European Commission

# Methodology for the implementation of a circular economy at the local and regional scale

Circular Cities & Regions Initiative

*Research and Innovation*

**Circular Cities and Regions Initiative | Methodology for the implementation of a circular economy at the local and regional scale**

European Commission
Directorate-General for Research and Innovation
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# Executive summary

Much has been invested in the circular economy at the EU level in recent years. Circularity is acknowledged in the Green Deal Communication as a key instrument for climate change mitigation and gained even more importance during the COVID-19 pandemic, due to its power to strengthen local communities and economies. Similarly, Horizon Europe brought a strong focus on systemic transition towards a circular economy (CE) and society. These funding programmes have already provided a boost to the roll-out of the CE – accelerating the transition to more sustainable consumption and production systems in which resource consumption and environmental degradation can stay within planetary boundaries. It is becoming increasingly clear that changing our long-standing socio-economic system based on 'take-make-discard' behaviour requires a systemic change to be pursued as a society. In this sense, cities, regions and territorial clusters can act as potential engines to close waste and material 'loops', providing a fertile ground for implementing, demonstrating and replicating innovative circular solutions.

A key condition for making these Circular Systemic Solutions (CSSs) work is to ensure that local policy and decision-makers have access to relevant information to implement, replicate or upscale circular solutions. **This document aims to provide decision-makers with actionable guidance to help accelerate the transition towards the circular economy at the local or regional level**. It takes stock and draws on past and current efforts/initiatives aimed at deploying the circular economy at local level and serves as the main reference/guidance within the CCRI laboratory to help the pilot groups and any other interested cities/regions develop and implement Circular Economy Action Plans and CSSs.

Developed in the framework of the Circular Cities and Regions Initiative (CCRI), this **methodology** is mainly designed for the use of policy and decision-makers operating at various levels of local and regional governance, who may be willing and competent to promote the development and implementation of circular economy initiatives and projects as well as the development of Circular Economy Action Plans and Circular Systemic Solutions within their respective territories. However, the document also considers issues relevant to the business sector as this is expected to play a key role in funding and promoting CE practices in collaboration with public authorities.

The CCRI Methodology distinguishes between **three phases** (inner circle): MAP – the territory and understand its potential; DESIGN – the circular systemic solution; and IMPLEMENT – the circular systemic solution. Each phase addresses several thematic/action areas (i.e., the cards around the circle) that should be addressed to move forward soundly along the decision-making process. Together, the phases and thematic areas define a tiered approach that helps to generate the relevant knowledge base to support decision-making since the early stages of the process until the implementation of concrete actions. Throughout the various thematic areas, **the methodology addresses the technological, scientific and governance components of Circular Systemic Solutions**, including environmental and societal aspects. Particularly, the CCRI Methodology considers:

- the building of quantitative and qualitative knowledge in relation to the resource consumption and waste generation in the territorial system;
- the definition of the city/region priorities and related objectives based on the quantitative and qualitative knowledge;
- the assessment of economic, environmental and social impacts (from generic to more detailed) of strategies and concrete CSS initiatives;
- the analysis of potential drivers and barriers (including regulatory, technological, economic) in relation to the implementation of specific circular solutions;
- the definition of specific measurables targets according to a time frame, as well as the indicators aimed at their measuring to monitor the accomplishment of the priorities and objectives;
- the formulation of a sounding Stakeholder Engagement Plan and the co-creation of inclusive Circular Systemic Solutions.

## The visual identity of the CCRI Methodology


The phases outlined in the methodology have been designed to be implemented consecutively. However, given the fact that cities and regions may find themselves in different situations and levels of advancement towards achieving their circularity ambitions, decision-makers and users of the methodology may access directly to the methodology phase they are most aligned with. Summary boxes are provided at the beginning and at the end of each chapter to warn the reader about the ambitions and results pursued in each phase. These summary boxes might also be used to check whether all phase requirements have been fulfilled, or conversely, if the decision-maker should take a few steps back to better address the key topics in the previous stages.

Finally, **the CCRI Methodology is being/has been developed in close cooperation with the CCRI Self-Assessment Tool** in order to guarantee a smooth integration and effective synergies between the two instruments. On the one hand, the CCRI Methodology offers the natural theoretical framework to which the users of the Self-Assessment Tool can refer to better interpret and analyse the results of the evaluation tool. On the other hand, the Self-Assessment Tool operationalises part of the available knowledge provided in the methodology to keep track of progress towards the implementation of the CSSs. One of the objectives of this co-development will be to link the results of the Self-Assessment Tool (in terms of identified gaps) to specific sections of the CCRI Methodology to allow the user a seamless experience between theory (CCRI Methodology) and practice (Self-Assessment Tool).

This guidance is the result of a collaboration led by the CCRI Coordination and Support Office with the European Commission and the CCRI Pilot cities and regions as key contributors. The methodology will also be developed in cooperation with the CCRI Fellows, Projects and the Associated Partners, including leading policymakers, businesses and academics, and relevant institutions and organisations.

This is a living document which will be improved and updated according to, *inter alia*, the experienced gained from applying and testing the methodology in CCRI Pilot cities and regions.

# List of abbreviations

| | |
|---|---|
| **AI** | Artificial Intelligence |
| **CBM** | Circular Business Model |
| **CBA** | Cost-Benefit Analysis |
| **CCRI** | Circular Cities and Regions Initiative |
| **CDW** | Construction and demolition waste |
| **CE** | Circular Economy |
| **CEAP** | Circular Economy Action Plan |
| **CEIP** | Circular Economy Investment Plan |
| **CSO** | Coordination and Support Office |
| **CSS** | Circular Systemic Solution |
| **EC** | European Commission |
| **EEA** | European Environmental Agency |
| **EIB** | European Investment Bank |
| **EU** | European Union |
| **EW-MFA** | Economic-Wide Material Flow Analysis |
| **ICT** | Information and communication technology |
| **IOT** | Internet Of Things |
| **KPI** | Key performance indicators |
| **KT** | Knowledge Transfer |
| **LCA** | Life cycle assessment |
| **MFA** | Material Flow Analysis |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PDA** | Project Development Assistance |
| **PPP** | Public-Private Partnership |
| **PSS** | Product-Service System |

| | |
|---|---|
| **RFID** | Radio Frequency identification |
| **RTO** | Research Technological Organisation |
| **SAT** | Self-Assessment Tool |
| **SEP** | Stakeholder Engagement Pan |
| **SME** | Small and medium-sized enterprises |
| **SRM** | Secondary raw material |
| **TRL** | Technology Readiness Level |
| **WEEE** | Waste from electrical and electronic equipment |

# Glossary

**Circular Economy (CE) action:** Within the CCRI Methodology, a CE action is a constituent element of a CSS, that is an initiative or activity, which together with others, contributes to the creation of a CSS.

**Circular Cities and Regions Initiative (CCRI):** The Circular Cities and Regions Initiative (CCRI) is an initiative of the European Commission launched by the Directorate-General for Research and Innovation (DG RTD) as part of the EU Circular Economy Action Plan 2020. It focuses on the implementation of Circular Systemic Solutions at local and regional scale. The CCRI provides a local contribution to the implementation of the European Green Deal and the European bioeconomy strategy.

**Circular Cities and Regions Initiative – Coordination and Support Office (CCRI-CSO):** Launched and funded by the European Commission, the Circular Cities and Regions Initiative – Coordination and Support Office (CCRI-CSO) is responsible for facilitating the implementation of the CCRI. The CCRI-CSO is made of a multidisciplinary team of experts in the field of circular economy, providing practical and tailor-made support to a group of cities, regions and territorial clusters to overcome circular economy gaps. It also supports the creation of synergies and complementarities with and among projects and initiatives that are relevant for CCRI and can provide valuable input for supporting the circular economy transition at local level.

**CCRI Associated Partners:** Institutions, organisations and foundations that have important initiatives relevant for the circular economy at local and regional levels. They include the European Investment Bank (EIB) and the Organisation for Economic Co-operation and Development (OECD). The CCRI-CSO will be exchanging knowledge with them and creating synergies. Furthermore, CCRI Associated Partners take an active role in supporting the Fellows and other interested cities/regions/clusters.

**CCRI Projects:** Research and innovation projects, funded by Horizon 2020 and Horizon Europe, which are generating innovative knowledge and demonstrating systemic solutions that contribute to providing support to cities and regions for implementing their Circular Systemic Solutions (CSS) at local and regional scale. These include demonstration, Project Development Assistance (PDA) and other cross-cutting projects which must be carried out in close cooperation and coordination with the CCRI-CSO.

**CCRI Self-Assessment Tool (CCRI-SAT):** The SAT is a supporting instrument that assesses the implementation process of a Circular Systemic Solution in a city, region, or territorial cluster. It is part of the methodological guidance provided by the Circular Cities and Regions Initiative (CCRI).

**Circular Economy Action Plan (CEAP)**: A strategic document for the implementation of the circular economy in a city, region or territorial cluster. A CEAP should identify key actors and drivers of the transition to circularity and analyse the economic, social and environmental benefits and challenges related to its implementation. A CEAP should also consider regulatory obstacles and drivers, and provide policy recommendations. Furthermore, it should analyse the effectiveness of financial schemes for territorial solutions. Ultimately, a CEAP defines the roadmap and the action agenda to move towards circular systems. A CEAP can include several Circular Systemic Solutions. A CEAP can be based on a local/regional strategy on circular economy or include strategic elements itself.

**Circular Economy Investment Plan (CEIP):** The Circular Economy Investment Plan is a plan identifying concrete investment opportunities to implement the respective Circular Systemic Solution(s) and CEAP.

**Circular Systemic Solutions (CSS):** A project aiming to achieve an overall net sustainability-added-value in a local context by applying innovative circular models. These projects are holistic and seek to achieve minimal trade-offs. They are systemic in a sense that they involve different actors and value-chains, potentially involving more than one level of government and governance, address a variety of circularity issues and consider all causal factors that may enable or hinder a transition towards circular economy at the local level. A CSS is systemic also in its impacts and outcomes, addressing and involving economic, social and environmental aspects. Circular Systemic Solutions should address the major challenge of effectively applying the circular economy concept beyond resource management and recovery in the waste and water sectors.

**Circular Territorial Cluster**: This is a socio-economic and environmental system composed of all relevant actors and dimensions to implement, demonstrate and facilitate the replication of at least one Circular Systemic Solution.

**Cost-Benefit Analysis (CBA):** This is the predominant tool used in welfare economics in order to assess whether an intervention – be it a project or policy – should be undertaken or not. The criterion for an intervention to be undertaken is that its benefits outweigh its costs. Societal CBA is used to refer to an extended CBA that takes into account the full spectrum of costs and benefits (including social and environmental effects) borne by society as a whole as a result of an intervention.

**CSS Action Plan:** In the CCRI Methodology, we refer to the CSS Action Plan as the document that outlines the steps/actions or activities necessary to carry out the CSS and achieve the set objectives. It's an essential part of the strategic planning process and helps with improving teamwork planning. Notably, the CSS Action Plan should include: i) the ambitions (objectives) of the city or region; ii) the list of actions needed to address each objective; iii) how CE actions (or the CSS) fulfil strategic objectives; iv) the timeline for the action's implementation; v) who will be responsible for actions implementation; v) expected impacts of the actions; and vi) a KPIs scoreboard to monitor CSS implementation. The CSS Action Plan (or a synthetic version) generally becomes part – in the more mature stages of project development – of the CSS Business Plan (see below).

**CSS Business Plan:** In the CCRI Methodology, we refer to the CSS Business Plan as the document defining in detail the CSS objectives and how it plans to achieve its goals, particularly financial and operational standpoints. It should describe: CSS customer(s) and the problems/needs they seek to address; the CSS value proposition highlighting how the proposed CSS will address these problems and create extra benefits; CSS owners/providers, key CSS actors and suppliers and key resources and activities that are required to implement and maintain the CSS; costs and expenses required to operationalise the business model; and revenue model(s) that will ensure profitability in the long run. The CSS Business Plan is a key document supporting the CEIP as it can be used to attract investment before the CSS has established a proven track record. It can also help to secure lending from financial institutions.

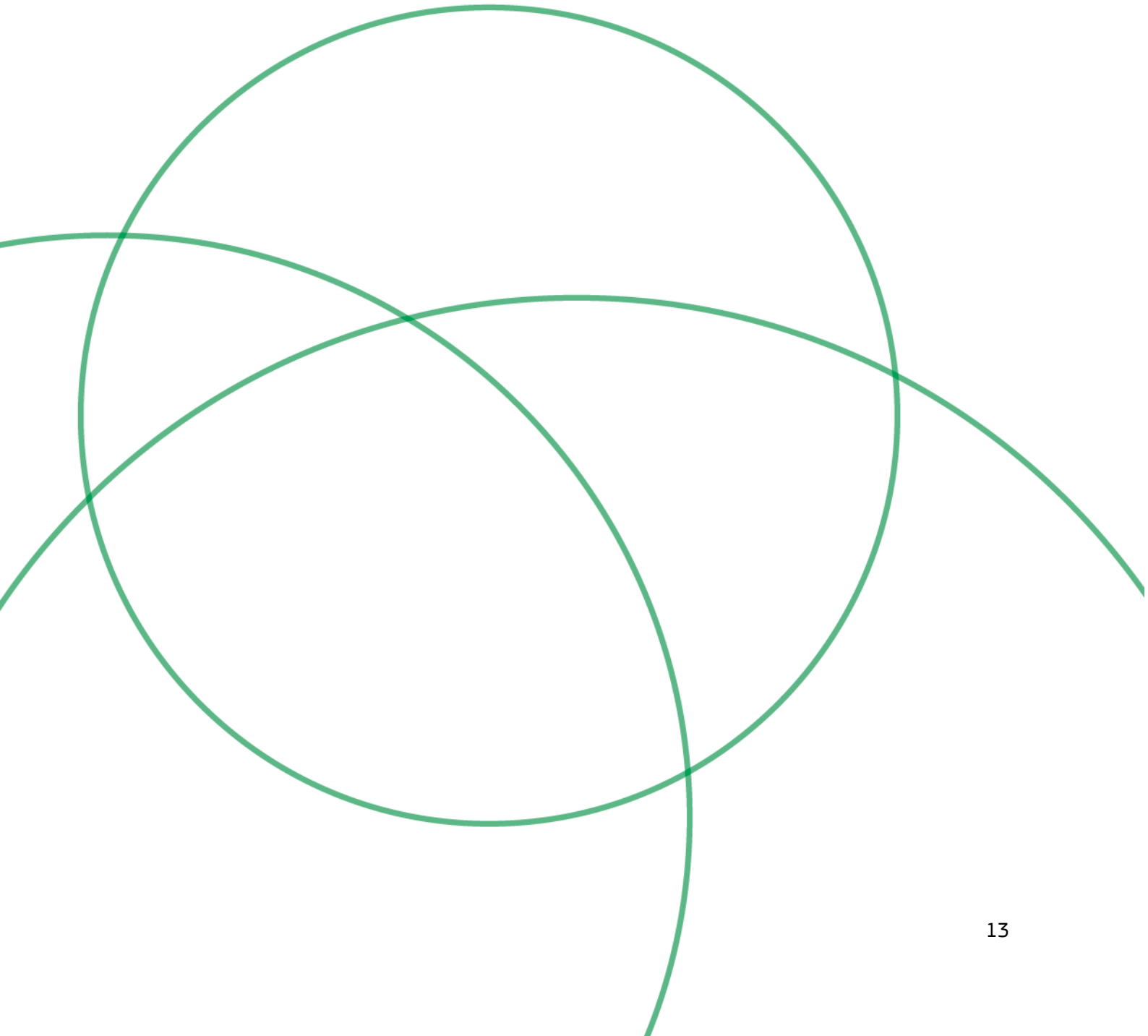
**Life Cycle Assessment (LCA):** LCA is a structured, comprehensive and internationally standardised method to quantify all relevant resource requirements, emissions, wastes and the related environmental and health impacts associated with a product, system, or service. LCA considers a product's full life cycle: from the extraction of resources, through production, use and recycling, up to its end-of-life. LCA represents one of the main scientific approaches behind modern environmental policies and business decision support related to Sustainable Consumption and Production.

**Urban metabolism (UM):** UM is a framework to facilitate the description and analysis of material and energy flows within cities. UM approaches generally focus on mass-based indicators and make use of Sankey diagrams to visualise the magnitude of materials moving within the territory. UM usually involves the mapping of flows of materials entering the city (e.g., imports of materials from other areas or withdrawals from the natural environment) and how they are consumed (e.g., energy, biomass), transformed (from raw materials to manufactured goods), accumulated (e.g., buildings), or discarded (i.e., waste) in the urban system.

**Value-chain:** A value-chain comprises of all the activities (or economic sectors) that provide or receive value from designing, making, distributing, retailing and consuming a product, including the extraction and provision of raw materials, as well as the activities that are involved with the product (e.g., textile) after its useful service life. In this sense, the value-chain covers all stages in a product's life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation. At all stages in the value-chain and in the transport of intermediate and finished products between the value-chain stages, raw materials and energy are required and emissions to the environment are produced. In addition, the value-chain is also comprised of the actors undertaking the activities and the stakeholders that can influence the activities. The value-chain thus incorporates not only the physical processes, such as farms and factories, but also the business models and the way products are designed, promoted and offered to consumers.

# Part I

## Introduction



# 1. About the CCRI Methodology

Being the places where people live and work, consume, and dispose, regions and cities have a key role to play in the transition to the circular economy. According to OECD (2020) and United Nations (2017), cities will host two thirds of global population by 2050. The extraordinary concentration of the socio-economic fabric in these territories will bring an excess of challenges and opportunities to move towards circular systems of production and consumption. A high density of businesses (especially retailers) and consumers makes cities concentrators of flows. This requires and allows the creation of reverse operations at scale. Since within city boundaries consumption is often higher than the production of goods, setting up local loops and increasing self-sufficiency will be key to ensuring sustainable and resilient economies. Cities are also a hotbed of innovation – incubator spaces, urban living labs and urban farming are just three examples of the various local initiatives aimed at experimenting with innovative production and consumption approaches. Finally, city governments can in certain instances move faster than their national counterparts, especially when united in city networks.

Despite the promising outlook, the full deployment of circular systems in cities and regions still needs to be unlocked. It remains extremely complex for a city to define which combinations of CE initiatives can be implemented ensuring, on the one hand, the economic and technical viability, and, on the other hand, fulfilling social and environmental goals. In this context, providing guidance to support the circular economy has proven to be key as also demonstrated by the exceptionally high number of guides developed over the last few years. As an example, 'A toolkit for policymakers' (Ellen MacArthur, 2015) was one of the first methodological guidelines in support of national policymakers to accelerate the transition towards the circular economy. While the approach to the CE from a national perspective remains important for defining general strategies and observing macroeconomic trends, the regional and local levels have proved to be the key context for the implementation of concrete circular solutions (Avdiushchenko, 2018). As a result, recent years have seen a flourishing development of methodologies and guides aimed at giving support to local actors. Just to cite a few, the OECD report 'The Circular Economy in Cities and Regions' (OECD, 2020) focuses on enabling local governance conditions to foster the transition to the circular economy in cities and regions, while the 'Roadmap for a Circular Resource Efficiency in cities' (2020), developed by the Circular Economy Partnership, provides a step-by-step plan that guides cities through the resource management development process.

This document complements previous research by providing a systematic methodology to guide the entire process of developing and implementing a CSS. The methodology is mainly thought for local policy and decision- makers, and it addresses technical, scientific and governance aspects of CSSs, including environmental and societal aspects. It presents and introduces the steps to be considered for the creation of an effective and systemic circular solution, including, *inter alia*, the use of a value-chain perspective, the prioritisation of intervention areas, and the identification of CE opportunities and their evaluation. This process, which makes the backbone of the CCRI Methodology is detailed in Part II of this document.

The CCRI Methodology aims at becoming the reference document in the future that will help key stakeholders use a common language for circular transitions and CSS implementation. Achieving this objective would help scaling up CCRI actions and foster a more efficient transfer of knowledge and know-how between EU cities and regions.

## 1.1. Who is this guidance for?

The CCRI Methodology represents one of the key resources of the Coordination and Support Office (CSO). It gathers most of the relevant technical and scientific approaches and tools that have been used in the past and present, and valorises the heterogeneous experiences of the CCRI Pilot regions and cities in order to inspire innovative CSSs and CEAPs able to contribute to the shift to more sustainable and circular local economies.

The CCRI Methodology addresses the various types of stakeholders interested in the implementation of circular economy projects and CEAPs at local and regional level, including local decision-makers, project promoters[1] and urban stakeholders. In order to guide and inspire CSS deployment, the CCRI Methodology takes stock and story-tells the CCRI Pilots' experiences in an easy-to-understand manner, explaining both the theoretical considerations behind the activities and the practical, deployment side.[2] Moreover, the methodology presents new operative resources, including the Self-Assessment Tool, a portfolio of CSSs and a template for the definition of a CSS business plan, among others. Overall, the CCRI Methodology offers a comprehensive insight to local decision-makers on how a CSS should be designed, gives ideas and inspires various local actors about their roles and opportunities, and informs the scientific community about the methodologies to use for evaluating CSSs (Figure 1).

Figure 1: Main audience of this document

**For local decision-makers, the CCRI methodology offers…**

- a comprehensive understanding on how to design, deploy and implement CSS based on local evidence, including the role of stakeholder engagement and the aligment within existing policies
- inspiration from different EU Circular Systemic Solutions and Circular Economy good Practices

**Urban stakeholders such as CSOs, companies, citizens will find in the CCRI methodology…**

- ideas to develop projects/commercial consulting services for decision-makers/local authorities in the area of circular economy;
- considerations and tools for stakeholder engagement that enable the direct involvement of the interested urban actors (e.g., companies, citizens, etc.)

**For research actors, the CCRI methodology provides…**

- detailed explanations of the various technical tools used to identify, design and implement CSSs and the way they can be applied in different practices
- an understanding and potential use of results in further research activities dedicated to CSSs at region and city level

[1] By project promoters we refer to any stakeholder willing to transform a circular idea into a proper innovative and/or bankable project.

[2] Note that for the time being 'pilots experience' are not provided (nor available). The intention is to document the experience of the pilots and, in general, the CCRI-CSO experience by introducing boxes in the document that story-tell specific case studies.

## 1.2. Reading Guide (document)

The document is divided into three parts. **Part I** introduces the framework of the CCRI-CSO along with basic concepts of circular economy. **Part II** presents the CCRI Methodology to support cities and regions in implementing CSSs, while **Part III** collects a list of technical factsheets, which offer specific insights into both CSS good practices and the tools that are used to design and implement CSSs. The following table explains how users can navigate through this document. The table also indicates which topics are of particular interest for local authorities and businesses.

Table 1: Where to find what in the document

| Part | Chapter | Sub-chapter | What is covered | For whom is this particularly relevant? | How can it help? |
|---|---|---|---|---|---|
| **Introduction** | **2** | **2.1** | Basic concepts of circular economy | For those unfamiliar with the circular economy | Provides an overview on main concepts related to circular economy, including main circular strategies and circular business models |
| | | **2.2** | The EU trajectory on circular economy, current EU financing programmes and key product value-chains | For those interested in the political domain of the circular economy | Presents the EU key strategic documents on circular economy and the main financing programmes. |
| | | **2.3** | The role of digitalisation in accelerating the circular transition | For those interested in knowing more about the link between the circular and digital economy | Provides an overview of how digitalisation can support circular solutions. |
| | **3** | | Key stakeholders | Especially for policy makers and project coordinators | Provides an overview of the key stakeholders to engage when defining a circular strategy, including their roles. |
| | **4** | | The link between the CCRI-CSO and this document | For all | Explains how this document was conceived and its main functions. |
| **CCRI Methodology** | **1** | | Mapping phase: all the preparatory activities required to start the CSS design | For all | Describes the activities required to get a good understanding of the local context. These include policy analysis, urban metabolism and stakeholder mapping. |
| | **2** | | Designing phase: all the activities required to identify, define and evaluate a CSS | Policymakers and academia & research institutions | Describes the activities required to design a systemic and effective CSS. These include stakeholder engagement, intervention area identification, CSS definition and evaluation. |
| | **3** | | Implementing phase: all the activities necessary to get the CSS in motion | Policymakers and businesses | Describes how to create a CSS business plan, the types of financing and the importance of both monitoring and report CSS progress. |
| **Factsheets** | **Tools** | | List of tools that can be used to design and assess CSSs | Academia & research institutions | Provides detailed information on selected tools, including reference to projects where these have been used |
| | **CSSs** | | List of CSSs currently implemented in EU | Policymakers and businesses | Provides detailed information of ongoing CSSs. |

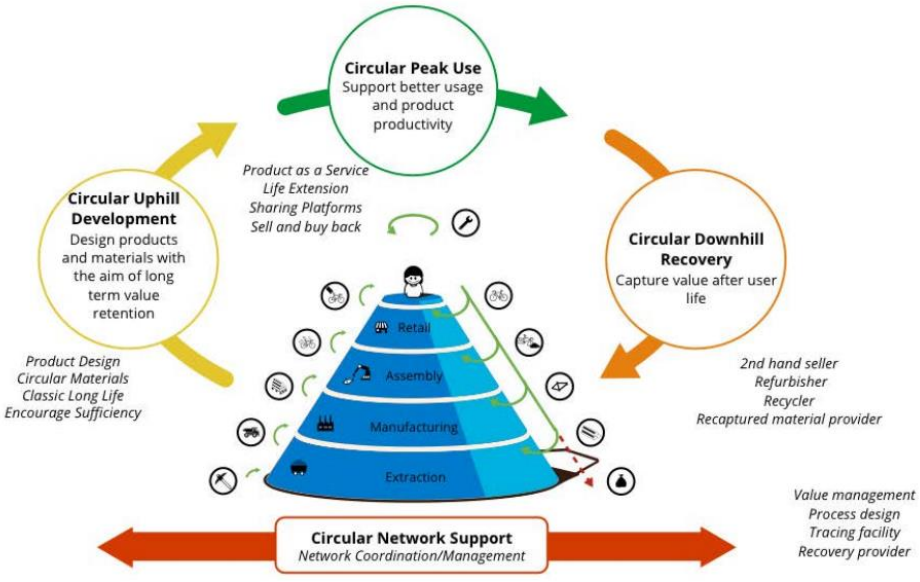
# 2. The circular economy in the EU

## 2.1. The need for Circular Systemic Solutions

Increasing global consumption and growing pressure on resources mean that there is an urgent need to decouple economic growth from resource use. The recognition of the need to integrate a new economic model, one that is less wasteful and environmentally damaging, has drawn increasing attention to the concept of 'circularity'. As defined by the Ellen MacArthur Foundation (2013), **a circular economy aims to preserve value –by designing out waste and pollution, and optimising resources – by keeping products and materials in use, and ensure system effectiveness by regenerating natural systems**. The efficient (re)use and recycling of resources, materials and products from closed loops represents the transition away from a consumption- and disposal-based linear models.

**Cities and regions** have an important role to play in making the circular transition happen, as they are at **the centre of key decisions determining economic growth, social well-being and environmental benefits**. On the one hand, cities and regions have direct competences in key CE sectors such as buildings, mobility and waste management, among others. On the other hand, cities and regions are also directly connected to local networks. As a result, they are in a privileged position to channel local resources for the deployment of circular innovations along the value-chain of priority sectors and products. For cities and regions, the circular economy represents an opportunity to rethink production and consumption models, services and infrastructure in order to enable long-term value retention of products and materials, increase resource productivity and further capture value after product end-of-life (Figure 2). In this context, the transition to a circular economy requires a systemic change where provision of services is carried out by ensuring an efficient use of primary resources and giving priority to their reuse; economic activities are planned from a life cycle perspective and carried out in order to close, slow and narrow loops across value-chains and infrastructures are designed and built to avoid linear locks-in (OECD, 2020).

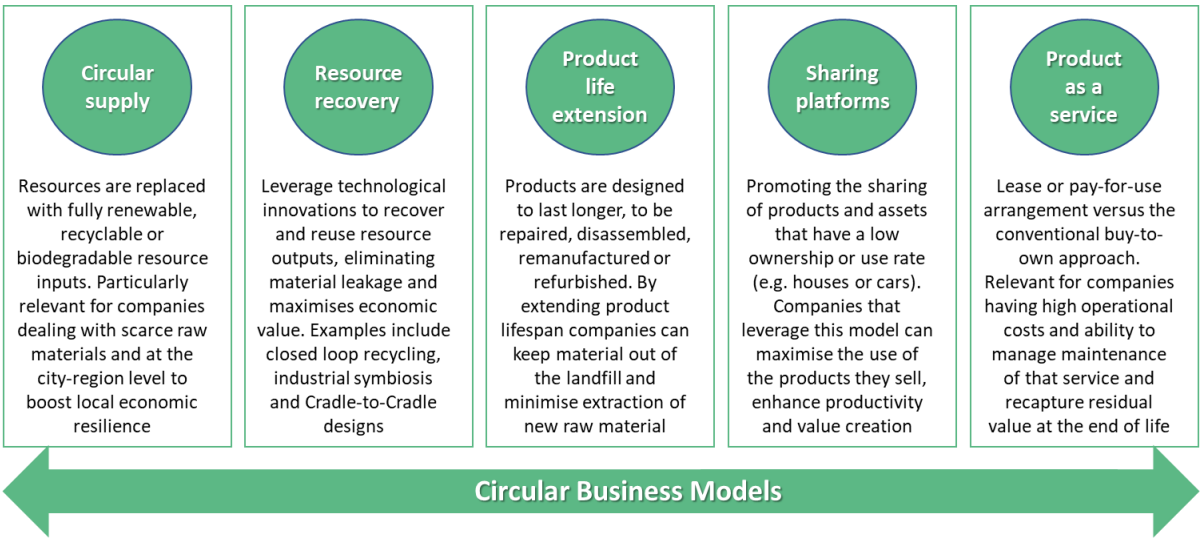
Figure 2: The 'value hill' of circular economy[3]




[3] Source: Roadmap for a Circular Resource Efficiency in cities – Partnership on Circular Economy of the Urban Agenda for the EU.

Moving towards an alternative economic system requires a transformation of production and consumption patterns, value-chains and sectors. This in turn requires new business models and innovations, which will be disruptive. **Circular Business Models (CBM)** represent fundamentally different ways of producing and consuming goods and services. Businesses have the potential to drive the transition towards a more resource efficient and circular economy and, in doing so, significantly reduce the environmental pressure resulting from economic activity. Although there are many possible business innovations and associated business models that may come to play when transitioning towards circularity, five overarching CBMs can be identified reflecting the basic principles of circular economy: circular supply; resource recovery; product life extension; and sharing platforms and products as a service. These are described in Figure 3.

Figure 3: Overarching Circular Business Models [4]




## Circular Economy Action Plan (CEAP)

A CEAP is a strategic document defining the roadmap and the action agenda to move towards circular systems. It identifies key actors and drivers of the transition to circularity and analyse the economic, social and environmental benefits and challenges related to its implementation. In general, a CEAP is based on different CE initiatives or CE projects covering different thematic areas, from cross-cutting initiatives aimed at increasing social awareness or the involvement of key stakeholders, to CSS projects targeting a sector/value-chain with the aim of making this more circular. Given the great variety of territorial contexts and priorities that characterise cities and regions, the design of CEAPs is place-based and includes circular solutions that respond to local ambitions and challenges (Bianchi et al., 2022; Tapia et al., 2021).

In previous years, several cities and regions in Europe have defined their own **Circular Economy Action Plans (CEAP)** to set the basis for sustainable circular ecosystems and to design participatory community-based innovation schemes in their localities (see e.g., Amsterdam[5] and Prague[6]).

The inherently very high ambitions of a circular economy together with its uniqueness linked to the local context – and therefore the difficulty of replicating it with one-fits-all strategy, have led the EC to further boost the 'circular transition' through the European Green Deal programme. Here, **the demonstration and replication of Circular Systemic Solutions** appear for the first time as **one of the main drivers for the circular**

[4] Source: Elaboration based on *Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth*, Accenture (2014).
[5] https://www.circle-economy.com/resources/developing-a-roadmap-for-the-first-circular-city-amsterdam
[6] https://www.circle-economy.com/resources/circular-prague

**transition**. A CSS represents a cross-sectoral project (or cluster of projects) for the territorial deployment of a circular and climate-neutral economy that involves several actors and is linked to a geographically cohesive territory. The distinguishing feature of CSSs is that they are *systemic*, i.e., they involve different actors and value-chains, address a variety of circularity issues and consider all causal factors that may enable or hinder a transition towards circular economy at the local level. CSSs should address the major challenge of effectively applying the circular economy concept beyond resource management and recovery in the waste and water sectors.

## 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:

1. **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 is engaged in each territory and adapted to the needs to implement a CSS (in cities, regions and territorial clusters).

   **Relevant links in the CCRI Methodology:**

   → Key stakeholders description

   →Stakeholders' analysis

   →Stakeholders' engagement

2. **Different sectors (desirable):** Ideally, a CSS should involve different sectors to be considered as 'systemic.' A good approach might be adopting a Key Product Values Chain perspective and considering affected sectors.

   **Relevant links in the CCRI Methodology:**

   → Identify intervention areas by adopting a value-chain approach

3. **Different dimensions of circularity (within the competence of the territory):** A CSS should include a wide range of *circular* orientated actions and cross-cutting tools in order to soundly address a problem. CE strategies and/or actions should adopt a life cycle perspective, thus addressing both upstream and downstream, and resource management, and being supported by cross-cutting tools such as funding and financing, regulations, and stakeholder engagement, among others.

   **Relevant links in the CCRI Methodology:**

   → Identifying CE actions to build a CSS case

4. **Different outcomes**: A CSS should provide positive social, economic and environmental outcomes.

**Relevant links in the CCRI Methodology:**

→CSS scenario and impacts assessment

In addition to the previous elements, three additional requirements will ensure that CSSs are effective and generate significant impacts in the territory:

5. **A combination of circular economy business models**: To transform CSSs into long lasting projects, the business uptake of circular models will be critical. Circular business models can refer to: circular supply; product life extension; resource recovery; and a product as a service and sharing platforms, among others.

6. **Holistic assessment:** Given the complexity of CSS, it is key to consider all causal factors that may enable or hinder the CSS implementation. These include: financial and economic drivers (or gaps); regulation; incumbent business practices; access to technology and infrastructures; and reluctance to adopt new collaboration schemes etc.

**Relevant links in the CCRI Methodology:**

→ Assess and define a CSS solution

7. **Innovative approaches**: To produce significant impacts (environmental, economic and societal), CSSs should adopt innovative approaches that go beyond traditional waste management and recover/recycling aims. Innovation can address sectors, value-chains, business models, processes and technologies, and should prioritise smart product and resource use and manufacture (i.e., higher R strategies), including land valorisation.

An overview of CSSs addressed within the CCRI is provided in the *CSSs portfolio***,** while for a more in-depth look the reader can refer to the *CSS factsheets*.

Given the great variety and complexity of CSSs, it may be arduous for cities and regions to define and implement a CSS – for example replicating an existing CSS already implemented in another territory. As identified by the work carried out by the Urban Agenda's Partnership on circular economy[7], delivering concrete solutions that go beyond the utility and waste management sector has proven to be **challenging for several cities and regions** as they currently lack a **holistic and comprehensive approach** for the circular economy. Ultimately, the design and implementation of a CSS is the result of a cooperation process between several local agents in which several issues need to be addressed, including technology, governance and scientific aspects. In this context, **the Circular Cities & Regions Initiative** (CCRI), as part of the New Circular Economy Action Plan (European Commission, 2020), **was created to provide tailored assistance and support to cities and regions focused on implementing Circular Systemic Solutions at local and regional level.**

[7] https://futurium.ec.europa.eu/en/urban-agenda/circular-economy

## 2.2. The EU policy framework and financing programmes

In the last years, the European Commission has ensured great prominence to the topic of circular economy on the local and regional levels. The **EU's Circular Economy Action Plan** (CEAP), adopted in 2015, introduced a comprehensive body of legislative and non-legislative actions which aimed to **transition the European economy to a circular model.** The Action Plan covered several policy areas, value-chains and sectors alongside cross-cutting measures to support change through innovation and investment. Crucially, ambitions have also been set out through the **European Green Deal** (European Commission, 2019), under which the updated **Circular Economy Action Plan** – mentioning explicitly the CCRI among the urban circular initiatives – was rolled out (European Commission, 2020). Differently from the first CEAP, which defined five priority areas facing specific challenges (i.e., plastics, food waste, critical raw materials, construction and buildings, and biomass and biobased products), the updated CEAP extends the scope of priority areas by addressing 'key product value-chains', i.e., the product chains that use the most resources and where the potential for circularity is high. These are illustrated in Figure 4 along with some of the key EU strategies and legislations underpinning each value-chain.

By focusing on value-chains rather than priority areas or sectors, the **CEAP highlights the systematic nature of circular solutions** as these should be understood by considering the whole life cycle of goods and materials and, therefore, embracing different sectors. As an example, the key product value-chain of food, water and nutrients might cover several sectors including agriculture, forestry and fishing, waste and water management, and accommodation and food services. **The CCRI Methodology also promotes the use of a 'key product value-chain' approach to map and identify key intervention areas for Circular Systemic Solutions** (Chapter 2.2).

Figure 4: The seven key product value-chains of the 2020 Circular Economy Action Plan


Alongside the specific initiatives and legislations linked to sectors or value-chains of key products, the CE transition is also guided by – and contributes to – cross-cutting EU strategies. As an example, circular systems will be some of the critical drivers of the **new Industrial Strategy**[8] (including the **Action Plan on Critical Raw Materials**[9]) as they will promote the supply of critical raw materials and foster the resilience of local economies, as well as the **Zero Pollution action plan**[10] by reducing waste generation and environmental degradation.

One of the key conditions for successful CSS upscaling and replication is access to a critical mass of public and private investment. It is important that the progress of circular solutions goes hand in hand with the

[8] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_416

[9] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474

[10] https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en

development of a **Circular Economy Investment Plan (CEIP)** that identifies concrete investment opportunities, making the project economically feasible (see IMPLEMENT phase, Chapter 3.1). In this context, the EU foresees a varied funding programme, which can benefit the circular cities and regions dealing with the implementation of the CSS. In particular, the demonstration and replication of CSSs are one of the key objectives of **Horizon Europe: Cluster 6** (Food, Bioeconomy, Natural Resources, Agriculture and Environment). Other relevant funding schemes supporting the deployment of CSSs might be the **Cohesion Policy 2021-2027, INTERREG** and **LIFE** programmes. See Table 2 for a broader overview of EU funding schemes.

Table 2: An overview of EU funding schemes and their relevance for CSS

| Funding scheme name | Description/Objectives | Relevance for CSS | Particularities of funding programme and how CSS can access financing |
|---|---|---|---|
| Horizon Europe: Cluster 6 | This cluster aims at reducing environmental degradation, halting and reversing the decline of biodiversity on land, inland waters and sea and better managing natural resources through transformative changes of the economy and society in both urban and rural areas.<br>Link: https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_it | The Cluster 6 within the Horizon Europe facility could be a good opportunity for CSS focused on research, experimentation and piloting. | Horizon Europe offers grants as the main funding model, complemented with dedicated financial instruments when appropriate.<br><br>The following activities are generally eligible for grants under Horizon Europe: research and innovation actions; innovation actions; coordination and support actions; programme co-fund actions; innovation and market deployment actions; and training and mobility actions. |
| Cohesion Fund 2021-2027 | EU Cohesion Policy contributes to strengthening economic, social and territorial cohesion in the European Union. It aims to correct imbalances between countries and regions. It delivers on the EU's political priorities, especially the green and digital transition.<br>Link https://ec.europa.eu/regional_policy/en/2021_2027/ | Cohesion Policy funds, being one of the main instruments to deliver the EU's green transition, could be a good funding source for many CSSs at a regional and local level.<br><br>Specifically, relevant is PO 2 – a greener, low-carbon transition towards a net-zero carbon economy and resilient Europe by promoting a clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility. | Member States can use the contribution from the Cohesion Fund to provide support to beneficiaries in the form of grants, financial instruments or prizes, or a combination thereof. Financial instrument products may include loans, guarantees, equity or quasi-equity. Moreover, Member States can tailor financial products according to their needs and capabilities or structure the financial instrument based on terms and conditions provided by the European Commission for 'off-the-shelf' instruments.<br><br>Projects can apply for funding under the Cohesion Fund only if you are based in a Member State with a gross national income per capita below 90 % of the EU-27 average. |

| | | | |
|---|---|---|---|
| Interreg | Interreg Europe is a cooperation programme, co-funded by the European Union. It helps local, regional and national governments across Europe to develop and deliver better policy, creating an environment and opportunities for sharing solutions to regional development issues. It supports the exchange of good practices and policy learning among European regions in 29 countries – the EU-27, Norway and Switzerland.<br><br>Budget: EUR 379 million.<br><br>Link: https://www.interregeurope.eu/what-is-interreg-europe | Interreg Europe offers an opportunity for interregional cooperation on the field of the circular economy. CSSs could profit from an environment of common opportunities, could learn from others and could develop common projects.<br><br>Specifically relevant is PO 2 – a greener, low-carbon transition towards a net-zero carbon and resilient Europe. | Interreg programmes can provide support to beneficiaries in the form of grants, financial instruments or prizes, or a combination thereof. Under Interreg programmes, the most common type of support is grants.<br><br>Interreg programmes support cooperation through project funding to jointly tackle common challenges and to find shared solutions.<br><br>Projects funded under Interreg often address pollution problems and loss of biodiversity as these are issues that extend beyond national boundaries. |
| InvestEU grants | The InvestEU programme gives an additional boost to investment, innovation and job creation in Europe between 2021-27. It has the aim of triggering a new wave of EUR 372 billion in investments using an EU budget guarantee.<br><br>Budget: EUR 26.2 billion<br><br>Link: https://investeu.europa.eu/about-investeu_en | InvestEU constitutes a good opportunity for CSSs, not only to receive funding from the programme itself, but also to become more attractive to private investors and funnel private funds to the initiatives.<br><br>Specifically, one of the policy windows includes sustainable infrastructure. This includes coverage of a key area titled 'the environment and resources' (e.g., water, waste management, the restoration of ecosystems and biodiversity, and the decarbonisation of energy production). | Financial products to be deployed under InvestEU may take the form of general products or thematic financial products. General financial products must support one or more policy areas covered under each policy window and can include either debt or equity interventions. |
| LIFE program me | The LIFE programme is the EU's funding instrument for the environment and climate action.<br><br>Link: https://cinea.ec.europa.eu/programmes/life_en | Sub-programme number 2 concerns circular economy and quality of life. The LIFE programme is a good, and relatively easy, opportunity for CSSs to access financing, given that its focus is primarily on climate action and the environment. | The LIFE programme funds environment-specific and environment-integrated projects in the form of grants, prizes and procurement. It may also finance technical assistance for investment operations. As examples, environment-specific projects can be financed through standard action projects, whereas strategic nature projects (SNAPs) and strategic integrated projects (SIPs) have the aim of supporting the implementation of a plan or strategy required by environmental and climate legislation or policies. LIFE also finances projects to improve governance in support of its environmental/climate objectives.<br><br>Actions under the InvestEU programme are expected to dedicate at least 30 % of the overall financial envelope of the InvestEU programme to climate objectives. However, for its sustainable infrastructure policy window, a combined climate and environmental target of 60 % has been put forward. |

| | | | |
|---|---|---|---|
| EIB venture debt | The EIB venture debt offers a long-term venture debt product to address the unique funding needs of fast-growing innovative companies. The financing structure includes bullet repayment and remuneration linked to the equity risk of the investees and complements existing venture capital financing.<br><br>Link: https://www.eib.org/en/products/equity/venture-debt.htm | The EIB venture debt constitutes an opportunity particularly well suited for CSS initiatives pioneered by private companies and that have a strong business component. | Eligibility is for small and medium-sized enterprises (SMEs) and mid-caps, developing highly innovative technologies, solutions or platforms. The company must have already raised equity from professional investors, have a sustainable business model and business plan, and have a solid corporate governance in place. |
| European Angels Fund (EAF) | EAF provides equity to Business Angels and other non-institutional investors for the financing of innovative companies in the form of co-investments. EAF works hand in hand with Business Angels and helps them to increase their investment capacity by co-investing into innovative companies in the seed, early or growth stage.<br><br>Budget: EUR 800 million.<br><br>Link: https://www.eif.org/what_we_do/equity/eaf/index.htm | The EAF could be a good funding source for highly innovative and high-risk CSS initiatives that have a strong business component and that can promise relatively high returns if they succeed. | Instead of granting co-investments on a deal-by-deal basis, EAF enters long-term contractual relationships with Business Angels. Co-investment framework agreements (CFAs) are established through which EAF commits a predefined amount of equity for co-investments upfront to each Business Angel for future investments. For ease and speed, these CFAs are generally standardised while leaving room for adaptation to specific requirements of individual Business Angels. Such elements include timeframe, sector focus and number of investments. |
| Joint Initiative on Circular Economy (JICE) | JICE is a partnership between the European Union's largest national promotional banks and the EIB to invest at least EUR 10 billion in the circular economy by 2023. This will support projects that prevent and eliminate waste, increase resource efficiency and promote circular business models.<br><br>Budget: EUR 10 billion.<br><br>Link: https://www.eib.org/en/publications/joint-initiative-on-circular-economy#:~:text=The%20Joint%20Initiative%20on%20Circular%20Economy%20(JICE)%20is%20a%20partnership,the%20circular%20economy%20by%202023 | JICE is a perfectly tailored initiative for any circular economy project. Given that the programme's focus is in the circular economy, CSSs are very well suited to benefit from it. | JICE provides loans, equity investment, guarantees, innovative financing structures and technical assistance. |

Since it may not be easy for cities and regions to navigate the complex EU political and financial ecosystem – on top of CSS implementation, and to corroborate the expected impact of the new EU CEAP, the EC also launched several initiatives to provide tailored assistance to cities and regions committed to CE transition, such as the **European Urban Initiative**, the **Intelligent Cities Challenge Initiative**, the **EIB Circular City Funding Guide**, the **European Circular Economy Stakeholder Platform** (including support to identify national funding programmes) and, last but not least, the **Circular Cities and Regions Initiative (CCRI)**. In particular, the CCRI will aim to facilitate collaboration and knowledge sharing between EU cities and regions and stakeholders across Europe, supporting cities and regions to find concrete CSSs that suit their own needs.

## 2.3. Digitalisation: an accelerator of circular economy

In addition to the circular economy, the EU is currently engaged in another transformation that could further accelerate the circular transition: digitalisation. If managed well, and in unison, they could help the EU to address one of its greatest challenges: to build a sustainable, green economy that is competitive on the global stage (European Policy Centre, 2020). The production, update, and sharing of timely, consistent, comparable policy-relevant and circular economy-related data and information is key to inform policymaking and implementation. Digitalisation can help close the material loops by providing accurate information on the availability, location and condition of products or waste flows. It can also enable more efficient processes in companies by monitoring and constantly optimising production factors. Finally, digitisation can facilitate different business models based on sharing platforms by connecting market supply and demand in real time and effortlessly.

In relation to the importance of digitalisation for supporting territorial transition towards circularity, the OECD report on 'The Circular Economy in Cities and Regions' confirms the vital role digitalisation is playing as enabler of circular economy. The 'circular economy: Going Digital' report (2020) identifies three major approaches to using digitalisation in the transition to a CE.

- **Improve knowledge, connections and information sharing**. Better management of data with a view of improving information and knowledge could raise awareness and guide action, as well as improve policymaking and the implementation of existing legislation. Digitally-enabled solutions can facilitate connections and partnerships between stakeholders, and help information travel with products and materials down the value-chains.
- **Make business models, products and processes more circular.** Better management of data and digitally-enabled solutions could contribute to greater circularity by supporting more sustainable business models and improving how we design, produce, use, reuse, repair and ultimately manage waste (including recycling).
- **Strengthen the role of citizens and consumers**. Digitalisation can be used to inform, educate and influence people, enable them to make sustainable choices and convert them into active participants in the data economy and co-creators of knowledge.

