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CircE
Interreg Europe

Project snapshot

CircE
Interreg Europe

Objectives and outputs

The objective of the **Interreg Europe Project CircE** - European Regions towards Circular Economy - is to **develop action plans** that, steering specific policy instruments (Plans and Programmes), support and improve the **transition to a circular economy** in definite **business sectors**.

Through the analysis of players (project partners, stakeholders and other entities), multi-disciplinary projects and good practices, it was possible to **identify a series of opportunities** (stemming from circularity gaps) that should enhance the transition to a circular economy model.

Both the barriers that need to be overcome in order to seize the identified opportunities, and the **policy options** to be used to **overcome** these **barriers**, were analysed.

Finally, as a result of the project, **action plans** were developed that list the actions to be implemented within the policy instruments identified both at the beginning of the project and during its implementation.

Project partners and stakeholders

LWARB

PP 5

LWARB – London Waste and Recycling Board
Capital City Metropolitan Development Agency
London, United Kingdom

provincie Gelderland

PP 4

Gelderland Province
Regional Government
Arnhem, the Netherlands

DOLNY ŚLĄSK

PP 3

Lower Silesia Region
Regional Government
Wrocław, Poland

CD2e

PP 6

CD2E - Center for
the Development
of Eco-enterprises
Lille, France

Generalitat de Catalunya
**Departament de Territori
i Sostenibilitat**

PP 2

Catalonia
Regional Government
Barcelona, Spain

Regione Lombardia

LP

Lombardy Region
Regional Government
Milano, Italy

Skupnost občin Slovenije
Association of Municipalities and Towns of Slovenia

PP 8

SOS - Skupnost občin Slovenije
Association of Municipalities and Towns
Maribor, Slovenia

PP 7

Sofia Municipality,
Bulgaria

LEGEND

**LP Lead Partner
PP Project partner**

After informal contacts carried out during 2016,
an application was deposited by **eight partners** as fellows
and approved in December, 2016. The **partnership** results
well balanced in terms of **spatial distribution** and
socio-economic aspects, representing European areas
with different peculiarities.

Each project partner gathered a p**anel of stakeholders**
for the sectors of interest and involved them in meetings,
analytical activities and site visits. The stakeholders played
a **key role** into the project, supporting the technical
activities and bringing into the project varied
perspectives and **experiences**.

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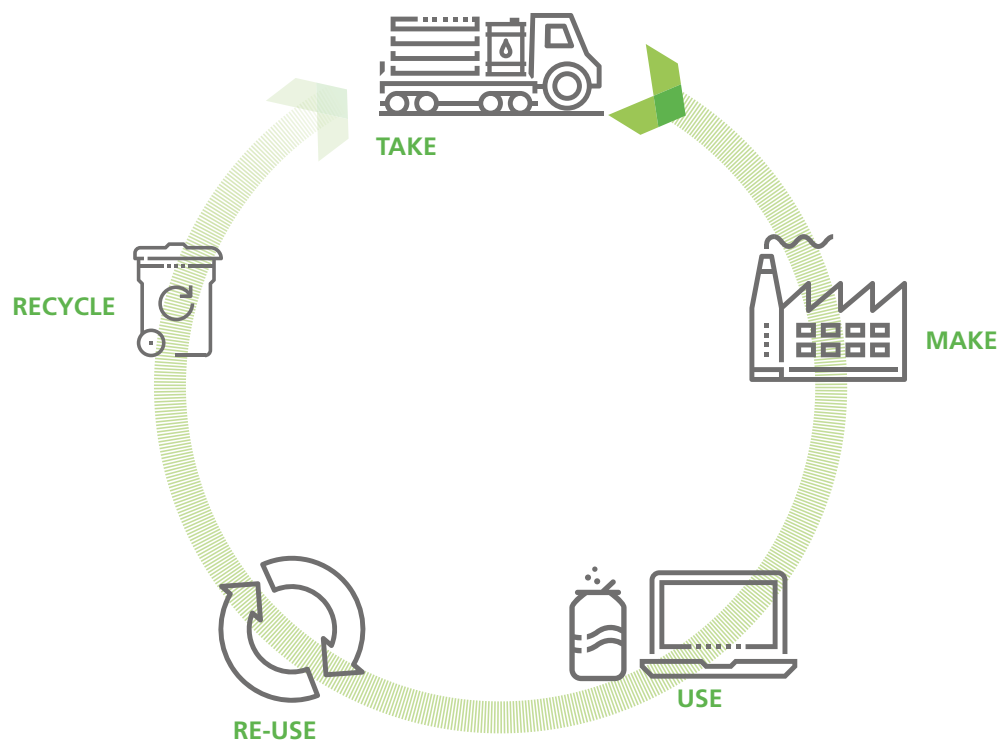
From a linear economy...

TAKE   MAKE   DISPOSE

....to a circular economy
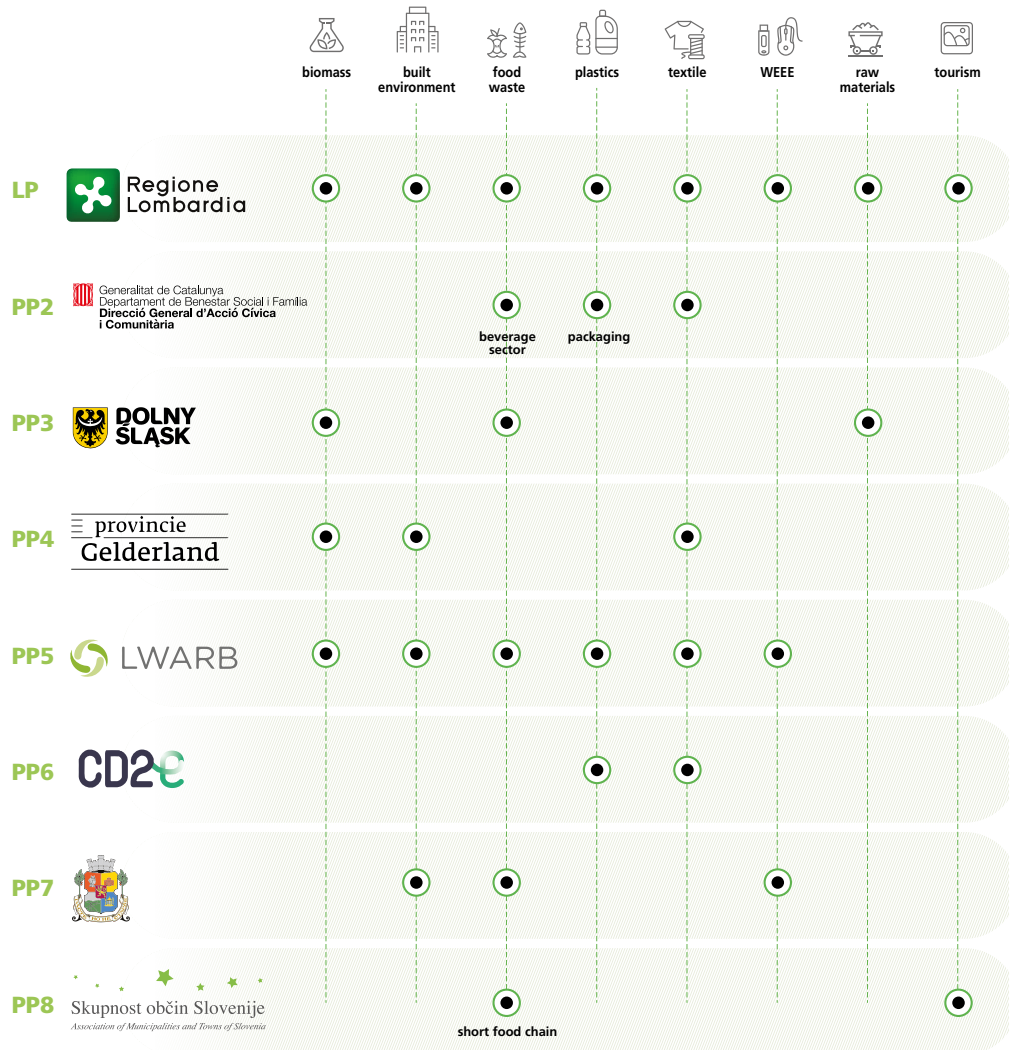

TAKE

MAKE

USE

RE-USE

RECYCLE

Perspective

Circular economy is a new economic model aimed at **decoupling economic growth** and **resource consumption**. The vision is to fundamentally change the prevailing linear "take–make–dispose" economic approach while keeping products, components, and materials at their highest utility and value along their life-cycle and, once the latter is completed, reusing them in the production process.

Also by exploring the **existing synergies** between the local **Research and Innovation Strategies for Smart Specialisation** (RIS3) and **core business sectors**, Regions can play a fundamental role in boosting the transition towards circular economy, driving the identification and growth of **innovative circular value-chains** in Europe, for the benefit of local stakeholders and the socio-economical regional eco-system. Circular economy opportunities emerge from stakeholders connected into innovative value-chains crossing the traditionally boundaries of business sectors and from a multi-disciplinary technical approaches.

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The identification of strategic sectors

		biomass	built environment	food waste	plastics	textile	WEEE	raw materials	tourism
LP	Regione Lombardia	●	●	●	●	●	●	●	●
PP2	Generalitat de Catalunya Departament de Benestar Social i Familia Direcció General d'Acció Cívica i Comunitària			● (beverage sector)	● (packaging)	●			
PP3	DOLNY ŚLĄSK	●		●				●	
PP4	provincie Gelderland	●	●			●			
PP5	LWARB	●	●	●	●	●	●		
PP6	CD2e				●	●			
PP7			●	●				●	
PP8	Skupnost občin Slovenije Association of Municipalities and Towns of Slovenia			● (short food chain)					●

The **8 sectors** covered by the project - **food waste, textile, biomass, plastics, built environment, WEEE/strategic metals, tourism, raw materials** - are a sort of hybrid category that results from a given economic activity, the required commodities and the resulting waste flows. The sectors were identified taking as a reference the **"Closing the loop - An EU action plan for the Circular Economy"** package [1]. Each Project Partner decided on which sectors to concentrate, taking into account - from semiquantitative assessments - the relative importance of each sector for the regional economy and its potential in terms of "circular" growth. Similar binary plots have been proposed in the **"Policymakers toolkit"** by the Ellen MacArthur Foundation [2].

Moreover, in order to ensure the compliance of the project approach with the macro-objectives of the Regions themselves, the areas of the **RIS3** (Research & Innovation Smart Specialization Strategy) of each Region, dealing with circular economy aspects, were identified and **related** with the **chosen sectors**.

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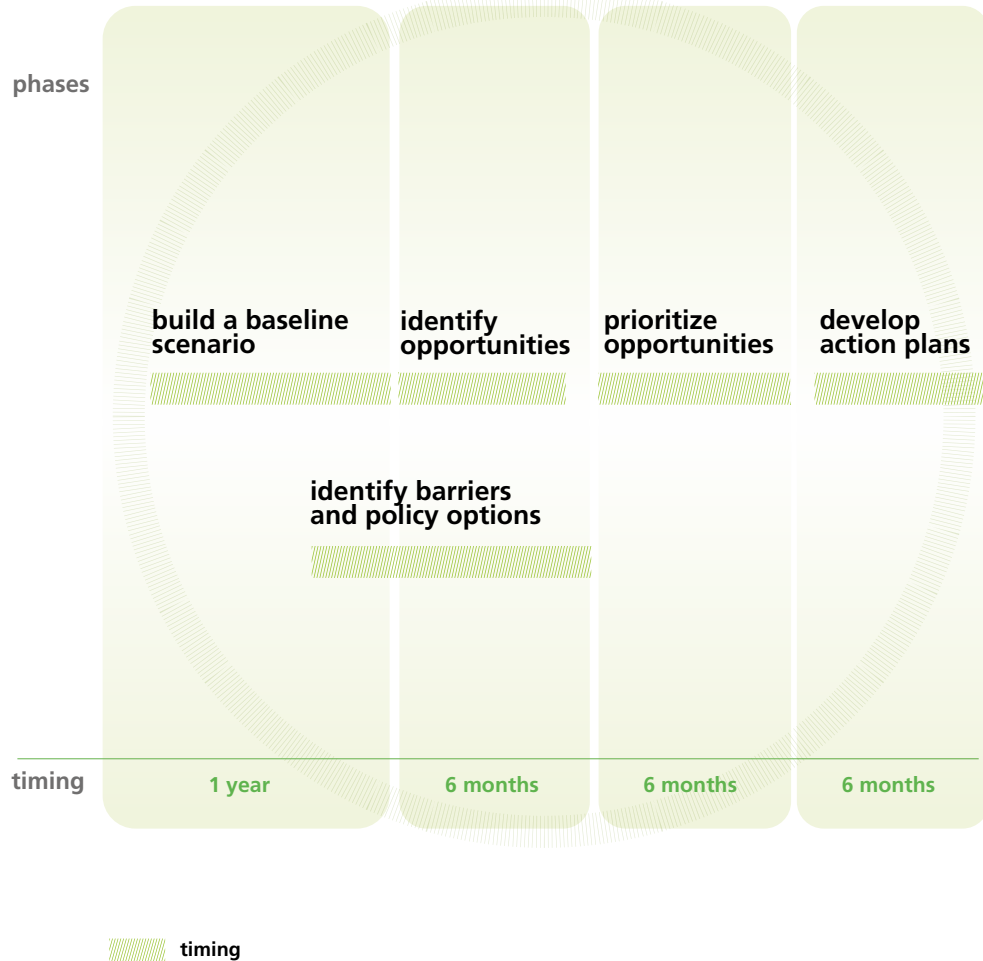
From theory to practice: the project phases

Build up a baseline circular economy scenario: within the selected sectors, **600 European stakeholders**, **120 multi-disciplinary projects** and **140 good practices** were mapped.

