, Hydropower operator, Waste management utilities	***
<b>Regional data collection as base for CSS</b>	A regional data for circular bioeconomy (water, wastewater, waste, remains of production, etc.) will be collected and linked to the regional policy lab.	8	Region	Research organisations, Municipal and national administration, utility services.	**
<b>Assessing circular potential of individual specific material flows</b>	Enhanced use of byproducts from different activities (agriculture, food production etc.) for circular biobased products.	6	Region	Regional SMEs, Research institutions	***
<b>Regional platform for bioeconomy</b>	Organisation of regular platform meetings (e.g. conferences) for exchange of good practices and new knowledge.	1 event / year	Region	Research institutions, Municipal administration, utility services	**
<b>Competency building</b>	Preparation of learning programmes for fostering circular bioeconomy	1 programme developed	Region	Regional VET providers, Academia	**
<b>Awareness raising</b>	Press releases containing information on circular bioeconomy sent to regional media.	2 press releases /year	Region	Regional media, general public	*

# 5.2 Preliminary recommendations

With the needs and challenges the region is facing, the Circular Bioeconomy also presents an opportunity, as it can become a generating force to start creating the critical mass, as it has the clear potential to overcome the institutional and administrative fragmentation within the Podravje region, especially as most of the identified topics involve a multi-municipal approach. Therefore, among the proposed Circular Systemic Solutions the priority is give to the following CSS demonstration for Podravje Region: Fertilizers.

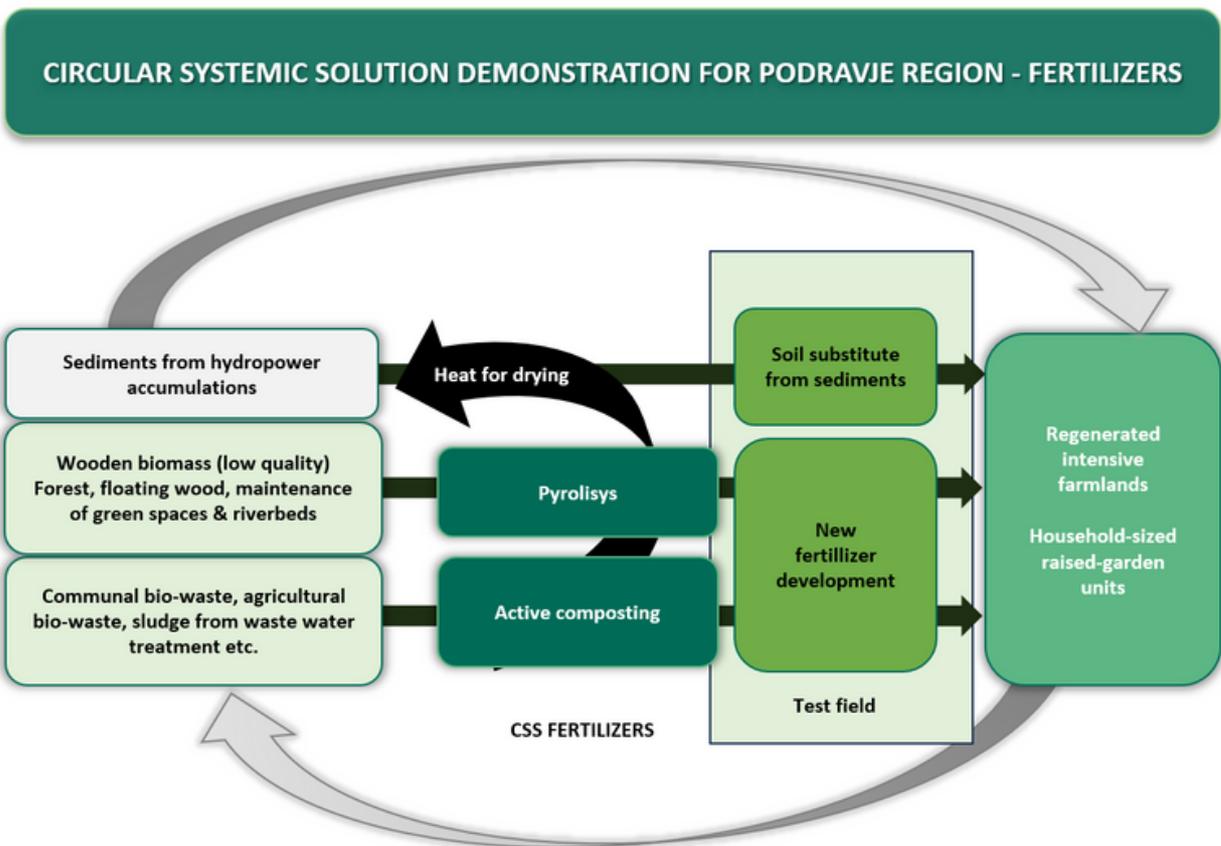


Image 20: CSS demonstration for Podravje - Fertilizers

# 6 Conclusions

This Strategy is based on the regional capacities, potential and Strategy for the Transition to Circular Economy for City of Maribor, providing guidelines for all stakeholders to implement bio economy in Podravje region. The experience gained in preparation of the City level strategy was the basis for the preparation of the current regional level strategic document.

Although the awareness of the constant increase in population and the limited availability of natural resources is always greater, it is possible to realize, on the basis of this Strategy, that the region is taking a responsible approach to efficient use of resources, preservation of nature and, consequently, the quality of life of its inhabitants. An innovative approach to the transition from linear to circular economy within the region of Podravje is also reflected in this strategic document, which additionally obliges all stakeholders to the long-term mutual cooperation and actual implementation of interconnection processes, not only between public companies and local (municipal) administration level, but also on other levels. With the professional support of the Regional Development Agency for Podravje - Maribor (as the CCRI coordinator) and E-Institute (as co-coordinator and expert partner of CCRI in the region), the Strategy provides regional decision makers and all others participating in the processes of the regional transition to a circular economy a basis and additional support in the implementation of new, also economically viable projects that will lead to greater material, energy and water self-sufficiency, better land management, to the interlacing development of co-operative economy.

The successful work in preparation and implementation of the Strategy for the Transition to Circular Economy in the Municipality of Maribor, as well as efforts of other cities and non-city municipalities of the Podravje region, supported by numerous projects won in various European tenders, has resulted in the upscaling of such initiatives from city to regional level. Therefore, the Strategy makers believe that the Strategy as a central strategic document at the regional level will give a clear indication that Podravje is developing its true potential to become a more innovative circular region not only Slovenia, but also in Europe.



Image 21: Council of Podravje region



**December 2023**

**Regional Development Agency for Podravje - Maribor  
E-Institute, Institute for Comprehensive Development Solutions**

<https://circular-cities-and-regions.ec.europa.eu/>