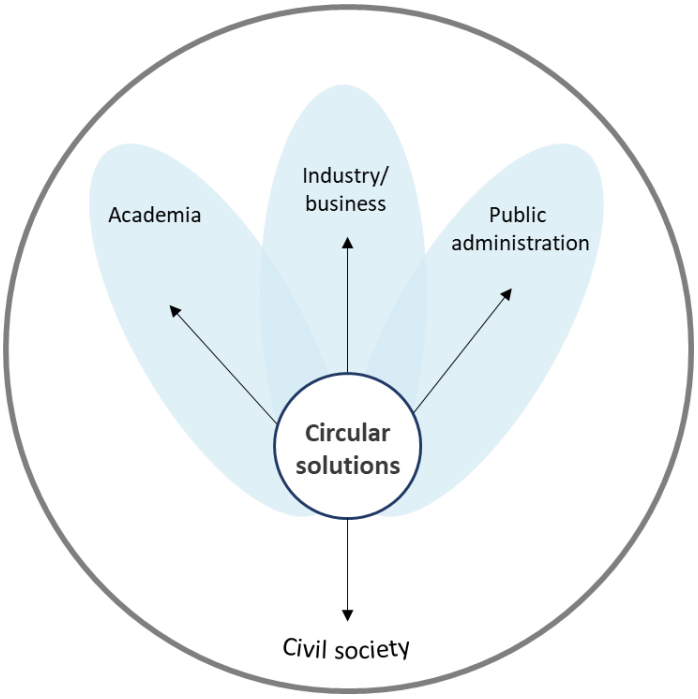
Data and digitally-enabled solutions like online platforms, smart devices, artificial intelligence (AI), the Internet of things (IOT) and blockchain are already widely integrated into our society. While the opportunities and potential benefits of using digital tools to support the transition towards a circular economy are recognised (European Policy Centre, 2020), some voices are raising concern to the fact that digitalisation may encourage more consumption of products, thus contributing to increase materials consumption and related environmental impacts. Indeed, the growing use of digital tools itself also requires more mineral resources and energy to produce and operate. Ultimately, digitalisation does not represent an end-goal for the transition towards circularity, but if used economically, it is an enabler or means to accelerate the transition to a sustainable, competitive economy. The digitally orientated initiatives for the circular economy at the local level include a wide range of applications and areas: from the creation of exchange platforms for secondary materials markets to stakeholder engagement platforms for raising awareness; from digital tools to monitor real time waste and material flows for better resource management, to the use of AI technology to identify potential downtime and accidents in industrial processes. While a comprehensive analysis of the potential of digitalisation for circular systems is beyond the scope of this guide, specific references to digital tools will be made in the methodology whenever these tools have been used to address a specific objective.

# 3. Key stakeholders

The systemic nature of the transition to circular economies in cities and regions requires the effort and involvement of multiple stakeholders working towards common aims and creating incentives and framework conditions for building synergies at the right scale, while minimising future liabilities for society at large (Espon, 2022). Since moving towards the circular economy several actors may have different, and possibly competing, objectives, **it is important to commit from the outset of the decision-making process to engage a wider range of stakeholders in order to carry out joint collaborative action.**

In this context, the **Circular Economy-Centric Quintuple-Helix Model** (Arsova et al., 2021) illustrates how circular solutions are driven by environmental ambitions, and arise at the intersection of different stakeholder groups - civil society being a key element (Figure 5). The pivotal role of **the natural environment as an engine for innovation and a trigger for action** is a distinguishing feature of circular systems, as it requires that innovations, technological solutions, and production methods should be true to nature, regenerative and restorative by design. Remaining stakeholders are represented by separate helices for academia, industry and public administration, respectively, while civil society acts as the overarching helix. Intersections between two or more helices give rise to hybrid organisations, which within CE context appear to be very effective and frequent, along with networks and/or platforms promoting collaboration across stakeholders.

Figure 5: CSSs arise from the intersection of different stakeholder groups



## 3.1. Public administration and local entities

**Local authorities** can play a crucial role in the transition towards a circular economy. There are three broad, complementary policymaking strategies that can help accelerate the circular economy. The first is to work as an **active agent** in circular economy activities. The second is to actively **stimulate business activity**. The third is to act as **promoter of circular consumption models**. These approaches are complementary and local policymakers can determine where to place the emphasis.

Local authorities can act as **direct implementers** of circular economy strategies. Among the main areas of direct intervention, we can find **territorial planning**, the **building and construction sector**, **mobility/transport** and **waste management**. These are core competences of local authorities that can be used to bring together key activities in a specific place and optimise the flow of materials and products. Creating **financing schemes** for different circular economy actions is also a good way of actively intervening in the circular economy deployment. This can include funding for programmes for circularity that **target actual city challenges**, which may help to overcome various obstacles of implementing circular initiatives (U4SSC, 2020).

Local authorities can actively **support businesses** in the deployment of circular business models through a range of actions. Firstly, by ensuring that there exists **an enabling framework** to become more circular. This includes cutting red tapes and adapting regulation, but also increasing cooperation among companies and with the public sector. Secondly, policymakers can directly **involve businesses** in the design of the circular economy strategy for the city or region. Crucially, individual businesses need to be involved in **identifying circular economy opportunities and barriers**. Thirdly, **collaboration through public-private partnerships** (PPPs) is critical for the successful implementation of circularity. As the Ellen MacArthur Foundation states, 'moving towards the circular economy offers a unique chance for businesses and policymakers collaboratively to accelerate specific business opportunities while at the same time helping to achieve wider societal goals.' Moreover, local authorities can create **research and development (R&D) programmes and incubators** that can help innovative businesses develop circular business models through access to finance, capacity-building and collaboration.

Local authorities can also significantly **impact consumption patterns** to make them more circular. Perhaps the most effective strategy to achieve this effect is **circular public procurement**. Circular public procurement must promote goods and services with lower environmental impacts and fully ensure that materials can re-enter the economy. Local policymakers should examine public procurement policies to **identify how they can contribute to the uptake of circular products**. Other policies to promote circular consumption models are also possible, such as conducting **awareness campaigns** to enhance consumer acceptance of circular products and supporting **product standards and certifications** for products based on secondary materials.

## 3.2. Industry and business

As key players in the economy**, industry and businesses** have a critical role to play in the deployment of the circularity in cities and regions. Businesses should **shift towards new circular business models**, not only because of environmental benefits but also because of the **huge profitability** waiting to be unlocked in the circular economy. Many SMEs have already implemented **resource efficiency measures**, such as minimising waste, saving energy and materials and recycling, while offering **green products and services**. Circularity provides significant opportunities for businesses and **encourages entrepreneurship**, allowing for the creation of new industries and business avenues.

Furthermore, the transition to circular business models may require changes to the supply chain, in turn creating synergies within and between sectors. Exploring **industrial symbiosis** options is a good way to increase business collaboration and identify new business opportunities. In this context, one of the key elements of

the Processes4Planet[11] Partnership Strategic Research and Innovation Agenda are the Hubs4Circularity[12] (H4Cs). Under these Hubs, the European Process Industries are joining forces with regions and cities to support the action plan announced in the European Green Deal. The H4Cs will bring European Process Industries at the core of CE, and will focus on the deployment of industrial symbiosis and industrial-urban symbiosis. For example, the Metropolitan Agency of Barcelona (Spain) has created a Metropolitan Industrial Symbiosis Programme that acts as a hub for industrial symbiosis, as well as offering cities and companies the tools, and the information and knowledge generated in each of these projects. , a dedicated platform will be launched under a Coordination and Support Action (Horizon Europe) for facilitating coordination and networking within the Processes4Planet Partnership.

## 3.3. Civil society

In a traditional linear economy, consumers are positioned at the end of the supply chain. However, one of the major changes associated with the implementation of CSSs will concern consumption patterns. As an example, the adoption of circular business models based on a Product-Service Systems (PSS) concept will substantially change the relationship between consumers and producers as they will pay for access to products and services rather than product ownership.

Firstly, consumers collaborate and interact with local governments or service providers in order to **facilitate the circular flow of materials**. The recycling industry relies on consumers for collection of recyclable materials, although the extent to which consumers are involved in the waste collection process varies by municipalities, regions and countries. In countries like the Netherlands and Germany, consumers can bring back empty glasses and plastic bottles to a deposit to receive money in return. Where the incentive scheme is not readily implemented or widely offered by retailers, consumers are generally required by municipalities to separate recyclable materials for collection.

Secondly, consumers are directly involved in the **value co-creation process with business actors in the repair and maintenance models, as well as reuse and redistribution ones**. Users are required to visit repair shops to maintain their products or return broken parts to a collection point. Alternatively, they need to request that damaged or used products are collected by service providers that are capable of performing reverse logistics operations. In this sense, the extended life of a product depends on **consumers' willingness to repair** the broken parts. In the reuse and redistribution models, clothing or other used products need to be sent back by consumers to be mended. These products can then be redistributed in the second-hand market.

Thirdly, consumers are also the essential **players in sharing platforms**. The concept of a sharing platform is driven by collaboration among consumers. For instance, in the case of the car-pooling platform Blablacar, users who have empty seats in their car travelling between big cities can offer rides to registered users who need to travel. In this way, consumers collaborate with the platform provider and other consumers to create value.

[11] Processes4Planet Partnership is a European co-programmed public-private partnership established between A.SPIRE – as the private entity – and the European Commission in the context of the Cluster 4 (Digital, Industry and Space) of Horizon Europe funding programme https://www.aspire2050.eu/p4planet/about-p4planet .

[12] https://www.aspire2050.eu/p4planet/hubs4circularity; A new flagship initiative – Hubs for Circularity' Concept, opportunities & challenges for successful implementation (europa.eu)

## 3.4. Academia, technological organisation and NGOs

**Knowledge institutions**, including universities and research technological organisations (RTO), contribute to **boosting innovation and research**, which are key enablers for firms that decide to renew their business models. It is important to establish relationships via dialogue and long-term interactions aimed at sharing know-how and selecting effective ways to introduce innovative circular products/services. These institutions can also partner with local businesses so that benefits can be shared and there exist a two-way support with implementation and financing. **Not-for-profit organisations (NGOs)** can also play their part through **bottom-up initiatives** or policy advocacy actions in a range of sectors, such as food and the built environment, to **raise awareness** for citizens and businesses on the circular economy. Moreover, NGOs can carry out **capacity-building** programmes on circular economy practices.

In general, the creation of networks is a key enabler for sharing knowledge, providing capacity-building and highlighting cross-sector opportunities and challenges. One of the key platforms bringing together different types of stakeholders active in the CE field in Europe is the **European Circular Economy Stakeholder Platform.**[13] This 'network of networks' is a hub gathering knowledge, a place for dialogue and a bridge between existing initiatives. It contributes to disseminating the concept of the circular economy at national, regional and local level by making the information more easily accessible and by providing a frame for exchange and discussion. Similarly, the following city and regions networks can also be mentioned: ACR+ (Association of Cities and Regions for sustainable resource management), ICLEI (Local Governments for Sustainability); Urban Agenda Partnership on Circular Economy; and the Council of European Municipalities and Regions.

[13] https://circulareconomy.europa.eu/platform/en

# 4. CCRI-CSO and the CCRI Methodology

## 4.1. CCRI Methodology approach and principles

The CCRI Methodology is designed for the use of project promoters, policy and decision-makers operating at various levels of local and regional governance, who may be willing and competent to promote the development and implementation of circular economy initiatives and projects as well as the development of CEAPs and CSSs within their respective territories. Given the importance of favouring systemic approaches towards circularity, the methodology entails issues that are also of relevance for private companies as these are expected to be involved in decision-making procedures at local level in collaboration with public authorities. The setting up of the CCRI Methodology is not motivated by the aim of providing another way of guiding local decision-makers on designing their CEAP or CSS, but aims at establishing, based on applications in different EU local contexts, a methodological guidance that provides local stakeholders with a minimum basis for decision-making support and inspired by recent and sound experiences in this field.

The proposed methodology distinguishes between three assessment levels, which in the document are referred as 'phases.' Together, these phases define a tiered approach that helps to generate the relevant knowledge base to support decision-making since early stages until the implementation of concrete actions. Further, the methodology suggests for each phase the needed inputs, possible assessment and governance tools and guidance as well as expected outcomes for proceeding with further decision-making. The information base is further extended with the provision of factsheets containing more details on CE best practices in EU local contexts.

The CCRI Methodology distinguishes three phases:

1. MAP: understand the local context and stakes
2. DESIGN: prioritise intervention areas, define and evaluate a CSS case
3. IMPLEMENT: identify funding and get the CSS in motion.

The CCRI Methodology aims at ensuring a decision-making process that is based on the following principles and values:

- scientific, environmental, economic and social evidence
- evaluation of the cost/benefit balance based on local factors, including environmental and societal impacts
- the involvement of multiple actors to ensure a systemic and inclusive approach to decision-making
- transparency and traceability.

## 4.2. Methodology building process

The CCRI Methodology is a **living document** based on a four-year collaboration led by the CSO with the European Commission and the members of cities and regions selected as Pilots. It also draws on feedback from the wider CCRI network, including CCRI Fellows, Projects and Associated Partners, received during CCRI dedicated events - i.e., webinars, coordination and support workshops.

The CCRI Methodology is characterised by two distinct building processes. The first building process takes stock and draws on past and current efforts aimed at providing actionable guidance for the diffusion of the circular economy (see Table 3 for a selection of key references). In this phase, more than 50 documents were reviewed, including toolkits, methodologies and guidelines in order to consolidate the state-of-the-art of CE implementation guidance. The result of this review is a comprehensive methodological framework which serves as the main reference/guidance within the CCRI laboratory to help the pilot groups develop and implement CEAPs and CSSs, including the respective Circular Economy Investment Plans (CEIP)

Table 3: Selected key reference documents employed to develop the CCRI Methodology

| **OECD – The Circular Economy in Cities and Regions (2020)** |
| --- |
| The OECD synthesis report was produced as part of the OECD Programme on the Circular Economy in Cities and Regions, which aims to support national and subnational governments in their transition towards the circular economy through evidence-based analysis, multi-stakeholder dialogues, tailored recommendations and customised action plans. The report provides an analytical framework, policy recommendations and a checklist for action for the transition towards the circular economy in cities, regions and countries. |
| **REPAiR – REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism (2016-2020)** |
| REPAiR was a European project funded under Horizon 2020 programme aiming at providing local and regional authorities with an innovative open-source geodesign decision support environment (GDSE). The GDSE was developed and implemented in living labs in six metropolitan areas and allowed for creating integrated, place-based eco-innovative spatial development strategies. These strategies promoted the use of waste as a resource, thus supporting the ongoing initiatives of the European Commission towards establishing a strong circular economy. |
| **ReTraCE – Realising the Transition to the Circular Economy (2018-2023)** |
| ReTraCE is a research project funded by Horizon 2020 EU's Marie Skłodowska-Curie Innovative Training Networks, supporting the implementation of the European Commission's circular economy strategy. The project will significantly advance the state-of-the-art in terms of the current understanding of the applicability of the CE paradigm from economic, environmental and social points of view, providing policy insights and implications for practice. |

**UrbanWINS – Urban metabolism accounts for building Waste management Innovative Networks and Strategies (2016-2019)**

UrbanWINS was a European project funded by the Research and Innovation Programme Horizon 2020 that studied how cities consume resources and products, and how they eliminate the waste produced to develop and test innovative plans and solutions aimed at improving waste prevention and management.

The project followed the urban metabolism approach in which cities are considered living organisms that use natural resources and create a flow of materials and energies. The results were used to define objectives and indicators of the Strategic Plans for Waste Prevention and Management in eight pilot cities. The outcome of the project is a toolkit for participatory and science-based decision-making and planning for waste management that can be applied in any public authority across Europe.

**Circular Economy Partnership – Roadmap for a Circular Resource Efficiency in cities (2020)**

The Roadmap for a Circular Resource Efficiency Management plan offers cities and urban areas a structured, step-by-step approach to develop a substantiated plan of action that improves resource efficiency and drives the transition to a circular economy.

**Ellen MacArthur Foundation – Delivering the circular economy – A toolkit for policymakers (2015)**

This report aims to provide policymakers with an actionable toolkit to help accelerate the transition towards the circular economy. It offers a detailed step-by-step methodology to: explore and prioritise circular economy opportunities; quantify their impact; identify the barriers limiting these opportunities; and map and prioritise the policy interventions to overcome these barriers.

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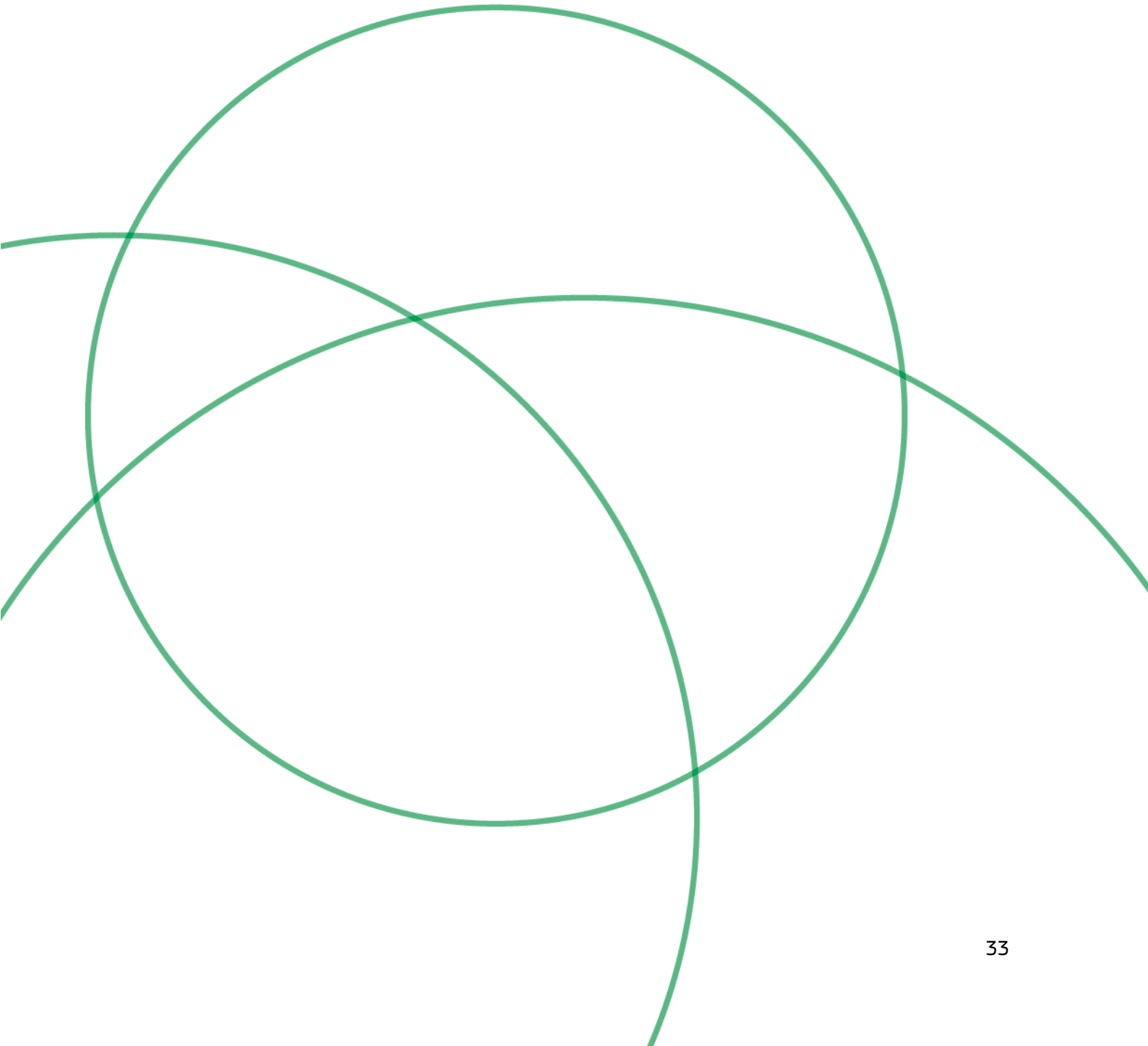
The forthcoming second building process aims at improving and adapting the methodology according to the needs of the pilot groups during the four years of the CCRI-CSO term. In this period, the methodology will be iteratively applied, tested and upgraded through collaboration with Pilots and feedback from the Advisory Panel of CCRI-CSO.

Feedback loops on the CCRI Methodology from the Pilots and the workshops have been taken as the basis for improving the methodology across the four years of CCRI-CSO development. These consist of the following:

- Integration of the CCRI Methodology in the agendas of the meetings of the working groups and tailored support activities
- Follow-up on the implementation of the actions and tools presented in the methodology, namely:
    - monitoring if and how specific stages of the methodology and corresponding concrete actions (e.g., use of specific diagnosis tools) were taken into account. This activity will also be supported by the Self-Assessment Tool,
    - coordination and support workshops as well as Thematic Working Groups meetings with multiple stakeholders aimed at collecting valuable feedback on challenges and success stories in the implementation of the CCRI Methodology,
    - collecting feedback on specific concerns expressed by Pilot group members and doubts/ difficulties in the use of specific concepts and tools for the deployment of the methodology's phases,
    - verifying the implication of local stakeholders in the uptake of the methodology's suggested actions, including the assessment of whether and how the various stakeholder groups acquired responsibilities;
- Follow-up of the outcomes of the self-assessments conducted by the different pilot groups.

# Part II

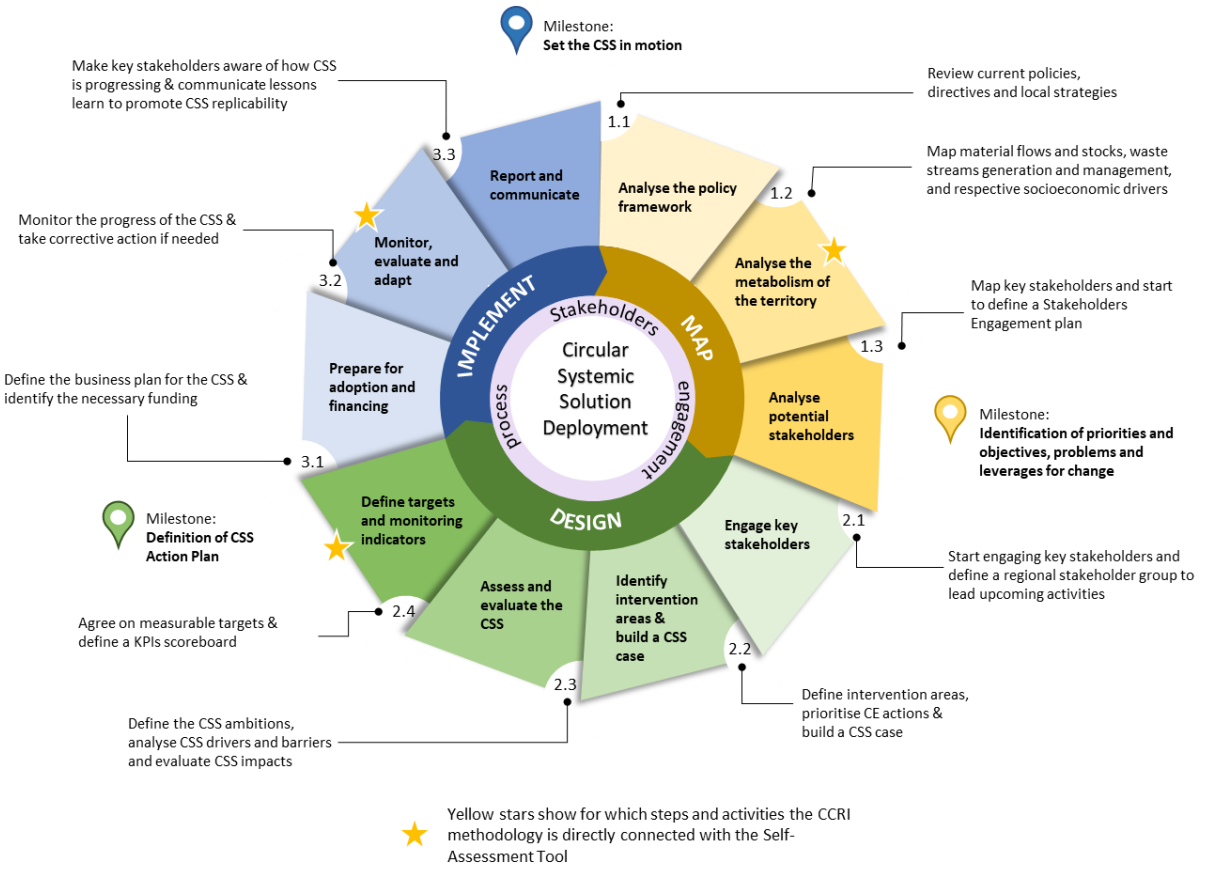
## CCRI Methodology



# Methodology overview

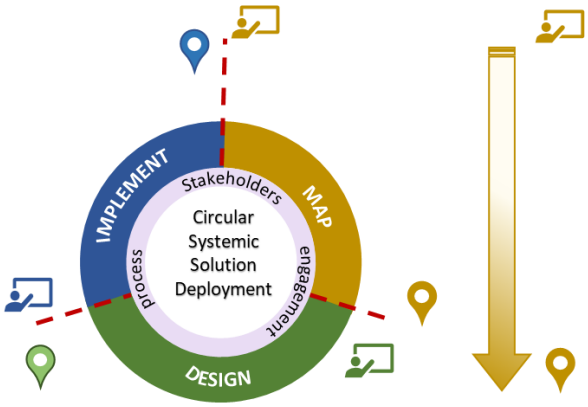
This methodology aims to support cities and regions that intend or are transitioning towards a circular economy by implementing Circular Systemic Solutions (CSSs). The methodology offers operational guidance through the entire CSS implementation process, which is organised in three major phases: MAP, DESIGN and IMPLEMENT. Each phase addresses several key thematic areas addressing the **technological, environmental, scientific** and **governance** components of a CSS, including drivers and barriers of technology solutions, inclusive CSS impacts assessment and state-of-the-art digital tools facilitating the transition. Each thematic area is key to developing and improving the knowledge base, thus allowing the advancement of the decision-making process and mobilising the necessary resources (business, technical/scientific, human and economic) (Figure 6).

Figure 6: CCRI Methodology overview




The phases outlined in the methodology have been designed to be implemented consecutively. However, given the fact that cities and regions may find themselves in different situations and levels of advancement towards achieving their circularity ambitions, decision-makers and users of the methodology may directly access the methodology phase they are most aligned with. It is therefore possible to access directly to the DESIGN or even IMPLEMENT phase if the needed elements for decision-making are objectively met. Thus, the methodology should be seen as a modular toolbox in which decision-makers could access different contents and tools. Summary boxes are provided at the beginning and at the end of each chapter to warn the reader of the ambitions and results pursued in each phase (see example in Figure 7). These summary boxes might also be used to check whether all phase requirements have been fulfilled, or conversely, if the decision-maker should take a few steps back to better address the key topics in the previous stages.

Figure 7: Phases' summary boxes





**Ambition: This phase aims to:**

- Generate a broad understanding of the landscape of existing CE related policies and financing opportunities
- Assess the baseline circularity of the territory (resource consumption and waste generation flows).
- Gain a systemic understanding of circularity perspectives at the local level
- Map key stakeholders, including civil society, and start defining a regional stakeholder group

**Ambitions' checklist**

| | | |
|---|---|---|
| **Policy framework analysis** | ✓ | Have existing (local, national and supranational) policies supporting the CE transition been identified? |
| | ✓ | Have potential policy or regulations gaps that could inhibit CE transition been identified? |
| | ✓ | What are the policy areas that allows for more targeted policy interventions in the local territory? |
| **Territorial framework analysis** | ✓ | Have the main flows of materials and waste in the territory been quantified, mapped, and benchmarked with other peers? |
| | ✓ | What the broader sectoral area with the greatest potential to retain value (for civil society, business and environment) are? |
| **Stakeholder analysis** | ✓ | Have key stakeholders been identified across all relevant groups? (industries, business including SMEs, academy, civil society and institutional bodies) |
| | ✓ | Have synergies, barriers and enablers for key stakeholder engagement been evaluated? |

In addition to the different phases and their respective key thematic areas, the methodology also features a wide range of elements, including the CSS factsheet and the tools in Part III. As the reader may want to jump back and forth between different sections of the document, a 'navigation toolbar' is provided at the beginning of each methodological step and at the end of each CSS and tools factsheet. This navigation toolbar allows the reader to navigate the document more easily.

Figure 8: Navigation toolbar of the methodology

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

For the sake of reading and clarity, the methodology also attempts to differentiate between key thematic/action areas that most likely occur in specific progress phases of the CSS implementation. However, it should be borne in mind that due to the complex and systemic nature of CSSs, most of the thematic areas should not be considered 'silos', but rather as thematic areas that interact with each other and in some cases evolve during the decision-making process. In particular, this is the case in i) Stakeholder engagement process and ii) Monitoring and evaluating process that touch upon and evolve through several thematic areas. These are further explained below.

# Stakeholder engagement process

The involvement of stakeholders is essential to ensure the participatory development of new policy actions that are needed to guarantee an effective implementation of CSSs. Likewise, their inclusion is key to identifying the most relevant CE opportunities and barriers in each focus sector. Therefore, the stakeholder engagement process should seek the involvement of relevant and needed parties in each phase along the decision-making process, from the earliest phases of planning until CSS development. Depending on the CSS deployment phase (Map–Design-Implement), the CCRI Methodology distinguishes specific activities to which stakeholders should contribute significantly (Figure 9).

During the **MAP phase,** it is important to **identify all relevant stakeholders at local, regional, national and EU level** that can influence the transition to the CE. These refer to public administration, business (including finance sector and investors), research and education, and civil society (Chapter 1.3). The selection should be based on a mutuality perspective, identifying the reasons why each stakeholder is important for the project, and, at the same time, the benefits stakeholders could gain from collaborating in the project activities. This would make it possible to become aware of the interest of the stakeholders and, therefore, to guarantee an active and constant involvement of the interested parties. Afterward, a **regional stakeholder group** should be formed (Chapter (2.1)). By joining the group, the stakeholder would commit to take part in the periodic meetings of the regional stakeholder group, where research activities, CE initiatives and results are discussed. Activities to map, classify and analyse potential stakeholders are presented thoroughly in (Chapter 1.3), along with the definition of a Stakeholder Engagement Plan. The DESIGN phase, on the other hand, would start with the direct engagement of stakeholders to build the regional stakeholder group (Chapter 2.1), which will take an active role in the project activities, especially in the exchange of experiences and in the co-development of CSS (Chapter 2.2).

**STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES**

Purple boxes are introduced in the document to further detail the involvement of key stakeholders, their roles and their activities across the different phases of the methodology according to their typology.

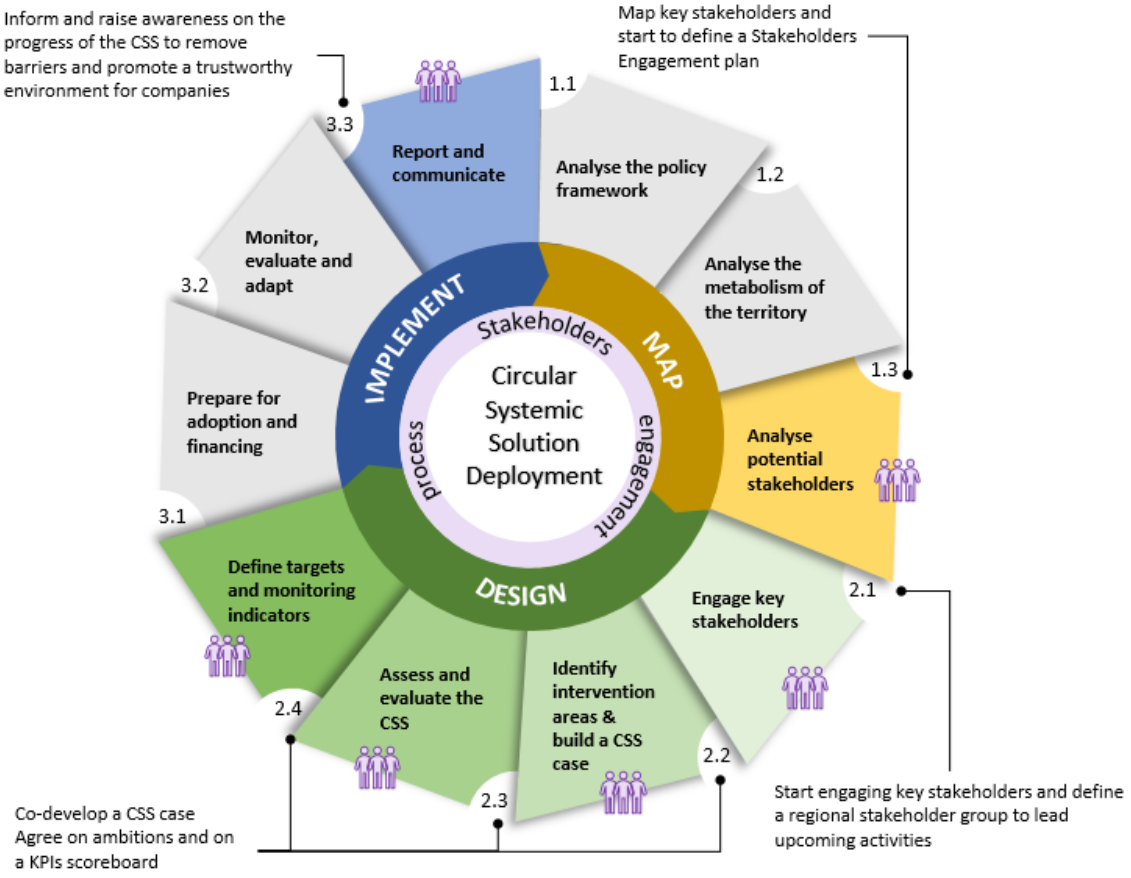
Public administration

Industry and business

Civil society

Academia, RTO and NGOs

Figure 9: Stakeholders Engagement Process




# Monitoring and evaluating processes

As highlighted in the OECD report (2020) and Moraga et al. (2019), several measurement frameworks exist for the circular economy. These can have very different scopes, from describing the baseline situation of regions and cities for identifing and triggering specific CE strategies, to measurement frameworks focusing instead on evaluating the performance and progress of circular economy initiatives. Depending on the scope of the analysis, different sets of indicators generally apply.

From the point of view of the CSS implementation process, the CCRI Methodology mainly distinguishes **three areas of application of monitoring and evaluation frameworks**[14]:

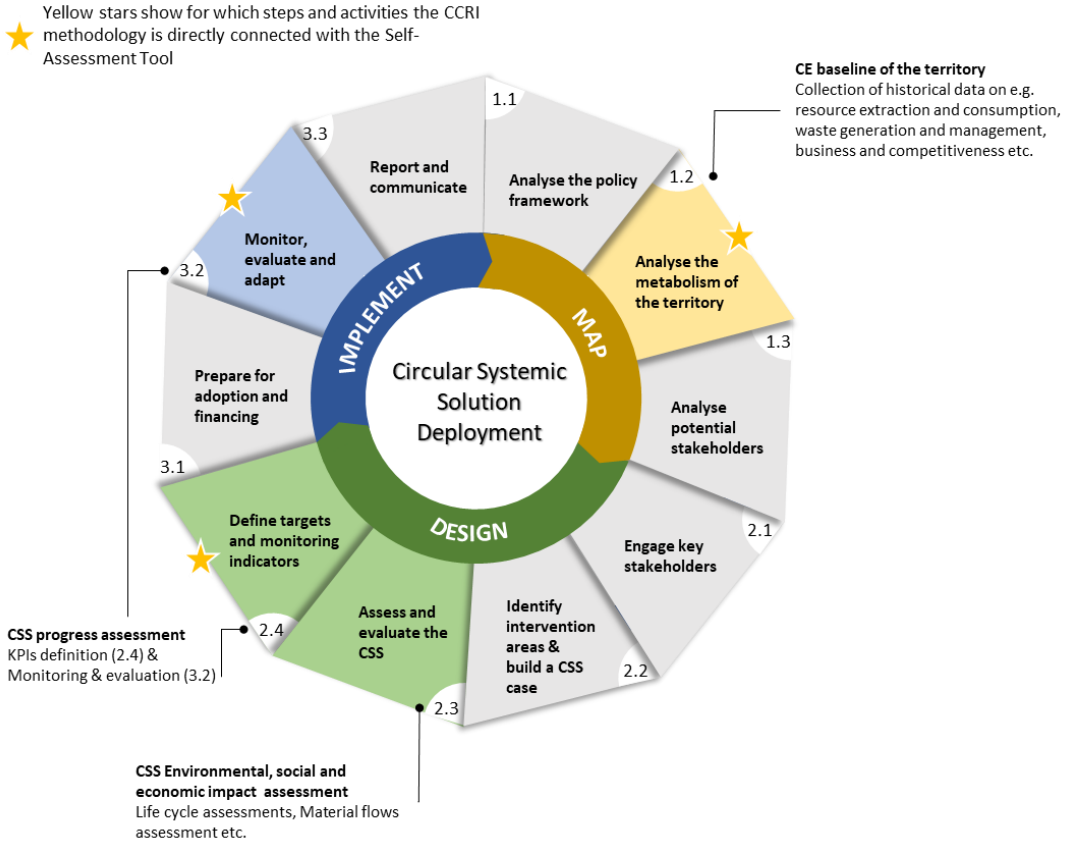
1. The assessment of the circularity baseline of the territory
2. The assessment of circularity progress (comparison over time)
3. The assessment of the environmental, social and economic impact of circularity.

By circularity we refer to a reference system to be assessed. This might be the circularity of a territory (a city, region, or country), the circularity of a circular systemic solution (e.g., the impact of circular buildings or circular textile in the respective value-chain) or the circularity of a product (e.g., a building or a T-shirt). Considering the scope of the CCRI Methodology, in this report 'circularity assessment' mostly refers to the assessment of a territory, a CSS or both. Ideally, as Figure 10 shows, in the MAP phase the circularity assessment should refer

[14] Note that this is aligned with the three dimensions mentioned in the tender RTD/2022/OP/0003, 'Indicators and methods for measuring transition to climate neutral circularity, its benefits, challenges and trade-offs' - i.e., level of circularity, changes and related impacts.

to the circular economy baseline of the territory. The goal of the **CE baseline of the territory** is to provide a solid understanding of the metabolism of a territory, including its socio-economic characteristics, and it represents the knowledge base with which to begin identifying CE opportunities and designing CSSs. The definition of a baseline monitoring framework generally occurs at a very early stage of the project (MAP phase) and it is based on available data from statistical offices. In some cases, these might be complemented with more advanced indicators calculated in ad-hoc studies through modelling techniques like material flow analysis. In addition, for those cities and regions that have already started some CSS or CE activity, it might be useful to complement the baseline situation by also including a second set of indicators informing on the state of implementation of current CSS. For a comprehensive overview of **baseline monitoring framework**, including a set proposal of indicator for regions and cities, the reader can refer to Chapter 1.2 in the MAP phase.

Figure 10: Monitoring and evaluation frameworks in the CCRI Methodology




After identifying the opportunities available for CE in a territory (Chapter (2.2)), said opportunities should be assessed and prioritsed in order to soundly design a CSS and develop an action plan for its implementation (Chapter (2.3)). The **social, economic and environmental impacts** should be assessed and, possibly, compared with current linear systems. In this context, specific methods and indicators can be used to model and assess (ex-ante) the CSS across the three dimensions. Other aspects, such as the level of support CSS have from stakeholders, their technical feasibility and scalability potential or the estimated timeline also play a key role and can complement the assessment. The information needed to fill in these parameters and feed the assessment models could rely on the database of the CE baseline territory, and further complemented with data collected from the regional stakeholder group.

Last but not least, the goal of the **CSS progress assessment** (Chapter (3.2)) is to monitor and evaluate the performance and progress of the CSSs (ex-post) in order to detect what works, what does not and the state of advancement. This evaluation framework should include specific **key performance indicators (KPIs)** tailored to the CSS. These should be defined during the design of the CSS (Chapter (2.3)) and, eventually, include both indicators used within the impact assessments, and indicators used within the CE baseline scenario. However, it will be important that CE indicators be referenced to a specific targets – and time frames to achieve them – in order to allow for an objective assessment of the expected impacts.

# The CCRI Methodology and the CCRI Self-Assessment Tool (SAT)

In line with the aim of capacity-building and generation of local knowledge about circular economy, an integral piece of the methodology is the SAT. The SAT supports the assessment of the implementation process of a CSS in a city, region or territorial cluster by:

1. **providing a monitoring function for the implementation of the CSS** that will help local actors to track the progress towards a defined set of targets and to identify potential blind spots for the CSS project's implementation;

2. **documenting the experiences of the pilot** to further support the work of the CCRI-CSO – mainly the analysis of research and innovation (R&I) gaps and the development of the CCRI Methodology;

3. **supporting the transfer of knowledge** by allowing Project Managers to share information on the implementation of CSS to regional stakeholders and beyond.

The SAT and the CCRI Methodology interact with each other in the following ways.

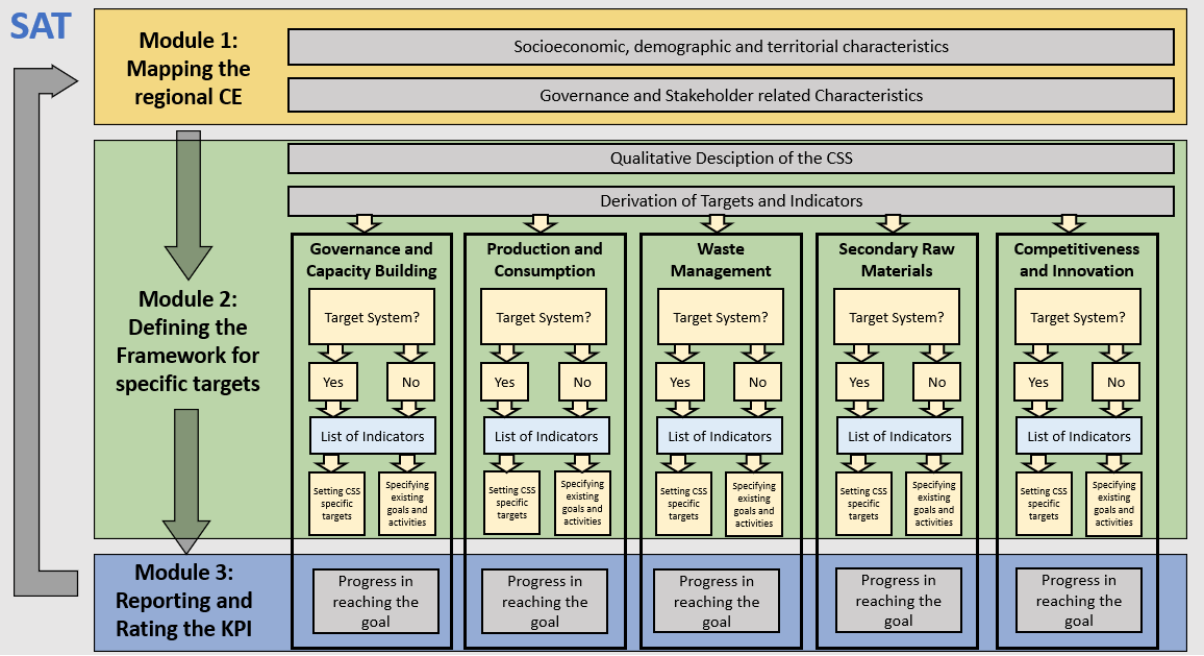
- **Operationalisation of the CCRI Methodology steps: baseline circularity level, KPIs definition and CSS evaluation and monitoring –** The SAT offers an operational way to implement and keep record of some of the steps of the CCRI Methodology (i.e., those marked with yellow stars in Figure 10). The SAT will help setting specific qualitative as well as quantitative targets for the implementation and progress of the CSS and to break down the goals into concrete outcome indicators. This allows for concise comparisons between the planned and the actual implementation progress of the CSS.
- **Reference to methodological guidance –** The results of the SAT can be used to understand which thematic areas of the CCRI Methodology should be explored further to address – and possibly improve – identified CSS gaps. In case the assessment reveals a need for improvements, the SAT will 'redirect' users to respective parts of the CCRI Methodology where specific guidance related to the shortfalls identified can be found. Hence, the users of the tool will have to 'loop' through certain steps of the methodology again, based on the results of their self-assessment.

The structure of the SAT is closely aligned with the CCRI Methodology and consists of three modules[15] (Figure 11).

- **Module 1**: **Mapping the regional CE** corresponds to the assessment of the CE baseline of the territory (Chapter 1.2). This is an indicator-based description regarding the regional socio-economic, demographic and territorial characteristics as well as governance structures of the territory and it sets the scene and provides background information to define and assess the specific targets of the CSS in the following modules.
- **Module 2**: **Defining the Framework for specific targets** enables the strategic positioning of the CSS within the context described beforehand, by deriving concrete KPI and target systems (Chapter 2.4). In this module, the users can select or insert new KPIs and targets, which will be used to later evaluate the CSS and report on the progress.
- **Module 3**: **Reporting and Rating the KPI** corresponds to the monitoring, evaluation and adaptation of the CSS (Chapter 3.2). This module contains the reporting on the indicators that were selected in the second module. The results of the inputs are then compared with the targets (e.g., by displaying the already achieved percentages and the difference to the target or by showing pathways on how to reach longer-term targets), including user-friendly visualisations.

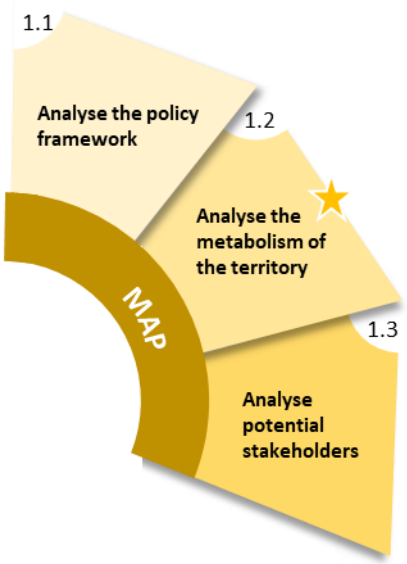
[15] Note that the SAT Modules 2 and 3 are subdivided by the four categories of the EU Circular Economy Monitoring Framework and the additional dimension of 'Governance and Capacity Building' (for further details see Map phase, Chapter 1.2).

Figure 11: Self-Assessment Tool structure



# 1. Map

A deep understanding of the local territory is the basis for the creation of effective circular solutions. As the circular economy focuses primarily on material flows and stocks, investing time and resources to get a complete picture of the local metabolism will facilitate both the definition of a CSS at a later time and its successful implementation. In addition to the analysis of material flows and stocks, it is important not to overlook an accurate review of local development policies to ensure the alignment of a CSS with overall local strategies.




**Ambitions**
**This phase aims to:**

- generate a broad understanding of the landscape of existing CE related policies and financing opportunities;
- assess the baseline circularity of the territory (resource consumption and waste generation flows);
- gain a systemic understanding of circularity perspectives at the local level;
- map key stakeholders, including civil society, and start defining a regional stakeholder group.

| Map | Design | Implement | Tools | Circular Systemic Solutions | Time Frame |
|---|---|---|---|---|---|
| | | | | | Up to 1 year |

The first phase of the methodology consists of performing an in-depth analysis of the political, metabolic and socio-economic context, gathering information about different key aspects of the territory. To successfully introduce circular strategies in the territorial system, it is crucial to understand its basic characteristics, identify particular assets, and determine strengths and weaknesses. The following tasks can contribute to the achievement of these objectives.