Identify opportunities (stemming from circularity gaps): in order to facilitate the transition towards a circular economy model, **191 new regional opportunities** and **40 cross-regional opportunities** were identified.

Identify barriers and policy options: the barriers that need to be overcome in order to seize the identified opportunities and the policy options to be used to get through these barriers were detected.

Prioritize the opportunities: in order to decide which opportunities have to be implemented first, the Project Partners defined a **priority opportunities ranking**.

Develop action plans: in order to influence the selected policy instruments, steering them to seize the identified opportunities and thus to overcome the related barriers, specific actions were designed by each Project Partner and collected into **one action plan per partner**.

phases

build a baseline scenario

identify opportunities

prioritize opportunities

develop action plans

identify barriers and policy options

timing

1 year

6 months

6 months

6 months

timing

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A set of connected tools to support circular economy policymaking

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The CircE Toolbox

The **method** – called **CircE Toolbox** – designed within the project and common to all the partnership - is considered, as well as the actions plans, an important achievement of the project, since it represents a **basis** for the **development** of a **support system** to **strategic decisions** for setting up **circular economy policies** within European Regions. It was developed following a mainly analytical approach for the first year, and a dialogic approach during the second year.

For each phase, **specific tools** were **designed** with the aim of facilitating the **baseline analysis** and, also through the **graphic representation** of the information collected, allowing the **connection** of **information** obtained from different sources and territories. In the following pages, the different tools are briefly presented while their use is then described in detail in the illustration of the different phases, using examples extracted from the project.
The elaboration of the **action plans** is the **result** of the **implementation** of the **CircE Toolbox**, applied with a certain degree of freedom by each partner.
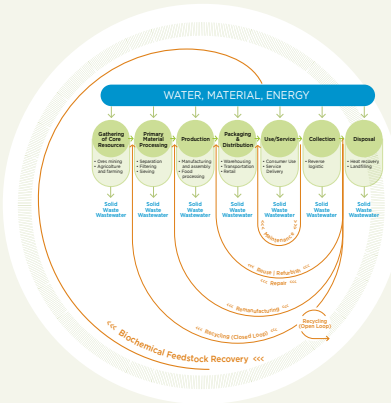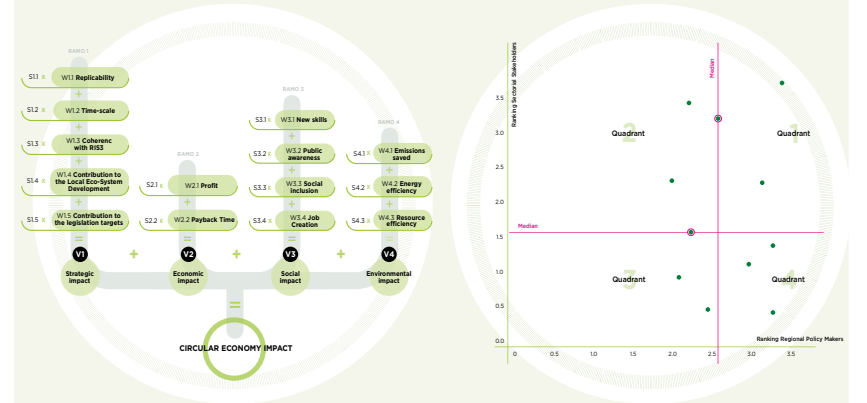
Synoptic framework

ANALYSIS	DIALOGUE - ANALYSIS	DIALOGUE - ANALYSIS

tools

CircE Mapping Tool

CircE Value Chain

CircE Barriers Tool

CircE Priorisation Tool

CircE Strategy Tool

phases

build a baseline scenario

identify opportunities

prioritize opportunities

identify barriers and policy options

timing

1 year	6 months	6 months

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The CircE Mapping Tool

The **main objective** is to define the **current circular economy baseline scenario** in the CircE Regions by collecting data on different topics, whilst remaining grounded in an integrated approach oriented to value-chains.
The tool [2, 4, 5], is a **data collection framework** containing the metadata structure for supporting the mapping of the regional capabilities.

For **each topic, specific data are collected**:
- **strategies**: RIS3 areas with circular economy opportunities, also so as to ensure the approach complies with the macro-objectives of the Region;
- **sectors**: data for defining the role in the regional economy and the circularity potential for each sector;
- **players** with circular economy related capabilities, their **projects and good practices**: data for identifying circular economy related potential links with other sectors and Regions;
- **opportunities**: data useful for prioritizing the opportunities, in order to plan their implementation;
- **policy options and barriers**: identification within the regional context.
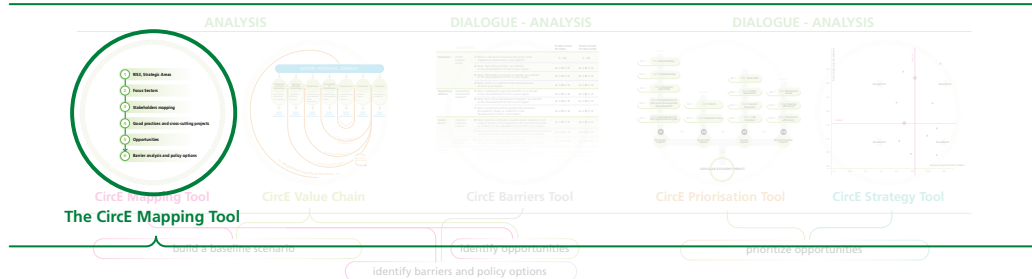
The CircE Value Chain Tool

The **main objective** of this framework is to provide a common **representation** of **circular value chains,** in order to map the **position** of specific **players**, **good practices**, **projects** and **opportunities** in the respective phase of the circular value chain.

The tool is a **taxonomy** of circular value chains and a shared definition of their core transformation phases. It's made by a **primary flow**, related to a particular product; some **secondary flows** (input flows e.g. materials, water and energy, and output flows e.g. by-products, such as solid wa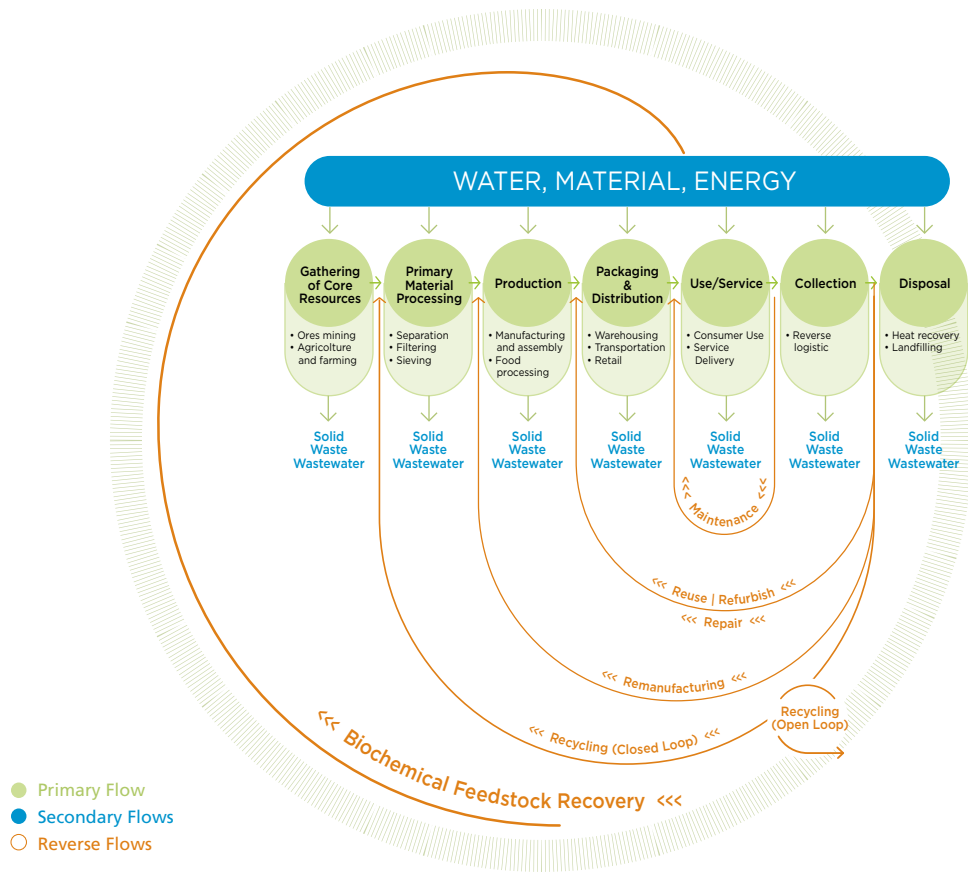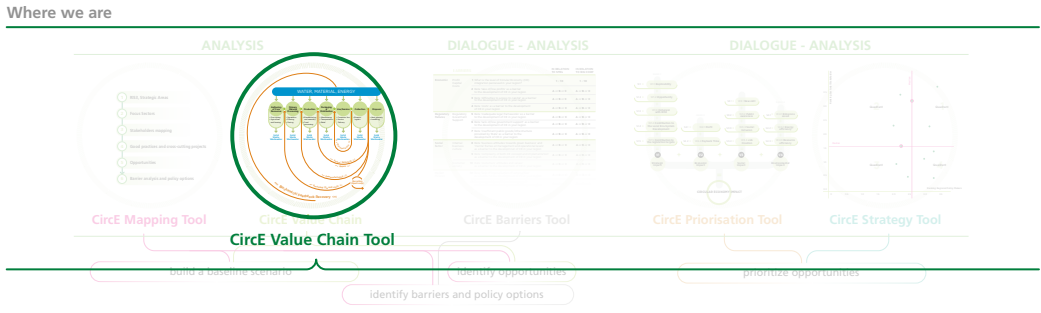ste and wastewater), that can result in primary flows of other value chain as well; some **reverse flows** that close the loop at different levels of the value chain according to the waste management hierarchy, in order to assure the transition from a linear to a circular value chain.

Some data collected through the **Mapping Tool** in relation to players, projects, good practices and opportunities are **represented through** the **Value Chain Tool,** so to run cross-regional and cross-sectorial value chain analysis in order to **identify new circular value chains**.

Diagram

WATER, MATERIAL, ENERGY

Phase	Details
Gathering of Core Resources	• Ores mining • Agricolture and farming
Primary Material Processing	• Separation • Filtering • Sieving
Production	• Manufacturing and assembly • Food processing
Packaging & Distribution	• Warehousing • Transportation • Retail
Use/Service	• Consumer Use • Service Delivery
Collection	• Reverse logistic
Disposal	• Heat recovery • Landfilling

Solid Waste Wastewater (under each phase)

Maintenance
Reuse | Refurbish
Repair
Remanufacturing
Recycling (Closed Loop)
Recycling (Open Loop)
Biochemical Feedstock Recovery

- ● Primary Flow
- ● Secondary Flows
- ○ Reverse Flows

Where we are

ANALYSIS · DIALOGUE - ANALYSIS · DIALOGUE - ANALYSIS

CircE Mapping Tool · **CircE Value Chain Tool** · CircE Barriers Tool · CircE Priorisation Tool · CircE Strategy Tool

build a baseline scenario · identify opportunities · prioritize opportunities
identify barriers and policy options

	BARRIERS			IN RELATION TO SMEs	IN RELATION TO BIG CORP
Economic	Profit Capital Costs	1	What is the level of Circular Economy (CE) integration perceived in your region?	1 ~ 10	1 ~ 10
		2	Rate 'lake of/low profits' as a barrier to the development of CE in your region	A or B or C	A or B or C
		3	Rate 'difficulties to access to capital' as a barrier to the development of CE in your region	A or B or C	A or B or C
		4	Rate 'costs' as a barrier to the development of CE in your region	A or B or C	A or B or C
Regulatory Failures	Regulatory Goverment Support	5	Rate 'inadequate legal frameworks' as a barrier to the development of CE in your region	A or B or C	A or B or C
		6	Rate 'lack of/low government support' as a barrier to the development of CE in your region	A or B or C	A or B or C
		7	Rate 'insufficient public goods/infrastructure provided by State' as a barrier to the development of CE in your region	A or B or C	A or B or C
Social factor	Internal business culture	8	Rate 'business attitudes towards green business' and 'mental frames at management and operational levels' as a barrier to the developmnet of CE in your region	A or B or C	A or B or C
		9	Rate 'complexity of both CE concept and implementation' as a barrier to the development of CE in your region	A or B or C	A or B or C
	Costumer society	10	Rate 'costumers' attitudes and values' as a barrier to the development of CE in your region	A or B or C	A or B or C
Market Failures		10	Rate 'lack of internalisation of externalities' as a barrier to the development of CE in your region	A or B or C	A or B or C
		11	Rate 'competition with business as usual' as a barrier to the development of CE in your region	A or B or C	A or B or C

1 - 10 From 1 (no existent) to 10 (totally implemented)
A not relevant | **B** important | **C** very important

Where we are

ANALYSIS	DIALOGUE - ANALYSIS	DIALOGUE - ANALYSIS
CircE Mapping Tool	CircE Value Chain	CircE Barrier Tool	CircE Priorisation Tool	CircE Strategy Tool

build a baseline scenario
identify barriers and policy options
identify opportunities
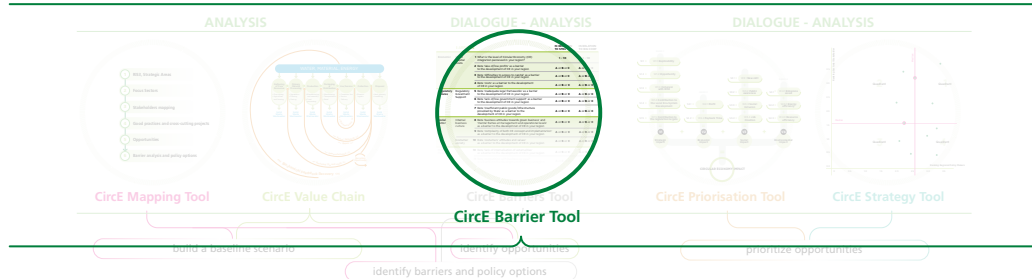prioritize opportunities

The CircE Barriers Tool

The **main objective** is to **describe** and **make up** an overall regional sectorial **scenario** of the **barriers,** in order to identify the **actions** to be taken to **overcome** the **barriers.**

The tool is a **questionnaire**, with a first set of general questions, in order to make up an overview of the barrier scenario, and some different sections, each one with specific questions dedicated to the following **typology** of **barriers**:

- **economic**: financial aspects;
- **regulatory failures**: legislation and government support;
- **social factors**: social acceptance and attitudes;
- **market failures**: aspects that the current market has not been able to regulate;
- **business structure**: business organization and governance issues;
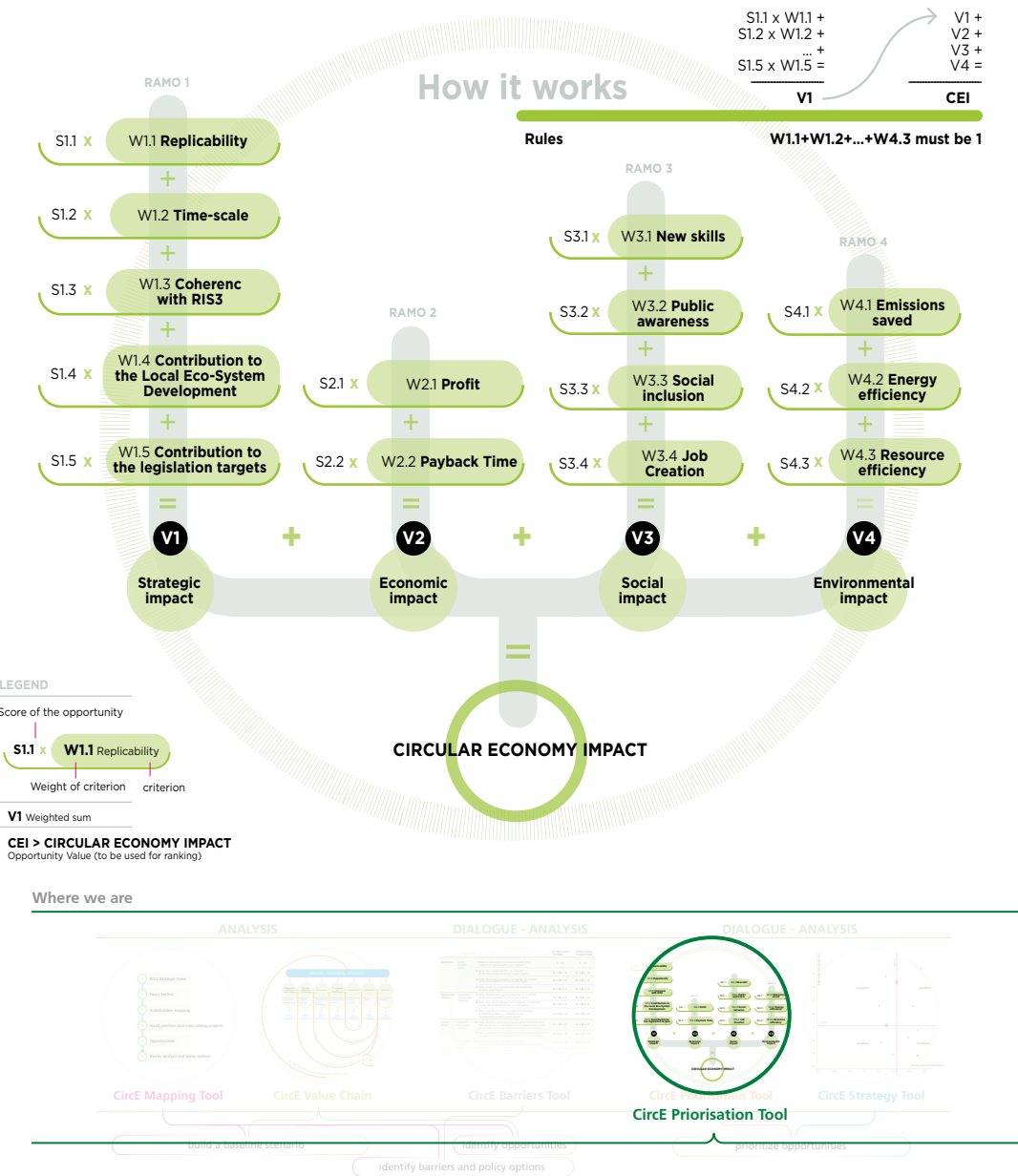- **technology**: access to technology and demand for new skills.

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The CircE Prioritization Tool

The **main objective** is to define a **priority ranking** of the **opportunities** (identified in a specific step of the project) for each Region and each sector, taking into account the **policymakers'** and **stakeholders' considerations**.

The tool is a **criteria tree** derived from the Analytic Hierarchy Process method (AHP) [3] and is based on the identification of **common criteria** - gathered in 4 impact groups: **strategic, economic, social** and **environmental** - and of **specific weights** of these criteria. The tree represents, in a hierarchical relationship, all the instances emerged in the discussions between project partners and stakeholders. The **impact** of an opportunity on the identified criteria is shown through **scores** (each criterion has a score, specific to a given opportunity).

The final **Project Partners' priority opportunities ranking** is obtained through two steps: within each branch of the tree, the results of the multiplication of weights by scores are added; then the results obtained in the different branches are added.
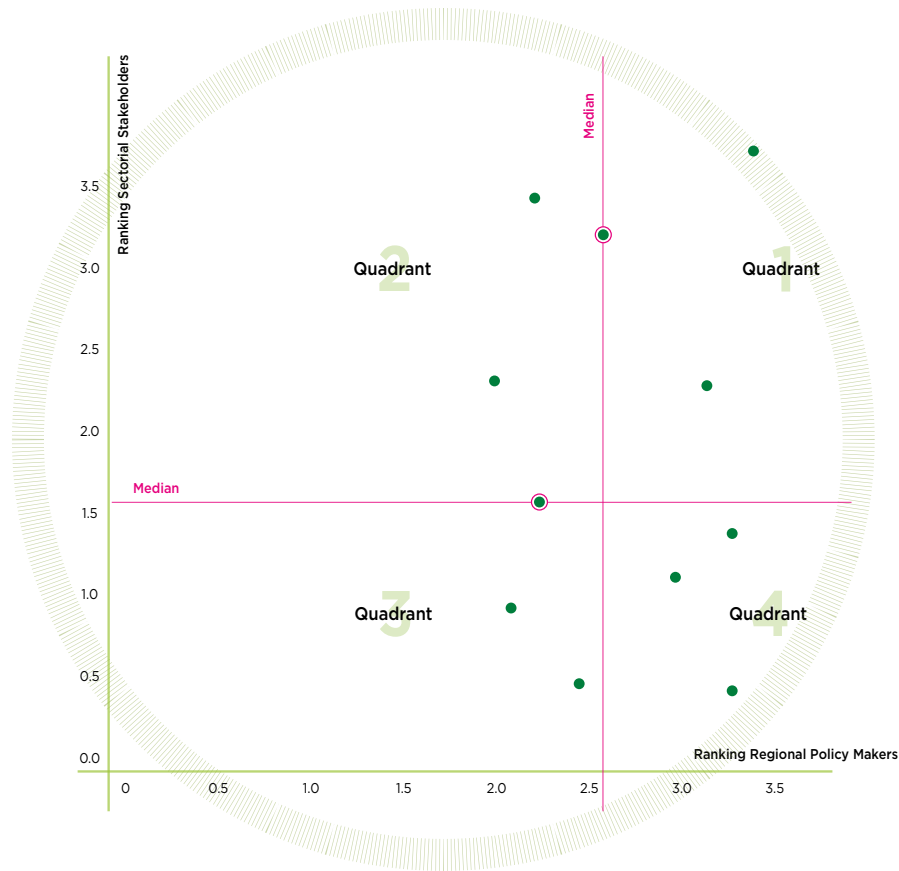

Diagram: How it works

$$\begin{array}{l} S1.1 \times W1.1 + \\ S1.2 \times W1.2 + \\ \dots + \\ S1.5 \times W1.5 = \end{array} \rightarrow \begin{array}{l} V1 + \\ V2 + \\ V3 + \\ V4 = \end{array}$$

| V1 | CEI |

Rules: W1.1+W1.2+...+W4.3 must be 1

RAMO 1
- S1.1 × W1.1 Replicability
- S1.2 × W1.2 Time-scale
- S1.3 × W1.3 Coherenc with RIS3
- S1.4 × W1.4 Contribution to the Local Eco-System Development
- S1.5 × W1.5 Contribution to the legislation targets
- = V1 Strategic impact

RAMO 2
- S2.1 × W2.1 Profit
- S2.2 × W2.2 Payback Time
- = V2 Economic impact

RAMO 3
- S3.1 × W3.1 New skills
- S3.2 × W3.2 Public awareness
- S3.3 × W3.3 Social inclusion
- S3.4 × W3.4 Job Creation
- = V3 Social impact

RAMO 4
- S4.1 × W4.1 Emissions saved
- S4.2 × W4.2 Energy efficiency
- S4.3 × W4.3 Resource efficiency
- = V4 Environmental impact

V1 + V2 + V3 + V4 = CIRCULAR ECONOMY IMPACT

LEGEND
- Score of the opportunity
- S1.1 × W1.1 Replicability
- Weight of criterion — criterion
- V1 Weighted sum
- CEI > CIRCULAR ECONOMY IMPACT
- Opportunity Value (to be used for ranking)

Where we are

| ANALYSIS | DIALOGUE - ANALYSIS | DIALOGUE - ANALYSIS |

- CircE Mapping Tool
- CircE Value Chain
- CircE Barriers Tool
- **CircE Priorisation Tool**
- CircE Strategy Tool

build a baseline scenario — identify opportunities — prioritize opportunities
identify barriers and policy options

The CircE Strategy Tool

The **main objective** is to highlight the **meaning** of **different scores** assigned to the opportunities by **different players** (policymaker vs sectorial stakeholders) in the process of prioritization, in order to support the **identification** of **specific implementation actions**, available to further help the **design** of effective **action plans**. In fact, different scores imply different perceptions of the impact of the identified opportunities.
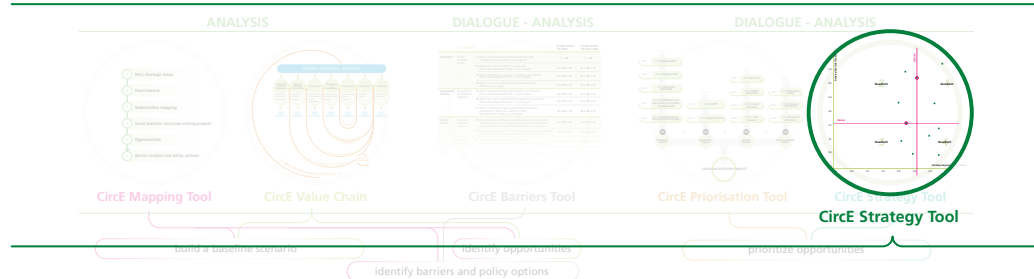
The tool is a **matrix** in which the different opportunities are placed based on the **assigned scores**. The matrix is divided into **4 quadrants** by the identification of the median:

• of the set of ranking scores provided by the sectorial stakeholders (for each sector);
• of the set of ranking scores provided by the regional policymaker (provided, for all the sectors considered, by the same team).