- **Review of existing policy, regulation and institutional landscape**: check if policy domains within the region/city administration (e.g., energy, mobility, spatial planning, procurement) have formulated objectives that may be related to circular economy and could be taken in consideration. Find out about the current circular activities and initiatives by stakeholders in the city and who is involved.
- **Analysis of the territory**: map the socio-economic context and the urban metabolism, collect historical data on material/waste flows (including environmental impacts indicators) in order to represent and grasp the spatial and volumetric realities of the territory. From here, key stakeholder can be identified and a first set of CSSs can be selected.
- **Stakeholder mapping**: identify key stakeholders directly related to the material/waste flows being studied (and policy domains interested). Assess their needs as well as their key challenges, problems and potential engagement mechanisms. Determine how they can participate in the project and provide their knowledge.

The expected outputs are included below.

- The **creation of a database**, based mainly on the collection of historical data, **describing the metabolism of the territory**. This can include material flows, waste generation and treatment streams. Advanced analyses may also include activity-based and/or geo-localised material flows analysis and the estimation of circularity.
- The **identification of key resource flows**. Ideally, a priority ranking of material flows/sectors may be defined.
- A review of existing local development strategies and policies, including targets and objectives.
- **List of key stakeholders to be engaged**. Ideally, interests and potential roles of stakeholders should be analysed, including the envisaged engagement mechanisms.

It should be borne in mind that while the CCRI Methodology promotes a scientific and evidence-based approach for the definition and implementation of CSS, the deepness and accuracy with which recommended tasks are carried out will also depend on available resources (economic and time) in each case. In this context, decision-makers may decide to address the mapping phase more or less comprehensively - or even skip it if they feel that all elements have been addressed. Similarly, decision-makers who started directly from designing (or even implementing) CSS may want to go back to the mapping stage to make sure the decisions made are the optimal ones.

## 1.1. Policy framework analysis

Understanding, at an early stage, the strengths and possible development areas of the current policy landscape allows for more targeted identification of relevant policy interventions later in the project. To engage stakeholders early on in a discussion on which broad types of policy interventions could make sense for the city or region. This discussion will of course be refined once specific circular economy opportunities and related barriers have been identified; yet getting a reflection started with key stakeholders as soon as possible is a valuable end. Such a discussion could reveal potential upcoming policy revisions, which are highly relevant to consider when new policy interventions are developed.

A review of the existing regional and/or local policy and institutional situation is necessary to identify goals and actions from public administrations that could be taken into consideration to support circular economy initiatives. Conversely, an analysis of the policy framework can also help identify policy objectives that may inhibit or hinder potential circular economy activities that need to be taken into account. Moreover, considering regional and/or local policy objectives and public administrations' activities with respect to the circular economy is also important to align CSSs to regional and/or local strategies. In this sense, CSSs should be understood as part of a broader local or regional territorial action plan, while at the same time effectively applying the circular economy concept.

An understanding of the policy landscape can be established addressing the six key categories illustrated with examples in Table 4. For each category it should be assessed if existing interventions are in place, planned or not considered to evaluate if: i) possible additional interventions can complement/improve the existing ones, or ii) new interventions should be foreseen to address specific policy areas. For this type of analysis, it would be advisable to conduct research on the circular economy policies that other regions and cities are pursuing and, on the interventions, discussed in the literature.

Table 4: Policy intervention areas at local level (adapted from (Macarthur, 2015))

| Policy intervention types | Examples |
|---|---|
| **Education, information and awareness** | Integration of circular economy/system/life cycle thinking into university and schools curricula |
| | Public communication and awareness campaigns |
| **Collaboration platforms** | PPPs with business at regional and city level |
| | Promotion of voluntary industry collaboration platforms, encouraging value-chain and cross-sectoral initiatives and information sharing |
| | R&D programmes |
| **Business support schemes** | Financial support to business (e.g., subsidies, provision of capital, financial guarantee) |
| | Technical support, advisory, capacity building and demonstration of best practices to business |
| **Public Procurement and Infrastructure** | Green Public Procurement |
| | Sustainable Finance |
| **Regulatory Framework** | Regional strategies and associated targets on resource productivity, decarbonisation and circular economy |
| | Product regulations, including design and extended warrants |
| | Waste regulation, including collection and treatment standards, and targets and take-back systems |
| **Fiscal Framework** | VAT or excise duty reduction for circular products and services |

An understanding of the policy and institutional situation can also be ascertained by identifying the different sectoral policies and consulting with the respective departments (Table 5). Although administrative competences may vary from country to country (especially when considering the subnational level), local public authorities generally play a key role in the administration of land use and land use planning, built environment and construction, water and waste management and, finally, transport and mobility. Each of these areas offers the possibility to introduce direct public interventions related to circular initiatives. Therefore, it is important to know the institutional situation, such as where the initiatives have been launched in the past, what the main objectives are and which administrative departments could be most interested in taking part in the development of a CSS.

Table 5: Policy sectors at local level

| Examples of policy areas | Examples of policy departments |
|---|---|
| **Land use and spatial planning** | Municipal urban planning department |
| | Regional land zoning office |
| **Built environment and construction** | Municipal licences and permits office for construction |
| | Regional department for building safety and construction materials |

| | |
|---|---|
| **Water management** | Municipal water utility company |
| | Regional agency for water safety |
| **Waste management** | Municipal waste management company |
| | Local department of waste collection |
| **Transportation and mobility** | Municipal transport company |
| | Regional mobility department |

## 1.2. Territorial metabolism analysis

### 1.2.1. Baseline circularity level

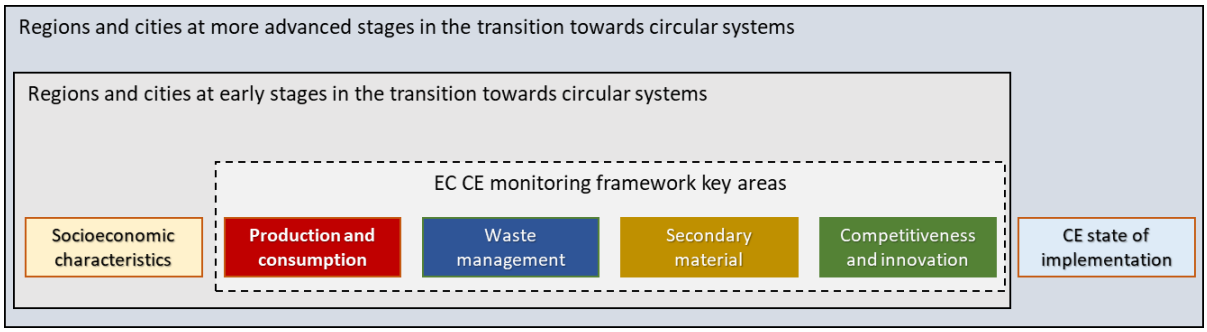
Assessing the current level of circularity provides the basis to identify priority areas for intervention. The circularity baselining gives a first indication of the areas in which a city or region is more or less advanced compared to their peers. It provides useful input for defining targets and leverage for changes. If a city performs very well on a certain metric, it may suggest that considerable attention has probably been given to it in the past and it may be useful to consider whether: i) significant progress beyond the expected impact of existing initiatives is still possible; ii) more innovative approaches to address the issue should be considered; or iii) prioritise other areas with wider room for improvement. An example from the CIRCTER SPINOFF project is the case study of Switzerland. Swiss regions have some of the highest recycling rates in Europe. However, they also register the highest amounts of municipal waste generation. Therefore, more ambitious goals are currently considered to reduce material waste through innovative taxation systems which shift taxation from labour to resources consumption (ESPON CIRCTER, 2019). On the other hand, if a city performs below average on a metric, it could be fruitful to use existing success practice to quickly advance in that area, or to leapfrog the potentially suboptimal solutions that other cities have adopted (e.g., a large incineration infrastructure to avoid landfilling).

To date, there is no set of indicators that fully captures all the main elements of the circular economy. At a city and regional scale, the availability of data is even more scarce compared with that at the national level. Several key indicators included in the EC CE monitoring framework such as the circular material use rate or number of jobs in circular economy sectors are not yet available at a regional level, beyond the ad-hoc evidence generated in specific projects or applications. Consequently, a good option is to start with estimates based on existing data to define the level of circularity of a territory in a reasonable time and effort. As an example, it is common practice in the analysis of urban metabolism to estimate the flows of materials starting from the values observed at the national level and using scale parameters such as population or economic activity to generate local estimates (Bianchi et al., 2020; Horta & Keirstead, 2017). Alternatively, specific data sets could be set-up, tailored to local ambitions and based on compiling data via specific queries. While the latter may offer the advantage of providing fit-for-purpose data, obtaining them is also more costly in terms of time and effort.

The CCRI Methodology defines a baseline monitoring framework for cities and regions in line with the EC CE monitoring framework in which indicators are classified into four key circularity areas (Figure 12).

- Production and consumption
- Waste management
- Secondary raw materials and
- Competitiveness and innovation.

Figure 12: CCRI key areas for circular economy baseline monitoring framework




In addition to the four key areas, the CCRI Methodology provides two complementary modules focused on the socio-economic characteristics of the territory and on the state of implementation of the circular initiatives.

- **The set of indicators that inform about the socio-economic characteristics of a territory (e.g., GDP per capita, population density, economic structure of the territory, etc.).** These indicators are necessary to contextualise and facilitate the interpretation of the CE indicators to better identify the potential CE solutions that best suit the type of territory.
- **The set of indicators that inform on the state of implementation of the CE.** These indicators can instead be used by those cities and regions at a more advanced state in the transition to circular systems, where circular initiatives or CSS are already in place.

Table 6 shows a set of key CE baseline metrics for each of the four key circularity areas, while

Table 7 presents some suggestions for measuring the state of play of CE implementation in regions and cities. These sets of indicators are the result of a selection of the most common metrics found in past and current studies and projects focusing on CE at the regional or city level.[16]

[16] The set of selected indicators is based on the EC CE monitoring framework, the Urban Agenda Partnership on Circular Economy, the CIRCTER ESPON project, the OECD synthesis report 'The circular economy in cities and regions' and the Net-Zero 2050 report 'Measuring progress towards climate neutrality.'

Table 6 differentiates between basic and advanced indicators. Basic indicators refer to the indicators most likely to be available from statistical office, or easily calculated based on primary available data (e.g., a ratio between two metrics). Advanced indicators refer to indicators whose availability depends on rather advanced data collection systems (e.g., waste collection or treatment by waste streams) or for which more complex modelling techniques are required (e.g., material footprint or circularity rate).

The set of indicators provided in

Table 6 is by no means comprehensive (the number of CE indicators identified exceeds one hundred), nor should it be intended as a prescriptive recommendation. Rather, readers should use it as a preliminary guide to get an idea of the information that would be useful to keep under control for the analysis of the respective territory. Complementary or similar indicators can of course be used. In this sense, the reader can refer to Appendix 1 for a comprehensive CE indicators overview.

Table 6: Circularity baselining: a selection of key CE metrics

| Key area | CE baseline Indicators | |
|---|---|---|
| | **Basic** | **Advanced** |
| **Production and consumption** | Generation of municipal waste per capita | Generation of municipal waste per capita by type of waste (including food waste)<br>Share of food waste over total food production |
| | Generation of industrial waste per capita | Generation of industrial waste per capita by sector (NACE activities) |
| | Domestic material consumption per capita | Material footprint |
| | Virgin material extraction per capita | Self-sufficiency of raw material per capita |
| | Resource productivity | Resource productivity by type of material/sector |
| | Energy consumption<br>Share of renewable energy in gross<br>final energy consumption | CO2 emissions from energy generation captured and used or stored<br>Carbon intensity of electricity generation |
| | Greenhouse gas (GHG) emissions by sector (NACE) activities (production-based), including transport | GHG emissions from final use of products (consumption-based)<br>GHG emissions per unit of food production<br>GHG emission by waste streams |
| | | Change in land use/coverage (forest Land, cropland, grassland, harvested wood products and other) |
| **Waste management** | Recycling rate of municipal waste | Recycling rate by waste streams |
| | Recovery rate of construction and demolition waste | |
| | Incineration rate | Incineration rate with(out) energy recovery |
| | Landfilling rate | GHG emissions by waste landfilling |
| | Waste intensity (tonnes/GDP) | Waste generated per material consumed (%) |
| | | |
| **Secondary raw materials** | | Circular material use rate (CMU) |
| | | End-of-life recycling input rates (EOL-RIR) |
| | | Trade in secondary raw materials |
| **Competitiveness and innovation** | Direct jobs in the circular economy | |
| | Value added generated by CE sectors (% of GDP) | |
| | CE related patents | |

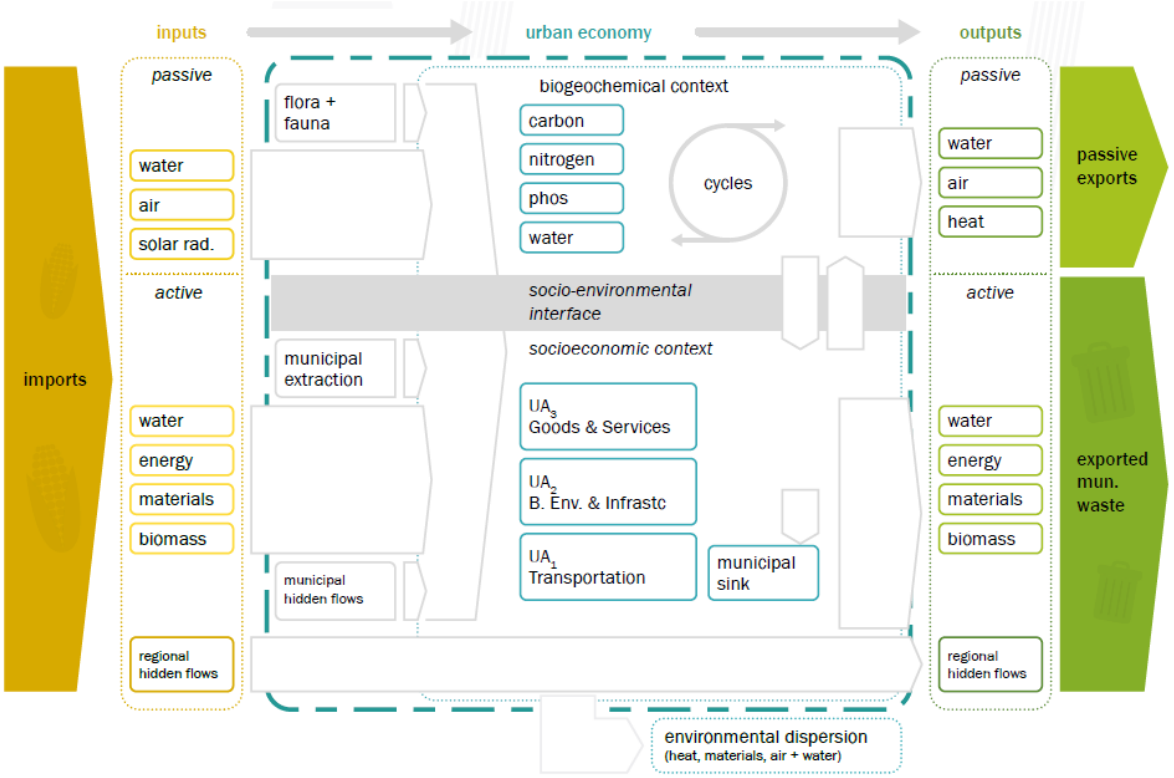
Table 7: Selected indicators for circular economy state of implementation

| Key area | CE state of implementation |
|---|---|
| **Awareness/ information campaigns/ events** | Awareness-raising campaigns for motivating stakeholders to take up CE measures |
| | Level of public awareness for circular economy and waste prevention |
| | Initiatives/awareness campaigns at city/region level for the reduction of food waste generation |
| | Communication measures (campaign, provision of information, events for the public/companies) on circular transformations and waste prevention |
| | Number of economic operators sensitised on CE |
| | Number of seminars organised on the CE |
| | Awards for circular businesses (e.g., stamps, stickers) |
| | Citizens involvement |
| **Capacity building** | Number of CE courses PhDs/university courses |
| | Number of schools that participate in environmental education projects |
| | Environmental education (% per school) |
| | Number of people trained in CE trades |
| | Number of circular economy businesses offered business support |
| | Number of students trained in CE occupations |
| **Regulation** | CE/waste prevention criteria developed in guidelines for procurement. |
| | Number of legislative and normative barriers identified and resolved |
| | Actions by the city intended to encourage the procurement of articles that use secondary raw materials |
| | Availability of innovative schemes for businesses at the city level, which are related to CE |
| | Number of legislative and normative incentives created |
| **Funding and taxation** | Budget amount allocated to calls for projects on CE and number of beneficiary companies |
| | Share of environmentally related tax revenue |
| **Policy** | Availability of a strategy for waste management. |
| | Availability of a roadmap for resource management |
| | Availability of a circular economy strategy or CEAP at city/region level. |
| **Industry – Industrial symbiosis** | Number of pilot/demonstration projects on CE. |
| | Number of jobs (existing and new) involved in industrial symbiosis |
| | Number of companies involved in industrial symbiosis |
| | Investment in symbiosis |
| | Number of eco-industrial parks |
| | Cubic metres of water saved |
| | Collective annual savings across firms |
| | Tonnes per year in $CO_2$ savings |
| | Million tonnes of landfill diversion |
| | Million tonnes of materials recovered and reused |
| | Billion in cost savings |
| | Tonnes of virgin resources saved |
| | Tonnes of waste turned resources |
| | Quantity of kg of reused items in the framework of reuse organisations. |
| **Eco-design** | Activities performed by cities/regions that encourage the implementation of eco-design measures. |

## 1.2.2. Urban metabolism: concept and approaches

Urban metabolism is a conceptual framework to facilitate the description and analysis of material and energy flows within cities. As showed in Figure 13, urban metabolism approaches visualise the flows of materials entering the city (e.g., imports of materials from other areas or withdrawals from the natural environment) and how they are consumed (e.g., energy, biomass), transformed (from raw materials to manufactured goods), accumulated (e.g., buildings), or discarded (i.e., waste) in the urban system.

Figure 13: Urban metabolism framework. Source: Roadmap for a Circular Resource Efficiency in cities – Circular Economy Partnership (2020)




Looking at cities and regions from an urban metabolism perspective implies reasoning on how resources and waste enter and leave the city boundaries and how these connect to the socio-economic system of a city. In turn, the use of urban metabolism provides key insights for the correct design of a CSS, highlighting how correct resource management goes far beyond the area of competence of the environment/waste departments, but rather requires broad and strategic thinking and a coordinated approach that aims at changing urban production and consumption activities, and citizens' lifestyles. In addition, besides improving the understanding of the qualitative links between waste and various urban flows and policies, the measurement of urban metabolism indicators shall also support the setting of a monitoring and evaluation framework.

The analysis of urban metabolism at an early stage is instrumental in providing decision-makers with relevant information to CSS design and provides key input for other analyses in the CCRI Methodology. In particular, it:

- provides scientific-based evidence for identifying the key material streams which should be addressed in the design phase (Chapter 2.2);
- identifies 'hidden' flows which are often disregarded;
- supports the creation of future scenarios for evaluating and prioritising CSS (Chapter 2.3);
- supports the identification of key stakeholder (Chapter (1.3)) as it provides a systematic way of mapping and organising stakeholders (see Tool Factsheet: **Stakeholder mapping by territorial metabolism components).**

Picturing the urban metabolism of a city implies considering the products and materials that go through the urban system as potential sources of future outputs: in other words, they will become waste that can either be prevented by reducing those products and materials at the source or transformed into new products and materials. Reduction, remanufacture, repair, reuse, recycling and recovery are the set of mandatory options that allow to put in place the EU waste hierarchy at all levels and to respect the paradigm of the circular economy.

In case of cities, waste reduction at the source can be the result of changed consumption choices put in place by individual households, local administrations and other urban organisations that will go hand in hand with innovative business activities. On the other hand, the way in which waste is collected and managed will determine the rates of recycling and the number of valuable materials that can find their way back into the urban economy.

Overall, the adoption of an urban metabolism perspective can therefore have a significant role in designing a CSS and supporting its integration in a circular economy strategy. Likewise, urban metabolism should be complemented by parallel activities aiming at:

- identifying the actors or centres for consumption, and transforming resources and waste at urban level (i.e., institutions, public actors, organisations of self-employed individuals, enterprises, non-profit organisations, research centres, training organisations and schools, citizens as individuals or as organisations);
- defining the sectors where these actors operate;
- defining their roles with respect to the use and transformation of material and energy resources as well as to the waste production.

These activities are further described in the stakeholder analysis (Chapter 1.3).

### 1.2.3. Links to the Self-Assessment Tool: Module 1

The data collected in the mapping phase and, in particular, those collected in the analysis of the territory (i.e., socio-economic and urban metabolism trends, as well as the information on the local governance) can be uploaded in the SAT to support the identification of structural enablers and hurdles of CE transition. Specifically, the users of the SAT will be asked to provide general information on the local territory and its economic specificities, as well as broader information on the regional status of the circular economy and environmental performance. Similarly, the SAT user is expected to state the number of identified policies related to the matter of circular economy across the different governmental authorities (output from Chapter 1.1), including the number of known non-governmental actors that have started to work towards increasing a regions circularity (output from Chapter 1.3). Eventually, the SAT can also be used as a quick analysis tool to check if all the elements presented in the mapping phase are acknowledged and if there is a solid foundation to move forward towards CSS design.

## 1.3. Stakeholders' analysis

According to the international standard **ISO 26000** 'Guidance on social responsibility', a stakeholder represents an individual or organisation that is affected, positively or negatively, by the decisions and activities of another organisation. The standard also defines the **stakeholder engagement** as an 'activity undertaken to create opportunities for dialogue between an organisation and one or more of its stakeholders, with the aim of providing an informed basis for the organisation's decisions.'

In the context of the CCRI, stakeholders refer to people and organisations having a direct or indirect interest in CSSs and participating in activities making these possible. Due to the systemic nature of circular solutions, decision-makers involved in CSS design and implementation need to challenge themselves to open the decision-making process to as many actors as possible to feed public policies with heterogenous perspectives, thus building the basis for public accountability and ensuring an interdisciplinary dialogue between disciplines and sectors.

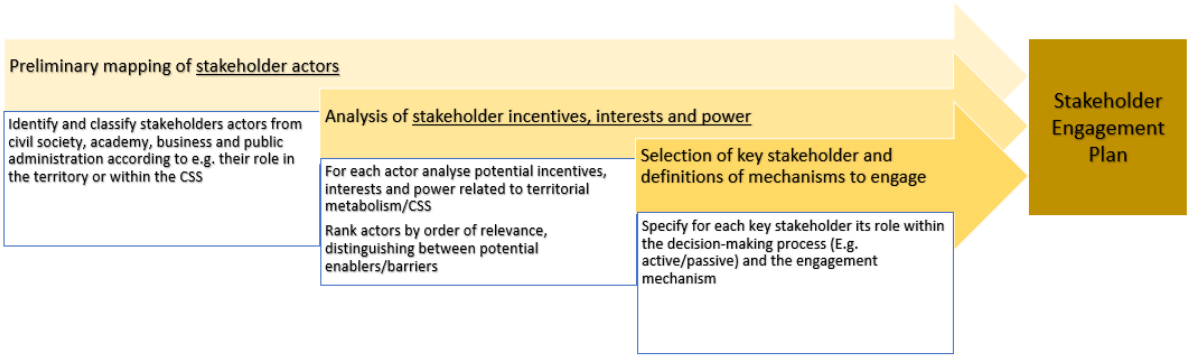
Prior to direct engagement, which in the CCRI Methodology represents the first step in the Design phase, key stakeholders should be identified by answering strategic '*who*', 'what', 'how' and 'when' political questions

related to the reasons why each stakeholder is important for the project and, at the same time, the benefits stakeholders could gain from collaborating in the project activities. This would make it possible to become aware of the interest of the stakeholders and, therefore, to guarantee an active and constant involvement of the interested parties. In practice, key stakeholders can be identified by answering the following questions:

- **Who** will be most *concerned* about the implementation of a CSS? Who can most *influence* the implementation of a CSS?
- **What** common vision can we build with the interested parties? **What** do we want to accomplish with the stakeholders? **What** are the reasons for proposing such a CSS?
- **How** and **when** interested parties should participate to the decision-process? **What** type of engagement mechanism/incentive can be used?

The main goal of the stakeholder analysis is to start building a **stakeholders' engagement plan (SEP)**, which is a living document, continuously updated throughout the project, defining and monitoring the governance of the stakeholders' engagement process in terms of planning, managing and monitoring of the activities and commitments of interested parties. Figure 14 illustrates the three activities that facilitate the identification and selection of the key stakeholders to be involved and represent the starting points for the definition of a SEP.

Figure 14: Stakeholder mapping and selection




Methods for **stakeholder identification** are several. Each of them has different goals, benefits and drawbacks. These positive and negative aspects may refer to the differing quality or quantity of the method's outputs or the costs attached to the application of each method. Moreover, some methods may be more suitable for different sub-stages of the stakeholder identification step, as many 'stakeholder identification' approaches require pre-identified stakeholders as an input (e.g., snowball mapping). However, this is usually not a trivial task, and so a combination of methods might be desirable. Four different methods are presented in Table 8 together with their strengths and weaknesses.

In parallel to stakeholder identification, it would be desirable to already **understand and differentiate between types of stakeholders**. This requires developing an understanding of how the different stakeholders and stakeholder groups are affected by, or can affect, the decision/policy in question, as well as their interests and perspectives. Several methods are available for developing this level of understanding, some more systematic than others. The most systematic methods rely on the categorisation of stakeholders with respect to categories that are typically useful in achieving some goal in a specific setting. As an example, Table 8 includes two approaches (namely the '**Stakeholder mapping by territorial metabolism components**' and the 'stakeholder mapping by CSS life cycle perspective') for the systematic categorisation of stakeholders with respect to: a) their role within the metabolism of the territory; and b) the role they have in a CSS from a LCA perspective. This is a good example of a highly systematic differentiation of stakeholders. Other methods, that are not so systematic, include methods that rely on the qualitative information obtained through close interaction with stakeholders (e.g., through brainstorming sessions). Given the variety of strengths and weaknesses associated with these methods, different goals will be best suited to different methods and, often, a combination of more than one method will prove particularly useful.

The **identification of relationships** between stakeholders or stakeholder groups is, in general, an exploration into the existence, quality (type) or quantity (strength) of these relationships. Therefore, most available methods for the identification of inter-stakeholder relationships are based on different scales through which

the quality, quantity or lack of a relationship may be identified. A cost-effective and easy application can be the definition of a table (matrix) containing all (relevant) stakeholders listed along the first column. Each box (row) is then filled with information about the relationship between the corresponding stakeholders (e.g., strength – from weak (W), to medium (M), to strong (S)). For relationships where not enough information is available, the boxes are typically left blank. The table might also be complemented with a visual representation of a two-axes graph (an example might be to classify stakeholders according to the level of interest (x-axis) and power/influence (y-axis), but other scales may be used in order to better align with the specific process). This would permit a quick identification of influence-dynamics of stakeholder system and offer a systematic basis for determining future stakeholder involvement and its levels. As an example, the reader can refer to the **Stakeholder value mapping** tool factsheet.

Table 8: Methods for stakeholder groups identification

| Method | Overview | Strengths | Weaknesses |
|---|---|---|---|
| **Territorial metabolism components** | It: 1) decomposes the metabolism of a territory in various components – (material) inputs and (waste) outputs, as well as territorial (non-material) endowments; and 2) identifies relevant stakeholders for each of them. | Systematic;<br>Cost-effective;<br>No pre-identified stakeholders needed;<br>Explicit consideration of territory stakes. | Requires the analysis of the metabolism of the territory. |
| **CSS life cycle thinking** | It: 1) applies a life cycle logic to the target CSS; and 2) identifies stakeholders per life cycle stage. | Very systematic;<br>Highly cost-effective;<br>No pre-identified stakeholders needed;<br>Explicit consideration of sustainability dimensions. | Requires the pre-identification of the CSS. |
| **Brainstorming sessions** | These can be summarised as organised discussions of a pre-determined topic in a focus-group like setting. This method aims at collecting large amounts of qualitative information on stakeholders, their interests and their knowledge. | Offers deep understanding of complex processes;<br>Convenient for creation of comprehensive stakeholder categories and classification criteria. | Requires a high level of preparation.<br>Requires a number of stakeholders pre-identified;<br>Requires a skilled facilitator. |
| **Snowball mapping** | It aims at ultimately achieving the identification of all relevant stakeholders, starting by interacting with the most accessible ones, first (base stakeholders). The expectation is to be able to extract from them information on further stakeholders, as well as contact information of stakeholders already in their social networks. | Fast and straightforward (undemanding of resources, time and expertise);<br>Easy access to base stakeholder social network (snowballing);<br>Most suitable for completing a list of stakeholders. | Potentially biased outcome due to the use of the snowballing technique;<br>Not very strong on its own<br>(combination with other methods is desirable). |

**STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES**

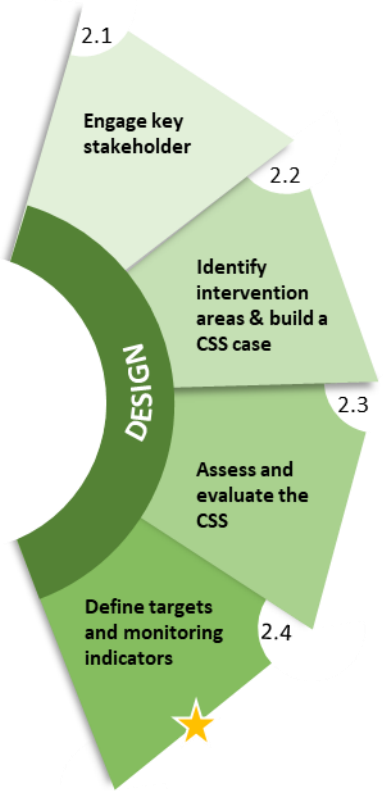
Before directly involving stakeholders, it is important to identify which are the most relevant groups (including companies or associations) in the area. This analysis can be carried out mainly on the initiative of the research centres with the collaboration of the public authorities. Defining in advance the potential opportunities for the various stakeholders and, at the same time, knowing what their interests are will be the key to a first contact and will favour stakeholder commitment since the beginning.

# Ambitions' achievements checklist

| Analysis of Ambitions' achievements | |
|---|---|
| **Policy framework analysis** | ✓ Have existing (local, national and supra-national) policies supporting the CE transition been identified?<br>✓ Have potential policy or regulations gaps that could inhibit CE transition been identified?<br>✓ What are the policy areas that allow for more targeted policy interventions in the local territory?<br>✓ What are the main objectives of local development strategies? |
| **Territorial framework analysis** | ✓ Have the main flows of materials and waste in the territory been quantified, mapped and benchmarked with other peers?<br>✓ What are the broader sectoral areas with the greatest potential to retain value (for civil society, business and environment)?<br>✓ What additional elements are missing to complete the understanding of the territorial framework? |
| **Stakeholder analysis** | ✓ Have key stakeholders been identified across all relevant groups? (industries, businesses including SMEs, academy, civil society and institutional bodies)<br>✓ Have synergies, barriers and enablers for key stakeholder engagement been evaluated? |

# 2. Design

There are many potential choices for implementing CSSs and it is important to identify a wide range of actions that can be considered by stakeholders. Some actions may help to cope with CSS barriers in the early stages, while others will help once a CSS is in motion. A good method is to develop a CSS Action Plan that lists the sequence of actions and options that can be implemented as the situation evolves.




**Ambitions**

**This phase aims to:**

- consolidate the stakeholders' group;
- develop the SEP with the definition of stakeholders' roles, engagement mechanisms and compromises for the period of CSS design and implementation;
- identify key intervention areas considering potential drivers, risks and barriers to action and co-establish mechanisms to overcome them;
- build a CSS in conjunction with stakeholders, assess and evaluate CSS economic, social and environmental impacts;
- develop an action plan to get the CSS in motion, including the schedule of required activities, clear objectives and performance indicators.

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

**Time frame**

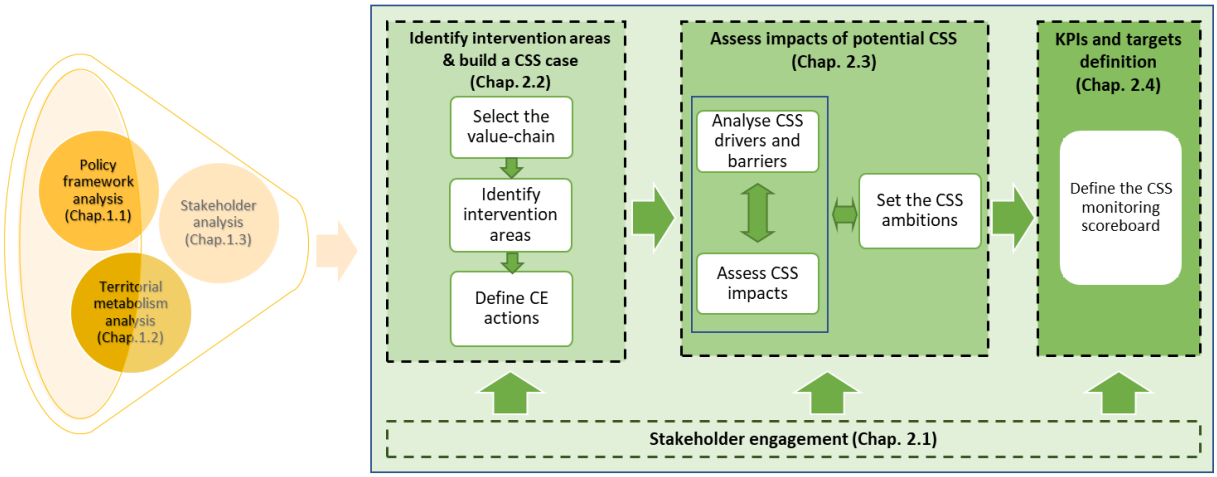
From 1 to 2 years

The Design phase represents the core of the CCRI Methodology, and it aims to first define a CSS and second to develop an action plan – i.e., an operational strategy to implement the CSS. As shown in Figure 15, the Design phase is structured in three main blocks, which describe the activities for the development of a CSS, and a transversal block to the activities that refers to stakeholder engagement. Namely:

- The **Stakeholders' engagement is** as parallel process that accompany the entire duration of the design phase. The CSS should be the result of a co-work process between all interested parties. Therefore, stakeholders should actively participate to all the activities of this phase, from the identification of intervention areas according to feasibility and willingness of parties, to the agreement on the set of KPIs to monitor CSS progress.

- The identification of intervention areas aims to solidify what CE actions can be implemented considering the drivers, barriers and priorities of the local territory. The circular actions will, together, constitute a CSS case.
- The assessment and evaluation of a CSS aims to ensure that the CSS is viable as a whole and that the expected impacts (economic, environmental and social) are positive. Scenarios' assessment can also help define medium and long-term goals.
- The definition of a KPIs system is the last step of the Design phase and it aims to define a monitoring framework for the evaluation of the CSS over time.

Figure 15: Design phase: visualisation of tasks, sub-tasks and their dynamic linkages




The Design phase mostly relies on the information generated in the first phase where a database informing on the metabolism of the territory should have been created. Based on this, ad-hoc and granular analyses will be further carried out on specific material flows or value-chains. Overall, the activities of the Design phase aim at generating the information/knowledge required for a CSS Action Plan, which should describe in detail how actions will be implemented to accomplish the objectives agreed by the stakeholders engaged.

The CSS Action Plan should specify:

- the ambitions (objectives) of the city or region;
- actions needed to address each objective;
- how CE actions (or the CSS) fulfil strategic objectives;
- the timeline for the action's implementation;
- who will be responsible for actions implementation;
- expected impacts of the actions;
- a KPIs scoreboard that allows to monitor CSS implementation.

Expected outputs include the:

- **definition of a SEP**: this is a living document that will be updated along the duration of the project and informs on the stakeholders' commitments and roles, the agenda of stakeholders' events and the engagement mechanisms agreed;
- **definition of a CSS:** this should start from the general identification of the key value-chain (or of the material flows), and then go on to detail the sectors and areas of intervention and a list of CE actions to be implemented;

- **assessment and evaluation of a CSS,** including CSS viability and life cycle based expected impacts;
- **definition of a set of KPIs** to monitor the CSS over time;
- **development of the CSS Action Plan**: this is a document that summarises all the information and data generated at this stage.

## 2.1. Stakeholders' engagement

The systemic nature of the transition to circular economies in cities and regions requires the effort and involvement of multiple stakeholders who discuss, debate, work together and create incentives and framework conditions for building synergies. This diversity of stakeholders is a source of ideas, opinions and work that must be harnessed. Nonetheless, it is important to consider that the several stakeholders involved in circular economy solutions will usually have different, and possibly competing, interests and goals. Therefore, it is important from the outset to identify which mechanisms or dynamics are most appropriate to involve each group of stakeholders. Addressing any stakeholder concerns early in the decision-making process can help to avoid obstacles and save valuable time. Hence, effective and active engagement will be essential to carry out joint collaborative efforts and ensure the participatory development of new policy actions, including the identification of more relevant and challenging opportunities.

Stakeholder engagement activities have the purpose of creating opportunities for dialogue between the persons and/or entities implementing a circular economy initiative and its stakeholders, with the aim of providing an informed basis for the decisions relating to the development of the initiative. While a stakeholder engagement process always includes some type of communication and exchanges between interested parties, the way in which this process is organised can take many forms. For the case of circular economy initiatives, the engagement process should be organised to allow stakeholders to discuss, collaborate, provide ideas and express concerns related to circular solutions. Many forms of engaging stakeholders exist, and each CSS should explore and identify the most appropriate strategies for their specific case. As a potential framework to define the exact stakeholder engagement strategy for circular economy initiatives, Salvioni and Alici (2020) propose a classification of engagement forms based on the desired level of engagement (low, medium, high) and the nature of the relationship (short, medium or long-term). This is summarised in Table 9: Stakeholders' engagement methods below.

Table 9: Stakeholders' engagement methods

| | **Short-term nature** | **Medium-term nature** | **Long-term nature** |
|---|---|---|---|
| **Low engagement level** | **Passive engagement** (communications through the media, newsletters and project websites) | **Monitor** (communications and advice from certain stakeholder, for example, through targeted interviews) | **Advocate** (continuous advocacy efforts to certain stakeholders) |
| **Medium engagement level** | **Inform** (direct communication with the stakeholder, including through conferences and presentations) | **Transact** (medium-term engagement through specific agreements and collaborations) | **Consult** (regular consultations on key issues through focus groups, meetings and workshops) |
| **High engagement level** | **Negotiate** (punctual engagement on a specific issue to reach a consensus) | **Involve** (joint learning and advice through forums, advisory sessions and consensus-building initiatives) | **Collaborate and empower** (joint learning and decision-making, the stakeholder plays critical role in shaping the initiative) |

Within the context of circular economy initiatives, stakeholders refer to people and entities having an interest in CSSs and participating in activities to realise them. Building upon the stakeholders identified in Part I of this methodology and the list of key stakeholder groups presented in the introduction ( **Key** stakeholders), the following categories of actors should be engaged (or at least considered) in any CSS development in order to maximise the probability of successfully achieving a collaborative and inclusive decision-making environment.

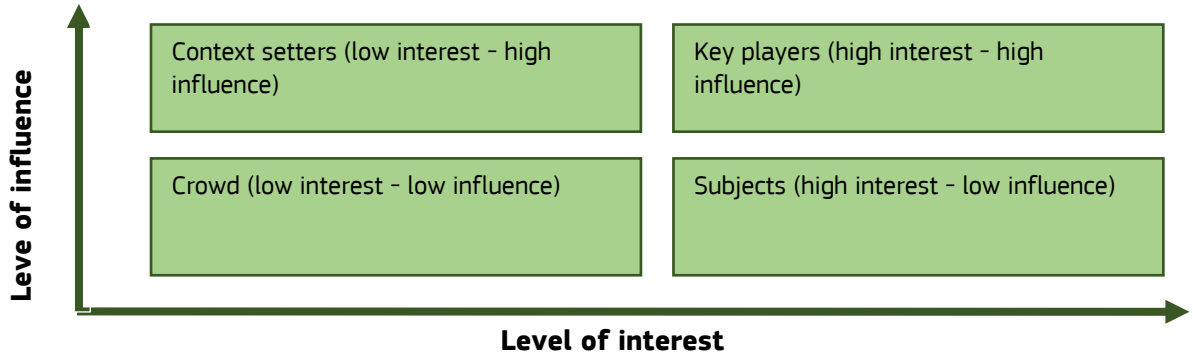
- **Local authorities**, which can play a crucial role in the transition towards a circular economy. Local authorities can act as active agents in circular economy activities, stimulate debate and provide valuable insights and expertise, and promote the concept of CSS and the activities of the project.
- **Industry and businesses** have a critical role to play in CSS given their nature as essential parts of local and regional economies. Businesses can provide very valuable expertise, resources and knowledge to the decision-making process.
- **Consumers** can be a key part of any CSS as they can provide highly valuable feedback and advice. Consumer organisations and NGOs could act as intermediaries to reach, engage and inform consumers.
- **Knowledge institutions**, including universities and research institutions, can contribute with precious knowledge, specific research and know-how.
- **Not-for-profit organisations** and other entities from civil society must also be involved as they can provide much needed bottom-up ideas and raise awareness.

Building on the findings of the **Stakeholders' analysis**, which informs on the strategic questions 'who', 'what', 'how' and 'when' about participating in CSS activities, it is critical to determine which of the engagement methods presented in Table 9 is the most appropriate for each stakeholder group. To this end, the level of influence and level of interest of a stakeholder must also be determined. This will allow to separate stakeholders and actors in four broad groups. For each group, a set of communication channels and engagement mechanisms will be more appropriate, according to the needed engagement level and the time nature of the relation that is to be built. Four broad groups can be distinguished.

- **Key Players** (high interest – high influence) have the resources to block or implement solutions. They deserve special attention during the engagement process as they can significantly determine the success of the circular economy initiative and have a high interest in it. The most appropriate engagement methods for this group are those that fall within the intersection of high and medium engagement and long and medium-term nature.
- **Context setters** (low interest – high influence) can significantly determine the success of the project but have little interest in it – e.g., because they think it is marginal to their interest. Constant low-level involvement will be needed. The most appropriate engagement methods for this group are those that fall within the intersection of medium and low engagement and long and medium-term nature.
- **Subjects** (high interest – low influence) are unlikely to play a significant role in the development of the circular economy initiative, although they are highly interested in it. Their concerns should be heard and taken into account, although their input must be expected to be limited. The most appropriate engagement methods for this group are those that fall within the intersection of high and medium engagement and short and medium-term nature.
- **Crowd** (low interest – low influence) cannot determine the success of the initiative, nor are they interested in it. Therefore, there is little need to consider them in much detail. The most appropriate engagement methods for this group are those that fall within the intersection of low and medium engagement and short and medium-term nature.

Figure 16 below provides a visual summary of the four different stakeholder groups based on influence and interest.

Figure 16. Categorisation of stakeholders based on influence and interest.




### 2.1.1. Define a Stakeholders Engagement Plan

Due to the systemic nature and complexity of circular solutions, the decision-making process that will guide the creation and implementation of a CSS will not only involve a large number of stakeholders but will also last several years. For this reason, it is recommended to plan and keep track of stakeholder engagement activities in a systematic way though the definition of a **Stakeholder Engagement Plan (SEP).**

A SEP enables communication with stakeholders to get support for the CSS project. The plan should outline the location and form of communication, contact person and communication frequency. The coordinator of the CSS project, together with key actors, should start developing this document at a very early stage – ideally in the mapping phase during the stakeholder analysis, and update it over time as stakeholders' needs change. A well-designed SEP facilitates transparency and support from involved stakeholders. A comprehensive and well-functioning SEP helps to:

- create trust between the different actors, stakeholders and promoters of a CSS;
- create opportunities for exchange and innovation;
- build local expertise and capacity, further contributing to the success of the circular economy initiative.

Practically speaking, the SEP should strive to make sure that relevant and needed parties are included in each stage along the decision-making process from the earliest phases of planning until CSS implementation. The stakeholder analysis presented in the previous section should be of significant help to identify and select relevant stakeholders and to start developing the SEP. The SEP should be a living document, continuously updated throughout the project, defining and monitoring the governance of the stakeholders' engagement process in terms of planning, managing and monitoring of the activities and commitments of interested parties.

The SEP should clearly define the following items.

- **Stakeholder list**, including contact person and preferred communication channel.
- **Project phase**: the identified stakeholders for each CSS project phase.
- **Interest level**: the stakes identified for each stakeholder. It highlights how the stakeholders' interests overlap with the CSS project, their goals and why they are interested.
- **Influence level:** the power to stop, change or accelerate the CSS.
- **Engagement approach**: the strategies for engaging each stakeholder. It should describe the frequency and forms of communication – e.g., daily, weekly or monthly emails, phone calls, or face-to-face meetings. Additionally, the content of the communication – e.g., design information and project progress – should also be highlighted.

The SEP should also anticipate the issues to be discussed with each stakeholder and in each engagement method even if they can vary during the actual development of the initiative. Examples of themes and topics that can be addressed in the stakeholder engagement sessions include good practices on circular economy initiatives and dedicated consultations on concerns and inputs from stakeholders.

**STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES**

The support of citizens can make the difference between a lasting CSS and a CSS that fails after a few years. People can actively take part in public policies in different ways and on different levels. To achieve stronger civic engagement, actions and good practices should be developed based on five principles.

- **Transparency:** the intention of the initiative must be clear. People must know the real potential outcomes and what commitments are expected from them.
- **Benevolence:** to develop a benevolent and respectful atmosphere for everybody, it is necessary to ensure a safe space that can help to channel divergent opinions.
- **Shared expertise:** encourage and enable greater accessibility for participation by finding relevant ways to meet and question citizens. Appropriate tools must be used for facilitating a constructive discussion.
- **Accessibility:** it is important to make sure that there are different options and services to include all kind of citizens (e.g., people who work, have children, have physical disabilities, cannot afford transportation, have difficult access to language or computers, etc.).
- **Experimentation:** ask for ideas, talk with participants and listen.

People have a strong need for belonging, and communities are great tools for connecting different issues and different stakeholders who can share similar goals. Civil society must feel part of an initiative that aligns their values and has a strong identity. Further information on how to involve citizens in circular economy can be found in CECI, an Interreg project aiming at transferring knowledge among regions to bring more relevant and efficient policies to promote citizen involvement in circular economy.

## 2.2. Identify intervention areas by adopting a value-chain approach

Adopting a value-chain approach allows identifying hotspots and shaping corresponding actions built on existing knowledge and available data. It provides a framework applicable to different sectors, products and geographical scales and it helps to identify the drivers and barriers that cause the value-chains of different sectors to operate as they do.

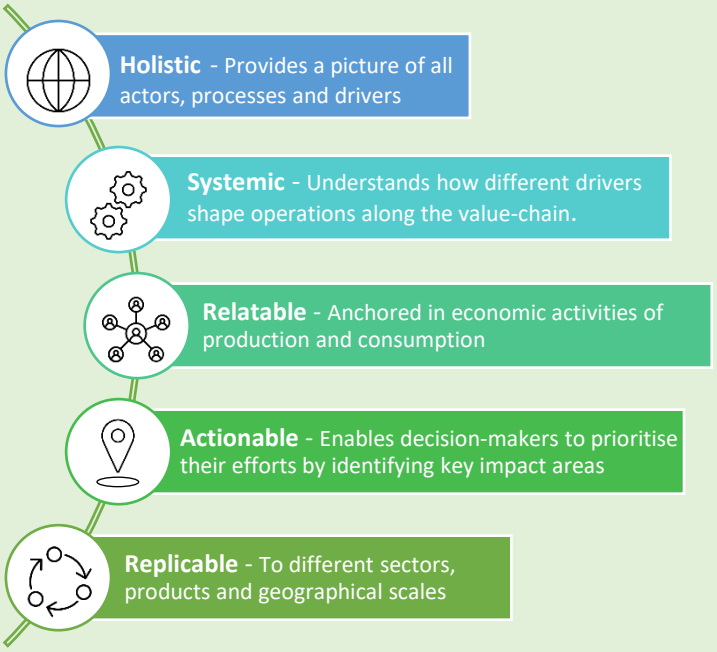
Over the past years several approaches have been proposed to identify and prioritise intervention areas for circular solutions. Therefore, the CCRI Methodology, and in particular this chapter, proposes a logical approach to *intervention area selection* and *CSS definition* that:

- builds on previous experience (see Table 10 for an overview of identified approaches);
- takes stock of both: 1) the systemic notion of circular solutions; and 2) the novel perspective of key product value-chains promoted by the CEAP – and, more recently, also endorsed by the United Nations Environment Programme (UNEP) report '*Catalysing Science-based Policy action on Sustainable Consumption and Production – The value-chain approach & its application to food, construction and textile*' (2021).

## THE VALUE-CHAIN APPROACH, United Nations Environment Programme, 2021

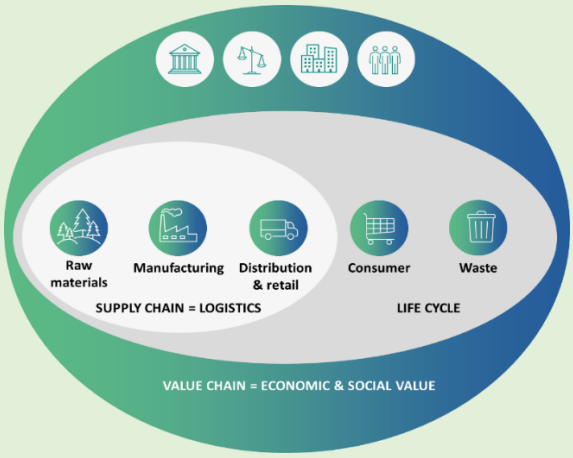
A value-chain can be defined as the set of the economic activities that provide or receive value from designing, making, distributing, retailing and consuming a product, including the extraction and provision of raw materials, as well as the activities that are involved with the product after its useful service life. In this sense, the value-chain covers all stages in a product's life, from supply of raw materials to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation. In addition, the value-chain is also comprised of the actors undertaking the activities and the stakeholders that can influence the activities. The value-chain thus incorporates not only the physical processes, such as farms and industries, but also the business models and the way products are designed, promoted and offered to consumers.

### FIVE VALUE-ADDING FEATURES OF THE VALUE-CHAIN APPROACH




By applying a systems lens, the value-chain approach identifies the drivers and barriers that cause the value-chains of different sectors to operate as they do, taking into account the complex drivers and feedback loops that determine and influence the operations and behaviours of actors along the value-chain. By engaging all actors along the value-chain, the value-chain approach identifies the most promising solutions and defines a common agenda for concerted actions that can transform the system.

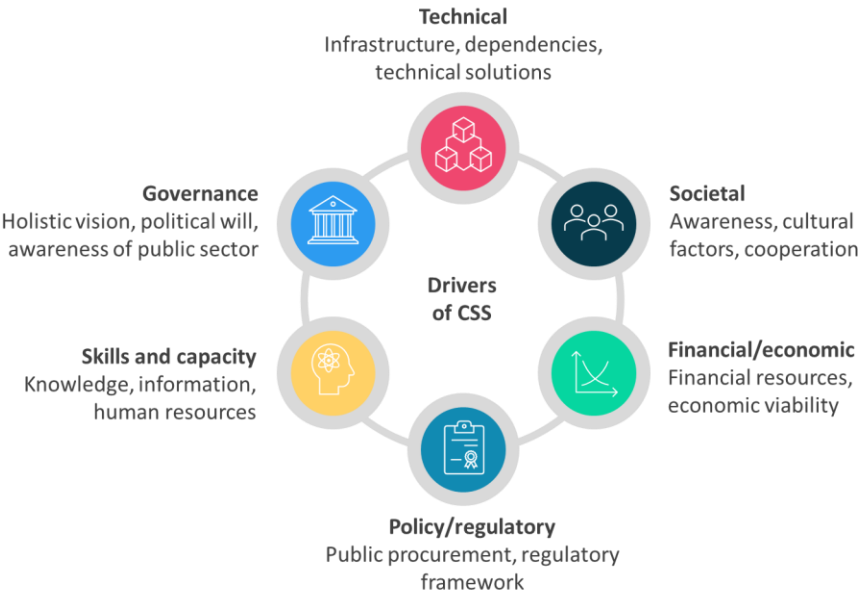
In this way, the value-chain approach identifies where the greatest opportunities for improvement occur and shapes corresponding actions by building on existing knowledge and available data.




*United Nations Environment Programme (2021) – 'Catalysing Science-based Policy action on Sustainable Consumption and Production – The value-chain approach & its application to food, construction and textiles.' Nairobi.*

The use of a value-chain approach aims to identify hotspots and shape corresponding actions built on existing knowledge and available data. In this case, the source of data and information will be primarily the output of the mapping phase – i.e., the analysis of the territory, including resource and waste flows, main stakeholders and regional strategies. The analysis of available data and information through the lens of value-chain economic activities allows for a 'system view', or, in other words, it supports the understanding of the systematic barriers and drivers along the value-chain. For instance, the mapping of data can have identified sectors of a value-chain where the majority of the natural resource use and impacts occur. However, it does not automatically follow that the solutions are only to be found in those sectors. It is necessary to apply a systems lens to move beyond a siloed and disconnected analysis, toward understanding how different drivers can synergistically work and shape a CSS along the value-chain and across different economic activities. CSS drivers such as institutions, regulation, technology, markets and other socio-economic and cultural factors also shape the operations along the value-chain (Figure 17).

Figure 17: CSS drivers




The drivers and the structure of the value-chain determine the level of influence and power of certain actors, and their ability to contribute to CSS solutions. Each of the drivers contribute to shaping the CSS and influencing the behaviour of the actors along the value-chain and determining what options are available to them. Equally, each of these drivers are possible points of intervention to positively shape the way the sector works and the behaviour of actors along the value-chain.

In this phase, the information generated by the MAP phase should be analysed and discussed under three key steps:

1. Understanding and selecting main product value-chains in the territory (following criteria of opportunities and/or criteria of risks/challenges).
2. Prioritising sectors and intervention areas.
3. Identifying CE actions to build a CSS case.

Differently from existing approaches, which adopt a rather sectoral perspective, the use of a (product) value-chain lens can help to better understand: 1) what is happening at different stages of the value-chain; 2) what are the main economic activities of relevance and how they operate as part of the whole system; and 3) what are the associated environmental and socio-economic impacts. The ultimate ambition is that a common agenda will guide all stakeholders in a holistic way towards the implementation of the desired CSS. It is very important that the three phases, described below, are undertaken through meaningful engagement with stakeholders.

**STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES**

Public authorities will act as initiators and drivers for the identification of main product value-chains in their territory. They are in a position to know about the local contexts' main challenges in different sectors of the economy. Beyond being aware of the socio-economic status quo situation in their territory, they also have a vision for the future. They are in a position to orientate focus of assessments in a specific direction if needed.

Research and technology organisations (RTOs) and academic institutions may support the assessment with appropriate methodologies and tools. They may, in turn, be supported by consultancy and service providers in their task.

RTOs have a good knowledge of the local industrial environment, their major challenges and opportunities. RTOs can provide sector-specific technical expertise and knowledge when needed in the initial process. They also offer knowledge of good practices and experiences from other EU contexts.

### 2.2.1. Understand and select main value-chains in the territory

The CEAP has identified seven key product value-chains that are expected to increase circularity (Chapter 2.2). Value-chains cover all stages of a product's life, from supply of raw materials through to disposal after use, and encompass the activities linked to value creation such as business models, education and awareness campaigns. In general, it is possible to link each stage of product's life with specific economic sectors. As an example, supply of raw material will mainly concern agriculture, forestry and mining, among others and economic sectors. Likewise, the disposal phase can find its economic activity counterpart in the waste management sector. This 'sectoral perspective' of the phases of the life cycle allows not only to clearly understand and visualise which economic activities and sectors are involved in each phase of the life cycle, but also allows, at a later stage, to link the value-chain stages with sectoral data, thus facilitating all empirical assessments required to evaluate and monitor CSS implementation.

We present in Figure 18 a matrix-framework linking key product value-chains (rows) and economic sectors (columns). While for illustrative reasons we have only considered the key product value-chains highlighted in the CEAP[17], regions and cities can adapt the matrix by considering different value-chains as needed. Similarly, we have limited ourselves to showing only the top-level aggregate economic activities, but these can be broken down further into sub-activities. For example, 'agriculture, forestry and fishing (A)' can be further broken down into '01 Plant and animal production, hunting and related services', '02 Forestry and logging' and '03 Fishing and aquaculture.' Even more granular activities are available. For a full overview the reader can refer to the Statistical Classification of Economic Activities in the European Community, Rev. 2 (2008). Finally, the framework also considers cross-cutting actions that can affect different sectors along the value-chain. These may be regulation or taxation initiatives, financing or funding schemes, governance and other. These elements are key enabling conditions for CSSs, and their (non)consideration is often at the base of (un)successful CSSs (Section 2.3.2).

At this stage, it is important to ensure that the key stages and underlying economic activities of the value-chain (including their actors) are captured. As an example, in Figure 18 relevant key areas for each value-chain were marked with green cards. It should be noted that value-chains are often global and, as such, affect a large geographical area that extends beyond the territory of a region/city. Therefore, cities and regions when mapping relevant key areas should focus (or at least prioritise) those areas within their reach, even if indirect effects can also be expected in other areas (e.g., the introduction of circular criteria in public procurement might influence extraction of primary material happening somewhere else).

[17] The CEAP identified the following value-chains: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water; and nutrients. However, it should be noted that other value-chains could also be considered depending on the specificities of cities and regions.

Building on the baseline circularity assessed in the MAP phase, regions and cities should be able at this stage to:

- select (or define) a product value-chain. Selected key value-chain(s) should be highly relevant for the territory in terms of: i) natural resource and material use: ii) environmental impacts; and iii) known socio-economic impacts (see Figure 19);
- identify the economic sectors/activities that affect the value-chain and whose actors are present (or available) in the territory.

Figure 18: Framework for identifying key areas for CSS interventions by key product value-chains and economic sectors (note green boxes are only provided as an example as a CSS can address different key areas).

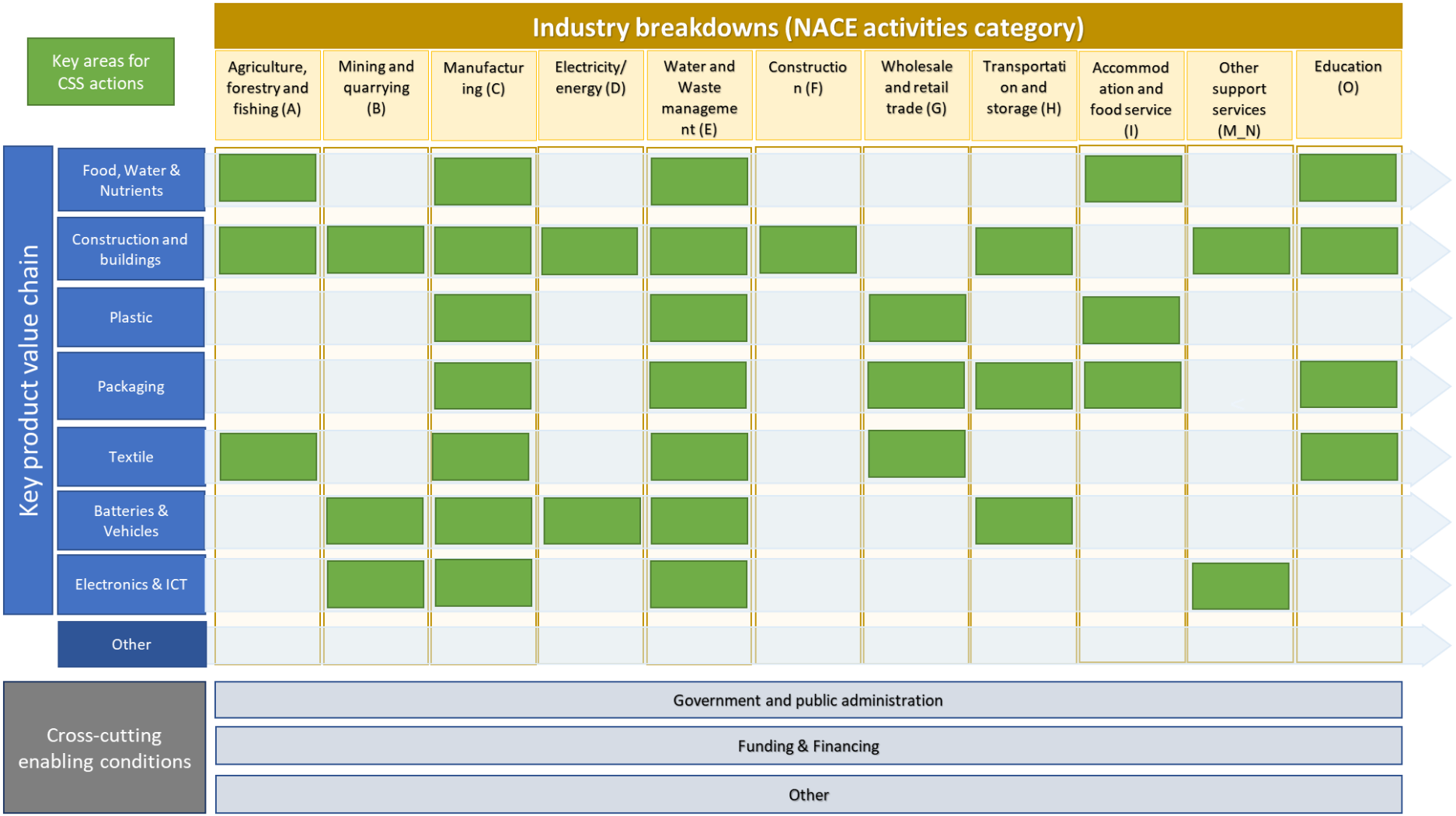
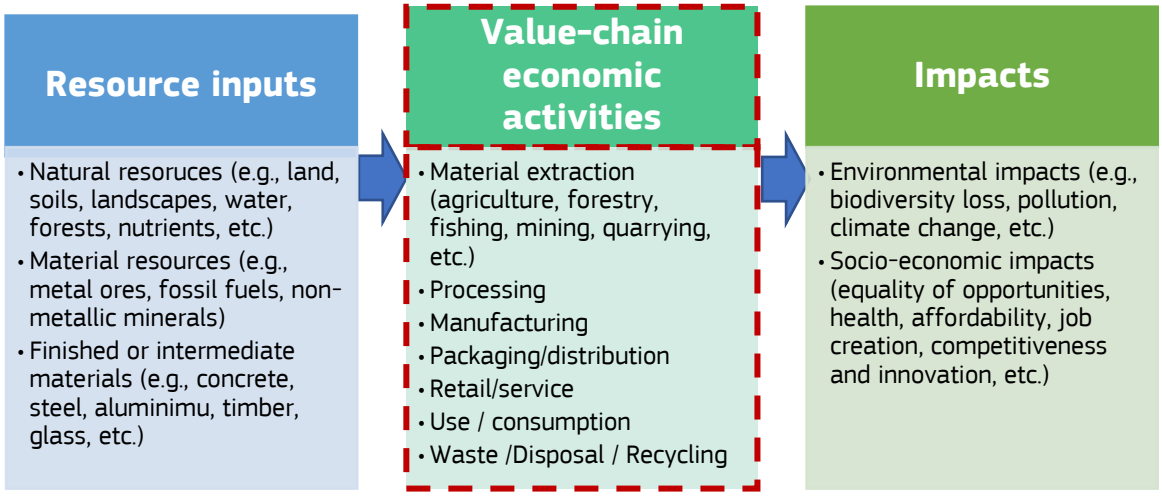


Figure 19: Economic activities of production and consumption in relation to natural resources and the environmental and socio-economic impacts.




### 2.2.2. Prioritise sectors and/or intervention areas

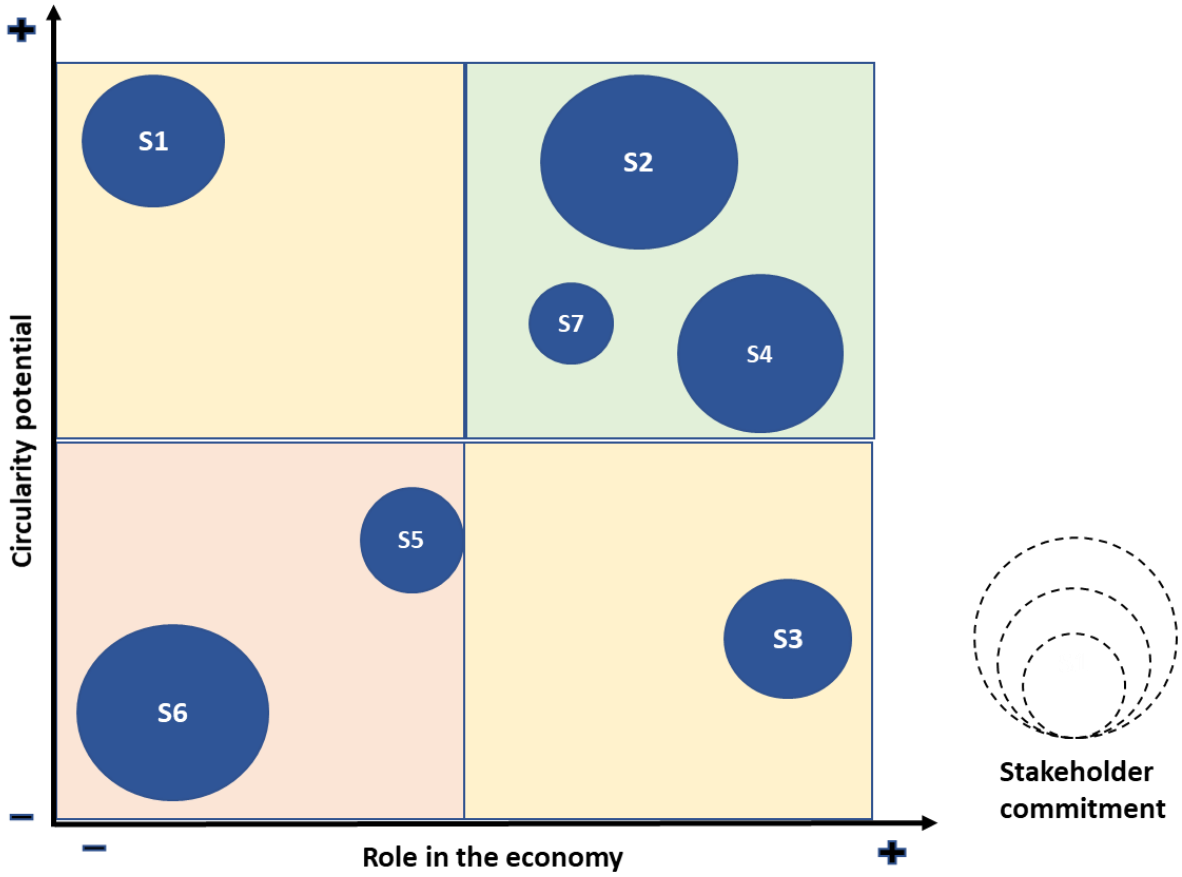
The prioritisation of economic sectors/activities is a key milestone in the decision-making chain for the implementation of a CSS as it implies the commitment of stakeholders and economic resources over a longer period and entails associated risks (i.e., opportunity costs). The selection of economic sectors automatically supposes the engagement of specific stakeholders while leaving other stakeholders in a lower commitment and engagement intensity. As we have seen above, early engagement of stakeholders is a key criterion to enhance the success probabilities of the CSS to be implemented and achieving the expected impacts.

The selection of key economic sectors should take into consideration three major aspects in parallel.

4. **The role of the selected sector(s) in the local economy**. The role in the economy could be given by: i) the contribution to the GDP; ii) employment figures; or iii) competitiveness level. These can be easily quantified (or estimated), if the NACE economic classification has been used, based on regional statistics.
5. **The circularity gap/potential and expected benefit of the selected sector(s).** This can be expressed by benchmarking local performance through various indicators (no official or standardised definition of circular potential is currently available): waste generation; material intensity; waste value recovery; environmental impact of resource extraction; and use or scarcity of required resources. While quantitative criteria of circularity potential might be easier to manage, other more qualitative criteria may also come to play and favour an even more systemic approach. These criteria may consider the following aspects:
   - sensitivity to circular economy: potential for reintroduction of waste as raw material, synergies, impact of circular economy on the sector,
   - motivation for CE: how motivated is the sector in terms of applying circular economy initiatives?,
   - circular economy experience: existence of circular economy (and/or sustainability) initiatives,
   - existence of organisational networks: does the sector actively belong to any formal or informal organisational network? (e.g., cluster, business association).
6. The stakeholder commitment. Ultimately, CSSs can only be implemented if supported by local stakeholders. Therefore, circularity potential can only be fully exploited if the identified sectors are represented by strongly committed stakeholders who: i) are willing to transition towards circularity: ii) are proactive for collaborating within new governance schemes together with new partners under new business models: and iii) are ready to invest resources over a longer period of time (human resources, infrastructures, economic resources) (see also Chapter 2.1 Stakeholders' engagement).

The process of the focus sectors selection according to the above-mentioned key criteria can be simplified through the representation in a two-dimensional grid in which 'role in the economy' and 'circularity potential' form the axes and the stakeholder commitment is reflected in the size of circles (Figure 20). In this figure, the sectors (circles) located in the upper right quadrant would represent the priority focus sectors to be further considered for the implementation of concrete CSSs. Sectors located in the lower left quadrant could be considered as non-relevant while sectors located in the upper left and lower right could be subject to further negotiations across stakeholders to eventually implement the CSS as either circularity potential or role in the economy are estimated as high. Depending on the interests and ambitions of specific stakeholders, actions in these sectors could eventually be undertaken.

Figure 20: Prioritisation of economic sectors



### 2.2.3. Identify CE actions to build a CSS case

Once focus sectors have been identified, the following step consists in identifying possible CE actions which will build the future circular systemic solution. Given the fact that opportunities can be manyfold for a given value- chain and/or geographic area, it is suggested to map CE actions as the fruit of a screening exercise, which can be carried out through a brainstorm session(s). Especially for this step, it is important to keep in mind that creativity is essential for generating as many viable ideas as possible. To identify the promising activities, it is important to involve relevant and suitable stakeholders for each selected value-chain/sectors and it is preferable to look for stakeholders which are known to be intrinsically motivated and willing to take action.

Several approaches and tools can be used for this exercise. As an example, the **ReSOLVE framework** developed by McKinsey and MacArthur takes the core principles of circularity and applies them to six main strategic actions: Regenerate; Share; Optimise; Loop; Virtualise; and Exchange. For each action, several opportunities and initiatives are foreseen for different sectors and business activities. Inversely, Circle Economy proposed an **Urban Opportunity Framework** that clusters opportunities by 'urban themes.' Urban themes are water, solid waste, energy, organics, buildings and consumables. While the ReSOLVE framework is mainly thought for businesses and national levels, the Urban Opportunity Framework mainly supports urban changemakers by presenting city level interventions based on principles of the circular economy. The Urban Opportunity Framework is also operationalised by the Circle City Scan Tool - an open-access tool that supports the identification and implementation of circular projects in cities.

Among the most recent proposals, the Circle Lab for Cities programme developed the **Circular City Actions Framework** (Figure 21). The Actions Framework provides local governments and city-based circular economy practitioners with five strategies and 15 linked sub-strategies. Finally, each sub-strategy consists of a diversity of tangible actions which are framed in relation to key thematic areas.[18] These are food systems, built environment, consumer goods, energy systems, mobility systems and water systems. Examples for each action can be found at the **Knowledge Hub Cities Collection** - an open-access library which features over 450 examples of city level circular economy interventions from a variety of sectors across the world.

Figure 21: Circular City Actions Framework

| Rethink | Regenerate | Reduce | Reuse | Recover |
|---|---|---|---|---|
| • Eliminate linear incentives and set goals and incentives for circularity practices<br>• Support closed-loop systems and cross-sectoral synergies<br>• Enable sustainable lifestyles | • Protect and restore local ecosystems<br>• Promote solutions inspired and supported by nature<br>• Prioritise renewable resources | • Design infrastructure and the built environment for resource efficiency<br>• Support circular and resource-efficient business innovations<br>• Support local, low-impact circular economies | • Design and regulate for extended use<br>• Facilitate second-hand markets, sharing and exchange platforms<br>• Support reuse, repair, remanufacturing and maintenance of existing resources, products, spaces and infrastructure | • Design and regulate for separation and recovery<br>• Collect and sort waste to facilitate recovery<br>• Process waste and ensure its re-entry into industry at its highest value |

[18] Key thematic areas identified in the Circular City Actions Framework reflect to a great extent the key product value-chain identified in the CEAP.

In the end, which approach/tool to use to map potential circular opportunities will depend on the degree of comfort decision-makers will have with one tool or the other. There is no better approach, but rather each of them could favour a perspective (e.g., ReSOLVE favours businesses/companies' perspective, while the Urban Opportunity Framework favours the perspective of public authorities). To support the identification of the most suitable tool, Table 10 shows an overview of identified approaches and tools to map potential circular opportunities, along with main advantages and shortcomings.

Table 10: Existing approaches and tools to identify CE intervention/opportunities areas

| Tools/methods/ approaches | Source | Strengths | Weaknesses |
|---|---|---|---|
| **Value-chain methodology** | UNEP | It favours a systemic perspective. It has been applied successfully to three value-chains: food; construction; and textiles.<br>It links qualitative concepts and sectors to quantitative data and statistical databases. | The trade-off between the (global) value-chain perspective and the local CSS scope could make full application of this approach difficult.<br>Not originally thought for circular economy but for Sustainable Consumption And Production. |
| **Toolkit for policy makers** | Ellen MacArthur (2015) | Step-by-step guidance.<br>Tested on a pilot study.<br>It links qualitative concepts and sectors to quantitative data and statistical databases. | Mainly thought for national policymakers. Systemic perspective not covered. |
| **ReSOLVE framework approach** | Ellen MacArthur, McKinsey (2015) | It encompasses a broad range of contexts and industries. It provides concrete examples of circular interventions organised by key circular strategies. | It is mainly a qualitative approach. Especially orientated to business and industries. |
| **Urban Opportunity Framework and the Circle Scan approach** | Circle Economy | It is thought for urban policymakers and organises CE opportunities according to 'urban themes.' The framework is operationalised by the Circle Scan tool, which provides CE opportunities tailored to the local context. The tool is open-access. | The Circle Scan tool is currently being tested. Its use requires registration on the web and the provision of local data. |
| **Methodological framework for the implementation of circular economy in urban systems** | Levoso et al. (2020) | It adapts the Toolkit for policy makers (Ellen MacArthur (2015)) to the regional context. Tested on a pilot. It provides a clear and good overview of the whole process. | It focuses mainly on the decision-making process but does not offer many insights into CE opportunities or actions. |
| **Circular City Action Framework** | Circle Lab for Cities programme | It provides a range of R strategies and sub-strategies along with respective case studies. The R strategies are especially thought for city actions. | It is principally descriptive and does not cover the process for identifying which R strategies apply to a specific context. |
| **Circular Strategies Scanner** | CIRCit NORDEN | It provides a comprehensive approach for identifying business strategies and/or circular business models. | The framework is mainly orientated to businesses and industries. It was only tested in manufacturing businesses. |
| **Catalogue of circular solutions and co-benefits** | NetZeroCities | It provides a catalogue of circular solutions and co-benefits. It is thought for city level. | The catalogue is not available yet. It will be made available through the NetZeroCities knowledge repository by the end of October. |

At the end of this phase, cities and regions should have identified a list of actions which, taken together, should set the basis for a CSS, or in other words should systematically contribute to circularity in a selected value-chain (or according to the Action Framework to a 'thematic area'). The list of identified actions should encompass different economic sectors and consider cross-cutting supporting initiatives. As an example of CSSs, the CCRI Methodology provides a portfolio of CSSs currently implemented in the EU for each product value-chain identified in the CEAP. This portfolio can be used at this stage as inspiration and a means to facilitate the identification and selection of CSSs, as well as to warn policymakers and decision-makers of potential obstacles and identify key enablers of a specific CSS. While this portfolio does not represent an exhaustive list of CSSs nor intend to be a recommendation for local decision-makers, these examples summarise some of the CSSs currently implemented in the EU, along with their main features. For a more detailed overview of these CSSs, the reader can refer to the **CSS factsheets**. The CSS portfolio will be updated during the term of the CCRI-CSO with new CSSs implemented by Pilots, Fellows or other CCRI Projects.

The next step will concern the feasibility check of identified actions, including the ex-ante analysis of expected impacts.

Table 11: CSSs portfolio

| Circular Systemic Solutions portfolio | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key product value-chain** | **Circular Systemic Solution title** | **Description** | **Technology Readiness level (TRL)** | **R strategy Circular City Actions Framework** | **Type of territory** | **Sectors involved** | **Financial effort** | **Stakeholders' engagement effort** |
| Food water & nutrients  | **Decentralised bio-waste collection and treatment** | This CSS approaches an integral method engaging stakeholders from the whole value-chain in very localised settings to collect and begin the process of waste valorisation in a decentralised manner. | 6 | Reuse<br>Recover | Rural areas, Cities | ★ | ★★ | ★★ |
| | **Reuse of grey and black waters for agricultural production** | The CSS addresses the implementation of technologies allowing the recovery of nutrients for multiple purposes, energy production and cascading use of water. | 7 | Regenerate<br>Reuse<br>Recover | Rural areas, Cities, Metropolitan areas | ★★ | ★★★ | ★ |
| | **Residential rainwater harvesting and reuse** | This CSS focuses on improving the water cycle by capturing more resources, improving their use and ensuring they are reused in a cost-efficient way. | 6 | Recover<br>Reuse<br>Regenerate | Rural areas, Cities, Metropolitan areas | ★ | ★★★ | ★★ |
| | **Public and free water points** | This is a CSS often explored by cities, consisting in making the access to potable and drinkable water available to citizens for free in several points across the city. The objective is to reduce the consumption of water bottles by providing water to refill them. | 9 | Reduce | Rural areas, Cities | ★ | ★ | ★ |
| | **Circular Buildings** | CSS addresses circular strategies solutions along the construction value-chain from circular material supply, 'design for R', lifespan expansion strategies until EOL management options. | 6-7 | Rethink<br>Recover<br>Reuse | Cities, Metropolitan areas, Provinces, Regions | ★★ | ★★★ | ★★ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Construction & Building  | **Building reuse and repurposing** | CSS focuses on integral solutions of building reuse together with land reuse and enable the regeneration of abandoned areas in urban and peri-urban contexts. | 8 | Rethink<br>Reuse | Rural areas, Cities, Metropolitan areas | ★ | ★★★ | ★★ |
| | **Urban Resources Cadasters** | CSS focuses on the establishment of a sound governance model which supports a coordinated management of materials stocks and flows from construction and demolition works (including needed infrastructures and supporting measures) at local level. | 6 | Rethink<br>Reuse<br>Recover | Cities, Metropolitan areas, Provinces, Regions, Country. | ★★ | ★★ | ★ |
| | **Supporting waste sorting in works and demolitions** | CSS considers the systemic planning of waste management in construction and demolition works, seeking broad collaboration of all key stakeholders along the value-chain. | 6-7 | Reduce<br>Reuse<br>Recover | Cities, Metropolitan areas, Provinces, Regions, Country | ★★ | ★★ | ★★★ |
| | **Reuse Wood and Furniture** | CSS addresses the challenge of bringing citizens closer with circular practices and the set-up of resources centres like repair cafes. | 8 | Recover<br>Reuse | Rural areas, Cities,<br>Metropolitan Areas, Provinces | ★★★ | ★★ | ★★ |
| Plastic  | **Small-scale eco-credits and rewards** | This CSS consists in the implementation of citizen engagement processes at neighbourhood and city level to promote plastic recycling with an important component of awareness-raising, use of innovative tools and promoting the participation of a wide range of local stakeholders. | 7 | Recover<br>Reuse | Rural areas, Cities, Metropolitan areas | ★ | ★ | ★★★ |
| Packaging  | **Smart collecting machines for revalorisation of packaging materials** | This CSS incentivises the correct waste sorting in households of specific packaging materials (plastic and glass bottles, metal cans) so that they can be effectively recovered to be reused or recycled. | 9 | Reduce<br>Recover | Cities, Metropolitan Areas, Provinces, Regions, Country | ★ | ★★ | ★★★ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Textile  | **Circular Textile** | Textile CSS should be seen as an opportunity to implement sustainable and secondary materials resources to create new business. They should be designed in a way that foster repair, reuse and recycling, and longer use with a low impact on the environment. Systems should ensure high levels of separate textile waste collection allowing public organisations, private companies and citizens collaborate. | 9 | Reduce<br>Reuse<br>Recover | Cities,<br>Metropolitan Areas,<br>Provinces | ★★ | ★★★ | ★★★ |
| Electronics & ICT  | **Decentralised collection systems for WEEE** | This CSS addresses the challenge of creating decentralised collection system as enablers for recovery, repair, reuse or recycling of electric and electronic equipment (EEE). | 9 | Rethink<br>Reuse<br>Recover | Rural areas, cities, metropolitan areas, Provinces, Regions | ★ | ★ | ★★ |
| | **Second-hand and repair centres for WEEE** | This CSS focuses on the establishment of a system to expand the life duration of (EEE) and reduce the waste generated from these types of products. | 8 | Reuse<br>recover | Cities, metropolitan areas, Provinces, Regions | ★★ | ★★★ | ★★ |
| Cross-cutting support/governance  | **Joint long-term strategy development and stakeholder engagement.** | This CSS focuses on creating the conditions to enable a multi-stakeholder conversation and vision on circular economy in a city or region. While public authorities need to address societal challenges, they do not have all the knowledge about certain topics and cannot do everything. The collaboration and alignment with other actors are fundamental. | 8 | Rethink | Rural areas, Cities, Metropolitan areas, Provinces, Regions, Countries | ★★★ | ★ | ★★★ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Support the links and exchanges of the Organised Waste Market (OWM).** | This solution consists in building a platform to trade waste of several value-chains. It can be both a single platform and a system connecting sectoral markets together, depending on the level of the waste market development of the region. The CSS involves the creation of an online space serving as a trading area to process market inquiries, expressions of interest, requests and offers on waste by both waste producers and operators and should be able to register transactions in a transparent manner. | 8 | Rethink<br>Reuse<br>Recover | Metropolitan areas, Provinces, Regions, Countries | ★ | ★ | ★★★ |
| | **Creating or Supporting Waste Recycling** | This CSS focuses on bringing together different actors involved in the reuse, recycling or circular economy sectors to actively generate synergies and promote joint projects between them. The creation of a cluster of specialised companies working on this domain is necessary as an ecosystem-building activity that can help identify the key players in the sector understand their needs and build programmes to enhance their activities and outreach. | 9 | Rethink<br>Reuse<br>Recover | Metropolitan areas, Provinces, Regions, Countries | ★ | ★ | ★★★ |
| | **ircular procurement clauses** | The CSS consists in integrating circularity procurement clauses in public offers to incentivise service providers to observe specific circular and sustainable practices (e.g., separation of waste, use of secondary raw materials, etc). | 8 | Rethink | Rural areas, Cities, Metropolitan areas, Provinces, Regions, Country, EU | ★ | ★ | ★★★ |

## 2.3. Assess and define a CSS solution

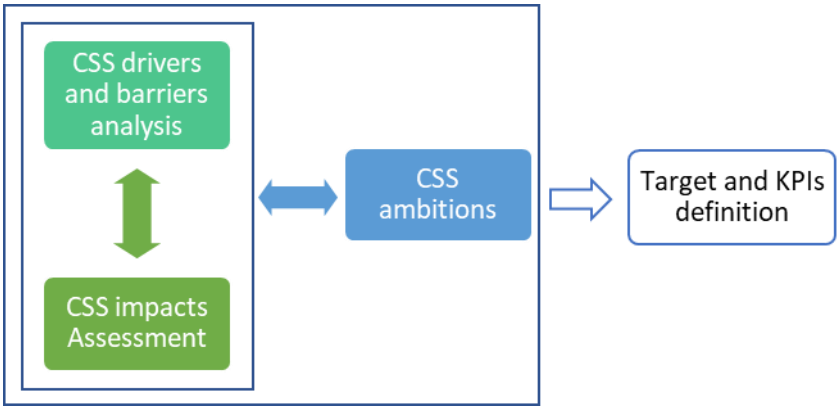
The variety of CE actions can be very wide. While this variety allows any territory to tailor its circular transition to its own needs, it can also lead to regions and cities designating rather general CEAPs that do not materialise into concrete CSS. To translate potential actions into workable and executable CSS, it is important to determine their feasibility and potential impacts. Prioritising areas of action that produce the greatest local impact is key to ensuring stakeholder consensus and ultimately the effective deployment of CSS.

After the list of potential actions has been identified, it is necessary to determine what can be done to set the CSS in motion. It will probably be unclear what the impacts of these actions are, whether they are feasible and what it takes to carry them out. That is why the potential activities need to be evaluated. It is important that, unlike the scanning of opportunities, here the selection of activities must be based on direct feedback from the engaged stakeholders of their compromise to collaborate.

Therefore, the intention of this phase is to move from concepts (or first sets of solutions) to specific, operationalised, assessable solutions, which respond to stakeholders' identified needs. A CSS needs to be detailed enough to allow stakeholders to imagine how it will affect their status quo. This, on the one hand, will facilitate the assessment of the economic, social and environmental impacts of CSSs, including their feasibility analysis and, on the other hand, will ensure the commitment of stakeholders.

To achieve this, the CCRI Methodology distinguishes three main activities to be considered (Figure 22): setting the CSS ambitions; analysing the CSS feasibility (it may also include viability); and assessing the CSS impacts. There is no strict order on how to conduct these activities. For example, in some cases ambitions can be defined once the feasibility and scope of a CSS has been analysed, while in other cases it may be the ambitions themselves that determine the level of intervention necessary to achieve the intended objective. In any case, it is advisable to carry out these activities iteratively until a final consensus is reached between the stakeholders involved on the level of ambitions and the desired impacts.

Figure 22: From assessing and evaluating a CSS to KPIs and targets definition




Likewise, there is no one-size-fits-all approach to evaluating a CSS. In most cases, depending on the field of application, there exist ad-hoc approaches (e.g., Level(s) – A common EU framework of core sustainability indicators for office and residential buildings[19]). Furthermore, it is possible to distinguish between rather qualitative evaluations mostly based on stakeholders' expertise, to more 'scientific' approaches based on models and simulation tools. In general, the complexity of the tool used to evaluate a CSS depends on the starting data and the availability of time, financial or skills resources. Results of this phase will inform directly the KPIs definition. In the following sections, the main methodological frameworks for CSS feasibility and CSS impacts are presented based on the experience from recent Horizon projects.

[19] https://susproc.jrc.ec.europa.eu/product-bureau//sites/default/files/2021-01/UM1_Introduction_to_Level(s)_v1.1_27pp.pdf#:~:text=Level%28s%29%20is%20a%20framework%20of%20core%20indicators%20of,actors%20that%20may%20be%20involved%20in%20this%20process.

**STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES**

**Public authorities** will be in a position to steer and contribute to the process of CSS's ambitions definition (i.e., environmental, economic and social ambitions). As potential funding organisation of CSS developments, public authorities may also be involved in the evaluation of the feasibility (i.e., in economic terms) of the suggested CSS. In this stage of CSS design, data is fundamental to support decision-making. Public authorities may play a key role as they manage information over multiple sectors and themes. In relation to impact assessment, they have a key role to play as they should promote those CSS ensuring higher quality of life, environmental protection and wealth.

**RTO/academic institutions and NGOs** have a good knowledge on technologies, system understanding and will be able to support feasibility assessments as well as impact assessments of a CSS in the local context. They will be in a position of intermediation and dialogue across stakeholders involved in this stage.

**Industries & businesses** are crucial at this stage of CSS definition as they will be the principal stakeholders directly engaged in implementing these in their organisations. Industries & businesses must be engaged, and dialogue among them facilitated to ease new collaboration schemes which might be requested for the implementation of new business models (i.e., industrial symbiosis). These actors need to understand in early stages where new value generation streams might be generated for them. This understanding may have the effect to leverage investments which would otherwise not have been mobilised. They will be essential to provide key data on their current processes and business models to facilitate multiple assessments and consequently, decision-making.

**Civil society** and consumers are essential at this stage of the decision-making process for CSS design as they will be impacted by the innovations implemented through these. This may happen as they will be part of the system's innovation themselves (i.e., as consumers they may have to adopt new consumption patterns like sharing, leasing products and services) or they may have a more passive role and adapt to new local systems of product and services offers. As consumers they can provide highly valuable feedback and advise on how products and services are provided to them and thus contribute to substantial improvements of the solutions suggested.

### 2.3.1. Set the ambitions of the CSS

At this stage, setting an ambition level can be a powerful lever to align engaged stakeholders on the overall goals of the CSS. The definition of 'ambitions' should respond to the questions:

- **What** (value-chain/need) does the CSS address?
- **How** much the CSS should improve the status quo?
- **When** the goals should be achieved?

The level of ambition will be determined considering the trade-off between the priorities and needs of the territory (identified in the MAP phase), the will and commitment of the stakeholders and the actual availability of resources.

At a first stage, the definition of ambitions could simply consist of a **declaration of intentions** (e.g., increase employment, reduction of GHG emissions, reduction of waste generation, etc.) and a list of CE actions to be implemented. However, in the later stages, when the inputs of the CSS evaluation will also be available, the ambitions should be clearly expressed through: 1) quantitative targets, which should complement the KPIs scoreboard; and 2) a detailed schedule of the CE actions to be implemented. A clear definition of targets will not only ensure a strong basis for actors' engagement, but it will also guarantee an effective monitoring of CSS over time.

### 2.3.2. CSS drivers and barriers analysis

This task aims at a comprehensive analysis of the CE actions identified in Chapter 2.2 in order to determine: 1) the uptake of CSS drivers and barriers factors; and 2) the potential impacts that the CSS would have on the territorial metabolism (qualitatively). The analysis should establish how the CSS encompasses and deals with multidisciplinary and multi-sectoral challenges. The goal is to determine if the CSS is effectively orientated to the needs of the territory and to reduce pressures on the environment.

This analysis should cover different key questions:

- What is the relevance of the CSS according to emerging trends in the territory?
- How the CSS will be developed and implemented?
- Does the CSS tackle the real needs of cities?
- Do the available resources (financial, technical, human) match the ambitions of the stakeholders?
- What are the results expected by the CSS?

At this stage, a good way to organise the information collected under the mapping phase across the intervention areas identified can be the use of the analytical frameworks **PESTEL**[20] and **SWOT.**[21] First conceived as tools for evaluating alternatives within organisations, these frameworks have proved to be of significant importance in the field of strategic planning due to their ability to provide a comprehensive overview on different factors, and simultaneously to highlight possible interdependencies and synergies between those.

PESTEL analysis has two basic functions supporting the definition of a CSS. The first is that it allows to identify the environment in which the CSS will operate, including main barriers and drivers. The second key function is that it provides information to predict situations and circumstances that cities and regions may encounter in the future, or, in other words, it can constitute the basis for setting future scenarios that may be further analysed through quantitative tools (see CSS scenario and impacts assessment). In this context, the use of the PESTEL framework can support the understanding of the `big picture´ in which a CSS operates, thus allowing stakeholders to decide what priorities and which CE action moves forward. As an example, the PESTEL analysis was used in the REPAiR project[22] to better understand the challenges for new ways of governance in urban regions moving to circular systems (Obersteg et al., 2019). The box below shows the results of the PESTEL analysis conducted in REPAiR for the city of Naples (Italy).

**PESTEL analysis on governance thematic area for the city of Naples (Italy)**
*REPAiR project*

| | |
|---|---|
| Policy/politics | • Competition among municipalities for leadership on waste management<br>• Lack of policies able to face problems beyond administrative boundaries<br>• Regional policies not calibrated to local contexts |
| Economic/financial | • European waste management sanctions to be paid<br>• Tendering not respondent to CE processes<br>• Highest waste tax of Italy in the Campania Region |
| Social/behavioural | • Citizens' distrust of institutions<br>• Suspicion of the quality of organic and C&D waste products<br>• NIMBY Syndrome in local communities |

[20] PESTEL acronym stands for Political, Economic, Social, Technological, Environmental and Legal
[21] SWOT acronym stands for Strengths, Weaknesses, Opportunities, Threats
[22] http://h2020repair.eu/

| | |
|---|---|
| Technological /infrastructure | • High percentage of organic waste displacement in Northern Italy's waste treatment plants<br>• Disposal of waste<br>• Lack of recycle points in the peri-urban area |
| Environmental | • Abandonment and illegal deposit of waste along peri-urban streets<br>• Deposit of Eco bales in peri-urban areas by Campania Region<br>• Peri-urban assemblages of wastelands |
| Legal | • Legal control by EU on regional waste management<br>• Poor measures for implementing CE processes<br>• Redundancy of authorisations for implementing waste plants |

Unlike the PESTEL analysis, which organises the main factors by thematic areas, the SWOT analysis differentiates the factors by considering whether they represent Strengths, Weaknesses, Opportunities and Threats. This approach was used, for instance, to resume the results of a CE mapping study for Switzerland and Liechtenstein for the elaboration of their CEAPs (ESPON CIRCTER, 2019) (see box below).

**SWOT analysis for the regions of Switzerland and Liechtenstein**

*ESPON CIRCTER SPINOFF project – Switzerland and Liechtenstein (2021).*

| Strengths | Weaknesses |
|---|---|
| • Highly efficient collection and recycling systems<br>• Well-established industry in advanced manufacturing<br>• Industry and key areas supported strongly by education and research institutes<br>• Platforms and networks help sharing experiences and disseminate innovations across the country and internationally<br>• Cutting-edge take-back system<br>• Favourable financial and business environment<br>• Transport logistic node with important corridors running through Europe<br>• Public awareness and institutional commitment on environmental/sustainability issues | • High municipal waste generation per capita<br>• Lack of natural resources and consequent dependence on foreign countries<br>• Shrinking employment in some regions (e.g., Ticino or Lake Geneve region)<br>• Different/'mismatched' geography for waste management initiatives at the local level<br>• Lack of industrial parks for industrial symbiosis |

| Opportunities | Threats |
|---|---|
| • Capability to adopt smart technological sustainable solutions<br>• Building closer collaboration of business innovation and research for circular-designed products<br>• Smart public solutions and competitive advantage for business through innovative public procurements<br>• Sustainable industry including production, new materials, digitalisation and circular business models<br>• Active participation in European collaborations/initiatives | • Increasing generation of municipal waste<br>• Increasing dependence from foreign countries<br>• Incineration lock-in effect<br>• Increasing urban-rural disparities and intra-regional centralisation<br>• Non-comprehensive planning for attractive rural areas |

While the previous examples refer to specific case studies, in Figure 23 we offer an overview of the common barriers faced by decision-makers when trying to move to circular systems. The barriers are classified by thematic areas similar to those of the PESTEL framework and are sorted by relevance level[23] (bottom barriers: less relevant and top barriers: more relevant). These barriers refer to CE in general, hence they might apply, to a less or a great extent, to any CSS. The figure could be used to verify whether the selected CE actions respond satisfactorily to the potential barriers listed. The list of CSSs previously presented, along with their technical fiche could also help in identifying likely barriers associated with a circular solution.

Although PESTEL and SWOT are pragmatic and relatively easy-to-use tools for identifying and addressing potential barriers and drivers of CSSs, they lack the systemic perspective - i.e., they do not capture the complex web of causal relationships that exist between the different factors of a CSS. Therefore, for the most ambitious CSSs, it is strongly suggested the use of more advanced tools that foster a system thinking and favour a better understanding of how circular solutions will impact the local system. An example of these tools is the Driver-Pressure-State-Impact-Response Framework (**DPSIR**) and the Causal Loop Diagrams (CLDs). These have been implemented in the UrbanWINS[24] and CIRCTER[25] projects, respectively.