The fact that an opportunity belongs to a quadrant implies specific peculiarities of that opportunity, in terms of **status**, **strategy** and **policy options** or **feasible actions**.

The tools applied to the project phases

CircE Mapping Tool

Tools

Where we are

build a baseline scenario

identify opportunities

identify barriers and policy options

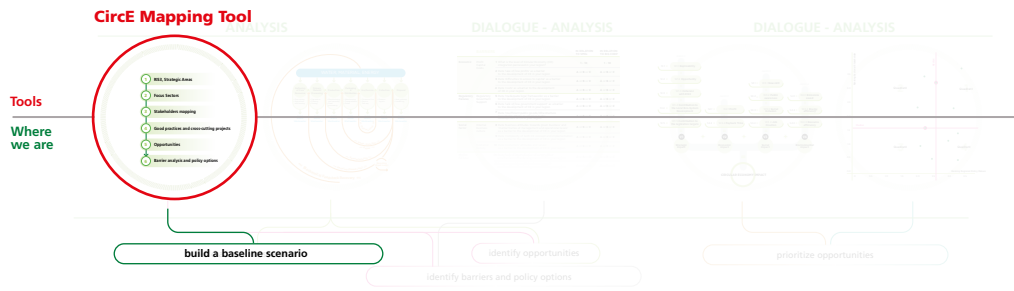prioritize opportunities

Build a baseline circular economy scenario: mapping RIS3 and sectors

The areas of the **RIS3 (Research & Innovation Smart Specialization Strategy)** of each Region, dealing with circular economy aspects, were identified and briefly described, in order to ensure the **compliance** of the project approach with the **macro-objectives** of the **Regions** themselves, so to enrich the whole framework of the baseline scenario with key elements identified into the RIS3. This analysis supported also the understanding of the strategic positioning of the Region within a given area of the circular economy.

Moreover, **each sector** chosen by project partners was **analysed** collecting **sectorial statistics** in order to define the **role** in the **regional economy**; define the **circularity potential** for each sector; identify circular economy-related potential links with other sectors and Regions, with the objective of supporting the value chain, cross-sectorial and cross-regional analyses.

Define the role of each sector in the regional economy

employees

turnover

gross value added

companies

Define the circularity potential for each sector

resource productivity

volume of waste generated

share of waste reused/remanufactured

share of waste recycled

share of waste incinerated

share of waste landfilled

energy consumption

water consumption

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Tools
Where we are

build a baseline scenario
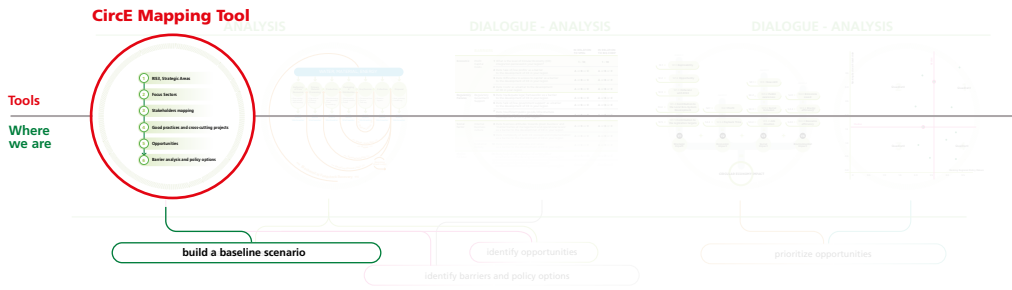
Build a baseline circular economy scenario: mapping players

For each sector chosen by project partners, **existing players (project partners, stakeholders and other entities)** in the Region, with **circular economy related capabilities,** were identified and analyzed. This allowed to build a detailed overview of the regional capabilities and expertise to seize circular economy opportunities, thus combining the top-down approach of the strategic analysis with the bottom-up approach of the operational analysis.

Among the collected data, some are meant to highlight **potential links** with **other sectors** and **Regions** under a circular economy perspective.

Industrial players

position in the circular value-chain
technical capabilities
input and output materials/components

R&D&I players

number of researchers
research domains
topics of relevance for CE
spin-off or start-ups related to CE
innovation infrastructure
enabling technologies
position in the circular value-chain

Education players

disciplines/school
level
number of students
topics of relevance for CE

Policy-making players

operational level
policy areas
supported actions
support instruments

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Build a baseline circular economy scenario: mapping projects and good practices

For the existing players identified, **completed** or **ongoing** circular economy projects, as well as **emerging good practices** were identified and analyzed.

Among the collected data, some are meant to highlight potential links with other sectors and Regions under a circular economy perspective, useful for identifying **potential cross-sectorial value chain links**.

Good practices

principal stakeholder

type of stakeholder and action

target product/material/service

expected impact
(social, economic, environmental)

potential stakeholders

target sectors

position in the value-chain

TRL Level
(Technology Readiness Level)

Projects

funding source and program

main sector

ideas for CircE

total budget

requested funding

consortium
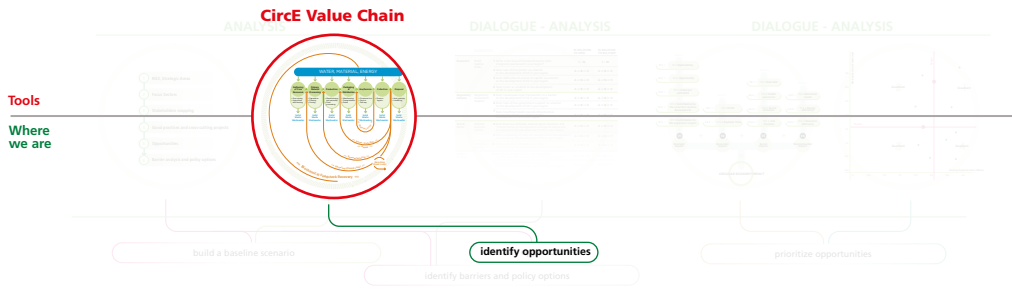
regional partners

target sectors

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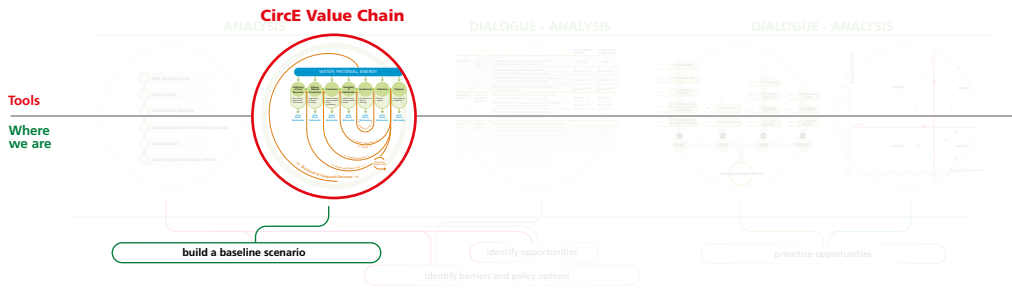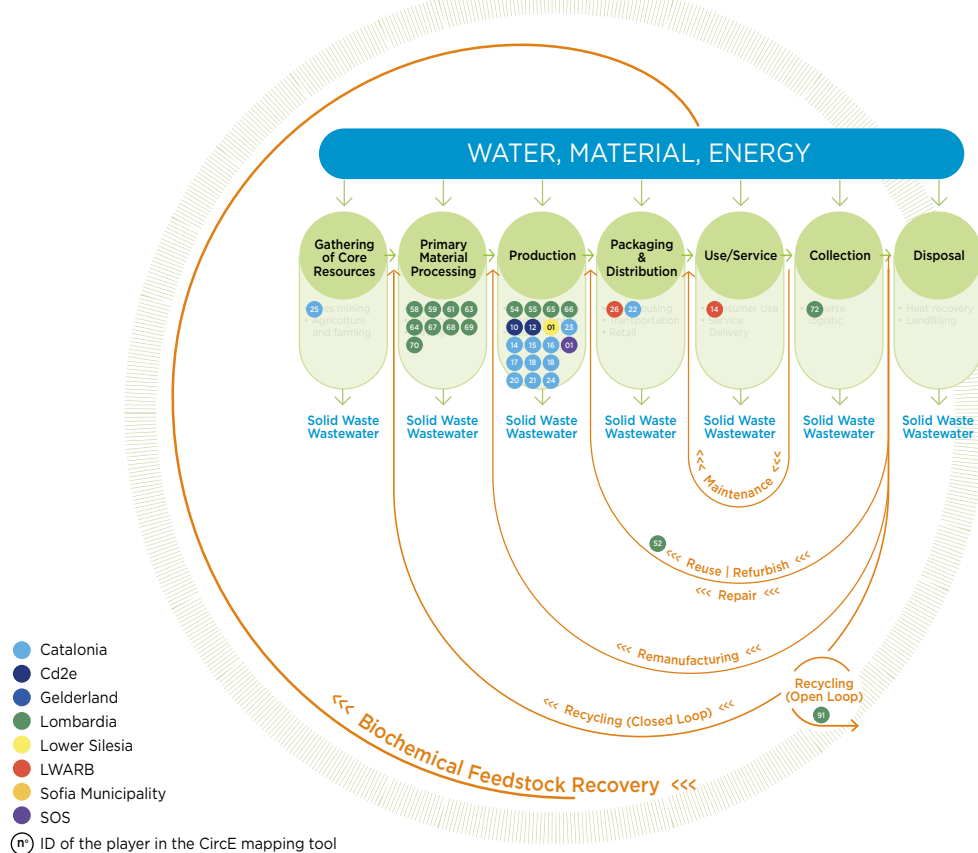
Build a baseline circular economy scenario: value chain representation

By representing on the value chain some of the information collected through the mapping tool of players, projects and good practices, it is possible to have a **synoptic overview** of the **value chain coverage** in the sectorial and geographical area of interest, in order to **identify general** or **local missing** nodes that hamper a transition from a linear to a circular value chain.

This representation was made both at **regional** and **cross-regional level**: for each analyzed sector, a stakeholders' map, a projects' map and a good practices' map were built (at regional level using information coming from the partner of the relevant Region, at cross-regional level using information coming from all partners).