[23] It should be noted that the 'relevance level' was proxied by the number of times a certain barrier was encountered during the literature review. Therefore, the guidance on the 'relevance' aspect should be taken with care as it may differ from reality, especially when the barriers are contextualised in specific territories.
[24] https://www.urbanwins.eu/
[25] https://www.espon.eu/circular-economy

Figure 23: Overview of common barriers to CE transition by barrier typology. The list and classification of the barriers is based on the review of R&I gaps and drivers conducted by the CCRI-CSO

The DPSIR is a framework for describing the interactions between society and the environment developed by the European Environmental Agency (EEA) and based on the former Pressures/State/Response (PSR) model proposed by the OECD. The DPSIR framework can be used to define cause and effect relationships among the drivers (i.e., human needs), pressures (e.g., emissions, waste), impacts (e.g., ecosystems changes, human health) and responses (e.g., policy initiatives and programmes or, in this case, CSSs). The aim is to understand the real drivers, which are sometimes unique to the local situation, and then to identify and implement the most effective responses to remove or at least reduce the pressure. The reader can refer to the technical factsheet for further info on the **DPSIR** framework.

The **Causal Loop Diagrams (CLDs),** or System Map, is a graphical and qualitative tool to explore and represent the interconnections between the key indicators in the analysed sector or system. CLDs support the analysis of causality, from problem to its root causes, or from policy interventions to their systemic impacts. In the CIRCTER project, CLDs have in fact been used to create storylines corresponding to the implementation of policy interventions by highlighting direct, indirect and induced policy outcomes across social, economic and environmental indicators. CLDs present several key advantages for defining a CSS (Bassi et al., 2020): (i) when developed to integrate knowledge and through a group model building exercise, a CLD elicits knowledge from different stakeholders and creates a shared understanding of the key drivers of change of a system, and hence on the possible outcomes of policy implementation across sectors and actors; (ii) CLDs highlight the boundaries of the analysis, supporting the inclusion of social, economic and environmental indicators in a single framework of analysis to fully capture the benefits of a CE; and (iii) by visualising how variables in the system are interconnected, CLDs allow all stakeholders to reach a basic-to-advanced knowledge of the systemic properties of the issues analysed. However, similarly to DPSIR, the use of CLD requires the presence of an expert in system thinking and modelling to guide the creation of the CLDs by integrating the different knowledge of the stakeholders. Further information, including case studies are provided in the respective technical factsheet.

### 2.3.3. CSS scenario and impacts assessment

In some cases, the decision to implement a CSS is based only on a qualitative analysis and expert judgement on the proposed solution. In this context, the methodological process generally stops at the SWOT-PESTEL activities presented before. It then moves on to define KPIs and then to implementation. However, the most ambitious CSSs generally require an additional layer of analysis - often quantitative - to guarantee and validate the effectiveness of the proposed solutions. Scenarios modelling and impact analysis are particularly necessary when the proposed solutions represent a radical change from the baseline and are systemic in nature, thus affecting different sectors/stakeholders.

The CCRI Methodology refers to: 1) scenarios as 'representations of possible futures events, used to analyse potential responses to new and upcoming CSSs'; and 2) simulations as quantified scenarios generated with models that are simplified representations of reality. The creation and quantification of scenarios with mathematical simulation models allows for the creation of quantitative estimates for various scenarios that can be used to inform the policymaking process (e.g., on implementing or not implementing a proposed CSS).

Specifically, the scenario assessment of a CSS is a key activity primarily used to:

- better understand how a selected CSS responds to cities and regions priorities: what are the expected outcome and impacts?
- better formulate a CSS: are the identified CE actions enough to achieve ambitions? Or should ambitions be reviewed?
- inform the monitoring and evaluation step about KPIs and targets to be considered.

There are two main types of scenarios.

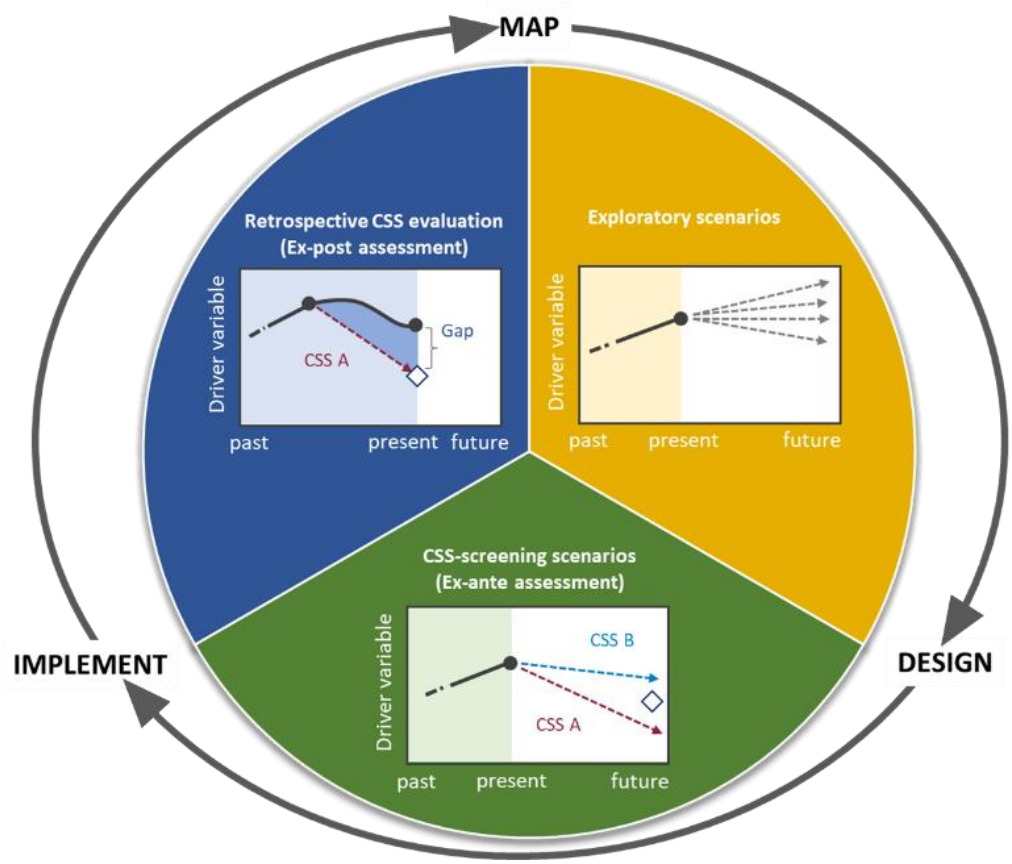
- **Baseline scenarios**: elaborated to define the trends to assess performance against (e.g., waste generation, GHG emission, food demand trends). This is also known as business-as-usual because it considers the likely future path without the implementation of CE actions under consideration, and it is based on the analysis performed in the mapping phase.
- **CSS scenarios**: generated to determine how the performance of a system is affected by the implementation of a CSS (e.g., a CSS focusing on Circular Buildings).

Depending on the maturity of the CSS or the implementation process, scenario analysis can be done for different purposes. Generally, we can distinguish between (Figure 24): (1) exploratory or ex-ante assessment; and (2) retrospective or ex-post assessment. Exploratory scenarios are generally used to forecast trends and possible outcomes of policy interventions. Ex-ante assessment primarily supports the issue identification and the agenda setting steps of the CSS implementation. For example, population growth projection can be used to estimate (or 'explore') expected demand for housing, construction material consumption and land-cover changes. Such an exercise would help identify land constraints (requiring new land use planning exercises and zoning) or the needs of alternative construction and manufacturing approaches, as well as what level of environmental and societal impacts can be expected. Afterwards, the business-as-usual trends should be compared with a similar scenario including the implementation of the CSS and its expected outcomes and impacts.

On the other hand, ex-post assessment is carried out after CSS implementation and it can be used to compare expectations to real, observed developments. Ex-post assessment can help to evaluate the current state of the CSS and indicate whether corrective action is needed.

This characterisation is consistent with the potential for scenarios to inform policymaking primarily in the design phase (ex-ante), and for monitoring and evaluation after implementation (ex-post).

Figure 24: Roles played by different types of scenarios corresponding to the major phases of the CCRI Methodology



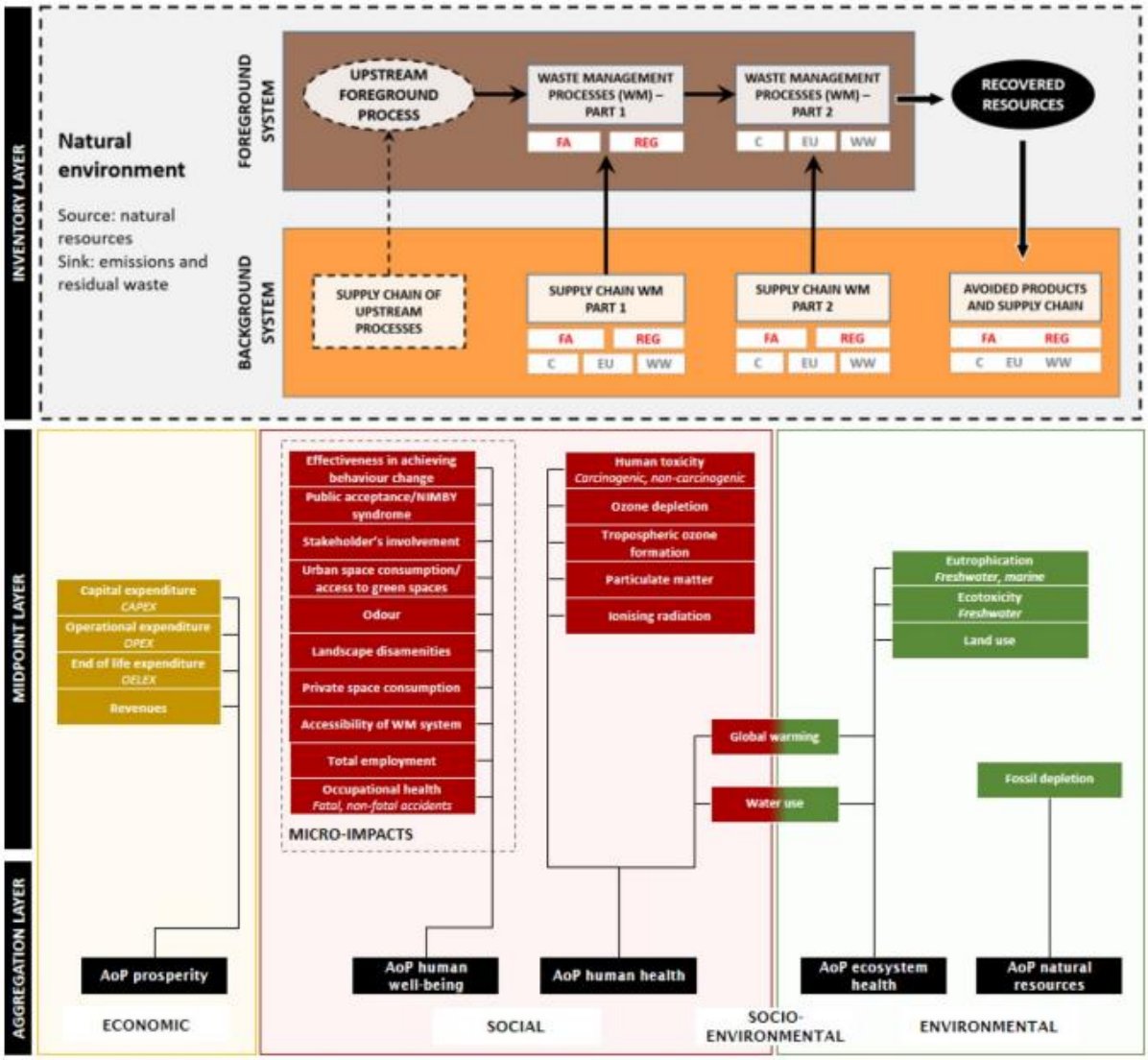
As the circular economy focuses primarily on material flows and stocks, including waste, most approaches to scenario simulation are based on the principles of urban metabolism and related accounting methods. Table 12 presents some of the most recent tools developed to conduct urban metabolism assessments, along with their main features. Further information for each tool is provided in the respective fiches (see **Tools factsheet**).

Table 12: An overview of urban metabolism assessment approaches employed in recent EU projects

| Project | Urban metabolism tool | Method approach/main features | Comments |
|---|---|---|---|
| **REPAiR** | Geodesign Decision Support Environment (**GDSE**) | Activity-Based Material Flow Analysis (MFA). It can include environmental (LCA) and social impacts. It offers spatial/geo-localised visualisation of material flows. | The method is made operative through an open-access software. However, an expert in the tool may be required due to its complexity. The tool can be used to guide the overall process of CSS definition, since the very early stages of decision-making. |
| **UrbanWINS** | Urban Metabolism Analyst (**UMAn**) | Eurostat's Economic-Wide Material Flow Analysis (EW-MFA), possibility to include environmental impacts by integrating LCA. | The method does not have a software tool associated. It mainly relies on EW-MFA accounting and generates local estimates through downscaling techniques. |
| **CITYLOOPS** | Urban Circularity Assessment (**UCA**) | Eurostat's EW-MFA. It also considers stock of material (besides flows). It offers spatial/geo-localised visualisation. | The method does not have a software tool associated. It mainly relies on EW-MFA accounting and generates local estimates through downscaling techniques. It also offers the possibility to monitor the 'stocks' of material. |
| **REFLOW** | Urban metabolism | MFA | |

Urban metabolism tools generally focus on mass-based indicators (e.g., stock and flows of materials and wastes) and make use of Sankey diagrams to visualise the magnitude of materials moving within the territory. However, when assessing CSSs, it should be borne in mind that the ultimate purpose of improving circularity is to reduce negative environmental, social and economic impacts associated with resource extraction and material consumption while increasing benefits for society. Therefore, CSS assessments focusing on the weight of materials, either for flows or for stocks, do not tell the full story. To go one step further, one may want to reveal the impacts associated to material use. More rigorous quantification of multiple impacts usually needs to combine life cycle impact assessment (LCIA) methodologies (ISO, 2006) with material flow data. While some urban metabolism tools foresee this option (e.g., the UMAn and GDSE exploits a set of 'plug-in' databases to allow more detailed analysis of material flows, including a comprehensive description of environmental impacts), in general a LCA should be conducted in parallel to assess the sustainability performance of the CSSs with its counterpart 'Status Quo'. As an example, Figure 25 shows an operational framework for sustainability assessment created in the REPAiR project to evaluate nine 'eco-innovative solutions.' Impacts on a variety of aspects are characterised into midpoint impact categories (e.g., eutrophication, acidification, climate change, ozone depletion, human toxicity, etc.) and are subsequently aggregated into areas of protection at the endpoint l–vel - e.g., human health and human well-being, ecosystem health and natural resources, and economic prosperity. In addition to evaluating a CSS, LCA-based impact indicators could also be used to inform KPIs and goal setting, although their inclusion in the monitoring framework will be more difficult as they cannot be measured directly and always require ancillary approaches to be assessed (Moraga et al., 2019).

Figure 25: The operational sustainability framework developed in REPAiR. Source (Taelman et al., 2019).




It is also important to bear in mind that the economic evaluation within a 'sustainability assessment' has a very different scope from a financial evaluation carried out within a company for the evaluation of a new business activity. Apart from the level of detail, which is much higher in the second case, the economic evaluation in the context of sustainability is generally carried out by researchers who are unlikely to be experts in the sector or who have direct contacts for budgeting proposals. Generally, these analyses are based on statistical and approximate data and, in some cases, also focus on the overall created value and not on the benefit or financial viability of each actor. Although the economic pillar in the sustainability analysis is recommended as it can provide an important input for decision-making, it does not replace a sound financial analysis of the CSS proposal. The latter is addressed in the third phase **Implement**.

## 2.4. KPIs and targets definition

KPIs and targets definition is an essential component of any CE project and should not be neglected. An accurate selection of KPIs is critical to ensure that information is used to inform decision-making, make appropriate adjustments, and report to stakeholders and decision-makers. Without a clear link between KPIs and decision-making, there is a risk that monitoring activities and resources will be seen as a drain on resources and discontinued.

The objective of the evaluation framework is to monitor the progress of a CSS through a limited set of significant KPIs that capture the main elements of the circular solution. This will also make it possible to identify the possible needs for further action (see Chapter 3.2). Ideally, consistency with the EC Circular Economy monitoring framework should also be considered. Wherever possible, indicators should be aligned to increase comparability and avoid indicator proliferation.

KPIs should include output and outcome indicators, and may also include impacts indicators:

- **Output indicators** inform on the implementation of the planned actions – e.g., has a stakeholder platform been built? Have circular criteria been introduced in public procurement?
- **Outcome indicators** inform on the expected direct –measurable– impacts generated by the implementation of a CSS – e.g., has the generation of waste reduced? Has employment been generated?
- **Impact indicators** inform on the expected indirect – measurable through ancillary approaches, e.g., LCA – impacts generated by the outcome or output of the CSS – e.g., have GHG emissions been reduced?

Distinguishing between output and outcome indicators will permit decision-makers to report on the completion of identified activities and to determine whether the objectives of activities have been achieved. Appropriate KPIs should be defined for each CE action and included in the CSS Action Plan.

As monitoring is often expensive and neglected, it is important to select the right indicators to support the assessment. In this context, an adapted version of **SMART** framework can be a useful way to identify quality indicators. SMART indicators are **Specific**, **Measurable**, **Achievable**, **Repeatable**, **Relevant** and **Timely**.

- **Specific** – Indicators need to be easily understood and meaningful for those who seek to use the information they provide. There is little point in collecting complex information if there is no capacity to analyse it or no intent to use it in the review of CSS progress.
- **Measurable** – Indicators should be measurable, with consideration given to the repeatability of assessment, the precision required for measurement and the resources (funding, time) needed for measurement.
- **Action-orientated** – It should be considered how measurement information is likely to be used and adjust the scope of monitoring appropriately. Additional depth and scope of measurement may be useful where there are management sensitivities. For example, a municipality making decisions about a food waste management may consider the level of food waste as well as business activity in hospitality sectors.
- **Repeatable** – Indicators should be framed in a way that enables comparison over time. Where appropriate, indicators should be similar to what others use in similar contexts to enable comparison, e.g., carbon emissions per GDP or per capita is used as part of climate impacts comparisons.
- **Relevant** – Indicators and associated measures need to be relevant to the CE strategies at hand. They also need to adequately reflect progress towards desired long-term outcomes.
- **Timely** – Indicators need to be sensitive to time-related factors. For example, some variables are slow to show a trend and can vary significantly across years (e.g., waste generation), meaning that progress towards outcomes can be difficult to assess over the short-term. In these situations, it is

helpful to identify intermediate outcomes/outputs that lead towards long-term outcomes (e.g., launch of an awareness campaign).

The nature of the KPIs will depend on the type of the CSS and the information or data collection infrastructures available. Quantitative KPIs are generally the best option because they guarantee an objective CSS assessment. However, qualitative KPIs remain often the only option due to missing data or a lack of funding required to build a data inventory, as an example.

Quantitative KPIs might be taken from the EU Circular Economy Monitoring Framework (see e.g.,

Table 6), but they can also refer to different strategic domains, e.g., climate change, resource efficiency, waste, industrial strategy and the sustainable development goals.

In addition to the KPIs, it is also important to establish the respective targets. Targets will permit to assess over time whether a CSS is producing the expected impacts or if some corrective measures need to be taken. Targets should be agreed among stakeholders taking in consideration the simulation results of CSS scenarios and overall ambitions of the CSS.

**Targets for output KPIs** may relate to:

1. the implementation in due course of the CE activities envisaged in the CSS Action Plan, e.g., the introduction of circular criteria in the schemes of public procurement within two years of the launch of the CSS Action Plan, or the construction of a certain facility within a certain year;
2. the implementation of a minimum number of CE activities, e.g., the carrying out of at least five knowledge transfer (KI) events or workshops, or a press release to interested parties at least on a half-yearly basis.

**Targets for outcome KPIs** (and, eventually, impact KPIs) generally refer to the reduction (or increase) of key elements of the CSS such as waste generation, material consumption, employment creation or gross value added. These can be expressed in percentage terms, i.e., a reduction of XX % compared to the baseline scenario, or as an absolute number, i.e., a generation of household waste of 100 kg per capita.

Thanks to the ongoing digitalisation of many processes, besides the traditional data collection systems (which are often expensive to implement from scratch), there are increasing opportunities to use novel sources of data to contribute to better monitoring the transition to a more circular economy, including the possibility to develop novel proxy indicators to increase the granularity of monitoring. Through their ability to monitor, interconnect and manage objects in the physical world electronically, digital technologies allow to collect, manage and process data and information, create knowledge about material composition of products, their origin and properties, their location, condition and availability, as well as their respective manufacturing processes and conditions for maintenance, dismantling and recycling (Barteková & Börkey, 2022). As an example, Smart waste management based on asset tracking enables better waste collection and recycling. This is facilitated by Radio Frequency Identification (RFID) tags (a combination of sensors, identification technology and internet connectivity). When attached to waste and recycling containers, RFID tags help implementing pay-as-you-throw waste programmes and optimising municipal waste collection in cities. Real time data stored and processed in the cloud and exchanged between the cloud, trucks, containers, recycling facilities and secondary material retailers, helps to track the status of containers, oversee route management and fleet productivity, as well as more effective and cost-efficient sorting, reuse and recycling. For further information on the role of digitalisation for the monitoring of the circular economy, please refer to the EEA briefing '**Monitoring the circular economy using emerging data streams'**[26]and the OECD Working Paper **Digitalisation for the transition to a resource efficient and circular economy.'**[27]

## STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES

**Public authorities** will play a key role in the validation of the KPIs as these will be the means to measure the performance of the implemented CSS and their capacity to generate valuable impacts and contribute to the policy objectives set at local level. Public authorities can also establish whether some KPIs can be measured based on the statistical infrastructure available and/or the possibility to implement a data collection system. Finally, public authorities are also in the position to manage ambitions vs achieved CSS impacts and, therefore, communicate with

[26] https://www.eea.europa.eu/publications/monitoring-the-circular-economy-with
[27] https://www.oecd-ilibrary.org/environment/digitalisation-for-the-transition-to-a-resource-efficient-and-circular-economy_6f6d18e7-en

all key actors of their territory (i.e., industries & businesses, civil society) with the aim of creating awareness and inform on the benefits and values generated, and eventually on the measures required to improve these further.

**RTO/academic institutions** will support the process of KPIs and targets definition building on their knowledge and expertise from multiple sectors and application fields and the results obtained by the CSS scenarios simulation. They will also be in a position of enabling knowledge transfer from other advanced regions/cities, which have performed similar exercises with a certain degree of success. RTOs/academic and institutions/NGOs may also have a coordinator role between the public authorities on the one side, and industries & businesses on the other, on the KPIs to be implemented.

**Industries & businesses,** like the public authorities, play a key role in validating KPIs and targets. Not only because KPIs will likely inform on the performance of business activities, but also because industries & businesses can also oversee implementing the means for KPIs measuring (i.e., technical means like sensors, human means). In addition, the choice of KPIs for industries & businesses represents a strategic decision as the data supports the assessment of key aspects of innovations and will give valuable information on how CSSs could be better reproduced/replicated in other contexts. Hence, the choice of KPI may have for industries & businesses indirectly impacts on their business expansion plans.

### 2.4.1. Links to the Self-Assessment Tool: Module 2

The definition of the KPIs and targets can be made operational through the SAT. Specifically, Module 2 'Defining the Framework for specific targets' offers a list of pre-selected KPIs based on the CE key areas to which the CSS refers. Identified key areas are: 1) Governance and Capacity Building; 2) Production and Consumption; 3) Waste Management; 4) Secondary Raw Materials; and 5) Competitiveness and Innovation. These reflect, to a great extent, the key areas for circular economy introduced in the CCRI baseline monitoring framework (see Figure 12 in Baseline circularity level). In the SAT the user will be asked whether a concrete target system is already in place for each area. If so, the predefined indicator list is presented, and, afterwards, the user can insert additional indicators, as needed. If the user states in the first place that no target system is in place, the list of pre-selected indicators is presented for each area from which at least five must be selected and target levels defined. For the pre-selected indicator lists by CE key area the reader can refer to the SAT manual.[28]

[28] The lists of preselected indicators are those provided in the document 'Draft Concept of the SAT.' A link will be provided to the document when finalised. Alternatively, the indicators lists can also be provided here in the CCRI methodology.

# Ambitions' achievements checklist

| Analysis of Ambitions' achievements | |
|---|---|
| **Stakeholder engagement** | ✓ Is there a consolidated group of stakeholders in place?<br>✓ Is there a clear agreement on the roles, tasks and duties of each involved party?<br>✓ Is a Stakeholder Engagement Plan (SEP) in development or achieved?<br>✓ Are stakeholders' interactions providing concrete outcomes/impacts, i.e., accordingly to the engagements agreed in the SEP? |
| **Identify intervention areas** | ✓ Has the process of screening ambitions, key product value-chains and intervention sectors/areas involved all relevant stakeholders to ensure an inclusive and systemic approach?<br>✓ Has the outcome of the above process been submitted to third parties for information/consultation?<br>✓ Has a key value-chain or key material flows been identified?<br>✓ Has a list of CE actions been drafted? |
| **Assess and define a CSS** | ✓ Have all potential barriers of selected CE actions been addressed?<br>✓ Do stakeholders agree on the technical viability of a CSS?<br>✓ Are the outcomes of the assessment and evaluation process of a CSS understood and accepted by all stakeholders? (i.e., impacts are satisfactory, trade-offs are clear and accepted, selected CSS is agreed to be the most suited for the purposes of the city/region, stakeholders and the community) |
| **Definition of targets and indicators** | ✓ Have the criteria (indicators) and methods that will be used to evaluate CSSs been identified?<br>✓ Once the CSS is running, is the indicator framework operational? I.e., is the data to feed the indicators provided by the corresponding stakeholders? |

# 3. Implement

This phase focuses on implementing CSSs. This includes putting CE actions in motion according to the outlined action plan and the agreed distribution of roles: designing a viable CSS business model (including CSS ownership model), obtaining funding, building partnerships, and ensuring engagement takes place throughout. It is also important to ensure that funds are available for CSS's start-up phase, as it is very likely that they will not be market-competitive in the early stages. Evaluating the CSS implementation and communicating the implementation progress to internal and external stakeholders is essential.


**Ambitions**

**This phase aims to:**

- build a business case for implementing CSS or priority CE actions;
- consider attracting funds or finance for actions;
- develop collaborations and partnerships to support CSS implementation;
- measure and evaluate CSSs to be accountable for projects, and to determine which CSS-orientated actions are not achieving desired outcomes and need to be changed;
- identify when an action is no longer effective, and a new action or suite of actions is required;
- reflect on the whole planning process, noting that monitoring and evaluation should be conducted on many of the activities during preparation of the CSS, helping to identify when adjustments are required.

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

**Time Frame**

From one to 'X' years depending on the CSS

At this point all the information that underpin a CSS, including what it takes to implement it and the expected benefits should be clear and agreed upon by all interested parties. Therefore, this phase mainly focuses on developing a business plan for the CSS, which will ensure stakeholder and organisational support, and facilitate the access to required – financial– resources. Ideally (if all the previous steps of the methodology have been fully addressed), there will be no need for further analysis.[29] Rather it will be a matter of organising the information generated up to the moment and starting to set in motion the decisions taken. Once the CSS is in place, it will be of equal importance to maintain a consolidated and proactive monitoring framework by discussing the possibility of taking corrective actions when the KPIs deviate from the set objectives, and regularly inform stakeholders on CSS progress to build political and societal support.

[29] The only exception is constituted by the in-house analyses conducted by the companies to test financial viability of their circular business models (if any). Since this type of analysis generally concerns confidential data, companies may wish to carry out - starting from the estimates of the CSS assessment - more detailed financial analyses to validate the economic viability for their business.

In summary, the implementation phase includes the following tasks:

- **The preparation for CSS adoption and financing**: this includes the development of a CSS business case and the identification of suitable funding or financing opportunities
- The monitoring of ongoing CSS through selected KPIs
- The reporting to interested parties and knowledge sharing with other cities and regions

Expected outputs include the:

- definition of financial needs and identification of funding channels to support the CSS;
- development of a CSS business plan;
- definition of a CSS monitoring and review programme;
- update of the SEP;
- update of the CSS Action Plan.

## 3.1. Prepare for adoption and financing

### 3.1.1. Build a business case for a CSS

Whether seeking approval of the CSS plan and related support to implement it, or seeking funding to implement a specific CE action, a business case must be prepared. Preparing a business case for a CSS can be difficult because results may not be achieved for some time and there are often complex non-monetary benefits that are difficult to quantify. However, if the previous steps of the methodology were carried out in a comprehensive manner, most of the data and information generated should be sufficient to prepare this document.

The development of a business case for a CSS should demonstrate the **financial viability of a CSS in the long run**, describing: **CSS customer(s)** and the **problems/needs** they seek to address; the **CSS value proposition** highlighting how the proposed CSS will address these problems and create extra benefits; **CSS owner/provider**, **key CSS actors and suppliers,** and **key resources and activities** that are required from their sides to implement and maintain the CSS; **costs and expenses** required to operationalise the business model; and **revenue model(s)** that will ensure profitability in the long run.

It is recommended to implement a **collaborative business modelling approach** where the strategic intentions of all the parties involved are considered and representatives of all relevant stakeholder groups are present and can contribute from the early design stage. Overall, **the CSS business case should be a living document** that is continuously updated throughout the design and implementation phases to incorporate changes in the underlining assumptions. **The CSS business case will support the identification of the amount of funding required** at the different stages of CSS development and implementation (see following Section 3.1.2. Identify suitable funding or financing instruments).

A template to help with preparation of a streamlined, targeted business case is provided in Appendix 2: CSS business case template.[30]

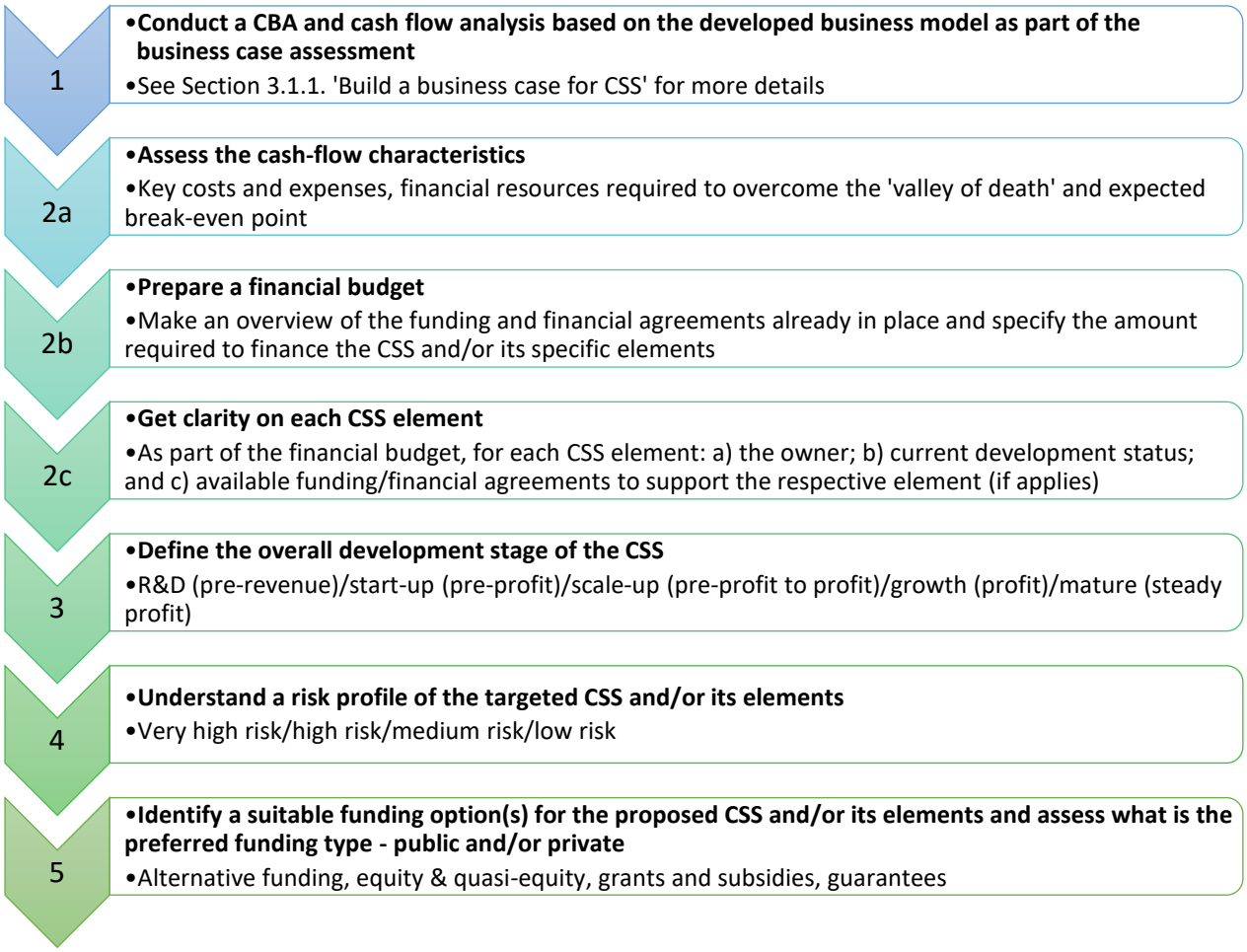
[30] In later stages, if useful, a template for CSS business canvas could also be provided.

### 3.1.2. Identify suitable funding or financing instruments

A thoroughly elaborated business case will provide a good basis for this task – identifying the most suitable funding and financing instruments and concrete investment opportunities for the proposed CSS and/or its specific elements. Indeed, the business case will provide a good understanding about the project size range, the expected project duration as well as the financial resources required at different stages of the development and implementation of the CSS and its elements.

The process described below summarises the steps to be taken to develop a Circular Economy Investment Plan (CEIP), a document that identifies **concrete investment opportunities** to implement the respective CSS (or its elements) and CEAP. To help ensure the upscaling and replication of successful CSSs, a critical mass of public and private investments should be made accessible. Funding opportunities can take many forms (e.g., grants, debt, equity, guarantees, etc.) and should be considered for each CSS (or its elements) together with the timelines and the risks associated with its implementation. The process for the CEIP development is summarised in Figure 26.

Figure 26: Steps to develop the CEIP for the CSS and its elements




As a **first step**, it is important to **assess the cash-flow characteristics**, including key costs and expenses, the amount of financial resources required to overcome the valley of death and the expected break-even point. Ideally, the cash-flow analysis should have already been completed in the previous step when the CSS business case was developed.

Next or in parallel to this activity, the CSS coordinator together with relevant CSS actors need to **make a financial budget** – an overview of the funding and financial agreements that are already in place and can either fully or partially cover the development and implementation of the CSS. This will allow to further specify whether it is the entire CSS or only its specific parts that require funding, as well as allow to get clarity on the

exact values. If possible, **the following aspects for each CSS element should be specified:** a) the owner of the CSS element; b) current status and; c) available funding/financial agreements to support the respective element. This information can also be integrated in the cash-flow analysis and the CSS business case document.

Overall, these assessments will support the **definition of the development stage the CSS project** is currently in. From a pure business point of view, these stages are generally defined as: R&D (pre-revenue), start-up (pre-profit), scale-up (pre-profit to profit), growth (profit) and mature (stable income). While this classification is, in general, relevant for identifying the risk profile of CSS projects (see next step), it is also important to keep in mind that CSS projects are not necessarily for profit. In some cases when the supplier is solely the public body, there may be no profit at all. But rather a more efficient use of resources or less environmental damage. This is to say that, depending on the CSS type, other classifications of the project phases could be considered, different from the business-orientated ones.

The fourth step concerns the **understanding of the risk profile of the targeted CSS and/or its specific elements**. Cross-checking with the points mentioned in the risk assessment performed as part of the business case analysis (see Section 3.1.1 for more details) and the CSS drivers and barriers analysis as part of the CSS assessment (see Section 2.3.2 for more details), ensures that the following aspects are thoroughly considered:

- technology / innovation readiness level and maturity
- risks posed by the external environment including potential political, economic and market, legal and social (including the engagement level of beneficiaries and end-users) risks
- risks associated with the business model, including in relation to the envisioned revenue streams (especially if the business model is still in the testing and validation phase)
- technical risks associated with deploying the CSS/its elements on the ground (for example, installation challenges for physical infrastructure or network connectivity issues for a software).

At this stage, it can be beneficial to consult with experts in relevant sectors to better understand potential risks and funding needs. Checking state aid regulations and involving legal experts might be needed too.

Based on the above assessments and the existing financial budget, the CSS coordinator together with the CSS actors, will be able to identify what funding type is most suitable for the proposed CSS or its specific elements. Depending on the development stage the CSS is in, a relatively large amount of financial support might be required for a successful development, implementation and maintenance of the entire CSS or its parts. Taking this into account, the CSS coordinator might want to consider different funding types per project stage and even per CSS building elements (if applicable). In this context, Table 13 below, which was developed for the Circular City Funding Guide, provides an overview of funding types that are applicable for projects at different development stages with varying risk profiles. This division is also useful for CSS projects and can be used to support identifying the most suitable funding types for either the entire CSS or its elements.

Table 13: Funding types for projects at different development stages and with varying risk profiles

| Organisation or project type | Cash flow characteristics / risk assessment | Funding options | | | | |
|---|---|---|---|---|---|---|
| R&D | Pre-revenue / Very high risk | Alternatives | Equity | Grants | Guarantees | |
| Start-up | Pre-profit / Very high risk | | Equity | Grants | Guarantees | |
| Scale-up | Pre-profit to profit / High risk | | Equity | | | Debt |
| Growth | Profit / Medium risk | | Equity | | | Debt |
| Mature | Profit / Low risk | | | | | Debt |
| Advisory | | | | Grants | | Debt |

Figure 27 presents the different types of funding options that the CSS coordinator can choose depending on the development stage of the project.

In assessing which type(s) of funding is best suited to support the development of the CSS, it is also important to make a distinction between public and private funding opportunities. The difference between grant applications and other types of funding is substantial and therefore needs to be considered. For example, some of the most common public funding schemes in Europe include Horizon 2020 and Horizon Europe, European Institute of Innovation and Technology (EIT), European Structural & Investment Funds, Interreg: European Territorial Cooperation, LIFE and Urban Innovation Actions (UIA), among others.[31] Application requirements and procedures vary widely between programmes. Therefore, it is highly recommended to consult with experts in grants and subsidies who can support the preparation and submission of applications. These experts will also be able to give advice on how to increase the success rate of an application.

Access to other types of finance is usually less structured and depends on a financial institution. Several options might be considered - from approaching EU financial institutions such as the European Investment Bank (EIB) or the European Bank for Reconstruction and Development (EBRD) to considering private sector financial institutions (e.g., banks, investors, vendor financiers).

[31] For a comprehensive overview the reader can refer to the list of relevant grant programmes to Circular City initiatives https://www.circularcityfundingguide.eu/funding-types-and-their-applicability/grants-and-subsidies/

Figure 27: Funding options (elaborated on the Circular City Funding Guide)


## STAKEHOLDER IMPLICATIONS AND EXPECTED MAIN ROLES

Seeking new funding opportunities (i.e., from EU or national and regional programmes) and providing direct financial support for the implementation of CSS is among public authorities' field of commitment possibilities. As public institutions, they are keen to bring CSS projects forward as a mean to generate prosperity, wealth and net positive impacts for the environment. Overall, public authorities may see the funding of CSS as investments capable to generate added value at local level on the long-term which will be benefiting to the society overall, including businesses and civil society.

RTO/academic institutions are familiarised with accessing funding opportunities through EU, national and regional R&I programmes. Driven by bringing technological and business model innovations to the market, they are capable to initiate associations of partners (including institutional local partners, industries and civil society) in ambitious projects with capacities to fund large demonstration projects under which CSS initiatives could be part.

Financial viability is at the heart of industries & businesses' concerns. In the frame of CSS implementations, industries & businesses are likely to be in front of new collaboration schemes with new partners and facing the challenges of new business models implementations. All these aspects are associated with certain financial risks which businesses are keen to identify and be able to mitigate with appropriate measures. As organisations driven by profit, they need to understand clearly how the balance of costs and value generation (benefits) from short to long-term will develop. Being able to map risks, costs and benefits will enable them to elaborate appropriate strategies to get access to investments and supporting fundings all along the CSS implementation and further development stages.

## 3.2. Monitor, evaluate and adapt CSS

Formalising a process of evaluation and review at this stage of the CSS planning cycle enables reflection on progress and lessons learnt in implementing the CSS. This is essential as CE best practices are continually evolving as new information becomes available, and as practitioners gain experience in implementing CSSs. It is important to bear in mind that monitoring and evaluation is not the end of the CSS plan, but is a new beginning!

Information from monitoring provides the resources to determine whether the CSS is progressing successfully (or not) and to draw lessons from the whole CSS deployment process to help refine it. Such learning (both positive and negative) can help to refine the existing planning and implementation approaches in order to get the envisaged CSS outcomes.

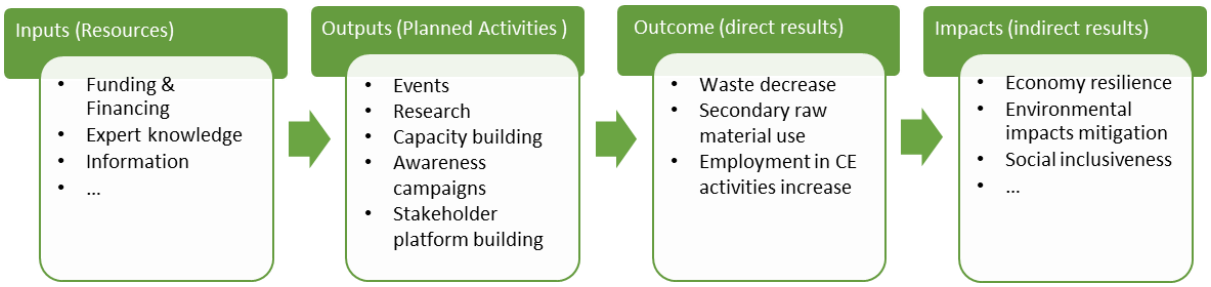
CSSs entail interventions in an urban context and, inevitably, will lead to various transformations. Therefore, it is important to assess their impacts retrospectively. To ensure an effective progress towards more sustainable production and consumption systems, cities and regions are strongly recommended to conduct assessments and compare the actual outcomes with the intended ones – previously established in the Chapter 2.4. An ex-post impact assessment would be highly beneficial in understanding various social, economic and environmental changes that have occurred in the territory and compare them to the intended ones prior to implementation. The comparison of ex-ante and ex-post impact assessments will indicate deviations in terms of intended and actual outcomes. Such impact assessments may aid in planning more accurately in due course or fine-tuning circularity initiatives/action items.

In evaluating the success of CSS planning approaches, a number of questions should be addressed:

- Is the CSS being implemented with the necessary support and leadership from engaged stakeholders?
- Have CE options been successful in receiving funds or triggering funding mechanisms?
- Are the reporting approaches working and are CSS progresses being received positively in the territory?
- Have the objectives of each CE action been met? (These may often be short-term objectives as long-term objectives may not be possible to achieve yet.)
- What CE actions have worked and what have not work? (This includes considerations of whether multiple benefits associated with objectives have been achieved.)
- Have there been any unexpected results from the implementation of the CSS Action Plan?
- Are the stakeholders, including civil society, been effectively engaged throughout and do they remain engaged? Have timeframes allocated for engagement been sufficient?

In this context, a basic logic framework approach, aligned with the type of KPIs introduced in Chapter 2.4, can facilitate the structuring of a KPIs scoreboard. A logic framework (Figure 28) consists in identifying: (i) the inputs such as the resources (e.g., funding, expert knowledge, information, etc.) that are needed to implement a CSS Action Plan; (ii) the outputs, or the activities that the plan undertakes (e.g., events, research, capacity building, etc.); (iii) the outcomes that are produced through the activities (e.g., the reduction in food waste generation, increase of employment in repairing activities, reduction of extraction of primary material, etc.); and (iv) the impacts of the outcomes - i.e., intended and unintended short and medium-term effects of CSSs (environmental, social and economic impacts, etc).

Figure 28: Logical framework to structure a KPIs scoreboard for monitoring and evaluating CSS implementation




Ideally, the KPIs scoreboard should also include **expected** target values (especially in the case of outcomes) and target implementation **timeframes**. The scoreboard can be used to regularly analyse the progress of the CSSs and evaluate whether the targets have been met in time or not. Any identified implementation gaps should be addressed and corrected in due course. The lessons learnt can be used to understand the positive and adverse consequences of CSSs. Positive aspects of successful circularity initiatives may potentially be cross-utilised among other circularity initiatives/action items. On the other hand, ineffective enablers should be reviewed in due course.

### 3.2.1. Assessing existing CSSs

Several cities and regions will already have their CSSs underway. As said above, it is important to evaluate CSSs regularly and assess them against the required quality, and relevance of the outputs and outcomes they provide. It is also important to reflect on the information that underpinned the selected CSS in the first place, and how it responds to the strategic needs and objectives of cities and regions. The needs of cities and regions as well as capacities will evolve over time. New information and new technologies will become available triggering new possibilities and, eventually, better solutions. Therefore, it will be important to keep in mind that the monitoring and evaluation step does not constitute the end of the process, but rather it is a new beginning to further improve or rethink current CSSs.

Table 14 below contains a series of questions to guide the evaluation of existing CSSs.

Table 14: Questions to support self-assessment of existing CSS

| |
|---|
| • Does the CSS articulate a clear vision? |
| • Are there goals and unambiguous, measurable objectives? |
| • Are there indicators for each action that can be measured to assess performance/delivery of each action? Can changes to the indicator be attributed to the action? |
| • Is there evidence that the CSS plan was developed with sufficient internal or external engagement? |
| • Does the CSS identify an internal or/and external champion(s) who will help to drive the implementation of the plan? |
| • Are there identified stakeholders to be responsible for the delivery or next steps associated with each action? |
| • Is the CSS plan suitably iterative and flexible to ensure it can be altered if outcomes are not achieved or as new information and technologies become available? |
| • Is the CSS equitable, with no particular stakeholder groups being disadvantaged? |
| • Does the CSS address the city/region priorities? |
| • Does the CSS contain a diverse range of options (e.g., no-regrets, short, medium and long-term)? |

### 3.2.2. Links to the Self-Assessment Tool: Module 3

The third module of the SAT can support the monitoring and evaluation of the CSS. Indeed, the SAT keeps track of the selected KPIs over time (ideally the assessment should be conducted on an annual basis), indicating whether targets have been met or the level of progress towards reaching them. In addition, the SAT will summarise the results through a comprehensive dashboard, providing an easy-to-read summary of the overall achievements and the extent to which the targets have been met.

## 3.3. Report to stakeholders and communicate lessons learnt

Stakeholder feedback is essential. People or groups who have an interest in the CSS, or who are responsible for delivering various actions must be made aware of how the CSS is progressing and of any changes that affect them. This is key to build political and societal support for CSS projects and CE initiatives. Equally wise, the lessons learnt (positive and negative) should be shared with a broader audience to foster knowledge transfer and, thereby, replicability of CSSs.

Having engaged with stakeholders and community throughout, it is essential to report progress and adaptation actions to these groups. This is important to build political and societal support for CE and CSS projects. Often, there is a tendency for monitoring reports to be filled with detailed statistical data, graphs, etc. However, audiences will find it easier to identify strengths and weaknesses of a given action if indicators are reported using qualitative or descriptive scales such as 'very good', 'good', 'poor', 'very poor', or more general statements such as 'positive', 'of concern', 'action required', etc. A good uptake is also generally achieved with narratives or 'stories' about how actions are tracking and what is being achieved, and what changes are being made in response to the monitoring activities.

This process should involve both internal and external stakeholders. Internal stakeholders - i.e., those directly affected by the CSS, should be kept informed on what changes and why changes to plans are being made. Key stakeholders that are responsible for delivering various actions must be made aware of any changes that affect them. Consideration must be given to how the CSS planning is being amended so that the planning cycle can be continued.

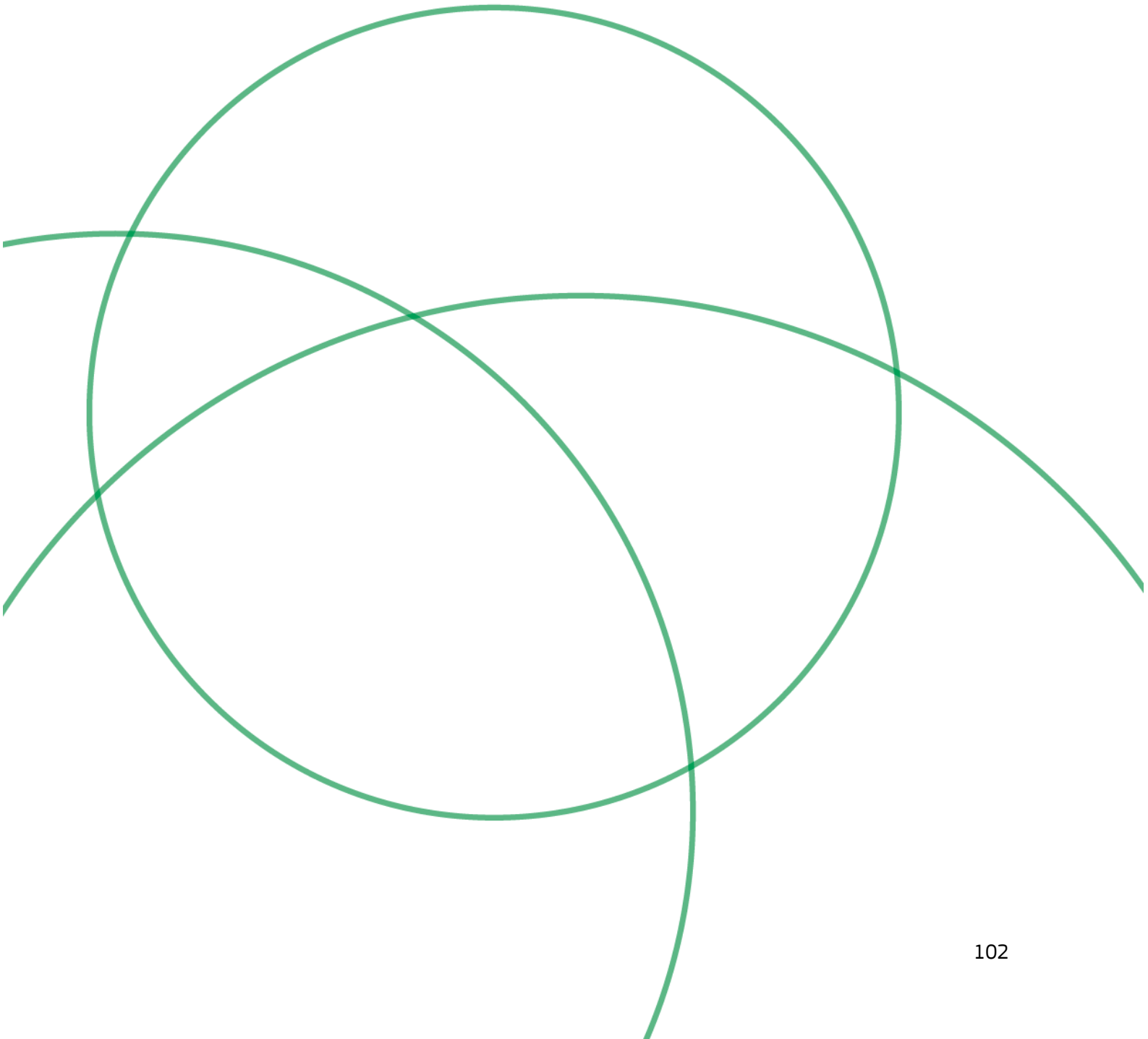
For what concerns external stakeholders, regions and cities should organise or participate to knowledge transfer (KT) events to further support the diffusion and replicability of CSSs. KT events aim at demonstrating transferable CSSs (via CSS card and/or CSS poster), discussing the scope for their adoption elsewhere, including potential modifications to adapt to the 'recipient' region context. A KT event will bring together different stakeholders from different regions/countries who will discover, confront and exchange information on the CSS, from best governance practices to technical issues. Practices identified in the different areas will be discussed from the point of view of their suitability for other contexts. Depending on the maturity level of the CSS, regions and cities can organise/participate to a KT event as 'export-orientated' or 'import-orientated' members. Export-orientated members will be regions and cities having advanced CSSs well-integrated in the territory, and whose interest is mainly sharing their knowledge and helping other territories to adopt and replicate CSSs. Import-orientated members are regions and cities at green phases who look for advisory support to better design their CSSs and get inspired from peers' experience.

# Ambitions' achievements checklist

| Analysis of Ambitions' achievements | |
|---|---|
| **Prepare for adoption and financing** | ✓ Has a business case been developed for implementing CSS, or for implementing CE priority actions within the CSS plan?<br>✓ Have funding needs been defined and financial resources found? |
| **Monitor, evaluate and adapt** | ✓ Has a monitoring and evaluation programme been designed underpinning the CSS?<br>✓ Are there indicators for each action, outputs and outcomes that can be measured to assess performance/delivery of the CSS?<br>✓ Have processes been established to evaluate and update the CSS plan at regular intervals? |
| **Review and communicate learn lessons** | ✓ Has it been considered how to refer to internal and external stakeholders on the results associated with the CSS implementation plan?<br>✓ Has it been considered how lessons learnt from completing this cycle will be used to enhance a next cycle and/or support other regions and cities? |

# Part III

## Technical factsheets



# Tools

## List of Tools

1. **Stakeholder analysis**
   - 1.1. Stakeholder mapping by territorial metabolism components
   - 1.2. Stakeholder value mapping

2. **Identify CE actions**
   - 2.1.
   - 2.2.
   - 2.3. **ReSOLVE framework**
   - 2.4. Urban Opportunity Framework
   - 2.5. Value-Chain approach

2.6. Circular Strategic Scanner

## 3. Understanding CSS barriers and drivers

3.1. DPSIR
3.2. PESTEL analysis
3.3. Causal Loop Diagrams

## 4. Urban metabolism

4.1. UMAn
4.2. UCA
4.3. GDSE

# Tools Templates: reading guidance

- **CCRI Methodology phase:** Indicates the phase of the CCRI Methodology (Map, Design, Implement) in which the tool is most likely to be used.
- **Thematic area:** Indicates the thematic area (e.g., stakeholder engagement, urban metabolism analysis, CE actions mapping, etc.) to which the tool refers.
- **Complexity:** Indicates how complex the use of the tool is (e.g., if it requires an expert, data collection, active involvement of stakeholders, etc.):

| | |
|---|---|
|  | The tool **does not require a tool expert**, it is **qualitative in nature** (no need of pre-filled data), and it does require a low to medium level of stakeholder engagement. |
|  | The tool **may require a tool expert or at least a moderator**; it is **qualitative in nature** (no need of precompiled data); and it requires a **low to medium level of stakeholder engagement**. |
|  | The tool requires **a tool expert,** it is **quantitative in nature** (need of data); and it requires **a medium to high level of stakeholder engagement**. |

- **Time**: Indicates how long it takes to use the tool (e.g., preparation for the use, execution in a single or several meetings, intensity of desk-based activities etc.):

| | |
|---|---|
|  | The **tool requires little preparatory work; it does not require desk analysis;** it can be applied through **one or a few meetings.** |
|  | **The tool requires preparatory work; it may require desk analysis**; it is applied through **several meetings.** |
|  | **The tool requires preparatory work; it requires extensive desk analysis**; it is applied through **several meetings.** |

- **Financial effort**: Indicates the financial efforts required to use the tool (e.g., if the tool is open-access or fee or licences are needed, if it requires hiring a moderator or a team of experts, etc)[32]:

| | |
|---|---|
|  | The tool is **open-access** and can be **used by a non-expert** (no need to contract experts). |
|  | The tool is **open-access** but may **require the hiring of an expert/moderator**. |
|  | The tool **requires a licence**, and generally requires the **hiring of a team of experts**. |

[32] Note that expenses related to the organisation of events are not considered as these can be conducted in mixed virtual/physical format.

# 1. Stakeholder analysis

## 1.1. Stakeholder mapping by territorial metabolism components

### Stakeholder mapping by territorial metabolism components

**Description:**

The elements of the metabolism process of a city or a region can be organised according to 'territorial components.' For example, material input (raw materials extraction, imports), physical outputs (waste, exports), and other territorial endowments such as knowledge (research institutions), technologies, infrastructures, etc.

For each element of the territorial component selected as relevant, likely stakeholders are identified based on their role in relation to that specific component - i.e., if they can be potentially affected by a change in the input/output, or if they can be potentially affecting that change with their actions and choices.

This leads to the identification of the general group of stakeholders that represent the basket of stakeholders to be addressed and potentially engaged by the organisation/decision-maker group.

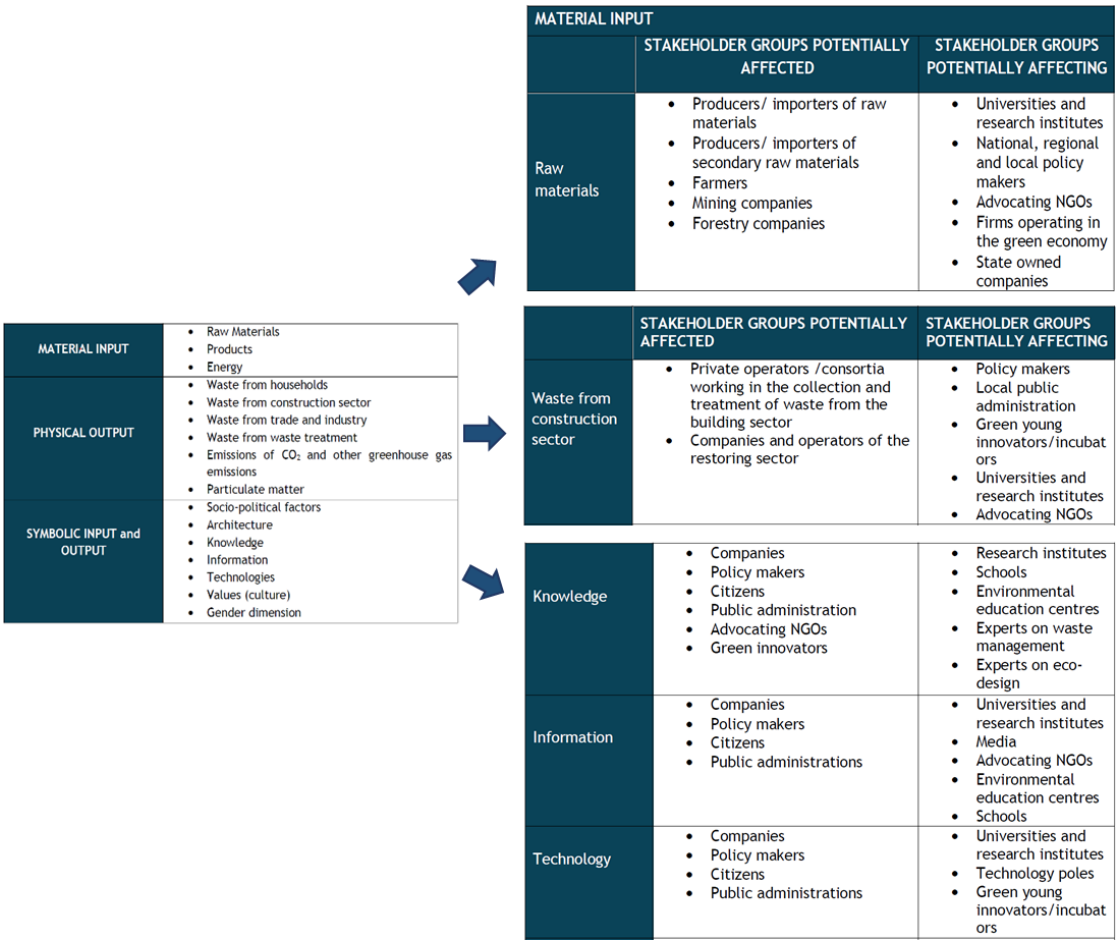
| CCRI Methodology phase |
|---|
| Map |
| **Thematic area** |
| Stakeholder analysis |
| **Complexity** |
| ★ |
| **Time** |
| ★★ |
| **Financial effort** |
| ★ |

**Reference**

UrbanWINS Toolkit Guidelines for the selection and implementation of adequate stakeholder engagement techniques - Part 3

https://www.urbanwins.eu/toolkit/

**Visual identity**



## 1.2. Stakeholder value mapping

### Stakeholder value mapping

**Description:**

The stakeholder value mapping is one of the tools presented in the CIRCit project to support various circular value-chain configurations, seeking innovation through stakeholder collaboration. The stakeholder value mapping helps to gain insights into how your circular strategy can be attractive for stakeholders, and supports the creation of a common ground by aligning stakeholders' interests. The result of this activity is an understanding of interests of current stakeholders (e.g., current value captured, value missed/destroyed/surplus/absence and value opportunities). The tool is structured in six steps:

1. Define the current situation and the new circular value-chain
2. Transfer the most important stakeholders from the Business Ecosystem Map
3. Identify current value captured
4. Identify pain points and latent needs
5. Identify stakeholder value opportunities
6. Identify who risks 'losing out.'

The stakeholder value mapping tool should be used in the mapping and designing phase and can help in defining what value the circular transition has for the different stakeholders.

| CCRI Methodology phase |
|---|
| Map |
| **Thematic area** |
| Stakeholder analysis |
| **Complexity** |
| ★★ |
| **Time** |
| ★★ |
| **Financial effort** |
| ★★ |

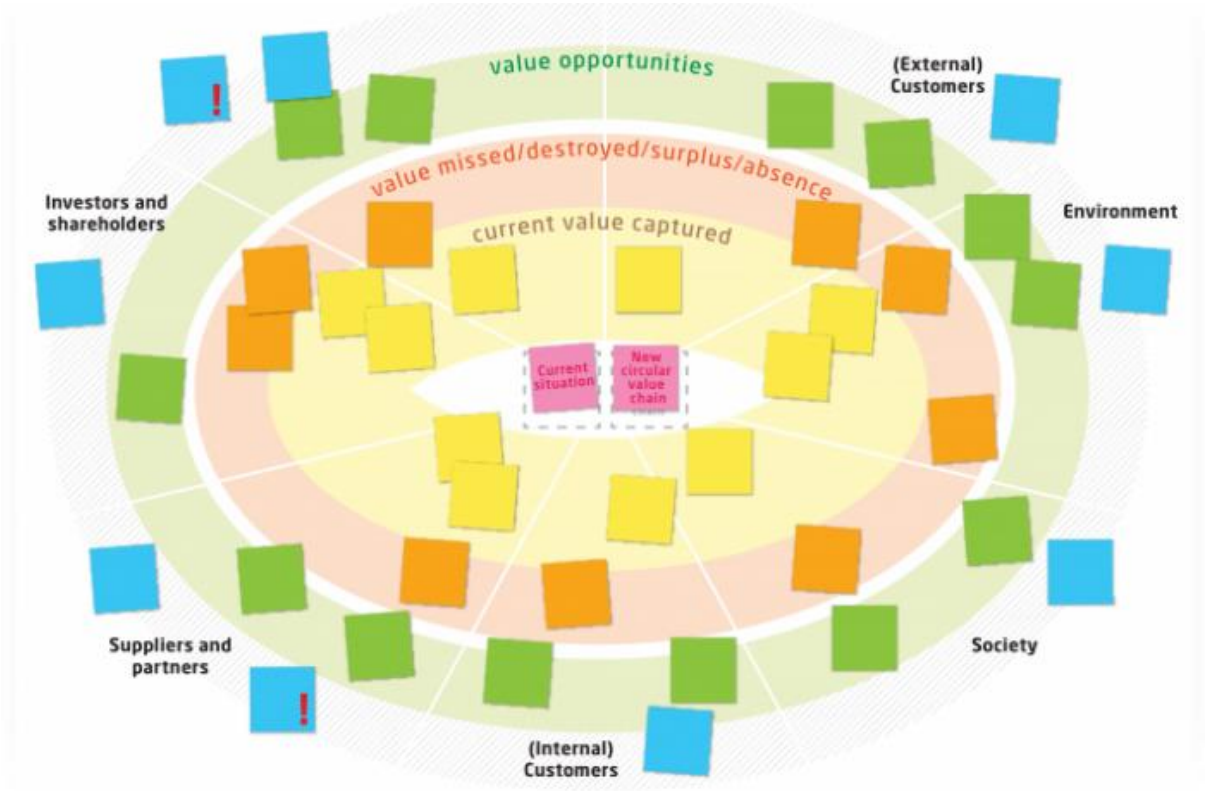
**Reference**

The CIRCit research project, which operates in Denmark, Sweden, Norway, Iceland and Finland, supports the Nordic industry to discover the opportunities of circular economy.

https://circitnord.com/tools/stakeholder-value-mapping/

https://circitnord.com/wp06-collaborating-and-networking-for-a-circular-economy/

**Visual identity**




| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

# 2. Identify CE actions

## 2.1. ReSOLVE framework

### ReSOLVE framework

**Description:**

The ReSOLVE framework is a tool for identifying and defining circular strategies and growth initiatives. It converts concepts for sustainable or circular industries such as sustainable supply chain, functional economy, sharing economy, dematerialisation and design for long lasting, among others, into guidelines for companies. It is composed of six business actions: Regenerate; Share; Optimise; Loop; Virtualise; and Exchange. Each action is linked to major circular business opportunities enabled by the technology revolution. These actions all increase the utilisation of physical assets, prolong their life and shift resource use from finite to renewable sources. Each action reinforces and accelerates the performance of the other actions, creating a strong reinforcing effect.

| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Identify CE actions |
| **Complexity** |
| ★★ |
| **Time** |
| ★★ |
| **Financial effort** |
| ★ |

**Reference**

Ellen MacArthur Foundation & McKinsey Centre for business and environment (2015). *GROWTH WITHIN: A CIRCULAR ECONOMY VISION FOR A COMPETITIVE EUROPE.*

https://ellenmacarthurfoundation.org/growth-within-a-circular-economy-vision-for-a-competitive-europe

**Visual identity**

*The ReSOLVE framework: six actions areas for businesses and countries waiting to move towards the circular economy*

| | |
|---|---|
| REGENERATE  | • Shift to renewable energy and materials<br>• Reclaim, retain, and restore health of ecosystems<br>• Return recovered biological resources to the biosphere |
| SHARE  | • Share assets (e.g., cars, rooms, appliances)<br>• Reuse/second-hand<br>• Prolong life through maintenance, design for durability, upgradability, etc. |
| OPTIMISE  | • Increase performance/efficiency of product<br>• Remove waste in production and supply chain<br>• Leverage big data, automation, remote sensing and steering |
| LOOP  | • Remanufacture products or components<br>• Recycle materials<br>• Digest anaerobically<br>• Extract biochemicals from organic waste |
| VIRTUALISE  | • • Books, music, travel, online shopping, autonomous vehicles, etc. |
| EXCHANGE  | • Replace old with advanced non-renewable materials<br>• Apply new technologies (e.g., 3D printing)<br>• Choose new product/service (e.g., multimodal transport) |

*Source:* Adapted from "GROWTH WITHIN: A CIRCULAR ECONOMY VISION FOR A COMPETITIVE EUROPE", 2015 p.26 (https://emf.thirdlight.com/link/8izw1qhml4ga-404tsz/@/preview/1?o).

## 2.2. Urban Opportunity Framework

### Urban Opportunity Framework - Circle City Scan Tool

**Description:**

This framework aims to support urban changemakers to start their journey towards circularity in cities and create a shared understanding by presenting city level interventions across pertinent urban themes based on the principles of the circular economy. It offers suitable circular opportunities clustered by 'urban themes' in the Urban Opportunity Framework. These are:

- water;
- solid waste;
- energy;
- organics;
- buildings;
- consumables.

Each theme contains an indicative and practical selection of related circular opportunities. This selection will be expanded on in detail over time.

The Urban Opportunity Framework is currently in testing via the Circle City Scan Tool—Circle Economy's open-access tool that supports the identification and implementation of circular projects in cities. In the Circle City Scan Tool, users are asked to define a focus area by selecting a sector, material and impact, based on the city analytics provided. Having selected a focus area, users are presented with a bespoke Opportunity Radar which prioritises and displays relevant opportunities for their city. The framework is used as the basis for this radar.

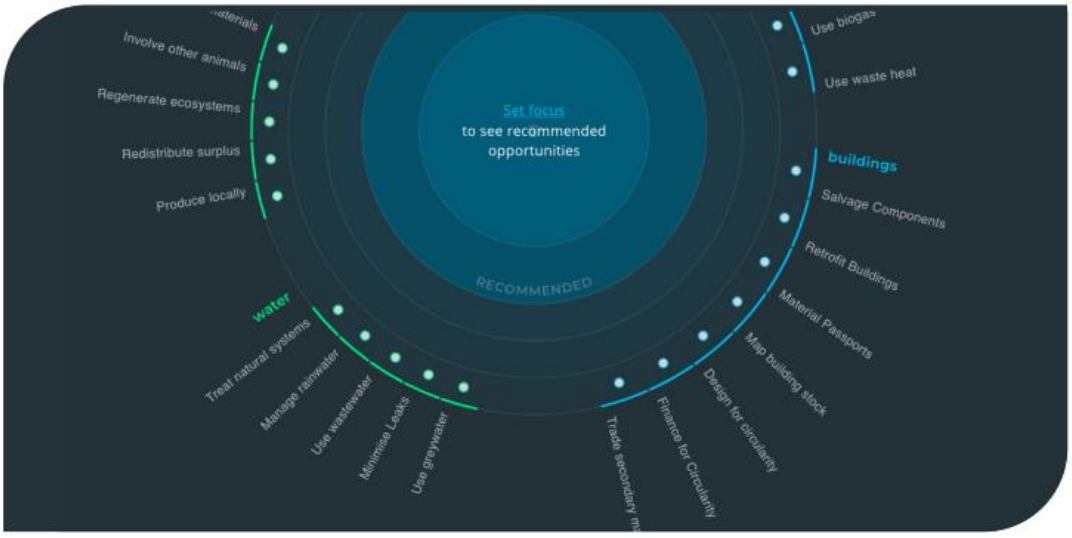
| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Identify CE actions |
| **Complexity** |
| ★★ |
| **Time** |
| ★★ |
| **Financial effort** |
| ★★ |

**Reference**

CIRCLE ECONOMY, 2020. *THE URBAN OPPORTUNITY FRAMEWORK.* https://www.circle-economy.com/resources/the-urban-opportunity-framework

**Visual identity**

Opportunity Radar in the Circle City Scan Tool




*Source:* From 'THE URBAN OPPORTUNITY FRAMEWORK', 2020, p.1 (https://assets.website-files.com/5d26d80e8836af2d12ed1269/5f86c11b59dadc152085705b_20201013%20-%20frameworks%20-%20urban%20opportunity%20-%20A4.pdf). In the public domain.

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

## 2.3. Value-Chain approach

### Value-chain approach

**Description:**

The Value-Chain Approach is a methodology for catalysing science-based policy action on sustainable consumption and production. Its purpose is to identify key points of intervention within economic systems to reduce natural resource use and environmental impacts caused by production and consumption, and to define a common agenda for action. The value-chain approach identifies where the greatest opportunities for improvement occur and shapes corresponding actions, building on existing knowledge and available data.

The approach analyses and discusses data and information in three steps:

1. Understand the value-chain and identify hotspots.
2. Consolidate existing action and identify opportunities to address the identified hotspots.
3. Define a common agenda and prioritise a participatory process.

The value-chain has been applied to three prioritised sectors: food; construction; and textiles. They provide actionable insights on the management of natural resources in relation to the 2030 Agenda for Sustainable Development.

**CCRI Methodology phase**

Design

**Thematic area**

Identify CE actions

**Complexity**

★★★

**Time**

★★

**Financial effort**

★★

**Reference**

UNEP (2021). CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION: The value-chain approach & its application to food, construction and textiles. https://www.unep.org/resources/publication/catalysing-science-based-policy-action-sustainable-consumption-and-production

**Visual identity**

Indicative mapping of main environmental impacts along the construction value-chain

| IMPACT | Financing | Planning, design, commissioning | Construction materials | Logistics | Property market | Construction | Operation | End-of-Life |
|---|---|---|---|---|---|---|---|---|
| Deforestation and land-use changes | | | Land conversion; use of timber; mining | | | Land conversion | Occupation of land over time | |
| Biodiversity loss | | | Land conversion; use of timber | | | Land conversion | | |
| Water - scarcity and pollution | | | River sand extraction | | | | Wastewater | |
| Soil pollution and run-off | | | Mining; material extraction and production | | | Land conversion | Day-to-day waste and wastewater | Demolition, landfills, unmanaged waste |
| Air pollution | | | Material extraction and production | | | Dust emissions during the construction | Indoor air quality; | Landfills |

*Source:* From 'CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION – The value-chain approach & its application to food, construction and textiles', 2021, p.36 (https://www.unep.org/resources/publication/catalysing-science-based-policy-action-sustainable-consumption-and-production).

## 2.4. Circular Strategic Scanner

### Tool name: Circular Strategies Scanner

**Description:**

The Circular Strategies Scanner is a framework that provides a taxonomy of circular strategies for manufacturing companies engaging with circular economy integration It serves to:

- create a comprehensive understanding of circular strategies;
- map current Circular Economy initiatives;
- generative ideas for increased circularity.

The Circular Strategies Scanner can be used in a workshop or similar setting to describe the circular strategies currently applied for a product or a service while aligning perceptions throughout the organisation. This mapping can be used as the starting point for scanning new opportunities to enhance or append additional Circular Economy strategies, thereby support the formulation of a shared vision for circular orientated innovation.

| CCRI Methodology step |
|---|
| Design |
| **Thematic area** |
| Identify CE actions |
| **Complexity** |
| ★ |
| **Time** |
| ★ |
| **Financial effort** |
| ★ |

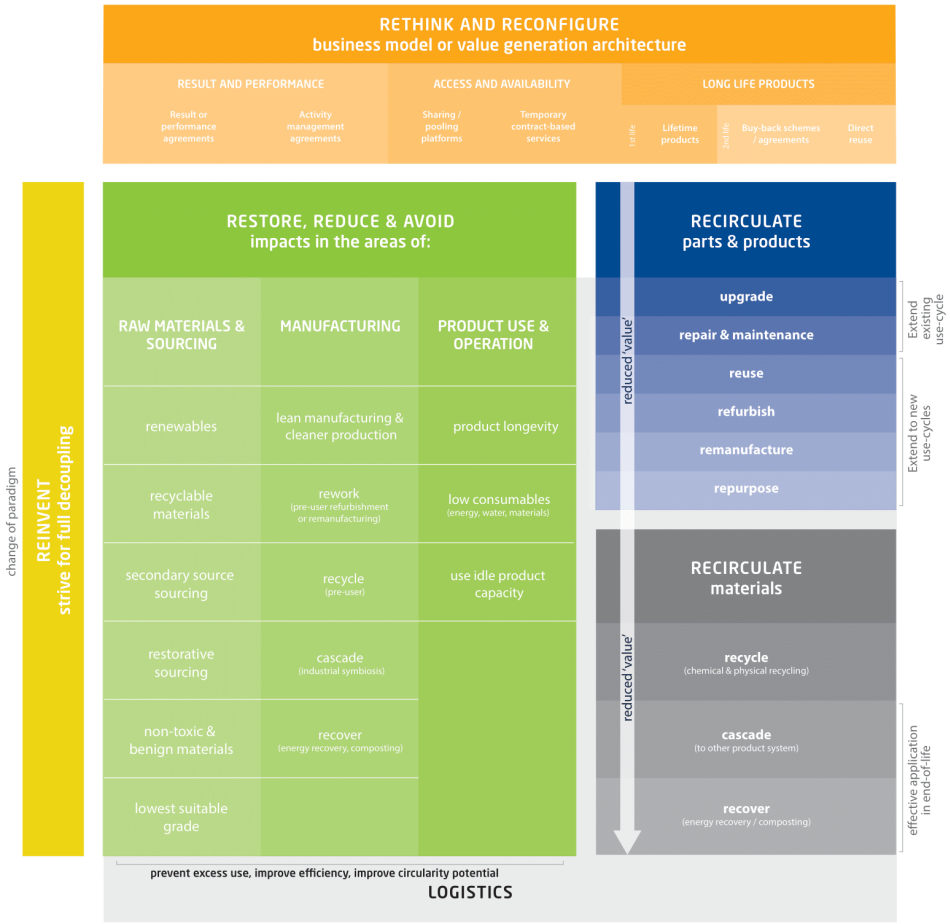
**Reference**

CIRCit NORDEN. (2020). CIRCULAR STRATEGIES SCANNER.

https://circitnord.com/tools/the-circular-strategies-scanner2/

**Visual identity**

Circular Strategies Scanner template




*Source:* From *CIRCit NORDEN*, 2020. (https://circitnord.com/tools/the-circular-strategies-scanner2/).

# 3. Understanding CSS barriers and drivers

## 3.1. DPSIR

### Driving forces-Pressures-State-Impact-Response model (DPSIR)

**Description:**

The DPSIR model can be used for a preliminary understanding and investigation of the causal relationships between different factors (economic, social and environmental) that shape the urban metabolism of a city and influence the design of the CSS. The DPSIR components are discussed below:

- Driving Forces: the factors that motivate human activities and fulfil basic human needs.
- Pressures: human activities that induce changes (Impacts) in the environment, or human behaviours that can influence human health.
- State: refers to the state of the natural and built environment (e.g., the quantity and quality of physical, chemical, and biological components), and human systems (e.g., population level and individual attributes).
- Impact: are changes in environmental functions affecting social, economic and environmental dimensions, which are caused by changes in the 'State' of the system. These 'Impacts' trigger 'Responses.'
- Responses: are the policy actions which are directly or indirectly triggered by the perception of 'Impacts', and which attempt to prevent, eliminate, compensate or reduce their consequences. These 'Responses' can in turn influence trends in the 'Driving Forces', 'Pressures', 'State' and 'Impacts.'

The DPSIR requires a very active stakeholder engagement and results in a collaborative learning process being carried out.

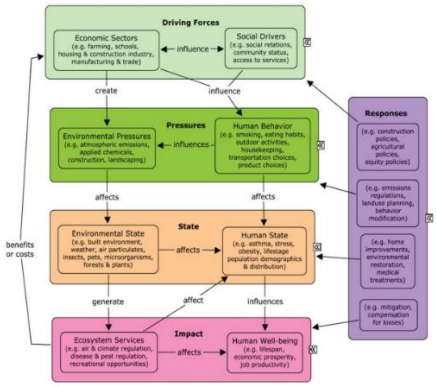
| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Understanding CSS barriers and drivers |
| **Complexity** |
| ★★★ |
| **Time** |
| ★★ |
| **Financial effort** |
| ★ |

**Reference**

The DPSIR model was used in UrbanWINS project (https://www.urbanwins.eu/) to support stakeholders in the definition of action proposals in the phase of strategic planning.

**Visual Identity**

Circular Strategies Scanner template




*Source:* UrbanWins project, 'DIPSIR model and LCA' Part 2B. 2019.

(https://www.urbanwins.eu/wp-content/uploads/2019/03/Part-2B-Dipsir-model-and-LCA.pdf). CC BY-NC

## 3.2. PESTEL analysis

### PESTEL analysis

**Description:**

PESTEL stands for Political, Economic, Social, Technological, Environmental and Legal and it is a framework generally used to gain a better understanding of the external environment related to a business position and to provide direction for future operations. The PESTEL framework has been applied to the concept of a circular economy to assess the factors having an impact (positive or negative) on the development of such economy.

PESTEL analysis has two basic functions for a CSS. The first is that it allows identification of the environment within which a CSS operates. The second basic function is that it provides data and information that will enable cities and regions to predict situations and circumstances that it might encounter in the future.

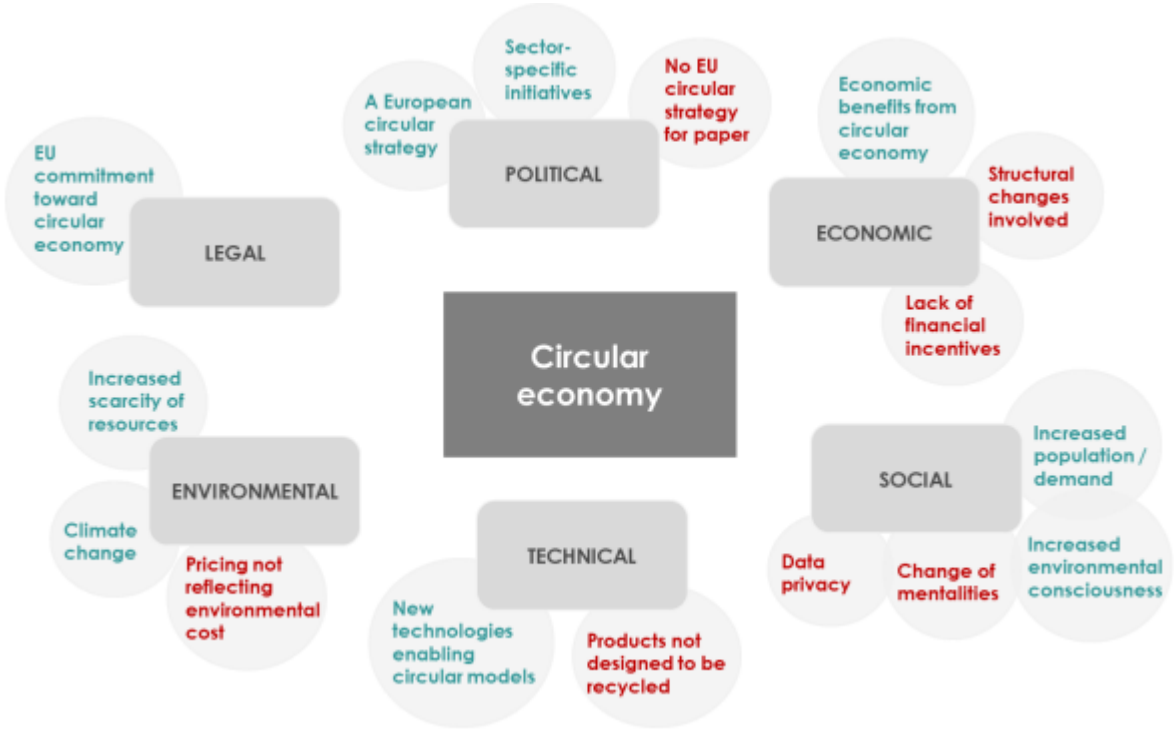
The PESTEL framework is generally implemented during the initial phases of CE/CSS strategy design to identify main barriers and drivers of the local territory. A first PESTEL analysis can be performed on desk-based research. This would later provide the starting point for discussion in the stakeholder seminar. Alternatively, PESTEL can also be implemented directly in a workshop by asking stakeholders to express their views on the different PESTEL factors. The framework is very intuitive and does not require experts to use it, but its simplicity also limits a more systemic understanding of territorial dynamics.

| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Understanding CSS barriers and drivers |
| **Complexity** |
| ★ |
| **Time** |
| ★ |
| **Financial effort** |
| ★ |

**Reference**

Obsterg et a., (2019). Urban Regions Shifting to Circular Economy: Understanding Challenges for New Ways of Governance. *Urban planning, Volume 4*, 19-31. https://doi.org/10.17645/up.v4i3.2158

**Visual identity**




Source: H2020 Project Paper Chain, D3.1 Comprehensive analysis of the existing and emerging approaches of circular economy models in pulp and paper industry *https://cordis.europa.eu/project/id/730305*

## 3.3. Causal Loop Diagrams (CLD)

### Tool name: Causal Loop Diagrams (CLD)

**Description:**

CLD is a graphical and qualitative tool developed in the field of system thinking that aims to explore and represent the interconnections between the key indicators in the analysed sector or system. CLDs include several elements, namely variables, arrows and polarity. The arrows represent causal links, and their polarity (presented with a '+' or '–' sign next to the arrowhead) can either be positive (representing a direct relationship) or negative (representing an inverse relationship). Circular causal relations between variables form feedback loops that can be either reinforcing or balancing.

CLDs can be used to assess and compare different CE strategies, fully considering the complexity of the CE and its various outcomes across social, economic and environmental indicators. It helps to gain a systemic understanding of complex systems from problem formulation to its root causes, or from policy interventions to their system impacts.

The use of CLDs requires, on the one hand, an expert in model thinking and knowledge integration and, on the other hand, an active role of engaged stakeholders, which should support and validate the creation of CLDs.

CLDs can be further used to generate quantitative scenarios through the System Dynamic tool.

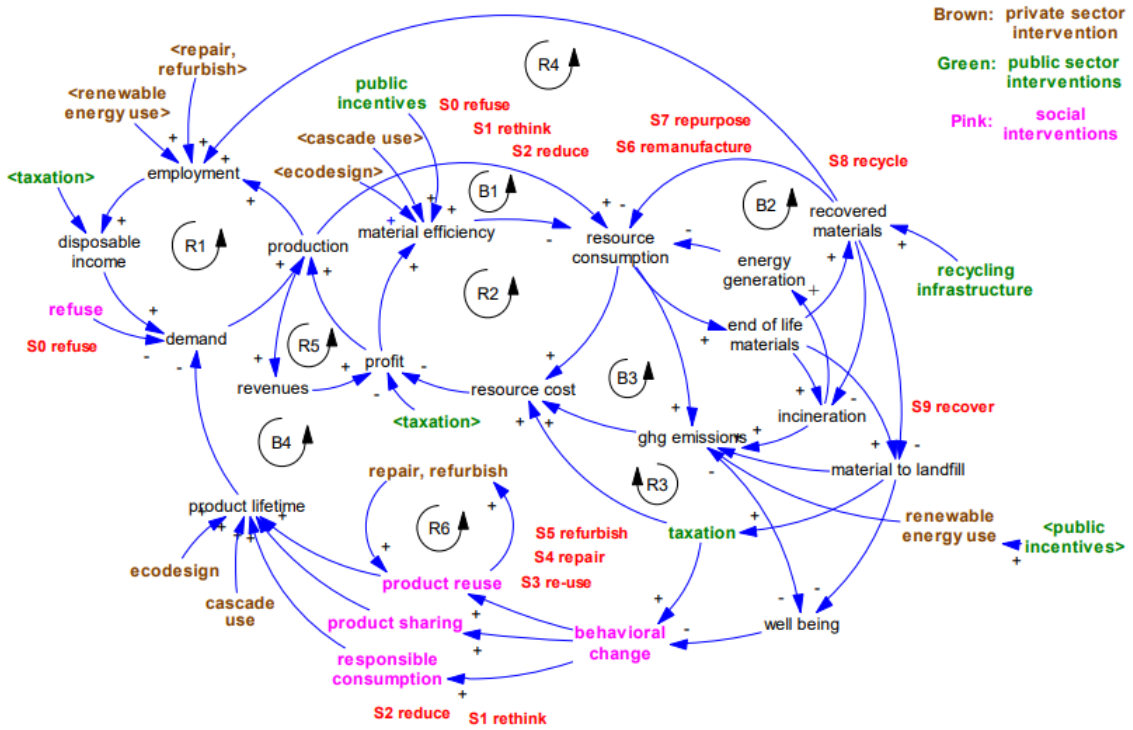
| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Understanding CSS barriers and drivers |
| **Complexity** |
| ★★★ |
| **Time** |
| ★★★ |
| **Financial effort** |
| ★★ |

**Reference**

Bassi et al. (2021) Improving the understanding of circular economy potential at territorial level using systems thinking. https://doi.org/10.1016/j.spc.2020.10.028

**Visual identity**

*Detailed integrated CLD*




From 'Improving the understanding of circular economy potential at territorial level using systems thinking', by Bassi et al., 2021, *Sustainable Production and Consuption, Volume 27,* p.134. Under a Creative Commons licence.

# 4. Urban metabolism

## 4.1. UMAn

### Tool name: UMAn

**Description:**

The Urban Metabolism Analyst (UMAn) tool offers a methodology for the computation of material flow accounts at urban scale. The UMAn approach is derived from the Economy-Wide Material Flow Analysis (EW-MFA) methodology, though the UMAn model adapts this methodology to be used for a smaller spatial unit, such as the urban scale. The model considers different aspects appearing in material flows at an urban level: matter movement through boundaries; extraction and production of materials and goods; and their consumption in addition to stock and emissions to nature.

The UMAn also allows to exploit a set of 'plug-ins' LCIA databases for more detailed analysis of urban flows, including the material composition of flows and the respective environmental impacts.
The use of UMAn requires expertise in urban metabolism, quantitative modelling and LCA.

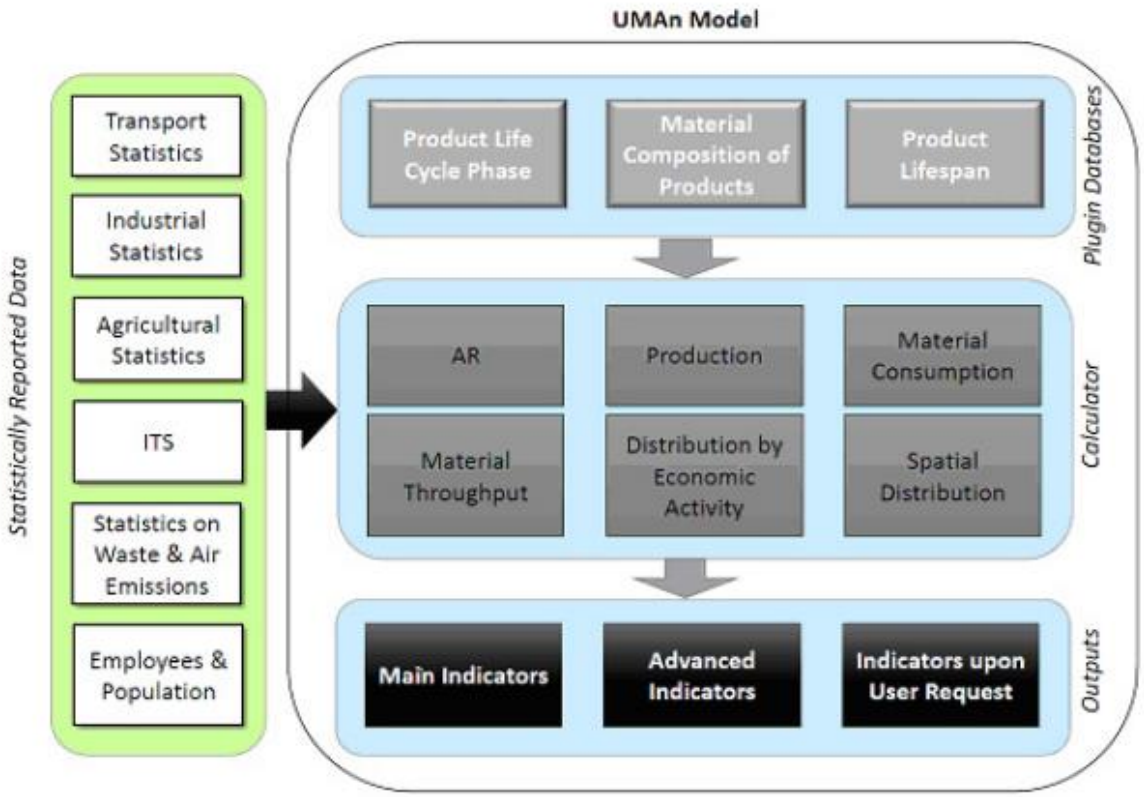
| CCRI Methodology step |
|---|
| Design |
| **Thematic area** |
| Urban metabolism |
| **Complexity** |
| ★★★ |
| **Time** |
| ★★★ |
| **Financial effort** |
| ★★★ |

**Reference**

URBANWINS. (2017)). Deliverables, UrbanWINS D2.1 Model architecture.
https://www.urbanwins.eu/wp-content/uploads/2019/02/D2.1-report.pdf

URBANWINS. (2019). Deliverables, UrbanWINS D2.2 Urban metabolism guide.
https://www.urbanwins.eu/wp-content/uploads/2019/05/UrbanWINS_D2.2-UMAn-guide-1.pdf

**Visual identity**




*Source*: From URBAN WINS DATABASE, (https://www.urbanwins.eu/database-uman/).

## 4.2. UCA

### Urban Circularity Assessment (UCA)

**Description:**

The UCA is an urban, EW-MFA and stock accounting method, which paired with indicators, enables the assessment of material circularity of a municipality or city. Its aim is to monitor progress towards a CE from an economy-wide perspective at city level, rather than just at the level of individual products sectors. The method is directed at policy makers and practitioners who are interested in measuring the material circularity of their city or municipality.

The UCA consists of three main parts:

1. Material flow and stock accounting
2. Analysis of Flows and Stocks: Measuring Indicators
3. Analysis of Indicators: Assessing Circularity.

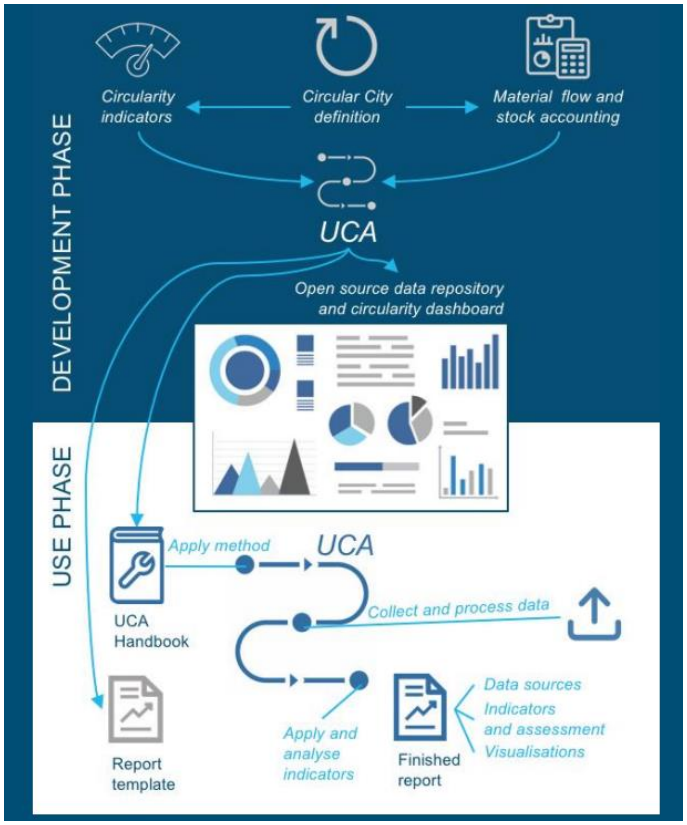
The use of the UCA requires expertise in urban metabolism and EW-MFA accounting. It can also be very time intensive in data collection or data generation (when data is not directly available). The tool can also provide a geo-localised view of stock and flows. The UCA can be used during the mapping phase to visualise stock and flows and throughout the design phase to analyse circularity and assess scenarios.

| CCRI Methodology step |
|---|
| Design |
| **Thematic area** |
| Urban metabolism |
| **Complexity** |
| ★★★ |
| **Time** |
| ★★★ |
| **Financial effort** |
| ★★★ |

**Reference**

CITYLOOPS – Metabolism of cities. (2022). https://cityloops.eu/resource?t=Urban%20Circularity%20Assessment

**Visual identity**




Source: CITYLOOPS – Metabolism of cities. (2022). *https://cityloops.eu/resource?t=Urban%20Circularity%20Assessment*

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

## 4.3. GDSE

### Geodesign Decision Support Environment (GDSE)

**Description:**

The GDSE is an online and open-access software designed for workshop sessions where small groups of participants cooperatively develop strategies for a more circular economy with a special focus on waste and resource management. The GDSE relies on the activity-based spatial material flow analysis (ASMFA), and it allows visualising the flows using classic Sankey diagrams as well as map representations.