Through this approach, a good practice, a project or a player, existing in a Region and having a specific position on the value chain map, can **inspire another Region** displaying a gap in the same position or stimulate collaborations among Regions.

identify opportunities

build a baseline scenario

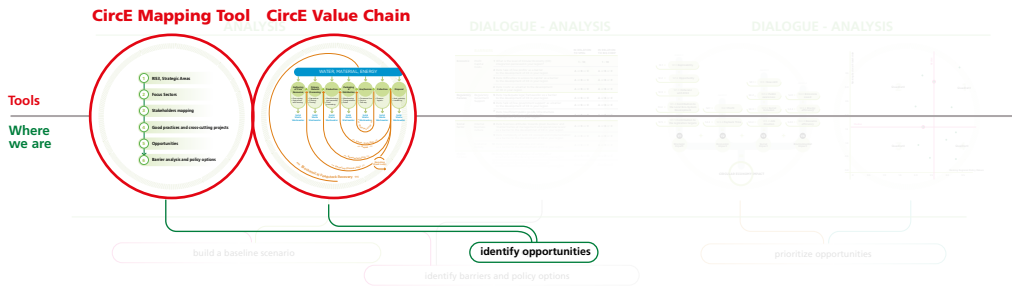identify barriers and policy options

prioritize opportunities

Identify opportunities: value chain analysis

The value chain representation allowed the **identification** of the **opportunities** (circularity gaps for a definite sector and Region) that, once seized, can **enhance** the **transition** to **a circular economy model**.
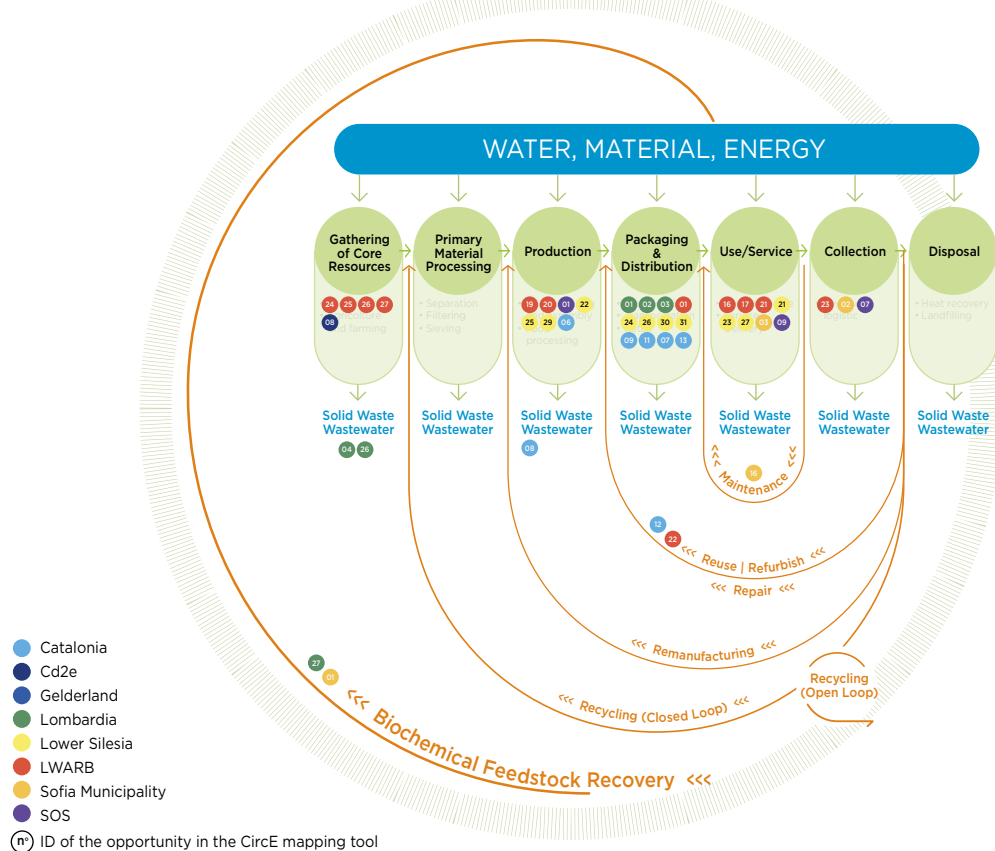
This is a **key phase**, where the CircE mapping tool is closely linked to the CircE value-chain analysis tool. The opportunities are identified through different mechanisms:

- through an **internal gap analysis**, for a given Region. In particular, gaps can be identified in the analysis of sectors and good practices or during the exchange of experience with other Project Partners.
- through a **cross-sectorial** or a **cross-regional value chain** analysis the opportunities emerge by linking stakeholders, projects and good practices in different sectors or Regions; in such cases, the value of interregional cooperation among stakeholders is crucial for highlighting and seizing opportunities.

See the related reports

Opportunities: textile sector

Increase the capacity of post consumer textile collection	Increase the reciclability, recycling and the use of recycled fibres, threads and fabrics	Explore the new ways of pre consumer textile waste upcycling for industrial uses	Scale up the creation of new business models	Ecodesign for durability	Intensify the search of alternatives to prevent the effect of microfibre release and other substances of concern during the product lifecycle	Increase water and energy savings and efficiency used during the production process
This opportunity focuses on the potential of increasing the availability of materials of post-consumer fashion and home textiles, by implementing selective collection and effective sorting systems that allow and facilitate a further retention of the value of the products in a closed loop.	*Beyond guaranteeing its collection, the recovery of textile waste (both pre-consumer and post-consumer) has to go with an improved channelling of these material inputs into assets that can be transformed into new products by other players in the value chain, with a minimum market viability.*	*The textile sectors in Europe produces a significant amount of textile waste from its own production process, which has the potential to be circularised back in the system again, as by-products for other industries, or valorised by treating and integrating them in production processes of other industries of the sectors, or in other value chais.*	*Digital technologies facilitate the creation of new business models which are revolutionising the way we relate to each other whether as individuals, users or consumers, and also in the way we produce. In fat, the impact of the new digital tools is larger in those business models that move from the product itself to its use as a service.*	*Taking into account the exponential increase of the consumed clothes and the dramatic reduction of the time of use of these products, the sector needs to set a future horizon which aspires to reduce the pressure on a raw materials, decelerating this product rotation and betting on a consumption model that extends as much as possible the durability of clothes.*	*The textile sector is an unintentional responsible for the release of 72,000 to 138,000 tonnes of microfibres annually to the maritime environment, originated in the use and maintenance phase of clothes and synthetic fabrics, thus, in a very quotidian and massive act such is laudering clothes made of polyester, nylon and acrylic fibres, which are present in a large amount of products and represent a significant share in the textile market.*	*The industry needs the intensive consumption of energy and water in order to maintain its activity, and for the creation and marketing of their products. One of the textile industry's main trends is the implementation of more efficent processes: reducing consumption, increasing efficiency in its use, and promoting reuse when possible.*

CircE Mapping Tool   CircE Value Chain

Tools
Where
we are

DIALOGUE - ANALYSIS   DIALOGUE - ANALYSIS

build a baseline scenario   identify opportunities   prioritize opportunities

identify barriers and policy options

Opportunities in the food waste sector

Catalonia
Cd2e
Gelderland
Lombardia
Lower Silesia
LWARB
Sofia Municipality
SOS
(n°) ID of the opportunity in the CircE mapping tool

Identify opportunities: information collected

For each opportunity identified using the mapping tool and the value chain tool, more detailed information were collected: **source** (e.g. gap analysis, cross-sectorial or cross-regional analysis) and **type** of opportunity (e.g. industrial, R&D, innovation, policy making, education and training, social awareness), **expected impact at economic**, **social** and **environmental level** and **approximate budget** for the opportunity development. These data will be **useful** for the future **prioritization** of the **opportunities**, in order to plan their implementation across the participating Regions.

Once identified and analyzed through the mapping tool, the **opportunities** too have been **plotted** on the **value chain**: in fact, an opportunity identified by one Region can be useful also in another territory.
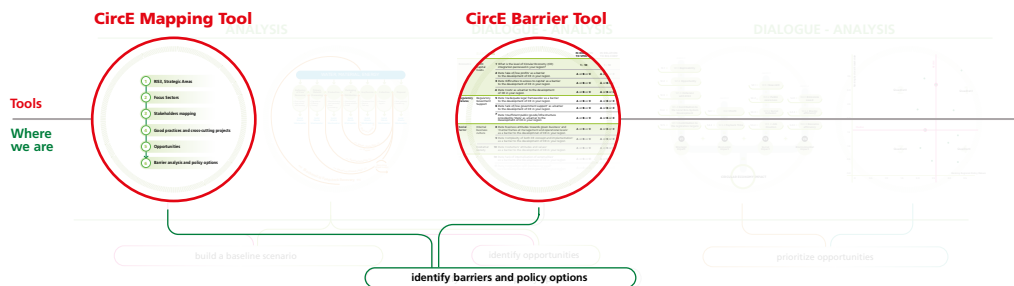
identify barriers and policy options

Categories of barriers identified in the project

ID	Category	Final Barrier
F1	Economics	Economics - Not profitable for businesses (1) even if other barriers are overcome - low capacity to generate revenues from introducing CE strategies
F2	Economics	Financial: acccess to credit not supported by existing financial instruments
F3	Economics	Economics - Capital intensive and/or uncertain payback times (the payback time is influenced also by the additonal costs)
F4	Economics	Economics - Technology not yet available at scale at a cost effective level
F5	Regulatory failures	Regulatory failures - legal frameworks to support the transition to a CE that are not yet in place at regional, national or European policy levels; the support received from institutions to lead such transition is inadequate.
F6	Regulatory failures	Regulatory failures - Inadequately defined legal frameworks that governs areas such as the use of new technologies
F7	Regulatory failures	Regulatory failures - Poorly defined targets and objectives which provide either insufficient or skewed direction to industry
F8	Regulatory failures	Regulatory failures -Implementation and enforcement failures leading to the effects of regulations being diluted or altered
F9	Regulatory failures	Regulatory failures -Unintended consequences of existing regulations that hamper circular practices (also coherencies and contradictions within the current legal frameworks or regulations)
F10	Social factor	Social factor - lack of strategic and managerial vision and business culture toward CE; attitudes and mental frames at management and operational levels
F11	Social factor	Social factors - Custom and habit: ingrained patterns of behaviour by consumers and businesses
F12	Social factor	Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - knowledge of CE and sustainability at a technical and employees level

Identify barriers

Barriers are the **obstacles** to the full implementation of opportunities. Once identified, actions to **remove** or **overcome** them can be planned. The identification of barriers was done through the application of two different tools:

- through **the CircE Barriers Tool** (a questionnaire) the project partners identified and described the **barriers associated** to each **analyzed sector**, in order to **provide a regional scenario** of the barriers. Different typologies of barriers were taken into consideration: economic, market failures, regulatory failures, social factors;
- through the **CircE Mapping Tool** the partners identified and described the **barriers associated** to each **considered opportunity**, classifying each barrier according to the typologies proposed in the questionnaire.

All the barriers identified (the regional sectoral ones and those associated to the single opportunities) were taken into consideration to strengthen the analysis.

See the related reports

CircE

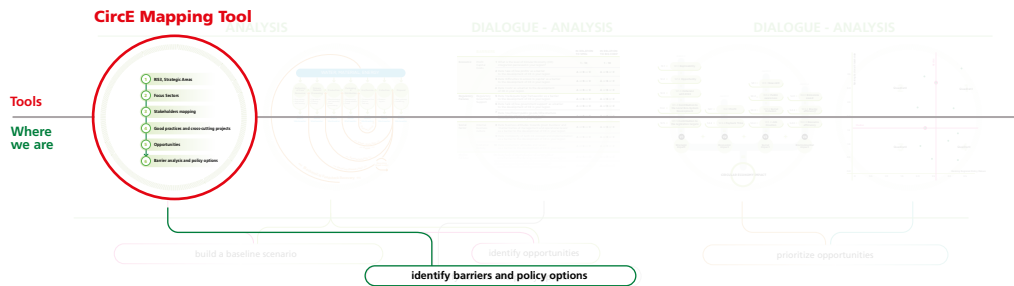Interreg Europe

identify barriers and policy options

Policy Intervention types

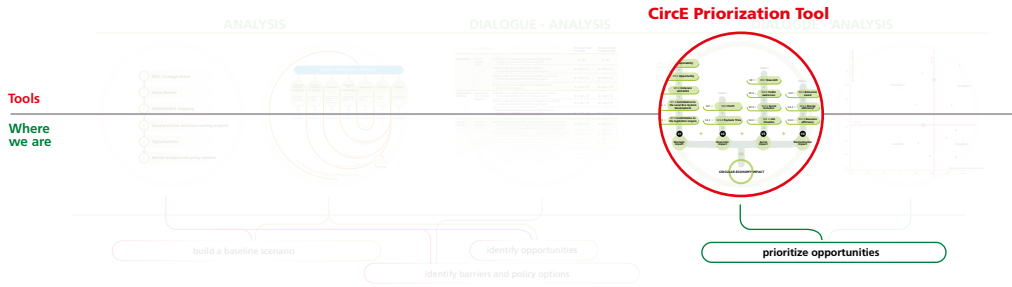|	Examples
Education, information, & awareness	Public communication and information campaigns
	Public support to new CE and system-thinking oriented education programs
Collaboration platforms	Public-private partnerships
	Industry collaboration platforms
	R&D programmes
Business support schemes	Financial support to business
	Technical support to business
Public procurement & infrastructure	Public procurement rules
	Public investment in infrastructure
Regulatory frameworks	Government strategy and targets
	Product regulations
	Waste regulations
	Industry, consumer, competition and trade regulations
	Accounting, reporting and financial regulations
Fiscal frameworks	VAT or excise duty reductions
	Tax shift from labour to resources

Identify policy options

At the beginning of the project each project partner identified one **policy instrument** to address and steer on the basis of the project results.

Steering a policy instrument means making it capable to **support** and **develop policy options,** which in turn represent ways to **overcome barriers** and **seize** the selected **opportunities**.