The GDSE is structured in five steps:

1. Study Area: the users define their study area and the key flows on which the workshops (or the research activity) will focus on. This includes defining key stakeholders working groups (WGs).
2. Status Quo: this step takes a detailed look at the status quo situation of the material and waste flows between the different activities in the study area.
3. Targets: WGs rank the overall objectives for the later strategy developments and transform them into mostly quantitative targets.
4. Strategy: WGs puts together a strategy (combination of solutions from a predefined catalogue) aiming to reach the objectives and targets set in the step before and implements them within the study area.
5. Conclusions: WGs meet in a plenary session to draw conclusions from the results.

The GDSE constituted the main digital support tool for both the research and the interactive workshop sessions for all six case studies in the REPAiR project. The use of the tool requires expertise in urban metabolism (and eventually programming skills if the code needs to be adapted). It can be time intensive in desk research for data accounting/modelling and requires active engagement of interested parties. The GDSE can also be used since the mapping phase throughout the design phase.

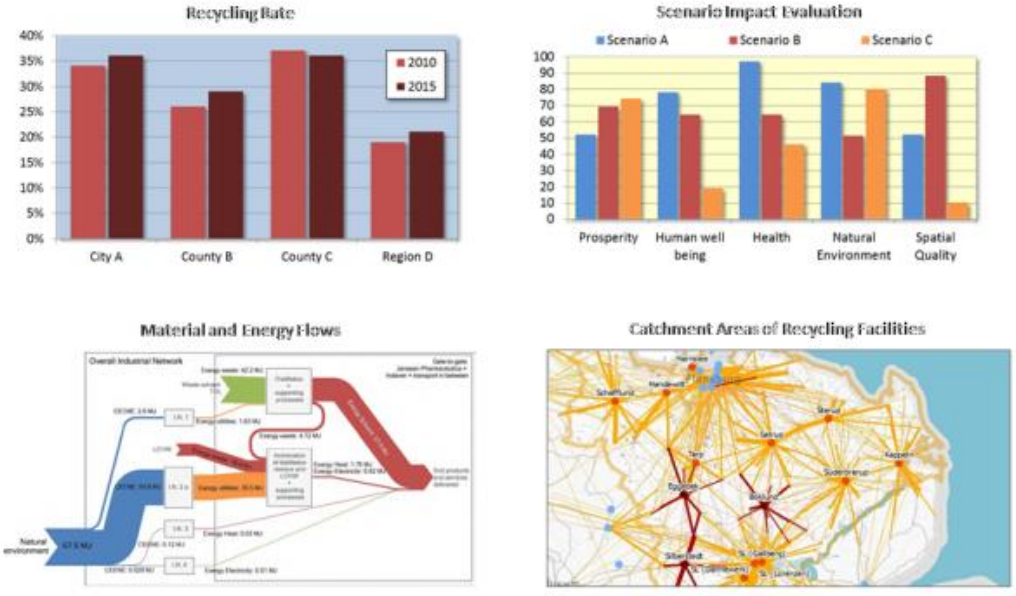
| CCRI Methodology phase |
|---|
| Design |
| **Thematic area** |
| Urban metabolism |
| **Complexity** |
| ★★★ |
| **Time** |
| ★★★ |
| **Financial effort** |
| ★★★ |

**Reference**

REPAiR. (2020). *GDSE description.* http://h2020repair.eu/gdse-software-package/

The GDSE and its source code can be found in the following GitHub repository: https://github.com/MaxBo/Repair-Web

**Visual identity**




Source: REPAiR. (2020).

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

# Circular Systemic Solutions

## List of Circular Systemic Solutions by key product value-chain

1. **Construction & Building**
   - 1.1. Reuse Wood and Furniture
   - 1.2. Circular Buildings
   - 1.3. Reusing and repurposing old buildings and neighbourhoods
   - 1.4. Supporting waste sorting in works and demolitions
   - 1.5. Urban Resources Cadasters

2. **Food water & nutrients**
   - 2.1. Decentralised bio-waste collection and treatment
   - 2.2. Reuse of grey and black waters for agricultural production
   - 2.3. Residential rainwater harvesting and reuse
   - 2.4. Public and free water points

3. **Plastic**
   - 3.1. Small-scale eco-credits and rewards

4. **Packaging**
   - 4.1. Deposit Return system for bottles

5. **Textile**
   - 5.1. Circular Textile

6. **Electronics & ICT**
   - 6.1. Decentralised collection systems for WEEE
   - 6.2. Second-hand and repair centres for WEEE

7. **Cross-cutting support/governance**
   - 7.1. Joint long-term strategy development
   - 7.2. Organised Waste Market
   - 7.3. Waste Recycling
   - 7.4. Circular procurement clauses

# CSS Templates: reading guidance

- **Type of R Strategy:** Identifies which R strategy the CSS belongs to. R strategies are based on the Circular City Action Framework: Rethink, Regenerate, Reduce, Reuse and Recover.
- **Technology Readiness Level (TRL):** Identify the correspondent level of technology maturity used by the European Commission in R&D programmes (available in the link).
- **Stakeholder engagement:** Identify level of stakeholder engagement necessary for the CSS to be successful among three basic levels:

| | |
|---|---|
| ★ | The solution requires **limited collaboration** with the interested key partners. **Public outreach and consultation are not necessary** to ensure its deployment and execution (e.g., B2B solutions). |
| ★★ | The solution requires a **certain level of engagement** from the public and/or relevant stakeholders, as it **demands a certain degree of behaviour change and adoption for implementation** - but no significant investment commitment is required from the parties. |
| ★★★ | The solution requires a **very high level of engagement and cannot be implemented without extensive consultations and communication** with key stakeholders and the public. It may require **consumer behaviour and business organisational change**, as well as **investment commitments from key partners**. |

- **Financial effort:** Identify the degree of financial efforts to be done to deploy and sustain the solution among three basic levels:

| | |
|---|---|
| ★ | The solution can be implemented with a **limited budget** that a community can raise with their **own means and with ordinary public support** (e.g., small grants or subsidies for specific activities already in place). |
| ★★ | The solution requires **financial contributions beyond what can be easily gathered by the beneficiary communities**. A fundraising strategy that includes the basic investments and related public or private financing is required for implementation. |
| ★★★ | The solution is **very intensive in the use of technology and/or deployment of infrastructure**. **Large, coordinated investments** from the public and/or private sectors are needed, including **long-term strategies** for future financing and maintenance. |

- **Type of Territory:** Identify up to two territories where the implementation of the CSS is more optimal, according to the classification in the 'CCRI Circular Systemic Solutions Classification', Typology 5b: Territories involved.
- **Key product value-chain**: Identify the product key value-chain(s) addressed by the CSS. Product key value-chains may refer to the seven highlighted in the new European Circular Economy Action Plan (CEAP)[33] - or others relevant to the city or region if particularly specific.
- **Sectors involved:** Identify the three relevant sectors involved in the CSS according to the broad structure of the classification of economic activities in the European Community (NACE) rev2[34], at the Section level (A, B, C, etc).

[33] European Commission's Circular Economy Action Plan (CEAP). Link to publication.
[34] NACE rev 2 (2008) list of Classification of Economic Activities in the European Community. Link to code list.

# 1. Construction & Building

## 1.1. Reuse Wood and Furniture

**Approaching the reuse and recycling of Wood and Furniture to citizens**

This CSS aims to increase the reuse and recycling of wood, improving the separation and collection of bulky and wood waste material for recovery and re-valorisation, while bringing citizens closer to these activities. Bulky materials such as furniture and wood items require a separate collection scheme and storage facilities that ensure timely collection and enable a proper separation process. The creation of a reuse centre and rethinking the logistics of their collection and transportation are necessary to ensure first steps are made to proper recovery and reuse.

The solution includes creating a reuse centre for wood and furniture where these items can be disposed and repaired, promoting fixed or pop-up repair cafes that approach these activities to the public and prevent waste, and rethinking the system of collection and separation of this type of materials so that major collection can be achieved.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS is quite dependent on the capacity of the city to provide the necessary spaces to store and work with wood, which normally require important land surfaces. The space also needs to be accessible to the public to enhance disposal and participation in repair activities. The establishment of the centre will also require the acquisition of equipment.
- **Technical:** A technical analysis of potential waste to be collected and repaired at the facility would be necessary to assess the future sustainability and uses of the centre. The study should also shed light onto how to improve the collection and separation system, according to existing constraints. The operation of the centre also requires the availability of qualified staff, and expertise to manage the facilities in an efficient way.
- **Context:** Pop-up repair cafes require spaces and groups that can host them. A network of Fab-labs or community centres that can host is necessary. Links with creative community are also helpful.

**Type of R Strategy**

Recover

Reuse

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

★★

**Stakeholder engagement**

★★

**Types of territory**

Rural areas, Cities,

Metropolitan Areas, Provinces

**Key product value-chain**

Construction and buildings

**Stakeholders**

Key stakeholders and the role they need to play in the solution (public administration, industry and businesses, civil society, academia)

The leading actor to deploy this CSS is a local public organisation (i.e., city council, regional government/agencies), but the active engagement of other stakeholders is fundamental for its success. To ensure the success and attractiveness of repair cafes, agreements with woodwork ateliers, artists, Fab-labs and makers is indispensable. Civil or environmental associations also need to be engaged to increase the outreach of the activity.

The participation of residents and local shops and stakeholders will determine the degree of success of the CSS. To increase the impact, other groups such as schools, social services and educational centres can also be involved.

**Sectors involved**

C. Manufacturing

F. Construction

G. Wholesale and retail trade

H. Transportation and storage

O. Public administration

P. Education

R. Arts, entertainment and recreation.

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The impact of this CSS is two-fold. The creation (or expansion) of reuse centres and the (pop-up) repair cafes will reduce the generation of woody waste, decreasing the generation of bulky material and ensuring it is reused and recycled. Moreover, a proper management of the materials – selling them or reusing them for public facilities can also contribute to provide revenue streams or savings for some projects. It can also generate new business opportunities for local artisans and companies or new professional options to vulnerable groups or youth.
- The second major impact is the awareness-raising potential of the activity, engaging citizens to learn how to repair furniture and how they can increase environmental sustainability, offering informal spaces to learn and interact with city authorities.
- Finally, these activities can be expanded and leverage their potential with other waste streams, such as EEE, plastics or textiles.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- One of the main barriers for this CSS is to ensure the sustainability of the reuse centre in the long-term, or the capacity to monitor and quantify its results. Conducting the necessary assessments before its launch and engaging the right actors that can help manage and valorise waste is of key importance.
- Fading engagement from the public is also a major risk, as an important part of the woody waste savings comes from individuals that manage to repair it. The involvement of associations and communities is hence important to ensure the constant engagement.
- Logistics of collection and separation are also an important barrier to consider, and engagement with companies involved in these processes are key to understand the constraints of the process and imagine new solutions.

**Examples**

1. **Pop-up repair cafes and 'Ripas' centre (Lisbon, Portugal).** During the implementation of the FORCE project (H2020), Lisbon Municipality opened a reuse centre open to all residents to reuse and repair wood items and furniture, combining it with pop-up cafes made in partnership with local associations and Lisbon Fab Lab. The city also added new intermediary facilities to be able to increase its capacity to collect and properly separate wood furniture for repair. During the piloting phase, the city counted that 374 kg of wood waste were avoided thanks to the pop-up repair cafes, and that 1.368 tonnes of wood were recycled.
2. **Guldminen (*Goldmine*) – Copenhagen, Denmark.** The purpose of the Goldmine at Vasbygade genbrugsstation (recycling station) has been to develop new business models within the circular economy and to be a temporary project to develop knowledge towards establishing Sydhavn Genbrugscenter. Through this Goldmine Iwanted to increase their ability to reuse and recycle waste streams delivered to this recycling station and learn about the potential of collaborating with NGOs, private individuals and companies. The Goldmine is a warehouse placed on a recycling station with storage facilities around the building. Inside the building, the Golddiggers have access to a wood workshop, workshop areas / teaching facilities (used also for teaching school classes about waste prevention), an office space, an area for storing materials and kitchen/bathroom facilities.

**References:**

Urban Resource Centres – Urban Agenda Partnership on Circular Economy.
https://ec.europa.eu/futurium/sites/futurium/files/classification_of_urban_resource_centres_0.pdf

FORCE project (H2020) - https://cordis.europa.eu/project/id/689157; http://www.ce-force.eu/

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

## 1.2. Circular Buildings

### Circular (smart) buildings

This CSS is a key element of a circular construction chain and focuses on creating buildings whose materials will have the longest possible lifespan through reuse and/or repurposing. Public authorities can encourage that buildings are designed, built and demolished following circularity principles. Circular buildings explore new innovative designs considering their future usability, making them adaptable to new uses and easy to update through modular designs which generate less pollution and waste. The use of recycled and reused materials in the construction process of new buildings also contributes to a more circular use of materials and prevents future waste.

These innovations are enhanced by public policies innovating in public procurement, approving flexible and new regulations, allowing new materials and designs to be tested in real buildings. This enables environments regarding material flows within the city.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** Circular buildings require availability of sustainable and circular construction materials (recycled, biobased, etc.). It is necessary that industry and research institutions developing and producing these materials are present in the local ecosystem and have enough production capacity. Reusing construction materials also requires the existence of suitable deposits or mechanisms to recover them from other activities or from demolitions. Finally, it is important that the secondary materials count with all the needed quality assurance tests, from a technical point of view as well as from an environmental point of view.
- **Technical:** The local or nearby ecosystems need to count with actors that have the capacity to explore new designs and have access to equipment such as 3D printers to explore more sustainable production techniques.
- **Context:** A circular economy ecosystem and related value-chain is required in the region to ensure access to specialised knowledge and materials. Existing structures and decommissioning rules supporting the reuse of materials through mapping, storage and classification enable circular buildings. Sandboxes and flexible regulations in the construction sector to test innovation are also strong levers for new approaches. Besides these technical aspects, supporting economic incentives may be required to make Secondary Raw Materials (SRM) competitive with natural raw materials (at least in an initial SRM market creation stage).

**Type of R Strategy**

Rethink, Recover, Reuse

**Technology Readiness level (TRL)**

TRL 6-7

**Financial effort**

★★★

**Stakeholder engagement**

★★

**Types of territory**

Cities, Metropolitan areas, Provinces, Regions

**Key product value-chain**

Construction and buildings

**Stakeholders**

Key stakeholders and the role they need to play in the solution (public administration, industry and businesses, civil society, academia).

Although the public sector is the instigator of this solution through public procurement and land development requirements, the novelty of the approach requires that involved stakeholders are consulted, trained and coordinated. The orchestration of stakeholders from the whole value-chain is necessary to ensure synergies between them and maximise materials flow. Construction companies, developers, waste companies and managers of key infrastructures are to be engaged. Subcontractors and ICT companies can also play a role in building the value-chain.

**Sectors involved**

C. Manufacturing

F. Construction

H. Transportation and storage

L. Real Estate Activities

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- Encouraging the construction of circular buildings at a large scale will primarily reduce the raw material extraction required for the construction of buildings, promoting the reuse of existing construction materials and of recycled ones. This will also reduce dependency from external providers and imports.
- The use of recycled and reused materials will also reduce the amount of $CO_2$ generated during the production of the more polluting construction materials, and the efforts necessary to repurpose and adapt the building to new uses over time.
- The focus on reusing local materials and recycled materials will have a positive impact in job creation in the local and nearby economies, providing new market opportunities for circular business models and new products.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- Capacity (i.e., expertise, supply chains, etc.) still needs to be built within the construction industry, and might be scarce in several regions. This has cost implications for companies and procurers that might hinder the adoption of this CSS until the market is ready.
- The contextual elements necessary to largely implement this CSS are important and require time to be able to sustain this approach widely. Cities and regions need to invest in the mapping of materials, coordination mechanisms, materials classification and passports and storage facilities to exchange in order to maximise the potential of circular buildings.
- The low TRL of new materials and some of the designs, as well as limited market-ready products can reduce the uptake of innovations at larger scales and reduce the scope of this CSS unless support mechanisms are put in place, such as flexible regulations, market incentives and marketplaces.

**Examples**

1. **Circular construction chain and circular buildings (Amsterdam, the Netherlands).** The City of Amsterdam conducted a circle scan of the municipality to identify opportunities for circularity. One of the major sectors of intervention was construction, which was targeted in the city's circular strategy through several actions including promoting smart designs, smart demolition, high-value recycling and creating a marketplace and resource bank. Following this scheme, developments such as Park 20|20, Temphousing or Solid have applied this methodology. The Circular Strategy foresees that the combination of strategies can lead to the creation of 700 new jobs, save 500 000 tonnes of materials and decrease $CO_2$ emissions by half for the development for the construction of 70 000 homes.
2. **EU-funded projects on circular buildings**

- **BAMB (H2020), Buildings As Material Banks**: is creating ways to increase the value of building materials. Dynamically and flexibly designed buildings can be incorporated into a circular economy – where materials in buildings sustain their value.
- **RE4 (H2020):** designing solutions for circular buildings, integrating recycled materials from construction and demolition waste. The EU-funded RE4 project has developed prefabricated energy-efficient building concepts containing up to 85 % of recycled materials and reused structures from construction and demolition waste (CDW). The RE4 concept enables the easy assembly and disassembly of buildings for future reuse.
- **CINDERELA (H2020):** New Circular Economy Business Model for More Sustainable Urban Construction. The project aims to develop a new circular economy business model (CEBM) for use of SRM in urban areas, connecting different industries, the construction sector and municipal services, decision-makers and the general public with the support of digital tools.

**References:**

City Circle Scan and Circular Amsterdam Strategy (Circle Economy): https://www.circle-economy.com/resources/developing-a-roadmap-for-the-first-circular-city-amsterdam

City of Amsterdam: Circular Policy: https://www.amsterdam.nl/en/policy/sustainability/circular-economy/

EU-funded projects

BAMB (H2020): https://cordis.europa.eu/project/id/642384

RE4 (H2020): https://cordis.europa.eu/project/id/723583

CINDERELA (H2020): https://cordis.europa.eu/project/id/776751

| Map | Design | Implement | Tools | Circular Systemic Solutions |
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## 1.3. Reusing and repurposing old buildings and neighbourhoods

### Reusing and repurposing old buildings and neighbourhoods

European cities grew exponentially during the period of industrialisation, but nowadays most of them have transitioned into a knowledge and service societies. This transformation results in old buildings, and industrial areas that need to adapt to new modern uses in the urban space. This CSS focuses on a new approach to update these spaces to the needs of urban societies with a circular approach – reusing existing buildings and spaces (i.e., abandoned areas, brownfields), avoiding demolition and construction, valorising the existing heritage to revitalise urban spaces, and creating new economic and social opportunities in collaboration with local stakeholders.

The adaptation of these areas initiates with a strong political will to meaningfully transform spaces and involves an integral urban planning approach. Large industrial complexes and/or historic constructions that have been abandoned, are framed in a modernisation plan for the whole area which recognises its historical value. Buildings are regenerated and repurposed using new design approaches, reducing waste, and leveraging heritage to enhance the local identity and generate economic opportunities for local actors and citizens.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** The buildings and areas to be regenerated are to be identified and well delimited. Buildings need to be in a conservation state that allows proper regeneration. Construction materials and important budgets are still necessary, but use of recycled and reused materials is often a project requirement. In terms of land reuse, options may consider the planning of new constructive assets, making best value of existing infrastructures and materials, other options may consider regenerating abandoned space for green land use which may have multiple functions such as landscape, biomass production, gardens, leisure, etc. Such new land uses may be implemented for long-term or short-term periods. The latter option may be of interest in a context of local rapidly changing socio-economic factors.
- **Technical:** The regeneration of old buildings and successful re-design of their spaces requires professional skills to ensure safety, quality, and attractiveness of the final project. This CSS requires the existence of local professional skills or the capacity to bring them on for the project. Moreover, these approaches are framed in neighbourhood-wide projects, meaning that urban planning skills aligned with this approach are also necessary to ensure the coherence of the intervention.
- **Context**: Cities need to have the ownership or the regulatory capacity to make decisions over the heritage buildings or areas. Experience on similar projects, or the possibility to learn closely from other similar regeneration projects is also important both for public and private actors.

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

Neighbours and local actors need to be engaged at different stages of the CSS, as they will be fundamental to identify uses for the new facilities and ensure they have a positive impact. To revitalise old areas, pop-up temporary activities during the regeneration process can help attract citizens and target groups.

The engagement of the private sector is also necessary to understand its capacities and incentives to participate in the project and find the right balance. Engagement with educational institutions of the construction sector is also an interesting approach to build capacities for the future.

**Type of R Strategy**

Rethink, Reuse

**Technology Readiness level (TRL)**

TRL 8

**Financial effort**

★★★

**Stakeholder engagement**

★★

**Types of territory**

Rural areas, Cities, Metropolitan areas

**Key product value-chain**

Construction and buildings

**Sectors involved**

A. Construction

G. Wholesale and retail trade

L. Real Estate Activities

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- Industrial complexes and old buildings are often wide constructions and whose materials have still limited recycling potential. Avoiding the demolition of these spaces avoids an important amount of waste generation and reduces the use of materials compared to raise up new buildings. Approaching the regeneration work from a circular perspective can also help make these spaces more sustainable in time and reduce the environmental footprint of the intervention.
- Regeneration projects focusing on heritage revalorisation have the potential to revitalise abandoned areas and bring new opportunities to what are often vulnerable neighbourhoods in most cities. A neighbourhood-wide approach with a right engagement of local actors can improve citizens lives and bring new economic opportunities to the area.
- In many cases, these approaches have created a new added value for the city, reinforcing its identity, cultural offer and international city branding. This increases the capacity to attract further investment, increase economic sustainability of the project and future initiatives.
- Reduction of pollution, reuse of existing materials and foundations, and avoid demolishing and decommission.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- One of the most important challenges is the correct implementation of the projects. This CSS implies important public works and urban developments that can take years to initiate and finalise. Long-term agreement within political actors in the city that ensure a coherent approach and support through time are important to ensure final results and future sustainability.
- Cities do not always have control over key buildings or old industrial areas that need reconstruction works. Sometimes they belong to supra-local authorities or to private entities, which have little incentives to improve their condition. Cities need to have some leverage at regulatory or political level to push these actors to react, or the project can be stuck for years or never take place.
- This CSS requires economic efforts from the city side, and its capacity to attract additional investment to execute the works, but also to attract key actors to the space and generate economic activities in the area that help to regenerate old and often marginalised areas. Without proper capacity of mobilisation of the private sector and social buy-in, these financial efforts risk having limited impact in the area in the long-term.

**Examples**

1. **22@ District (Barcelona**). Poblenou area in Barcelona used to be an industrial area increasingly marginalised after deindustrialisation. In July 2000, the 22@ Plan was approved and included in the Metropolitan Mater Plan, foreseeing an urban, social and economic refurbishment of the area. The Plan included regenerating buildings and adapting to the existing landscape, creating 4 million $m^2$ new floor space to productive activities, as well as housing, services and green spaces. Partnerships with private sector and coherence over different municipal governments have contributed to generate a vibrant economic area with local and international presence in 2020s.
2. **Halele Carol (Bucharest, Romania) (H2020).** The Hesper factory is located in a building in the oldest industrial area of Bucharest and continues operating there. With time, it has stopped using several of the old halls. Halele Carol began as an initiative led by local alternative youth, the city council and private industries to revalorise industrial heritage in 2013. Several buildings have been regenerated, and nowadays leisure and productive activities take place and find synergies in the same area.
3. **EU-funded Project TIMBRE (FP7-ENVIRONMENT):** Tailored Improvement of Brownfield Regeneration in Europe. Timbre endorses tailored mega site regeneration by providing updated information on state-of-the-art technologies and tools. The project supports integrated assessments of regeneration options for particular sites and facilitates contaminated sites portfolio management by setting the right priorities.

**References:**

Centrinno project – New Centralisites in Industrial areas as engines for innovation and urban transformation. https://centrinno.eu/

Barcelona City Council – 22@ office https://ajuntament.barcelona.cat/ecologiaurbana/22barcelona/en/

OpenHeritage project (H2020)– Halele Carol (Observatory Case)

https://openheritage.eu/halele-carol/

TIMBRE (FP7-ENVIRONMENT): https://cordis.europa.eu/project/id/265364/reporting

| Map | Design | Implement | Tools | Circular Systemic Solutions |
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## 1.4. Supporting waste sorting in works and demolitions

### Supporting waste sorting in works and demolitions

This CSS focuses on the engagement of the whole value-chain to improve the sorting and reuse of construction waste through the provision of support services to developers and construction companies during their demolition works. A publicly promoted entity (in the form of a PPP, consortium or company) specialised in supporting the recovery of construction and demolition waste (CDW) during construction can be part of the projects and provide specific services at different stages. During the first stage, it can support with the interpretation of current regulations, planning the demolition activities and conducting on-site studies in partnership with developers. In the implementation stage, it provides concrete guidelines and technical assistance on how to manage on-site sorting, help with the separation of materials and even assume the removal of materials for reuse. In some cases, the same entity can facilitate contacts with recycling companies and related value-chains.

Such an entity can also become a forum to engage with stakeholders in the construction sector for further dialogues, train professionals and companies in best practices for CDW reuse and generate new jobs for unemployed people in the city.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and necessary contextual conditions to enable the implementation or ensure the success of the solution.

- **Material:** Depending on which role is given to the platform, some equipment to help sort or remove waste from construction sites (also including digital technologies and equipment), or spaces to storage waste in the city might be necessary.
- **Technical:** It is fundamental that this entity counts with specialised staff and expertise on current regulations regarding CDW separation, and existing methods to valorise it, in order to become a valued partner in construction projects.
- **Context:** Existing regulations and public recommendations issued by public authorities on how to sort, remove and reuse construction waste are necessary to make this collaboration more attractive to private developers and enhance these efforts. The success of the initiative will require that value-chains to valorise main CDW are already established in the region. Systems to reuse and exchange materials within the city can also increase the impact of the initiative.

**Type of R Strategy**

Reduce, Reuse, Recover

**Technology Readiness level (TRL)**

TRL 6-7

**Financial effort**

★★

**Stakeholder engagement**

★★

**Types of territory**

Cities, Metropolitan areas, Provinces, Regions, Countries

**Key product value-chain**

Construction and buildings

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia)

The entity needs to act as a partner in construction projects, being able to bring value and improve existing processes along the project. At the same time, it is an initiative bringing together actors from the value-chain to enable a forum of discussion and technical exchange and support. Therefore, it is necessary that stakeholders from the entire construction value-chain participate and bring their expertise to the entity (architects, recycling centres and companies, city council, engineers, construction companies). Strong links and interactions with waste valorisation chains are also necessary to ensure the results in the different projects.

Additional actors can be engaged in concrete projects and to discuss future regulations or approaches, such as universities.

The outreach of the initiative should also extend vocational training centres and design hubs to build more local capacities.

**Sectors involved**

B. Mining and quarrying

F. Construction

H. Transportation and storage

L. Real Estate Activities

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The main impact of this initiative is the reduction of CDW during projects where the entity is engaged, ensuring correct application of regulations, implementation of more effective protocols to sort and remove waste, and enhancing the reuse and recycling of materials through the connection with waste valorisation actors.
- Improving the separation and removal of CDW increases their potential for reuse and recycling, increasing the effectiveness of current techniques and generating more added value. If these materials are sold or reused in public buildings, this can generate direct economic gains or savings to concrete projects.
- The development and piloting of better sorting and removal techniques in real construction sites, and the tight collaboration between the entity and private stakeholders generates more trained professionals in this domain and increases the capacities of the sector to better treat CDW.
- The collaboration of different stakeholders and institutionalisation of this work can help build strong foundations of the city's circular economy on this sector, also serving as a technical forum and space for dialogue.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- The success of this initiatives relies on the entity's capacity to effectively collaborate with the private sector and bring an added value to projects – in terms of savings, effectiveness of solutions, etc. The collaboration with this entity needs to be perceived as an improvement for projects and not an administrative burden for developers, or the potential impacts of the initiative might be hindered by a negative perception.
- The set-up and maintenance of an initiative of this kind has an important initial cost, and a learning curve. The strategic approach, good connections with the sector and right incentives are necessary to ensure its profitability and economic sustainability in the long-term, but an initial and sustained effort is necessary.
- The benefits of this initiative are limited to the capacity of the local/regional ecosystem to absorb and valorise several CDW streams, and to the existing treatment facilities and logistic platforms (including containers and storage spaces) to support the transportation and valorisation of waste.

**Examples**

1. **Baukarussell consortium (Vienna, Austria**): Austria has several national norms regarding the recycling of construction materials (including the standards ÖNORM B3151), which apply to dismantling procedures for buildings generating more than 750 tonnes of waste. Promoted by the city, Baukarussell is a consortium of different actors of the construction value-chain that partner with private developers and help them plan the demolition, sort and remove reusable waste from the site and connect with valorisation chains. In the first pilot of this scheme, the collaboration generated EUR 100 000 in economic turnover and prevented 450 tonnes of waste.
2. **Democlés initiative (France):** Democlés initiated as a collaborative project involving a wide range of stakeholders of the French construction sector, partially financed by the French Environmental Agency (ADEME) and environmental company Ecosystème. The project developed guidelines and trainings and provided technical support in construction sites to improve the sorting and removal of CDW. Democlés supported both with preliminary studies, technical assistance on-site and connecting with valorisation value-chains.
3. **EU-funded projects**

- **HISER (H2020):** Holistic innovative solutions for efficient recycling and recovery of valuable raw materials. HISER has developed and demonstrated holistic, technological and cost-effective solutions to increase recovery rates from increasingly complex CDW with due regard for circular economy principles on the value-chain in the construction sector (from buildings' end-of-life to new buildings).
- **ICEBERG (H2020):** Innovative Circular Economy Based solutions demonstrating the efficient recovery of valuable material Resources from the generation of representative end-of-Life building.

**References:**

Official page of Baukarussell: https://www.baukarussell.at/about-us/

Circular Economy European Stakeholder platform – best practices

https://circulareconomy.europa.eu/platform/en/dialogue/existing-eu-platforms/baukarussell-recovery-oriented-demolition

Official page Democlés : https://www.democles.org/

UrbanWins (H2020) project best practices list: https://www.urbanwins.eu/democles/

EU-funded projects

HISER (H2020): https://cordis.europa.eu/project/id/642085

ICEBERG (H2020): https://cordis.europa.eu/project/id/869336

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## 1.5. Urban Resources Cadasters

### Urban Resources Cadasters

This CSS consists of gathering and systematising knowledge about local resources and creating a coordination mechanism across the city to ensure the proper reuse and recovery of materials from construction and demolishing. The focus is on enhancing material stock reutilisation across different works across the city for one or several resources.

It is necessary to establish a governance system for material stocks of the building environment that includes the identification of key materials, enforces and improves relevant regulations, and helps public authorities to visualise flows of materials to promote their reuse and exchange. The coordination mechanism gathers data regarding how much material stock from current and upcoming construction works will be generated and needed, maps storage areas for these materials, and identifies needs of additional infrastructure. Once it is settled, the city can help to allocate resources from one project to another to save costs (for instance, using land masses extracted from one construction site as raw material for another).

This governance model should be scaled to regional level to enable the exchange of more materials among more cities in their public works, reducing storage costs across time.

#### Resources and pre-conditions

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This approach requires the existence of enlargement of storage facilities for some materials, and/or some transportation equipment and logistic systems at local and or regional level to ensure that the recovered materials can be timely distributed and correctly stored if needed.
- **Technical:** An initial mapping of existing storage and logistic facilities is necessary to understand the local and regional capacities to manage these materials. Technical expertise from key experts within and from outside city authority is required to identify targeted materials and protocols to handle them. Digital infrastructure is also an important asset that would allow to build a dynamic system to organise and visualise the material stocks and flows and assign resources between projects over time.
- **Context:** The establishment of a new governance mechanisms requires strong political will that the institutional framework can support this new approach. Existing regulations or guidelines providing an accepted taxonomy of CDW and other parameters to assess the type and quality of resources are a requirement to set up this mechanism. The existence of cities networks at regional level and supra-local support can help to scale the initiative beyond one city and generate more impact and efficiencies.

#### Type of R Strategy

Recover, Reuse, Rethink

#### Technology Readiness level (TRL)

TRL 6

#### Financial effort

★★

#### Stakeholder engagement

★

#### Types of territory

Cities, Metropolitan areas, Provinces, Regions, Countries

#### Key product value-chain

Construction and buildings

#### Stakeholders

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

The most important stakeholders to involve are private sector actors involved in the construction sector, public officials in charge of public works in the city, and CDW specialised actors that are key in the transportation and storage of materials. In the longer-term, supra-local public authorities and actors valorising CDW also need to be more intensively engaged to scale the impact of the initiative.

#### Sectors involved

B. Mining and Quarrying

F. Construction

L. Real Estate Activities

O. Public administration and defence

#### Impact

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The main impact of this initiative is reducing the extraction and production of construction materials through the generation of synergies and reuse of materials between construction sites.
- Additionally, this approach can generate important cost savings between public sector projects, reducing the costs of disposal for some of the projects and the materials cost for the ones reusing the materials.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- For some materials, which require processing before reuse or that are lower quality, it can be more difficult to establish an efficient process, and economic viability might be less obvious, reducing the incentives to scale the initiative.
- In the long-term, a proper exchange system with other municipalities is necessary for the sustainability of the approach, as timings of different works in one single city might imply too much time of storage to make the system economically interesting. This also will require important institutional changes for many municipalities and more complexity in terms of storage facilities and transportation, making the necessary scale up more difficult to achieve.

**Examples**

1. **Excavated land mass coordination group (Helsinki, Finland):** The city of Helsinki founded the coordination group with the objective to support exchange of land masses across the city's public infrastructure works to avoid wasting excavated land in some works and buying land for other projects. In the first years of the programme, the city saved EUR 32 million, 4.5 million litres of water and 11 300 tonnes of $CO_2$ emissions.
2. **CREATE Project (several countries):** This project funded under the ERA-NET Urban Transformation Capacities (H2020) works with five cities (Vienna, Brasov, Gothenburg, Rennes and Nijmegen) developing a system to collect relevant data about material stocks and flows of public constructions sites. This also entails creating common standards to classify the type of materials and flows, supporting the governance structures within the different cities, and developing visualisation tools that can support the mapping and distribution of resources.
3. **MADASTER:** The digital library of materials.
4. **GRONDBANK-TRACIMAT (Flanders):** Logistics, infrastructures, and traceability of soil materials as raw material for building materials/products.

**References:**

Official Helsinki page on the project: https://helsinginilmastoteot.fi/en/city-climate-actions/land-mass-coordination/

ERA-NET Cofound Urban Transformation Capacities (H2020): https://jpi-urbaneurope.eu/projects/

MADASTER: https://madaster.com/

GRONDBANK: https://bouwen.vlaanderen-circulair.be/en/cases-in-flanders/detail/grondbank

| Map | Design | Implement | Tools | Circular Systemic Solutions |
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# 2. Food water & nutrients

## 2.1 Decentralised bio-waste collection and treatment

### Decentralised bio-waste collection and treatment

As for a diversity of waste streams, the valorisation of bio-waste finds important challenges in the domain of collection and transportation, with the added challenge that this waste has shorter time of processing. This CSS approaches an integral method engaging stakeholders from the whole value-chain in very localised settings to collect and begin the process of waste valorisation in a decentralised manner.

The solution leverages the availability of bio-waste, especially food waste, in the majority of settings, and proposes a first step of valorisation in proximity of the bio-waste sources via the installation of digesters that can produce biological by-products. Digestate and biogas produced in these local digesters can then be distributed to different stakeholders within the local area or beyond, such as farms or chemicals companies producing products for the agricultural sector (i.e., fertilisers, pesticides etc.).

The CSS also involves an important degree of public engagement and awareness, as public collaboration is necessary to properly separate and dispose bio-waste, so that it can be effectively treated in these intermediary facilities.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS relies on the installation and maintenance of micro-scale anaerobic digesters (or other small-scale treatment installations) that produce biogas and digestate or relevant biological by-products. The establishments and households participating in the collection also need to have (or be provided) adequate storage facilities or containers. Finally, optimised logistic systems and vehicles are necessary to collect the bio-waste in convenient frequencies.
- **Technical:** Staff with the technical knowledge to operate the plant and ensure its correct functioning and maintenance is necessary. The availability of technical components and machinery capable of operating at a local scale is also fundamental to implement this CSS.
- **Context:** An existing ecosystem or local value-chain capable of valorising digestate and biogas is required, notably involving farmers and chemical industry. Regulations or local ordinances establishing waste separation practices for households or establishments that reinforce or don't block the proper collection of bio-waste are also important for the first steps of the process. Finally, local regulations also need to be flexible regarding the conditions to install digestors in specific areas.

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia)

This CSS involves a wide spectrum of stakeholders across the entire value- chain as the engagement of all of them in the approach is fundamental to obtain results. These actors include local waste management companies, local authorities, food waste generators such as households or food processing companies like restaurants, canteens or retail, and consumers of biological by-products such as farms and industry (chemical industry mostly, for the production of fertilisers or other agricultural inputs).

**Type of R Strategy**

Reuse, Recover

**Technology Readiness level (TRL)**

TRL 6

**Financial effort**

**Stakeholder engagement**

**Types of territory**

Rural areas, Cities

**Key product value-chain**

Food, water and nutrients

**Sectors involved**

A. Agriculture, forestry and fishing

E. Water supply, Sewerage, Waste management and remediation activities

I. Accommodation and food service activities

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The proximity of digestate plants reduces the transportation costs of the raw bio-waste to larger and more complex plants at regional or provincial level.
- The treatment of local bio-waste at proximity offers new opportunities of waste valorisation and reuse within the same municipality (for instance, using digestate for fertiliser for the city gardens and parks).
- The local treatment and redistribution can also increase the visibility of the results for the public and increase collaboration among local actors in building a more resilient value-chain.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- The system often requires a good quality of the bio-waste so that it can be properly treated, and the plant is cost-effective, relying on the capacity of waste generators to properly sort and dispose it. Local ordinances and waste collection practices, distribution of buckets and containers, intensive communication with actors, or high collection frequencies can help to improve the sorting of waste and the overall quality.
- Good logistic systems and equipment are particularly important for a type of waste that in urban settings can generate inconveniences to neighbours such as smells, or even health hazards.

**Examples**

1. **Bio-digestors in the urban farm (Great Lyon, France).** The Great Lyon area didn't have a concrete bio-waste collecting system nor had any value stream created around this type of waste before the DECISIVE project (H2020). During the project, a pilot took place in a suburban area in the proximity to the farm of the public school of agriculture (CFPH). The farm hosts the digestors and was the main user of the generated by-products. Several establishments and facilities in the proximity volunteered to participate in the pilot and generated enough bio-waste for the plant to operate successfully.

2. **Reducing costs with local solutions (Dolina, Italy).** Dolina already had established an efficient bio-waste collection system in the city, managed by a private company and based on a door-to-door collection. However, the treatment plan was located far from the city, increasing losses and transportation costs. In an effort to reduce these costs and increase efficiency, the local plant was installed and new synergies were built across the local value-chain. After the pilot during the DECISIVE project, the company was also considering including garden waste in the mix and finding local options to valorise this bio-waste.

**References:**

1, 2) DECISIVE (H2020): http://www.decisive2020.eu/

## 2.2 Reuse of grey and black waters for agricultural production

### Reuse of grey and black waters for agricultural production

Grey and black waters of urban settlements are a source of reusable substances and nutrients. Several technological systemic solutions approaches have been testing how to transform this traditional waste into new raw materials that can reinvigorate local agricultural production and industrial economies.

Some technological systems provide solutions to recover nutrients and energy of grey and black waters at the city or neighbourhood level, as a complement to sewage plants or integrated in the normal water management cycle. Plants conducting anaerobic digestion or relying on other methods can process the overall wastewater from cities or neighbourhoods, generating a series of by-products such as treated sewage sludge and biogas that can be used for agricultural production of non-alimentary plants (e.g., biomass and forestry production) and for city district heating.

Besides the nutrients recovered through different techniques and of great interest for agricultural production such as nitrogen and phosphorus, the treatment of grey and black waters for nutrients recovery at neighbourhood or building level can also help reduce water consumption, obtaining water that can be reused for some concrete activities (although normally doesn't include human or animal consumption).

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS has important material requirements in terms of the necessary equipment and its often costly installation in nearby sites. Availability of land to build such facilities is also an important requirement, especially in limited urban developments. Important financing and expected returns on the investment are necessary to justify the costs of setting it up.
- **Technical:** The nature of these components often requires strict health and environmental controls. It is important that the facility counts with staff and support institutions that have the capacity to monitor results of the water processing and assess the quality and safety of the products obtained. Availability of experts in water treatment and engineers on the technical solution is necessary.
- **Context:** It is necessary for the launch and success in the long-term that there is a legal framework enabling the recovery of grey and black waters. Specific regulations about some of the nutrients recovered from these materials and on which sectors they can be used are also relevant to determine the extent of recovery potential and cost-efficiency of some of the facilities.

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

The deployment of this CSS requires an important commitment of a number of very specific actors. City authorities act as project managers and orchestrators, while construction and real estate companies need to be engaged and brought on board if smaller scale projects are to be deployed at district or neighbourhood level. Special pipes are to be installed or some spaces need to be saved for nutrient recovery.

Chemical and agricultural companies in the local arena that will become the final users of the recovered material are also to be involved as a last step in the value-chain and are to be integrated in the planned activities.

**Type of R Strategy**

Recover, Regenerate, Reuse

**Technology Readiness level (TRL)**

TRL 7

**Financial effort**

**Stakeholder engagement**

**Types of territory**

Rural areas, Cities, Metropolitan areas.

**Key product value-chain**

Food, water and nutrients.

**Sectors involved**

A. Agriculture, forestry and fishing

D. Electricity, gas, steam and air conditioning supply

E. Water supply, Sewerage, Waste management and remediation activities

F. Construction

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- Reduction of water consumption.
- Reduction of water pollution (eutrophication).
- Recovery of nutrients such as nitrogen and phosphorus, and creation of more circular and local systems, where nutrients are rapidly collected, treated and can be used for local activities. Reuse of Nitrogen (N), Potassium (K) and Phosphorus (P).
- Generation of energy from renewable sources such as biomass anaerobic digestion.
- Awareness-raising – proximity allows to see impact and potential of circular solutions, engages citizens to collaborate and understand implications and results of actions.
- Materials to be reused and enhance soil recovery and remediation efforts, including fertilisers for some specific plantations.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- There are relevant technical barriers regarding the use of the recovered nutrients and materials from black and grey waters, especially for agricultural production, therefore reducing the number of reuse opportunities.
- Despite European minimum requirements to reuse recovered nutrients from black and grey waters, there are still a lot of different regulations at Member State level, which makes it difficult for solutions to be replicated in different contexts.
- The deployment of this solution requires an important upfront investment and very specialised knowledge, which needs to be backed by strong political will and have a solid business plan.

**Examples**

3. **Demonstration site of circular solutions (Sneek, the Netherlands).** Through the H2020 funded project RUN4LIFE, 32 house units with a population of approximately 100 people piloted a hygienically safe production of NPK fertilisers thanks to the installation of a HYPER-THERMOPHILIC ANAEROBIC DIGESTION (HTAD) of black waters. The technology also included low flush vacuum toilets to reduce water consumption, which made the system more efficient.
4. **Circular business centre (Vigo, Spain).** The business centre Centro de Negocios Proto do Molle was equipped with separate collection of black and grey waters, which were reused for toilet flushing and treated with an Anaerobic Membrane Bioreactor (AnMBR) to recover resources and nutrients. The recovered materials were used to produce fertilisers, biogas and treated water for non-consumption uses.
5. **Bio-waste for woody biomass production (Vilnius, Lithuania).** Through the project NutriBiomass4LIFE, the city of Vilnius deployed a circular system that recovered nutrients from black waters in municipal facilities. Since these nutrients couldn't be used for agricultural production of food, they were used by local exploitations of biomass (forestry). The biogas recovered during the process, with other by-products, was also used for heating the city.

**References:**

1) RUN4LIFE (H2020): https://run4life-project.eu/

2) NutriBiomass4LIFE (LIFE): https://www.nutribiomass.eu/project/

## 2.3 Residential rainwater harvesting and reuse

### Residential rainwater harvesting and reuse

This CSS focuses on improving the water cycle by capturing more resources, improving their use and ensuring they are reused in a cost-efficient way.

In inhabited areas, rainwater can be harvested through different solutions, such as residential roofs directing to water storage tanks, vapour condensation units, capturing surface runoff water and building bioswale systems.

The reclaimed water can then be directly used for residential purposes or agricultural activities, or it can be stored for drought periods or returned to regenerate natural aquifers.

Besides the capture of water, this CSS implies a holistic approach towards water consumption, ensuring a sustainable use of the reclaimed water and maximising its reuse for each of the activities. For instance introducing precision irrigation techniques on local small crops or reducing unnecessary water consumption for daily activities (low consumption toilets, behaviour change).

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS requires the installation of technically advanced equipment for several steps of the water cycle - to capture and store water, to build and bring into operation bioswales systems, or vapour condensation units. It also requires the adaptation of residential units for the harvesting of water and related works.
- **Technical:** The operation of these local water capture and use approaches requires available expertise to operate and maintain machinery, as well as technical knowledge about water treatment and quality to ensure a correct operation of the solutions.
- **Context:** Local regulations regarding urbanism and building construction, and water usage and reuse are fundamental in order to allow for several elements of the CSS to be implemented. The success of this holistic approach also depends on local climatic conditions and demand of products.

**Type of R Strategy**

Recover, Reuse, Regenerate

**Technology Readiness level (TRL)**

TRL 6

**Financial effort**

★★★

**Stakeholder engagement**

★★

**Types of territory**

Rural areas, Cities, Metropolitan areas

**Key product value-chain**

Food, water and nutrients

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

At a hyper-local level, where this approach is used in specific properties or small communities as a way of reducing their ecological footprint, the key stakeholders are the inhabitants or owners of the property, providers of the technology and the city authorities, which can support the implementation of these approaches.

In urban areas, some solutions can be implemented in urban parks, parking areas, public buildings, etc. and engagement of the community can be positive for awareness-raising and accountability of these initiatives.

**Sectors involved**

A. Agriculture, forestry and fishing
E. Water supply, Sewerage, Waste management and remediation activities
F. Construction

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- Water is an increasingly scarce resource in many regions, with limited availability during some seasons and excess in others. The capacity to capture water during wet seasons and use it to regenerate the ecosystem or use it during dry seasons has the huge impact of reducing hydric pressure to ecological systems and avoid the over-exploitation of such a natural resource.
- Several capture solutions such as bioswale systems also have in some cases the potential to prevent other related water challenges such as the effects of floods, impacting positively in the resilience of communities' face to different climate-challenges.
- The deployment of water capture and reuse solutions in communities and public spaces can help to raise awareness among citizens about a pressing and important challenge of our societies and demonstrate how new solutions can also provide quality and comfort while ensuring the sustainability of settlements in the long-term.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them.