The technical literature provides general categories and detailed typology of policy options [7]. The project took inspiration from this literature to tailor policy solutions to be inserted into the action plans.

prioritize opportunities

Prioritize the identified opportunities

The **opportunities** were **prioritized** using the **Criteria Tree** quoted in slide 15: the process consisted in multiplying the weights – that represent the importance of each criterion - by the scores - that represent the impact of an opportunity on each criterion - and first adding up the values obtained within each branch of the tree (strategic, economic, social and environmental) and then the total values of the 4 branches.
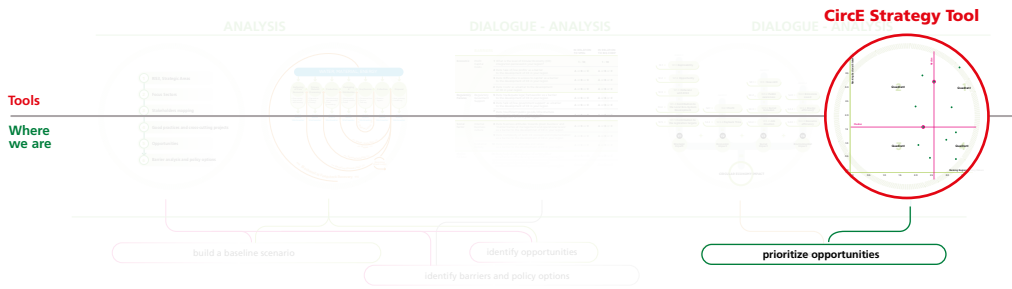
The result is the final **project partners' priority opportunities ranking**.
Some project partners produced just **one final ranking**, where the two scores got by stakeholders and policymaker were already been resolved and merged into a single score for each opportunity.
Other partners decided to keep the two different scores, got by stakeholders and policymaker, separated as **two different rankings**.

A Textile sector case

Opportunities

Opportunities	Strategic Impact	Economic Impact	Social Impact	Environmental Impact	Score
Increase the capacity of post-consumer textile collection	8,32	8,42	8,74	7,78	**8,237**
Increase the reciclability, recycling and the use of recycled fibres, threads and fabrics	8,77	8,08	6,3	8,43	**8,059**
Explore new ways of upcycling pre consumer textile waste for industrial uses	7,94	8,12	7,64	7,59	**7,809**
Scale up the creation of new business models	8	6,36	8,36	7,23	**7,450**
Ecodesign for durability	6,79	5,68	6,18	7,56	**6,698**
Intensify the search of alternatives to prevent the effects to microfibre release and other substances of concern during the product lifecycle	6,8	6,12	6,3	6,45	**6,445**
Increase savings and water and energy efficency used during the production process	5,67	7,12	4,64	7,29	**6,344**

See the related reports   See the related report _ Synoptic report

Tools
Where we are

CircE
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prioritize opportunities

Prioritize the identified opportunities: the meaning of different scores

Since **different scores** - got by stakeholders and policymaker - imply **different perceptions** of the **impact** of the **opportunities** on the **criteria**, some project partners decided to value this difference, keeping the two different scores separated as **two different rankings**.

In **Quadrant** (Q) **1** and **3**, the **perceptions** of policymaker and stakeholders are **aligned**: the opportunities in **Q1** - high scores by both groups - need a **medium-level public support** and efforts shall be devoted to **remove** the **barriers**; the opportunities in Q3 - low scores - should be supported only if surplus resources are available. In **Q2** and **Q4**, the **perceptions** of policymaker and stakeholders are **misaligned**: the opportunities in **Q2** need to **improve** their level of **maturity** and the **appreciation** of their **potential** by **policymakers**; the opportunities in **Q4** need efforts in **supporting awareness raising** towards the stakeholders and **networking** with other stakeholders that could enhance the implementation of those opportunities, possibly coupled with **financial or regulatory support**.

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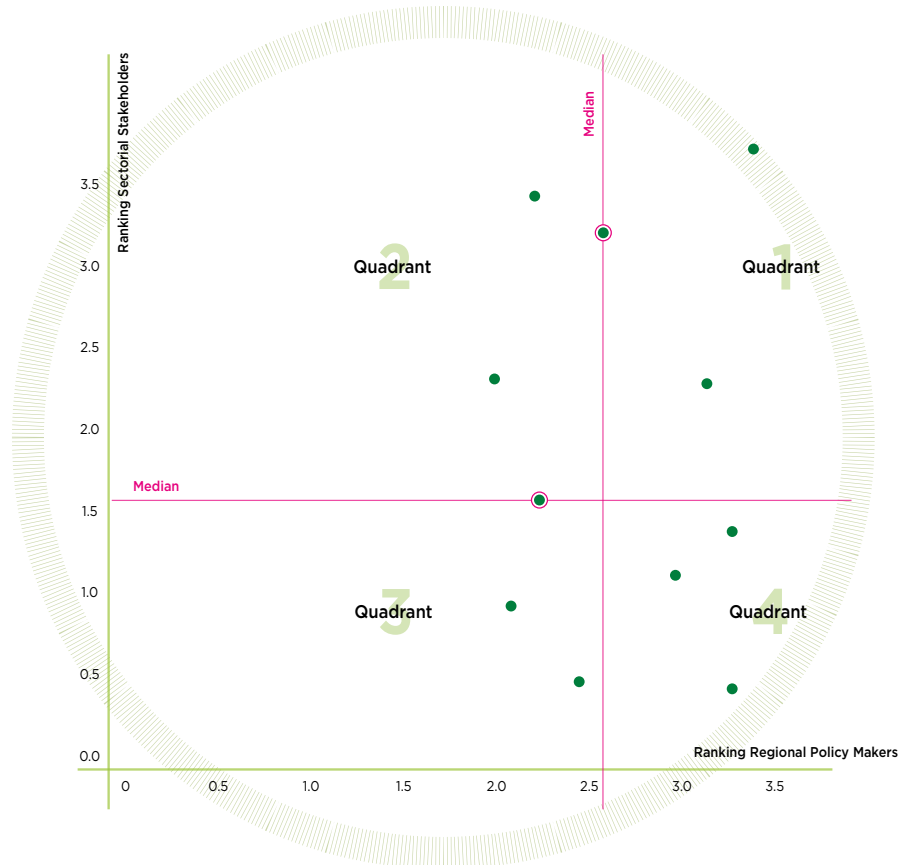
The partners and the achieved results

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Lombardy has a surface area of almost 24,000 km² and a population of about 10 million inhabitants.

The GDP per capita is among the highest in Europe and amounted up to €37,800 in 2017 (€28,400 in Italy and €29,500 in the EU). In the same year, with M€ 380.955,24, Lombardy has had the fifth largest GDP among European Regions, representing about 23% of the Italian GDP.

The economy of Lombardy, affected by an unemployment rate of 6% (compared to 10.6% for Italy and 6.9% for the EU) is characterised by a variety of activities in all the traditional sectors, such as farming (1.2% of the employees) and industry (31.5%). Services (67.3%) have also had a strong development in the recent post-industrial phase, especially in the capital city Milan. SMEs, mostly family owned businesses, dominate the market.

With 14 universities and many more research centres, Lombardy is the first Italian Region by number of patents registered at the European Patent Register concerning manufacturing technologies.

In the last five years, since circular economy (CE) has moved its first steps in the EU agenda, Lombardy has witnessed many initiatives involving policymakers, enterprises and research centres to especially enhance waste prevention and material recovery.

These pioneering, often bottom-up initiatives have been recently framed into a first Roadmap focused on Research & Innovation in CE.

MILAN, ITALY - Grande Disco

Action 1 – Steering Research and Innovation Work Programs (RIWP), calls and project

Promoting the priority opportunities, which got the highest scores in the ranking:

• taking part in the RIWP revision process lobbying for upgrading them, considering that RIWP support the effectiveness of ERDF ROP (Regional Operational Programme of the European Regional Development Fund) Axis 1 actions and of RIS3 regional strategy.

• directly designing new calls and inspiring new projects coherent with the CircE opportunity as well as with the RIWP.

Action 2 – Enhancing the maturity of emerging opportunities

Working on the opportunities which

got different scores from stakeholders (SH) and policymaker. Whenever a SH perceives the high potential of an initiative that the policymaker does not recognise as such, a possible failure in the tools available to the policymaker to monitor the state-of-the-art and set the policies is accordingly identified; vice versa, if the policymaker envisages opportunities that SHs do not perceive, an effort in supporting awareness raising, as well as a regulatory or financial intervention, may be needed to increase the competitiveness of the available options. In both cases, a dialogue involving the regional ecosystem (through specific meetings and the collaboration with the Regional Observatory for the CE & energy transition) is indicated.

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Action 3 – Further shaping the future
The CircE Toolbox can be conceived as a decision support system. The wide results coming from the exchange of experiences, steered and enhanced by the CircE Toolbox, represent a rich knowledge base available. Both the CircE Toolbox and those results can support several other policies, in particular the innovation policies. The action wants to boost the use of this package (method + results) in this direction. Some results have already been achieved, for example in relation to the Roadmap for Research and Innovation on Circular Economy and the Milan Food Policy.

Action 4 – Common action: Awareness raising and capacity-building
The activity of all the Project Partners

(through the analysis of opportunities and barriers in particular) showed that awareness-raising and capacity-building are key aspects and priorities in order to develop CE. The action wants to promote in all the activities run in the other actions the importance of awareness-raising and capacity-building and the design of a reference document, defining how to produce sound and effective dissemination, awareness and communication plans to support CE projects.

Lombardy Roadmap for Research and Innovation on Circular Economy
—————————
R&I priorities enhancing Circular Economy in Lombardy

MILANO FOOD POLICY

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With 7,6 million inhabitants and a surface area of 32,108 km², Catalonia is a diverse territory, with extensive mountains, inland depressions, and a coastline that stretches for 214 km. Catalan culture, architecture and history have developed its own unique and universal identity over the centuries. The industrial activity, which represents nearly 21% of the Catalan GDP, is highly diversified with the main branches being chemicals, food and beverage, motor vehicles, pharma, energy and metal products. This traditional industrial production together with emerging sectors such biotech and renewable

energy, services sectors like trading, ICTs, finance, healthcare, media and logistics together now represent two thirds of the Catalan GDP.

The Catalan Government has a strong commitment for circular economy policies. The Strategy "Promoting Green and Circular Economy" was adopted in 2015 to foster sustainability as a strategic element to attain economic recovery, increase competitiveness, create jobs and reduce environmental risks. In 2020 this strategy is intended to be updated and to evolve into a Circular Economy Roadmap. Apart from

Circularity: a staircase in La Sagrada Família

policies, the Catalan Government is also developing cross-cutting tools such as Catalunya Circular, the Circular Economy Observatory, which is meant to boost circular economy as well as the creation of public -private partnerships.

#CATALUNYACIRCULAR

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Action 1 – Awareness raising and capacity-building
Action focused on the textile sector with the idea of finding solutions to a real challenge regarding circularity in the textile sector through the involvement of university students.

Action 2 – Pilot action to develop an agreement on the transformation towards a circular textile sector
Action focused on the textile sector with the aim of creating a voluntary agreement to boost circular economy in the sector from a value chain perspective.

Action 3 – Identification of tools regarding circular economy and food waste prevention, and support for

their implementation: guidelines and workshop for different beverage subsectors
Action focused on the beverage sector aiming at raising awareness and promoting the adoption of circular initiatives in the sector through the elaboration of a guide showcasing circular economy tools and best practices from different subsectors of the beverage value chain.

CircE Stakeholder meeting, 2019

Action 4 – Analysis of RDI needs to increase the percentage of recycled plastic in new packaging and to seek new packaging materials
Action focused on the beverage sector with the objective of analysing –in a participatory way– priority RDI needs regarding 1) the increase in the proportion of recycled materials in new packaging and 2) the search for new packaging materials in different beverage subsectors.
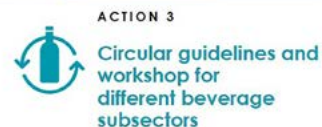
Action 5 – Integration of the circular economy in the new ERDF Operational Programme for Catalonia 2021-2027
Creation of a working group at the Department of Territory and Sustainability with the aim

of integrating circular economy issues in the new ERDF Operational Programme for Catalonia 2021-2027, both through the incorporation of 1) new core themes regarding circular economy and 2) circular economy criteria in other thematic areas subject to financing.

All actions will be carried out with the involvement of CircE Local Stakeholder Groups and are meant to improve the current and next ERDF Operational Programme Catalonia through the development of information and awareness programmes, and collaborative platforms.

ACTION PLAN TO PROMOTE CIRCULAR ECONOMY IN THE
TEXTILE AND BEVERAGE SECTORS
IN CATALONIA
2019–2021

ACTION 1
Awareness raising and capacity-building

ACTION 3
Circular guidelines and workshop for different beverage subsectors

ACTION 5
Integration of the circular economy in the new ERDF OP for Catalonia 2021-2027

ACTION 2
Agreement on the transformation towards a circular textile sector

ACTION 4
Analysis of RDI needs to increase the percentage of recycled plastic in new packaging and to seek new packaging materials

CircE
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Lower Silesia is a Region located in Central Europe. It is one of the most advanced industrial Regions in Poland. Two of the most important branches of economy are ICT and electro-mechanical sectors. Another leading industry is mining, especially extraction of copper. In addition, Lower Silesia excels in the domestic appliances and automotive sectors, although both are dominated by foreign players.

The Region is fully committed to the circular economy although it is quite a new topic in Poland. That's why Lower Silesia is also very keen to learn from policy experiences in other European Regions who share the same circular ambitions.

Before launching the CircE project Poland didn't have any document regulating the circular economy. However there were already strategies and researches that pointed out the importance of activities in this area. Since 2016 Ministry of Development has been working on establishing Inter-resorts team for circular economy in cooperation with NGOs, self-government representatives and scientists to prepare a Roadmap which is also one of the strategic projects of the Responsible Development Strategy. The Roadmap aims to identify, in particular, actions to increase resource efficiency and reduce waste production.

Action 1 – Updating Regional Innovation Strategy, one of the tools of Regional Development Strategy (RDS) 2030

The opportunity to increase the importance of CE will be included in the newly formed Regional Innovation Strategy of Lower Silesia Region that include new smart specialisations as well as the operational goals that will be set by experts working on the document. Both new smart specialisations and operational goals show the direction of future actions that the Region will have opportunities to implement. They will also be part of the Region's achievement of commitments to the transformation of the economy toward circular economy. They will also be part of the implementation of the Region's commitments to transform the economy into a circular economy.

Action 2 – Educational pilot test

It consists of several innovative

workshops for pupils and students in line with environmental priorities in the city or Region. This action came from exchange of experience during the project, especially with Catalonia Region and Gelderland Province.

Newly trained pupils will soon face the dynamic change in the approach to the product and its life-cycle. Education is a key asset in the knowledge-based economy therefore the Voivodeship executive board fully support this initiative.

The experience and knowledge gained during the project contributed to update regional strategic documents such as the Regional Development Strategy and the Regional Innovation Strategy for Lower Silesia Voivodeship. The crucial work involved the analysis of the Region's priorities, the search for opportunities and barriers in the implementation of the CE and the cooperation with local stakeholders. Due to complex approach to the topic, the 20 October 2018 update of the Regional Development Strategy includes an operational objective of circular economy, realistic and adapted to the needs of the Region.

Designing the future
The best scenario for the future is to

have a well functioning network of value chains with a consolidated market for secondary raw materials, high consumer awareness, new business models development, sustainable industrial production, critical raw materials recovery, proper biomass management and good cooperation within Poland and outside the country.

Śnieżka peak, Lower Silesia

CircE
Interreg Europe
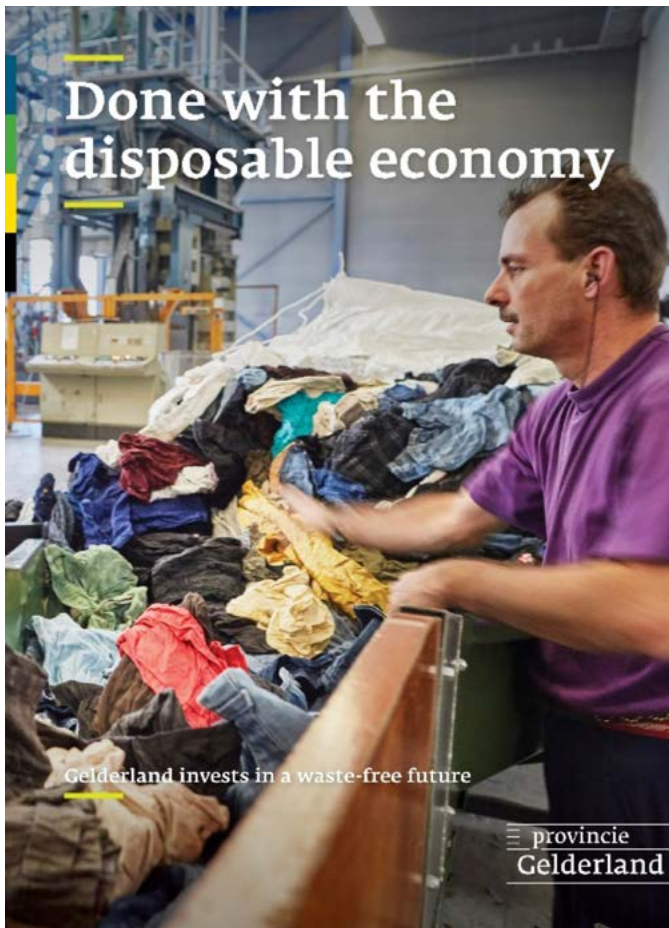
Gelderland is Netherlands largest province (2 mln inhabitants) and in 2016 one of the first Regions to launch a plan dedicated to circular economy. Over the past 3 years a total of more than 60 initiatives have been supported. Gelderland is now ready for the next step. In the new coalition agreement for the administration period 2019-2023, the circular economy is connected to residential building, economy, agriculture and permit granting processes. This approach is part of the provincial innovation policy. The policy is currently reassessed in the S3 strategy as a first step to a new ERDF program 2021-2028.

In preparation, we have shared our experiences as partner in the Interreg

EU CircE with 7 European partners. We have zoomed in on 3 sectors that are relevant to us: biomass, textile and the construction industry. The CircE-collaboration has resulted in a concise CircE action plan. It describes three concrete actions to steer policy instruments within our European Regional Development Fund program (OP Oost) more towards circular economy.

Action 1 – Circular textile
We support the development of Circular Design Hub GIST (Gelderland Innovation System for Textile) and facilitate the GIST partners to write a proposal to be granted by our EFRD-program (OP Oost). Furthermore we facilitate a new initiative called the Circular Fashion games.
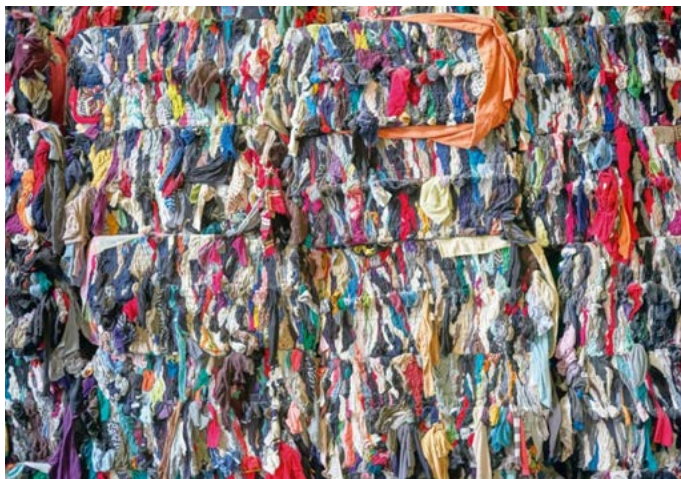
Players involved: Circular Fashion Lab Wageningen UR, ArtEZ University of the Arts, Kiemt Foundation, Modinth textile branche organization.

Action 2 – New applications for biomass
A shift from fossil to biomass material is needed to speed up the circular transition in industry. Therefore we will introduce a public tender "Smart&Circular" to speed up the market for new biomass applications. Furthermore we continue to support The Protein Cluster (TPC) aimed at cultivation, product development and marketing of new protein-rich foods. We also continue research and efforts to apply fertilizer from livestock manure in agriculture.
Players involved: TPC, Food Valley

NL, SMEs, Wageningen University & Research, Regional Development Agency Oost NL, Kiemt Foundation, Initiators manure processing plant (farmers, cooperatives), technology providers, licensing authorities (environment, spatial), European Commissions (laws and regulations applying manure in agriculture).

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Action 3 – Circular concepts for building industry

Building and construction companies are large users of virgin raw materials. Therefore we take several actions to encourage the re-use of building materials. We bring together actors, data and expertise on a regional level (Achterhoek Region). This will lead to digital and/or physical marketplace (hub) for the exchange of used building material. Furthermore, the province Gelderland itself will increase their effort to act as launching customer for reuse of building materials. As contractor in a local development project called "Bestuurskwartier" we will set and apply criteria to increase the reuse of timber.

Players involved: project developers, housing associations, municipalities, Regions, construction businesses, architects, contractors, raw material (biobased material) providers.

London is the capital and largest city of England and the United Kingdom. Greater London encompasses a total area of 1,583 square kilometres (611 sq mi). The economy of London is dominated by service industries, particularly financial services and associated professional services. By 2050, London is expected to be home to 11.1 million people, compared to around 8.7 million people today. This means that just to meet demand, at least 66,000 new homes need to be built – along with space for tens of thousands of new jobs – every single year.

The administration of London is formed of two tiers: a citywide, strategic tier and a local tier. Citywide administration is coordinated by

London overview _ Image by LWARB

the Greater London Authority (GLA), while local administration is carried out by 33 smaller authorities. The Mayor of London has a vision for London to transition to a low carbon circular economy. The London Environment Strategy (LES) is the

key policy instrument for London which sets out the Mayors ambitions and targets for the environment in London, and includes consideration of policies to support circular economy including support for the London Circular Economy Route Map.

Repair workshop _ Image by London Reuse Network

Textile upcycling _ Image by LWARB

The London Plan is the policy instrument which sets out the strategic economic, environmental, and social framework for development in London. The new London Plan expected to be published in Autumn 2020. The plan includes policies which require developers to consider CE principles during the design of developments, and for all major developments to create Circular Economy Statements which set out how they have considered circular economy principles within the life of the development.

Action 1 – Creation of Circular Economy Statement Guidance
The Circular Economy Statement (CES) is a new policy which requires major developments to embed CE. This action will create guidance which allows a clear and standardized approach to ensure the new CES policy requirements can be met.

Actors: GLA, LWARB, Technical policy experts, Planning officers in municipalities, Built environment stakeholders.

Action 2 – London Circular Economy Route Map Review and Update
The London Circular Economy Route Map (RM) is a document which sets out key actions for London to deliver to transition to a circular economy. It was published in June 2017 by LWARB. The RM will be updated to reflect learnings from the CircE project and improve the strategic approach to delivering the RM.

Actors: LWARB, GLA, SMEs, London universities, stakeholders across the 5 sectors – plastics, built environment, textiles, food and electronics

Action 3 – CE public procurement
This action would help to ensure individual London municipalities are enabled to embed circular economy principles. Guidance will be created to help embed circular economy principles in municipality procurement.
Actors: LWARB, London municipalities, SMEs, procurement experts

London Route map _ Image by LWARB

CircE
Interreg Europe

Sofia is the capital of Bulgaria and the largest political, administrative, cultural and educational center in the country, with a population of 1,3 mln. inhabitants (2018). Sofia Municipality is an administrative unit with a status of a Region, divided into 24 districts administered by local mayors. The main activities of the Municipality include: environmental protection, healthcare, transport, social, educational and cultural activities for the citizens of Sofia.

One of Sofia Municipality's key competences lies in adopting and implementing strategies, programmes and plans on local issues, concerning the sustainable development of the city. The partner, due to its role, is the local authority responsible for the drawing up, implementation and management of strategies and policies for waste collection and treatment. Sofia is obliged by Bulgarian National Legislation to develop a Municipal Waste Management Programme consistent with the National Plan for Waste Management. The city of Sofia defines in its Programme the objectives and measures and implements the policy about waste management. The action plan developed within the CircE project will be an integral part of the Sofia Waste Management Programme for the period 2021-2025.

National Palace of Culture

Action 1 – Development of strategic documents: the action foresees the first steps towards the modification and updating of the Waste Management Programme of Sofia Municipality for the next period with the inclusion of a circular economy section.

Action 2 – Design and construction of a pelletizing plant: the action foresees the design and construction of a pelletizing plant for the recovery of wood waste generated by the Sofia municipal waste treatment company. The pellets produced will be used for feeding the local heating systems for administrative and social purpose buildings, owned by Sofia Municipality, with the aim of

maximising and positively exploiting the potential of biodegradable waste.

Action 3 – Mobile separate collection: the action foresees the implementation
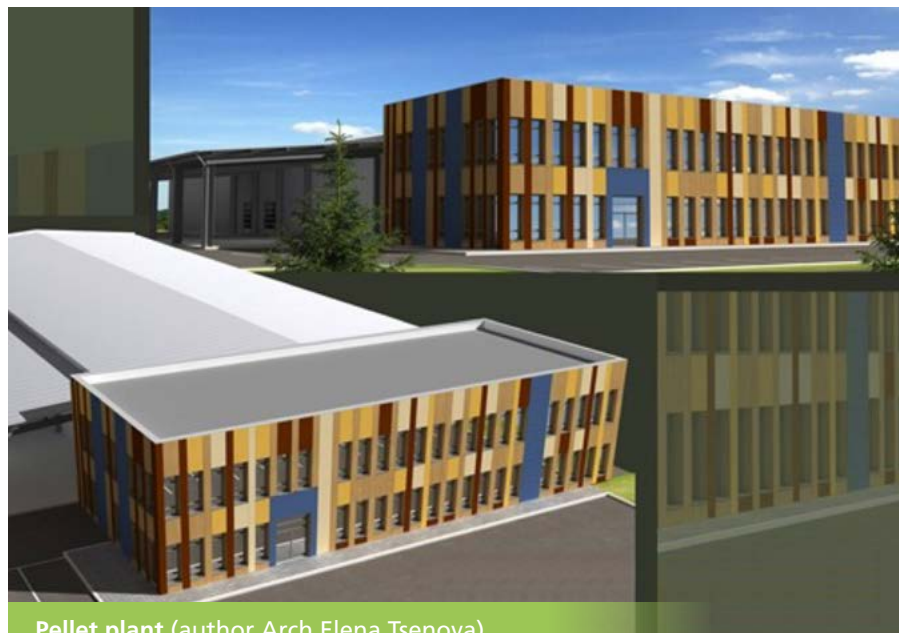
Pellet plant (author Arch Elena Tsenova)

of new separate collection systems with small bins, placed in city transport vehicles (buses and trolleybuses), owned by Sofia Municipality. In parallel with the positioning of mobile bins for separate collection, the action foresees the creation of guidelines for their implementation, to be distibuted to citizens.

Action 4 – Preparation of guidelines: the action foresees the preparation of guidelines, containing the sequential actions to be taken in case of destruction and demolition of buildings and the subsequent treatment of generated demolition waste.

CircE
Interreg Europe

In addition, the action plan sums up all identified and evaluated options for which a specific source of funding and/or initiative cannot be currently identified ((their implementation is therefore postponed) for example:

- *Sectoral separate waste collection*: biodegradable waste in hotels and accommodation as well as in municipal hospitals;
- *Centers for reuse and repair*: the main goal is to build an ECO-INDUSTRIAL PARK, representing a multifunctional complex, illustrating the idea of resource efficiency and circular economy.

Moreover the action plan proposes a section "Indirectly implemented Opportunities", with all the opportunities, whose main objectives were realized indirectly during

the CircE project through the implementation of similar projects and/or through the implementation of similar initiatives, such as:

- "Partnership" - preparation and signature of a partnership and a mutual assistance agreement in the environmental and circular economy sectors with specialised universities, targeting public awareness.
- "Public campaigns" - the opportunity identified includes campaigns, meetings, seminars and public debates to raise awareness of the potential of the transition to the circular economy.
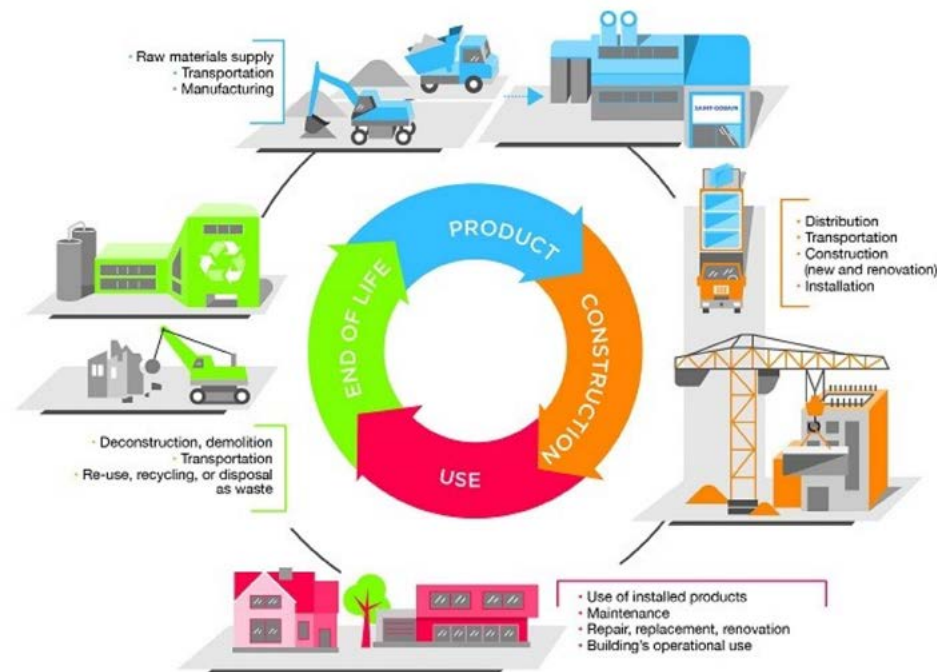
SOS together with stakeholders decided to focus on CE potential in tourism sector. The reason for this is the already achieved international recognition of Slovenia as a green tourist destination and the national strategic orientation towards sustainable development of tourism. In 2018 in Slovenia, the total contribution of tourism to the gross domestic product (GDP) increased by 6 % and accounted for 12.3 % of the total GDP, employed by the tourism industry represents 12.8 % of all employment.

With action plan SOS wants to upgrade the existing sustainable orientation with so-called circular tourism or by setting up good practices of circular tourism in activities, where municipalities have powers to act. SOS defines following sector priorities:

1. Mobility: sustainable forms and sharing economy
2. Food reduction of food waste and short food-supply chains
3. Accommodation: efficient consumption of resources, energy and space, other types of consumption, diffused hotel
4. Waste: re-use of items/objects/equipment, new business models (rent-a-service, re-use centres)

CircE
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Subject to a review of opportunities, policies and obstacles, two recommended measures are proposed to reduce obstacles and enhance the feasibility of opportunities for circular tourism in accordance with the strategic definitions of Slovenia for sustainable development and a CE.

- Measure 1: Integrating Circular Tourism into Tourism Investment Public Procurement Criteria
- Measure 2 or Joint measure: Awareness raising and capacity building

Measure 1 - Integrating Circular Tourism into Tourism Investment Public Procurement Criteria
Calls for tenders for investments into the development of integrated tourism products, shall give priority to circular tourism projects, which shall demonstrate closed-loop material flows and combination of various partners in their circular tourism principle-based product, through their scoring system.

Action from measure 1 - MOBILITY: sustainable forms and sharing economy
City municipalities with the sustainable mobility plans are supported by Integrated Territorial Investment (ITI) with projects for environmentally friendly public transport, rental of bicycles (including electric) and development of cycling infrastructure; promotion of soft mobility and sharing economy and developing an incentivising support environment for the development of electric mobility.

Coffee break organized by municipality Kočevje, on of the Plastic-free events

Measure 2 or JOINT MEASURE: AWARENESS-BUILDING AND CAPACITY BUILDING

SOS's action under measure 2: Slovenian municipalities towards organizing events without the single-use plastics

Joint measures for all CircE partners are measures aimed at building capacity, implemented in all Regions irrespective of the differences in defined options and sectors that they deal with. SOS is implementing this with campaign "Plastic-free events".
 The number of public events in Slovenia increases from year to year. In 2018 we had more than 15.000 events and there were already 16.000 events in 2019, many of them organised by municipalties.
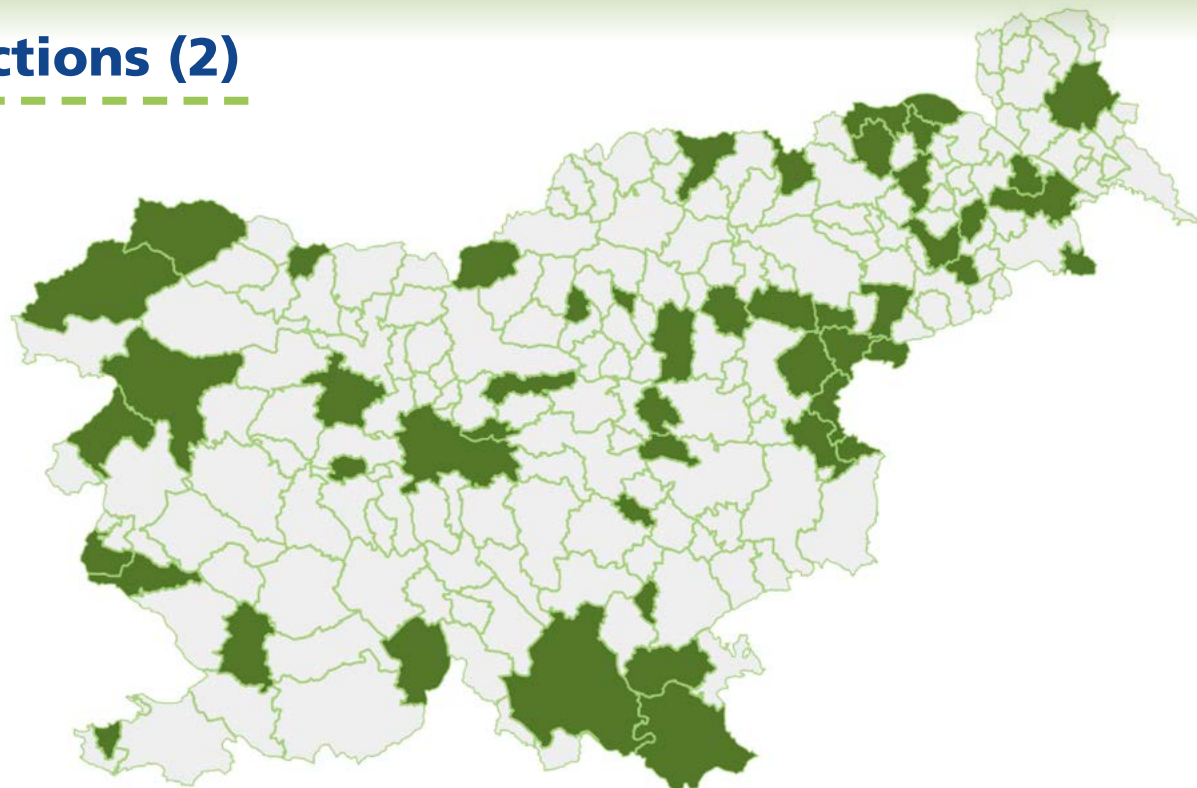
49 municipalities voluntarily committed to organize events without single-use plastics

In November 2019 Slovenian Government and SOS signed an agreement on organizing events without the single-use plastics. SOS invited municipalities to co-signed the agreement. Until May 2020 SOS collected 49 voluntarily based signatures of municipalities and numbers still growing are available on map of SOS website.

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CD2E is a French association including universities, centers of research, SMEs, companies, local authorities and the regional government of Hauts-de-France. Since 2002, it has supported regional businesses to develop existing competencies, cultivate new expertise, create jobs and innovation in Northern France, in six environmental sectors: Ecoconstruction, Water, Renewable energy, Life Cycle Management, Recycling & material recovery, and Sediment.

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Definitions, references and bibliography

Definitions of flows in the value chain

Primary flow/product flow
(core resources transformation)

Gathering of Core Resources: this encompasses all the activities referred to the gathering of raw materials.

Primary Material Processing: this encompasses all the activities that pre-process the "core" material, before production in the narrow sense.

Production: this encompasses all the production activities, i.e. the activities and processes which act on the pre-processed input material and transform it to generate the core value-added product within the value chain.

Packaging & Distribution: this encompasses all the operations dealing with the packaging of the value-added final product, and its distribution to the users.

Use/Service: this encompasses the use of the product and the related services.

Collection: this encompasses all the reverse logistics operations of collection of post-use products or materials.

Disposal: This encompasses all the activities concurrent to the non-circular disposal of the product or its materials in landfills.

Secondary flows/product flows

For each position in the linear value chain (primary flows), it is possible to identify "*Secondary Flows*". They can be either input flows (e.g. materials, water and energy) or output flows (e.g. by-products, such as solid waste and wastewater) of a specific position in the value chain. These latter can result in "Primary Flows" of other value chains as well. Please note that the property of a product/material flow of being "Primary" or "Secondary" depends on the value chain under analysis.

Reverse flows

Maintenance: operations performed on a product, in order to extend its useful lifetime.

Reuse: operations where a return product is put back into service, essentially in the same form, with or without repair or remediation

Repair: correction of specified faults in a product; actions performed in order to return a product or component purely to a functioning condition after a failure has been detected.

Remanufacturing: standardized industrial process aiming at restoring or upgrading the functions of a product, in line with technical specifications.

Closed Loop Recycling: resource recovery method involving the collection and treatment of waste products for use as raw material in the manufacture of the same or a similar product.

Open Loop Recycling: conversion of material from one or more products into a new product, involving a change in the inherent properties of the material itself.

Biochemical Feedstock Recovery: process of restoring materials found in the waste stream to a beneficial use which may be for purposes other than the original use.

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This publication is dedicated to the vivid memory of **Paola Ornella Mariani,** who passed away, after a long battle with her disease, at the end of June 2019 - just at the switch from Phase I to Phase II of CircE. A brilliant scientist based in the Technological Park of Lodi (Lombardy), Paola has been an active stakeholder in CircE all over Phase I, participating in many meetings in Milano, Ljubljana, Barcelona on behalf of CAT.AL - *Cluster Alta Tecnologia Agrofood Lombardia.* We already miss her wit, enthusiasm and profound empathy; getting to know her has been a privilege, nonetheless.

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Credits

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