- The majority of harvest and efficient use of water require the acquisition and installation of complex and expensive equipment. This implies that the initial costs are high, and that technical expertise needs to be available locally in the long-term to ensure the correct operation of this equipment.
- Water remains a topic quite distant for the majority of citizens and there is limited awareness on the future challenges at urban level. Pilots and experimentations tend to be done at hyper-local level and limited experiences at larger scale exist to be emulated.
- Efficient water management has an important behaviour change component, and citizen awareness is critical. However, many areas suffering water challenges are also touristic spots that receive a very high number of visitors – often with limited sensibility to the issue during holiday seasons and that leave an important ecological footprint on the region. The importance of these flows in local economies is often too important to allow communities to force a change.

**Examples**

1. **Rainwater harvesting for residential and agricultural use (Mykonos, Greece).** The EU-funded/H2020 project Hydrousa explored the integration of water harvesting techniques in the village of Ano Mera, where rainfall water was collected and reused for daily residential activities and to irrigate proximity lavender crops. The initiative was targeting the recovery of at least 10 $m^3$ litres of drinking water, the irrigation of 0.2ha of lavender crops and increase up to 200m3 litres the local aquifer.
2. **Circular water management in Eco touristic exploitation (Tinos, Greece).** Through Hydrousa project the Tinos Ecolodge integrating self-sufficient practices, introduced a circular water cycle via the collection of rainwater through roof containers and vapour condensation units. Nature-based solutions such as wetlands were also deployed to contribute to the disinfection of waters, which are finally employed as irrigation water for small crops of local vegetables.

**References:**

Hydrousa project official website: https://www.hydrousa.org/

| Map | Design | Implement | Tools | Circular Systemic Solutions |
|---|---|---|---|---|

## 2.4 Public and free water points

### Public and free water points

This is a CSS often explored by cities, consisting in making available to citizens the access to potable and drinkable water for free in several points across the city, with the objective of reducing the consumption of water bottles by providing water to refill them. Besides the availability of the fountains, it is important how these locations are marketed (providing information, visible water houses, communication campaigns, etc.) in order to ensure that they get the maximum impact among public.

This initiative is often combined with additional objectives, such as providing citizens and visitors with cold islands to find refuge from heat, for instance spreading water to refresh during high temperatures, or providing further information about hydration and water consumption.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS requires the acquisition and deployment of the water tanks that will be distributed across the city to make water available. Besides the acquisition of the machines, there is need to foresee the installation and connection to existing pipes in all locations, as well as maintenance costs to ensure the correct functioning of the machines, quality of water and normal maintenance.
- **Technical:** Any technical skills are necessary for this initiative but providing companies should provide maintenance services in their contract. Previous analysis on where the most suitable and impactful areas are to locate the machines can help to ensure a correct location for them.
- **Context:** This initiative should be implemented in the framework of an existing city strategy to address plastic waste, or resilience plans to ease access to cold spaces in the city. Political will to ensure its sustainability is also necessary, as public funding is fundamental to deploy and maintain this service to citizens.

**Type of R Strategy**

Reduce

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

**Stakeholder engagement**

**Types of territory**

Rural areas, Cities

**Key product value-chain**

Plastics

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

It is not necessary to engage a lot of stakeholders to implement this practice, although it can be used to raise awareness on water consumption, resilience and plastic waste.

However, a good communication and marketing of these resources is fundamental to ensure that the public feels attracted to use the fountains or water houses and that they realise that they are contributing to reduce waste.

**Sectors involved**

E. Water supply, Sewerage, Waste management and remediation activities.

I. Accommodation and food service activities

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The main impact of this solution is the reduction of plastic waste generation. Offering the possibility to refill water bottles in the street without effort and for free encourages citizens to reuse their plastic bottles and discourages them from buying new bottles to get water.
- The reduction of water bottles consumption also entails a reduction of $CO_2$ emissions that would be related to the production and transportation of new water bottles.
- This solution also impacts positively in the well-being and health of citizens and visitors during months of heat, providing fresh spots in the city where people can find some relief from the heat and providing a perfect platform to raise awareness about climate change and the challenges laying ahead.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- The sustainability in time of the business model is a clear challenge for this CSS, as it relies entirely on the city council covering the entire costs of providing free water both to citizens and visitors. Analysis highlighting the impact of the initiative are important to justify its cost in the long-term.

**Examples**

1. **Water Ecological Islands programme (Turin, Italy).** Through the H2020 funded project UrbanWINS (H2020) the city deployed 168 water houses and points providing free drinkable water to citizens across the city. The objective was to reduce water bottles consumption and the polluting costs related to the transportation and production of bottled water. In one year, it was calculated that the initiatives saved 668 tonnes of $CO_2$ emissions and 29 million plastic bottles.
2. **Alpine water fountains in Vienna (Vienna, Austria).** The city of Vienna has installed more than 900 drinking water fountains across the city, mostly in parks, playgrounds, markets or touristic spots. They ensure a small discharge of water to avoid spilling and wasting it. Some water houses also offer some light water spray to refresh atmosphere during hot weather times. The city has also made sure that a map with the location of water fountains is available in different city apps (dedicated to find water resources, but also the general city map).

**References:**

UrbanWINS (H2020) reference to the case: https://www.urbanwins.eu/water-ecological-islands/

City of Vienna official page: https://www.wien.gv.at/video/1041/Wiener-Wasser-der-Sommerdrink-des-Jahres

Vienna drinking fountains city map: https://m.wien.gv.at/stadtplan/#zoom=13&lat=48.2009&lon=16.3449&layer=trinkbrunnen&base=karte

# 3. Plastic

## 3.1 Small-scale eco-credits and rewards

### Small-scale eco-credits and rewards

This CSS consists in the implementation of citizen engagement processes at neighbourhood and city level to promote plastic recycling with an important component of awareness-raising, use of innovative tools and promoting the participation of a wide range of local stakeholders.

Despite the possibility to separate plastic waste from the other waste streams in many cities, much of the packaging waste is still mixed with residual waste, and sometimes sorting can be improved.

To motivate households to recycle plastic and packaging waste, a rewards system can be put in place, so that they get bonus or benefits for their contribution to recycling waste. This system requires the deployment of smart containers that can identify the resident that is contributing with plastic waste, and the establishment of a system of 'eco-points' or rewards that give them discounts to buy in local shops and restaurants, equipment, or public services.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** The system can rely on smart "containers" that are able to identify the user and the amount of material. Therefore, the acquisition of the adapted equipment is necessary to launch the solution. For larger projects, adapted software to manage the information about users and their rewards might be necessary.
- **Technical:** No technical knowledge or capacities are particularly relevant for this CSS. The collection system could be integrated within the normal waste collection of the city, reducing logistic adjustments.
- **Context:** The capacity to effectively recycle and reuse plastics will depend on the overall capacity of the value-chain in the region or country. The predisposition of local shops and establishments to participate in publicly led initiatives is also important, as they are the key part of the reward system.

**Type of R Strategy**

Recover, Reuse

**Technology Readiness level (TRL)**

TRL 7

**Financial effort**

★

**Stakeholder engagement**

★★★

**Types of territory**

Rural areas, Cities, Metropolitan areas

**Key product value-chain**

Plastics

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

The whole CSS is around citizen engagement and awareness-raising as the reward system acts more like an incentive than an economic reward. Hence, communication efforts are fundamental to ensure that long-term behavioural change occurs and that correct sorting is understood in households.

Local shops and establishments, both public and private, are fundamental actors for the success of the solution as they need to be willing to participate in the rewards scheme. City authorities can economically support this initiative, but still might add an additional layer of management for many of the local shops.

**Sectors involved**

G. Wholesale and retail trade, repair of motor vehicles

H. Transportation and storage

P. Education

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The system positively reduces the amount of plastic that ends up being disposed in residual waste, encouraging and rewarding citizens and households that make an effort to correctly dispose it.
- The CSS has an important social impact in terms of raising awareness and building capacities among citizens about the importance of plastics, how plastic can be recycled, and what efforts different actors and public authorities are making around this topic.
- Small-scale pilots can be a first step to install smart systems at city-wide level, rewarding households or local establishments that recycle plastic properly with reduced taxes, benefits, public recognitions, etc.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- The scaling-up of this CSS beyond district level can be challenging due to a more complex management system and would require an increased budget to ensure the reward system.
- In the long-term, it is necessary to engage stakeholders from the value-chain that work on valorisation to ensure a more sustainable approach in time. However, these stakeholders already have access to their raw material and these negotiations might not be interesting for them in the current context of many cities.

**Examples**

1. **Rewarding circular plastic use (Valencia, Spain).** In the framework of the PlastiCircle project (H2020), Valencia conducted a pilot project to raise awareness among families and children on the importance to correctly sort and recycle plastic. The project conducted wide awareness-raising campaigns in schools and public spaces. Citizens interested in participating in the campaign registered to a dedicated website and received individual identification. When they deposited plastic in 'smart containers' across the neighbourhood, they could identify themselves and they received eco-points that gave them discounts in local shops and establishments.

**References:**

PlastiCircle (H2020): https://plasticircle.eu/cities/pilot-1-valencia/

# 4. Packaging

## 4.1 Deposit Return system for bottles

### Deposit Return System for bottles

This CSS incentivises the correct waste sorting in households of specific packaging materials (plastic and glass bottles, metal cans) so that they can be effectively recovered to be reused or recycled.

The implementation of the system involves the establishment of a fix-deposit amount that all consumers will need to pay when buying products contained in the specific packaging item. This deposit (often between EUR 0.05 and 0.30) will be recovered by consumers once they deposit the item (plastic or glass bottles, metal cans) in special containers located in retail stores and supermarkets. The system is also able to increase packaging collection without deposit return, only providing handy recovery containers in retail stores. The collection machines can be both public or industry-owned, and the payment scheme can also be public-led by regulation or agreed between public authorities and private companies processing waste or intermediating with producers.

For long-term sustainability and to get the right impact, it is important to accompany the initiative with a communication campaign to effectively encourage returning the items in the containers, not only to recover the deposit, but also to contribute to a more circular economy in the city, especially during initial stages of the CSS.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** This CSS requires the deployment of self-collecting machines to collect the packaging and return the deposit to consumers in an important number of retail stores. Besides the cost of equipment, the deployment of a logistics network that enables the timely collection and treatment or distribution of these packaging waste to be reused or recycled needs to be considered.
- **Technical:** It is important to ensure that the initiative is accompanied by a suitable communication campaign to avoid opposite results and ensure long-term impact.
- **Context:** The impact of this solution is dependent on the capacity of producers and waste valorisation value-chain actors to reuse and recycle the packaging collection. In the cases where a deposit is fixed for all packaging items, a regulation needs to be approved to set up this obligation. It is important to take all stakeholders' perspectives into consideration to avoid the risks of this approach and contrary impacts.

**Type of R Strategy**

Reduce, Recover

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

★★

**Stakeholder engagement**

★★★

**Types of territory**

Cities, Metropolitan Areas, Provinces, Regions, Countries

**Key product value-chain**

Packaging

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

The deposit system – through a compulsory deposit on the packaging, or via reward vouchers for recycles, implies a complex collaboration with several stakeholders in the value-chain. All actors need to be onboard the initiative and find their 'win' in the system.

Although each case needs to identify which stakeholders can lead the initiative and how they would partner, the key actors are: retailers, who might get new logistic challenges for the system, but can also benefit and use it as a means to build loyalty for customers; the producers, who need to be onboard to avoid strategies to reduce the final price of their product once the deposit is applied; and the consumers, who need to be well informed about the approach, its objectives and how they can benefit from it.

**Sectors involved**

C. Manufacturing

G. Wholesale and retail trade, repair of motor vehicles

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The deposit system has the overall potential to save raw materials, energy and $CO_2$ from the production of new bottles and packaging that is saved thanks to the reuse and recycling of bottles.
- The increased availability of bottles for reuse can also increase jobs related to circular economy.
- Important awareness-raising effects also come from this solution, asking citizens to undertake an active role for the sorting of waste and removing some barriers that might be hindering higher recycling taxes (such as inconvenient locations, lack of reward, etc.).

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- The deposit system implies an initial increase of the price for consumers. To avoid this increase, some producers that are not onboard with the initiative could switch back to single-use bottles to ensure their products remain in the right price-range and have not benefited from the collaboration on recycling. Extensive engagement and preventative regulatory or fiscal measures need to be put in place to avoid this situation.
- The retail stores participating need to be engaged and their concerns listened to. This system can generate new logistic costs for the stores selling reusables and some of them might be tempted to begin offering products that come with non-reusable or recyclable packaging under this scheme.
- If the system is not accompanied by a behaviour change from consumers, the establishment of a deposit can end up only increasing prices for consumers.

**Examples**

1. **SIGUREC return system (Romania)** – The Romanian Ministry of Environment and major private companies in the waste recycling value-chain agreed to deploy a packaging collecting system in supermarkets. They would later create a joint PPP to manage the initiative. In partnership with SIGUREC, an advanced waste collecting service, several collecting machines were located inside stores, for which shopping vouchers were delivered. During the first pilot phase of the project more than 30 tonnes of PET and of 7 tonnes of glass were collected in the SIGUREC machines.
2. **Pfand system (Germany) –** Germany has one of the earliest and most successful deposit return systems in the world. Products contained in plastic or glass bottles are applied a 'Pfand' or deposit that the consumer will get back once the packaging item is returned to special machines in the supermarkets.

**References:**

EU Circular Economy Stakeholder platform use case: https://circulareconomy.europa.eu/platform/en/good-practices/sigurec-smart-machines-recyclable-waste

Official website of the Pfand system in Germany: https://allaboutberlin.com/guides/pfand-bottles

# 5. Textile

## 5.1 Circular Textile

### Circular textile

Circular Textile Solutions (CTS) are an opportunity to implement SRMs as an input for new clothes to increase the recycling content of garments (i.e., using SRM source). This is applied for producing clothes made of synthetic fibres. Different plastic products can serve as an input (e.g., polyethylene terephthalate (PET) bottles). Concerning the end-of-life-phase, fibres of used clothes are recovered to produce fabrics that are used for purposes other than clothing as a form of open-loop recycling. Full closed-loop recycling of post-consumer-waste requires specialised recycling technologies that follow processes like sorting, separation, shredding and discolouring. CTS are designed in a way that foster reuse, repair, recycling and longer use with a low impact on the environment. Systems should ensure high levels of separate waste collection making public organisations, private companies and citizens collaborate. Known as a sector which consumes high volumes of water resources, CSS implemented at local level should ideally contemplate the establishment of circular solutions that will help to reduce the water footprint, preferably with solutions enabling more efficient use of water, the recovery of heat and nutrients from wastewater as well as the cascading use of water.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** the implementation of circular solutions on textiles requires some technical conditions which are critical for the successful development - i.e., need to establish efficient post-consumer goods collecting system (good practices are in Germany, UK, France and some Nordic countries), need of high-quality collected textiles, need for data on amount of collected textiles and need for standards for collection and processing techniques. Given the fact that many textiles manufacturing infrastructure and factories do not support circular economy models, factories need transformation of processes to install recycling machines in current setups.
- **Technical:** the actual practice in the sector, to a large extend, is dominated by the concept of fast fashion with changing trends every year. Overconsumption and habits focused on cheap clothing may hinder the uptake of new circular practices in the sector. Therefore, awareness- raising, and education of consumers are needed to help start change tendencies in the sector. Education on circularity across schools for textile (design) would help boost circular practices. Information exchange across stakeholders is key to improve market penetration of innovative start-ups.
- **Context:** these solutions require established network of industries with technological capacities in the sector as some parts of the value-chain require specialised expertise: i.e., circular design (life extension, reusable, recyclable, cleaner textiles, i.e., phase out harmful substances, microplastics); sorting of used textiles, carbonisation and rag-tearing, carding, spinning, warping, fulling, dyeing and finishing (among others). Further necessary contextual conditions may address factors related to market conditions, i.e., access to constant supply of SRM from the textile industry and access to the market in which demand of circular textile goods is secured (preferably local, or accessible via low cost fret capacities).

**Type of R Strategy**

Reduce, Reuse, Recycle

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

**Stakeholder engagement**

**Types of territory**

Large cities, Urban regions, Provinces/counties

**Key product value-chain**

Textile

Plastics

| **Stakeholders**<br>Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia). | **Sectors involved** |
|---|---|
| The transition towards circular textile and the implementation of CSS in this sector requires the implication of multiple stakeholders including citizens. Among the most relevant stakeholders to be involved:<br>• Industry: as vectors of innovation and GDP creation<br>• Administration-public authorities: facilitators and enablers through specific procurement policies and legal / economic incentives implementation. Awareness-raising<br>• Citizen: active actors as responsible consumers of textiles, breeding ground for innovative ideas, important actor for steering demand/offer of innovative circular products<br>• Academia/RTOs: support for business innovation, awareness-raising. | C. Manufacturing<br>E. Water supply, sewerage, waste management and remediation activities<br>K. Financial and insurance activities<br>N. Administrative and support service activities |

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- Extension of the useful life of the products and models of reuse
- Sustainable consumption models and sharing economy activities
- Recycling of resources from waste

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- Lack of technical expertise and knowledge at local level for all the processes needed for a circular textile sector
- Competing context with other key industrial sectors to get access to funding. This can also be seen as an opportunity to create synergies with other industrial sectors (i.e., through industrial symbiosis collaborations)
- Difficulty in raising awareness among citizen and funders/investors

**Examples**

1. **Circular Textile District (Prato, Italy).** Prato processes 15 % of all recycled clothes in the world. With their long history of expertise in reusing the waste from textile processes, Prato recycles high-quality wool produced from other parts of the world. A total of 239 enterprises in Prato have gained the Global Recycled Standard (GRS), which has made textile industry recycling stand out as one of the main industries in Prato
2. **Moment Česká republika o.p.s (Czechia)** is a Czech second-hand shop and non-profit organisation that creates funds for other non-profit organisations. Moment collects second-hand garments donated by citizens and re-uses, recycles, repurposes and resells them. Moment donates all profits from second-hand garments to non-profit organisations
3. **CircTex (InterReg)**: CircTex focuses on the development of recycling and production technologies in a closed-loop process chain for PET workwear, decreasing as such non-renewable input materials and the ecological impact in NWE textiles.
4. **SCIRT (H2020):** System Circularity & Innovative Recycling of Textiles. SCIRT aims to accelerate the transition to a circular fashion system through technological innovation in textile-to-textile recycling.
5. **RESYNTEX project (H2020):** Chemical monomer recycling for non-plastic based fibres like cotton and wool. RESYNTEX project aims at designing, developing and demonstrating new high environmental impact industrial symbiosis between the unwearable blends and pure components of textile waste and the chemical and textile industries.
6. **CIRCOAX project (COSME):** Transforming Fashion and Textile (F&T) companies towards a regenerative, circular and sustainable industry by applying a progressive and innovative approach. CirCoAx has a holistic approach to the circular economy based on the principles of regenerative industries, co-creation and community engagement models. The aim is to achieve the broadest application of circularity, considering environmental, social and economic dimensions in a balanced way.

**References:**

Circular Textile District, (Prato, IT):

Prato: building on existing local circular practices » Circular City Funding Guide

https://www.cittadiprato.it/EN/Sezioni/225/Textile-sector-and-sustainability

https://www.cittadiprato.it/EN/Sezioni/620/Circular-economy/

https://vlaanderen-circulair.be/circulargovernance/files/Prato.pdf

Moment (Czechia): Promoting reuse of textiles and circular economy | Interreg Europe - Sharing solutions for better policy

CircTex (InterReg): https://www.nweurope.eu/projects/project-search/circtex-innovation-towards-a-circular-future-for-nwe-textiles/

SCIRT (H2020): https://scirt.eu/

RESYNTEX (H2020): https://cordis.europa.eu/project/id/641942

CIRCOAX (COSME): https://circoax.eu/

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# 6. Electronics & ICT

## 6.1 Decentralised collection systems for WEEE

### Decentralised collection systems for WEEE

A fundamental challenge regarding the recovery of waste electrical and electronic equipment (WEEE) is how to organise the collection system so that most of this equipment can be properly recovered for repair, reuse or recycling. This CSS addresses this challenge through the development of decentralised collection systems that enable and encourage citizens and locals to hand over their WEEE, especially in isolated towns or neighbourhoods with little access to existing repairing facilities located in the territory.

The decentralised collection system complements the existence of collection and/or sorting facilities where citizens and companies can go directly to deposit their WEEE. The centres are often far from urban centres, so decentralised facilities can provide a more convenient and accessible alternative. This approach relies on the deployment of mobile collection spaces that can stay for a few months or weeks in specific locations, or that can be more mobile and change location every few weeks, depending on the needs of citizens. This approach also enables wider awareness-raising campaigns as they can take place upon the period that the collection point is available in an area and repeats at a certain time. The operation is often shared with different actors and can receive contributions from interested parties participating in WEEE value-chain.

This decentralised collection of house appliances and small EEE can also be done through retailer, upon new purchases or as an additional facility, enforcing existing regulations and looking at synergies between them.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** The most relevant material requirement is the availability of space in sorting centres to receive and sort the collected space, and a good organisation on how this space is used upon the reception of materials collected via the mobile system. Logistic arrangements are also necessary, which can be co-funded or shared with interested parties across the value-chain.
- **Technical:** The deployment of mobile collection points does not require specific technical capacities. However, it is necessary to have a good planning and understanding of what the best areas are to locate mobile units. An initial pilot of locations, combined with feedback from citizens can help identify progressively the best spots, dates and frequencies.
- **Context:** This CSS is a complement to existing facilities and aims to feed more WEEE to the system. Therefore, it is required that there are already working facilities and an ecosystem of actors dedicated to recycling WEEE. Regulations supporting the collection through different locations (e.g., retailers) and enhancing the reuse of EEE are also instrumental to implement the solution.

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

For this CSS the engagement of several stakeholders of the value-chain is necessary. City authorities will need to partner and arrange a cooperation system with retailers and other local stakeholders such as associations and community centres that can contribute to the decentralised collection. Logistic companies engaged in the collection and transport processes will also need to adapt to the new conditions.

Producer associations (i.e., Producer Responsibility Organisation (PRO)) and social enterprises often play an important role, as this CSS can also align with their own interest, and they can participate both on the collection or transportation efforts.

Citizens need to be highly engaged as an important element of the CSS and its awareness-raising potential. Accountability and feedback need to be ensured for sustainable results.

**Type of R Strategy**

Rethink, Reuse, Recover

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

★

**Stakeholder engagement**

★★

**Types of territory**

Rural areas, Cities, Metropolitan areas, Provinces, Regions

**Key product value-chain**

Electronics and ICT

**Sectors involved**

G. Wholesale and retail trade
H. Transportation and storage

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- This system aims to increase the amount of recovered WEEE so that it can be reused, repaired or recycled. Besides the reduction of environmental hazards generated by this waste, the reutilisation of their components supposes a reduced production of new ones, limiting environmental effects of extraction and processing of new equipment or components.
- The cost of the solution is not particularly high but can have remarkable effects in terms of increased amount of recovered WEEE.
- The decentralised collection of WEEE can increase the collection and storage capacity of the entire system, as part of the materials are temporarily stored across several small locations, giving more time to sorting centres to process materials and make space.
- The cyclicity of mobile collection spaces offers an opportunity to keep a recurrent engagement of citizens and awareness-raising campaigns, increasing the outreach and behaviour change in a more durable way.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- This solution has limits, as it is particularly useful for small EEE, like laptops, lamps, and mobile phones, but larger home appliances - which also have a larger environmental impact potential - can rarely benefit from this approach.
- This CSS focuses on the efficiency in the collection of WEEE, but the capacity of sorting it, reusing and recycling will be limited to the capacities of the city or region. Moreover, if WEEE is widely collected but is then poorly treated and recycled, it might have a negative effect on citizens' motivation to continue sorting and delivering the products properly.

**Examples**

1. **Introduction of mobile collection systems (Genova, Italy).** In the framework of the WEENMODELS project (LIFE), the city put in place a mobile collection system operating daily across the region that recurrently brought additional WEEE to the existing ecological plants. During the first pilot of this system in the city, 1.172 kg of small WEEE were collected. The city also deployed an information platform and several communication channels to interact with citizens and provide information about the results of waste recycling.
2. **Decentralising WEEE across the region (Helsinki region, Finland).** In the framework of the Collectors2020 project (H2020), in order to increase its WEEE collection capacity, the Helsinki region began enforcing European directive and collaborating with retail stores to engage them in the collection of WEEE, according to store size and types of equipment. To reach more remote areas and small localities, the region also deploys a bi-annual mobile collection system that is operated by two different actors of the value-chain. Retail stores collection is quite important, where is estimated that 7.6 kg/capita are collected, versus the 3.5 kg/capital collected in non-mobile centres.

**References:**

Collectors2020 (H2020), use-cases analysed for the project: https://www.collectors2020.eu/results/case-studies/

WEENMODELS (LIFE): https://www.weeenmodels.eu/

## 6.2 Second-hand and repair centres for WEEE

### Second-hand and repair centres for WEEE

This CSS focuses on the establishment of a system to expand the life duration of EEE and reduce the waste generated from these types of products. The approach is two-fold: it promotes a paradigm shift by raising awareness among citizens and consumers about the possibility to reuse and repair these goods (instead of replacing them); and also builds capacity and knowledge about how to improve the re-usability and reparation of products.

This solution is based on the establishment of sorting and reparation centres where electronic goods and home appliances can be stored, repaired, remanufactured and distributed at a city or regional level. This approach also includes the activation of a logistics chain for the collection, transportation and distribution of goods, and investing in outreach activities to obtain waste and encourage acquisition of repaired goods.

The operation of the centres and activities can be both delegated to private companies or be done in partnership with organisations with a relevant background, knowledge and infrastructure to assume part of the necessary tasks. These activities can also generate employment opportunities for vulnerable groups and contribute to build skills and generate new knowledge for employability.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** The basic requirement of this CSS is the availability of storage space to store, sort and repair the different appliances included in WEEE. Likewise, it is necessary to count with some spaces and networks to reach customers for repaired goods and collect appliances to be repaired. Equipment to conduct these activities, including logistics, need to be considered. Different types of partners can bring part of their resources to the operation.
- **Technical:** It is necessary to count with staff that have the skills to effectively repair EEE, and also improve their functionalities (e.g., increasing water or energy efficiency). These skills can also be transferred to new groups and can help develop impactful approaches (such as guides for more reusable products and standards, guidelines for individuals, DYI, etc.).
- **Context:** This CSS requires an important level of stakeholder engagement and awareness to participate in collection campaigns and for some others to become customers. Operations for sorting and repairing facilities can be complex and requires expertise from the private sector. It is important that the country has regulations enabling meaningful collaborations and partnerships with private sector and non-profit actors.

**Type of R Strategy**

Recover, Reuse

**Technology Readiness level (TRL)**

TRL 8

**Financial effort**

★★★

**Stakeholder engagement**

★★

**Types of territory**

Cities, Metropolitan areas, Provinces, Regions

**Key product value-chain**

Electronics and ICT

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

The public authorities implementing this CSS will need to create an agency or establish collaborations and partnerships with the private sector or with non-profit organisations to ensure the operation of the centre(s) and the engagement of citizens. This collaboration can take the form of PPPs, concessions or financial support. In any case, these actors will play a fundamental role to ensure the success and impact of the solution.

Engagement of citizens and local stakeholders is important since the beginning of operations, as they will be the ones providing WEEE and, at the same time, being the main customers of repaired equipment.

**Sectors involved**

C. Manufacturing
D. Electricity, gas, steam and air conditioning supply
G. Wholesale and retail trade
H. Transportation and storage
J. Information and Communication

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The main impact of this CSS is the reduction of electronic and electric equipment waste, promoting the reuse of old appliances, repairing them and extending their use life. The decrease of consumption of new equipment will also have an impact in the reduction of $CO_2$ emissions and materials-use to produce new appliances.
- Beside the reuse and repair approaches, the centre's technicians can also improve the performance of some of the appliances that are to be sold and increase their efficiency (e.g., reduce water use, or increase energy efficiency) for some of them.
- This CSS also involves a paradigm shift, from consuming and replacing EEE to reusing and repairing it as a common alternative. As we are still at the early stages of this approach, one of the key potential impacts of this CSS is to demonstrate the potential of this approach, increasing confidence on these types of projects, build awareness on more sustainable practices and sorting needs, and increasing the demand for the repaired products.
- Working directly with these materials can also generate more knowledge on key challenges for repair and reuse. This knowledge can be used to create guidelines, standards or technical requirements to improve the product design from a circular perspective.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- Financial sustainability is a current challenge for this CSS, especially if it relies on a partnership with a non-profit for its implementation. It is important during the development of the programme and the partnership that business models make this practice more self-sustainable and are contemplated to reduce the reliance on grants or improve the efficiency of public funds.
- The number of devices that can be repaired depends on their reparability and the extent to which their specifications allow for reuse. There are already discussions taking place on new standards to ensure that devices can be more easily repaired, and their usable life is extended.
- Unless adapted infrastructures are already in place, the initial costs of creating sorting and repair centres are quite high and setting up the operation of the whole system also requires an important effort. Political commitment and well-thought business plans can partly help to overcome these challenges.

**Examples**

1. **Independent repair service centre for electrical goods (Vienna, Austria).** R.U.S.Z. is a non-profit organisation that had traditionally worked with vulnerable groups and capacity building. The municipality of Vienna supported them in projects regarding collection, repair and reuse of electronic appliances. Thanks to this collaboration, the initiative grew and they are now leading permanent campaigns to collect e-waste from citizens, repair and resell it. Annually they repair about 400 tonnes of appliances. It is estimated that they and have reduced energy and water consumption of appliances by 20 % in old machines that are later reused.
2. **Establishment of two waste sorting and repair centres (Attika and Central Macedonia, Greece)**. In the framework of the LIFE RE-WEEE (LIFE), two new sorting centres for electronic waste were set up in the regions of Attika and Central Macedonia, in Greece. During the project lifespan, more than 5 800 kg of reused EEE was sold in the Greek market.

**References:**

R.U.S.Z official website: https://rusz.at/en/

European Circular Economy platform: https://circulareconomy.europa.eu/platform/en/good-practices/social-innovation-repair-giving-second-life-electrical-and-electronic-appliances-rusz-case

LIFE RE-WEEE (LIFE): https://www.reweee.gr/en

# 7. Cross-cutting support/governance

## 7.1 Joint long-term strategy development

### Joint long-term strategy development

This CSS focuses on creating the conditions to enable a multi-stakeholder conversation and vision on circular economy in a city or region. While public authorities need to address societal challenges, they do not have all the knowledge about certain topics and cannot do everything. The collaboration and alignment with other actors is fundamental.

The engagement of stakeholders from different value-chains and from different levels and positions in the development of a city/region-wide initiative about circular economy is important to set realistic objectives in the region (which understand departing point and constraints faced at all levels). The adoption of a holistic perspective or systems-approach is particularly important for circular economy as it engages with a diversity of sectors with specific dynamics that need to be assessed. Finally, the collaboration with a diversity of actors that properly represents the circular economy sector in the area is important to align the actions, ensure success of public programmes, and identify synergies and common goals that can help move towards common objectives and create a portfolio of projects.

The definition of the strategy via participatory and engagement methods also needs to be supported with the creation of an institutional arrangement or governance structure that can lead and steer the efforts from different angles. This structure can be internal to the city council (acting horizontally), a public-private foundation, a joint agreement, etc. depending on the concrete context.

### Resources and pre-conditions

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Material:** No specific material requirements are necessary for this CSS, beyond what elements are used for workshops and meetings. Some seed funding for the managing entity (public agency, foundation, association, etc.) might be necessary to set up the governance structure before concrete projects can sustain it.
- **Technical:** It is important to engage stakeholders from all the existing and potential value-chains, and others that have technical knowledge about key technologies in order to filter what can be realistic objectives and initiatives, and identify potential synergies and collaborations with current projects, sector interests or investments. Even if consulting firms can be hired to lead the project, previous experiences from the public authorities on similar multi-stakeholder engagement process will be of value to help reach compromises and animate the network.
- **Context:** City or regional authorities need to have credibility among private sector stakeholders participating in this process or build this trust during the project. The success of the implementation of the strategy will depend on the will of all stakeholders under the orchestration of public authorities. City general or sectoral plans including circular economy approaches or mentions will help to speed up the identification of key topics, synergies and stakeholders.

### Stakeholders

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

- It is important to engage deeply with the key stakeholders that have a prominent role in circular economy in the city and that will be leading the implementation of the different initiatives, such a waste management companies (public, private ones in contract or previous applicants), water and energy management public or private companies, public transportation operators or agencies.
- The involvement of academia and technical stakeholders is also important as it can bring different perspectives to all these debates, point towards new possibilities, nuance expectations and identify gaps on research and key investments to improve the effectiveness of new techniques.

### Type of R Strategy

Rethink

### Technology Readiness level (TRL)

TRL 8

### Financial effort

### Stakeholder engagement

### Types of territory

Rural areas, Cities, Metropolitan areas, Provinces, Regions, Countries

### Key product value-chain

Cross-cutting support and Governance

### Sectors involved

A. Agriculture, forestry and fishing

B. Mining and Quarrying

C. Manufacturing

D. Electricity, gas, steam and air conditioning supply

E. Water supply, Sewerage, Waste management and remediation activities

F. Construction

| | |
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| • Finally, the engagement of civil organisations representing interest groups such as environmental NGOs, individual citizens/neighbour communities and enterprise clusters is also necessary to ensure that the views of different groups with stakes in the strategy and potential to support it are also taken into account. | G. Wholesale and retail trade; repair of motor vehicles<br>H. Transportation and storage<br>I. Accommodation and food service activities<br>J. Information and Communication<br>L. Real Estate Activities<br>M. Professional, Scientific and technical activities |

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The main impact of this strategy is the capacity to get a more holistic overview of circular economy in the territory thanks to integrating the perspectives of all actors. This common approach can be the basis for a sound, realistic and implementable roadmap.
- The wide stakeholder engagement, if done properly, will help to integrate the strategy objectives within each organisations' own targets, and align the efforts of different actors towards a common goal.
- The process and the horizontal governance structure must help identify concrete initiatives that are attractive for different key actors that will commit to participate and allocate resources for them.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- Identify middle grounds between sectors, and even between public and private agendas can be very challenging and time consuming. The debate needs to be properly guided, and objectives of the process need to be clear in order to avoid deviating towards to open debates or to specifics of certain policy areas.
- It is possible that some targets are not accepted by some stakeholders, so concessions in exchange of commitment need to be made. Hence, it is important to know which stakeholders are necessary for the implementation of the strategy to understand what the gains and losses of this negotiations are.
- The whole process needs to be supported and steered by senior levels of city authorities and a direct engagement with decision-makers in other public and private stakeholders are needed to ensure that long-term commitments are made from different organisations.

**Examples**

1. **Maribor Circular Economy Strategy (Maribor, Slovenia).** The city developed a circular economy strategy for the city in partnership with stakeholders in relevant value-chains, creating a public Institute (Wcycle) to implement strategic projects integrated by public utility companies (water, energy, waste, etc.) and the city council.
2. **Joint long-term strategy for a circular port (Malmö, Sweden).** Malmö municipality is the owner of the city harbour. In the framework of its circular strategy, the city decided to engage in conversations with different stakeholders for a concrete initiative on how to use the harbour's heat to benefit the city. The dialogue included a wide range of stakeholders and generated a common vision for the port and the city, including specific collaboration actions among different actors and an industrial symbiosis project. Out of this discussion, more dialogues were planned to explore further synergies on different areas.

**References:**

Maribor City Circular Strategy: https://ec.europa.eu/futurium/en/circular-economy/strategy-transition-circular-economy-municipality-maribor.html

Wycicle Instituete Maribor Official website: https://wcycle.com/en/wcycle-english/

Malmö Industrial Park official website: https://www.malmoindustrialpark.com/industrial-symbiosis/

Municipality-led circular economy case studies, EIT Climate KIC, European Commission, 2018. Download at: https://www.climate-kic.org/wp-content/uploads/2019/01/Circular-Cities.pdf

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## 7.2 Organised Waste Market

### Organised Waste Market

This solution consists in building a platform to trade waste of several value-chains. It can be both a single platform and a system connecting sectoral markets together, depending on the level of the waste market development of the region. The CSS involves the creation of an online space serving as a trading area to process market inquiries, expressions of interest, requests and offers on waste by both waste producers and operators and should be able to register transactions in a transparent manner.

Besides the marketplace itself, the development of this platform can offer an environment connecting different actors of the waste market, which is able to connect players from different value-chains. It can further provide a reference on where companies can find information or resources to start a circular initiative or further develop their circular practices. It can also become a space where new waste streams are identified or proposed by new actors and set the basis for future regulations.

These platforms are often developed and operated under the auspices of public administration with intense participation of private companies with experience and interest on waste management and valorisation.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Technical:** One of the important technical requirements is the IT software that enables communication between actors. Besides the digital tool itself, this also requires agreement between participants on what information is to be provided and which standards to use. If there are already existing platforms within different value-chains, a process of harmonisation of data and processes would be necessary. It might be necessary to engage technical experts for some of these discussions.
- **Context:** It is necessary to have regulations in place that organise the foundations of waste purchases and exchanges, especially regarding the reporting of waste, their classification, and quality standards. The platform needs to provide more transparency and security than other systems, and the role of the administration is to regulate these and support the enforcement.

**Type of R Strategy**

Rethink, Reuse, Recover

**Technology Readiness level (TRL)**

TRL 8

**Financial effort**

★

**Stakeholder engagement**

★★★

**Types of territory**

Metropolitan areas, Provinces, Regions, Countries.

**Key product value-chain**

N/A

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

This solution needs to be orchestrated by public authorities but must count with active participation from all actors in the different waste value-chains.

Private stakeholders from waste management companies, waste producers and waste operators need to be involved as final users of the platform. In some cases, they can also participate in the operation or development of the platform, to ensure its design and animate the network of actors that it brings together.

**Sectors involved**

J. Information and communication

E. Water supply, sewerage, waste management and remediation activities

O. Public administration and defence

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The platform can help to reduce the demand of virgin raw materials by facilitating the exchange of waste. It also creates efficiencies in the system by reducing the costs associated to identifying and obtaining these materials by decreasing the operational costs and improving transparency and reliability of the transaction.
- The platform is also a means of animating and bringing together stakeholders from the circular economy domain and identifying synergies between different value-chains. For less developed markets it can also provide the conditions to create a more dynamic ecosystem and enable first industrial symbioses.
- Centralising the waste market in this solution can also provide improved monitoring on how many materials are exchanged and tracking new challenges that stakeholders report.
- The safety of the market is improved as the exchanges need to follow the regulations and transactions, which are transparent and reduce the costs of transaction and risks for companies.
- These market platforms have an important effect by reducing barriers for businesses to find and acquire waste, or to sell it, which can encourage businesses to approach circularity by lowering the cost of managing waste.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- This solution impact is limited by the market size of the waste market. It requires that there is at least a critical mass of companies in the area or country that are interested in buying and selling waste, and that they can improve their current practices with the platform. However, once the platform is set up, it can encourage other companies to recycle and increase its outreach.
- It requires a long-term commitment from administration and from private companies helping to run the platform. A bad operation of the platform can make recycling less attractive for some companies and reduce credibility of this approach in the eyes of the sector.
- Most of the organised waste markets are developed at regional and national levels in order to leverage a wider market.

**Examples**

1. **Mercado Organizado de Resíduos (Portugal).** A company formed by several waste management operators from several value-chains created Portugal's first Waste Organised Market platform, which was approved and managed by the Portuguese Agency of Environment. Waste operators and generators can participate in the platform for a small annual fee and a commission on transactions, in exchange to having access to a wide market and to safe transactions.
2. **Industrial Symbiosis Platform (Sicily, Italy).** The Sicilian Innovation Agency (ENEA) developed the Industrial Symbiosis Platform with the objective to support businesses to match regionally to sell, buy and exchange waste from stone, plastics and agro-industrial activities. The platform is open to all operators and managed publicly. It has also become a point of reference about recycling and circularity for interested stakeholders.

**References:**

Official site of the Portuguese Environment Agency: https://apambiente.pt/residuos/mercado-organizado-de-residuos-0

Piattaforma di simbiosi industriale Official website - http://www.industrialsymbiosis.it/piattaforma

European Circular Economy Stakeholder platform – Best practices: https://circulareconomy.europa.eu/platform/en/dialogue/existing-eu-platforms/enea-platform-industrial-symbiosis

## 7.3 Waste Recycling Cluster

### Waste valorisation clusters

This CSS focuses on bringing together different actors involved in the reuse, recycling or circular economy sectors to actively generate synergies and promote joint projects between them. The creation of a cluster of specialised companies working on this domain is necessary as an ecosystem-building activity that can help identify the key players in the sector, understand their needs, and build programmes to enhance their activities and outreach.

The cluster, orchestrated by public agencies but animated with the contributions of the participating entities, is a tool to make information about regulations, business opportunities, standards, discussions and funding lines more accessible to the professional of the sectors (e.g., thematic working groups).

The organisation of the key stakeholders under a cluster is often operationalised through collaboration platforms that allow stakeholders to identify synergies, collaborate for new projects and imagine new initiatives beyond their individual capacities. Cluster collaboration platforms also offer a space for dialogue and exchange with public authorities where needs and requests can be shared, and where technical dialogues and trainings can be facilitated. The cluster can also support interregional or international exchanges that can be used for peer-learning or exploring opportunities in new markets, expanding business opportunities of the participants and generating joint branding and economies of scale.

**Resources and pre-conditions**

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Context:** In some contexts, the cluster needs to be supported and initially steered by public authorities, and the success of exchanges will rely on its capacity to attract important players of the sector into participating in the cluster. Therefore, it is important that innovation or environmental agencies have credibility among the public. The national or regional conditions of operation of clusters can also be an important factor to take into consideration, which will limit the potential outreach of the initiative or provide support to its activities.

- For the cluster to be initiated and mostly animated by private actors, it is necessary that the market has a certain degree of maturity and that there are strong stakeholders with recognised leadership in the sector that can steer the initiative, especially at the beginning. Public support in the form of tax reduction of seed funding can increase the interest of these actors to engage in the activity.

**Type of R Strategy**

Rethink, Reuse, Recover

**Technology Readiness level (TRL)**

TRL 9

**Financial effort**

★

**Stakeholder engagement**

★★★

**Types of territory**

Metropolitan areas, Provinces, Regions, Countries

**Key product value-chain**

N/A

**Stakeholders**

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

It is fundamental for the success of the cluster to gain the interest and sustained engagement of all the participating actors in the value-chain. While public bodies can sometimes animate and organise the cluster, they can also be created at the initiative of private actors. Moreover, the relevance of the joint projects, the visibility of the group and the capacity to innovate and create new solutions together is completely dependent on the degree of engagement of the participants of the cluster, and their willingness to contribute with their resources to some of the initiatives.

**Sectors involved**

J- Information and communication

E- Water supply, sewerage, waste management and remediation activities

O- Public administration and defence

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The organisation of a circular economy cluster can be a powerful initiative to help identify synergies and joint projects for stakeholders, promoting collaboration within and across value-chains and sectors.
- This is an ecosystem-builder exercise, that also creates the forum to hold discussions and have dialogues about circular economy for policymaking and joint activities.
- This initiative can also support the actors of the sector to establish new collaborations across regions, nationally and internationally, enhancing the competitivity of private businesses and actors in the waste market.

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- This solution is more efficient at a regional level, since the economies of scale are bigger and more stakeholders are engaged. However, similar approaches can be taken at local level to promote synergies between key actors and liaise them with supra-local initiatives to increase impact.
- Funding can be a challenge for the activities of some clusters, especially to sustain new joint initiatives and projects between actors. Some seed funding for the cluster, but also financial incentives for first collaborations to build trust and demonstrate the approach can help to increase the impacts.

**Examples**

1. **Green Economy Cluster (Estonia)** – Estonia's Waste Management Association initiated the creation of a Waste Recycling cluster to develop waste recycling projects and trainings for all participant stakeholders. The initiative counts with the participation of large companies, SMEs, academia and RTOs. The centre later evolved into the Estonian Recycling Competence Centre and has been promoting international collaborations and joint projects between its participants on six sector domains.

**References:**

Official website of the Estonian Recycling Competence Centre: http://www.recycling.ee/

Dedicated page on the European Cluster Collaboration Platform: https://tinyurl.com/mr34bywj

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## 7.4 Circular procurement clauses

### Circular procurement clauses

In Europe, it is estimated that public procurement of goods and services is equivalent to up to 14 % of the European GDP, an equivalent of a 2 trillion market per year. The integration of circular procurement clauses in the acquisition of goods or the provision of services is a powerful approach to generate visible impacts at a local and supra-national level.

The CSS consists in integrating circularity procurement clauses in public offers to incentivise service providers to observe specific circular/sustainable practices (e.g., separation of waste, use of secondary raw materials, etc.). Similarly, for the acquisition of equipment, energy efficiency criteria of appliances, life cycle costs, inclusion of reuse and recycling approaches in the life cycle of the items can also be introduced. Besides indications on the concrete service or equipment, other considerations regarding the provider of the general operation can be taken into consideration, for instance, holding environmental certificates, using more sustainable logistic approaches, etc.

These elements can be integrated into procurement procedures both as specific requirements for the service (selection criteria), or as desirable elements giving extra points on bid evaluation. While each contract will have its own specificities, general guidelines and clauses can be prepared by procurement units to help streamline the practice and facilitate the adoption of this approach for different departments.

#### Resources and pre-conditions

**Main resources** (technological, material, time, etc.) and **necessary contextual conditions** to enable the implementation or ensure the success of the solution.

- **Technical:** To ensure the impact of the measure, it is necessary to have some information and baseline data regarding waste and recycling in some services/sectors, including the available alternatives and improvements that can be requested. This will inform the procurer on the realistic objectives for the circular clauses, considering both the quality that can be expected from the service or equipment, and budget available.
- Previous experience of procurement using similar approaches such as social or environmental clauses can make the process easier to adopt for public authorities.
- **Context:** A general city or departmental strategy promoting circular economy and foreseeing specific objectives and KPIs can help to initiate and upscale this practice across the administration, and also to monitor its results from an aggregated perspective. Regulations on procurement (at local but also regional and national level) need to allow space for some flexibility (competence norms, etc).

#### Stakeholders

Key stakeholders and role they need to play in the solution (public administration, industry and businesses, civil society, academia).

In this approach, public authorities and procurers are the leading stakeholder and client. Internal coordination between departments (legal and technical, or across sector department) is necessary to ensure that the process is sustainable and backed by all the interested parties.

Beyond the procurers' side though, engaging and sharing information with manufacturers and service providers with time before the publication of the calls is important to ensure that the opportunity can still be interesting for them, and if there are more effective implementation methods.

#### Type of R Strategy

Rethink

#### Technology Readiness level (TRL)

TRL 8

#### Financial effort

★

#### Stakeholder engagement

★★

#### Types of territory

Rural areas, Cities, Metropolitan areas, Provinces, Regions, Country, EU

#### Key product value-chain

N/A

#### Sectors involved

O. Public administration and defence

**Impact**

Potential impacts and benefit of the solution to enhance Circular Economy in the City.

- The introduction and normalisation of circular clauses in public contracts has the potential impact of effectively changing the market, introducing a new competitivity factor for companies to consider, and enhance their investment in improving their performance on these aspects.
- This approach can help public administrations to achieve their objectives of reduction of waste, consumption or use of recycled materials at an aggregated scale through public contracts.
- Sharing experiences about practices, and establishing guidelines about how to introduce, monitor and enforce these clauses can help more departments to pro-actively use them and extend this approach to more sectors and value-chains (for instance, tested with catering providers for events, later scaled to school meals suppliers, and then transferred to cleaning services for public buildings).

**Barriers and risks**

What are the main obstacles and risks of implementing the solution, including possible ways to address them?

- In some markets, it is necessary that procurers have a good understanding of the market and technical expertise to define realistic requirements for the procurement process. Otherwise, they might need to consult with stakeholders before the procurement. Lack of adjusted requirements to the market can end up with failed procurement processes, approval of unrealisable contracts or breach of contract in the long-term.
- Public procurement is often a bureaucratic and slow process for many administrations, generating frustration and loss of productivity for both the procurer and the provider. The introduction of new clauses can make it even heavier. Agile approaches with clear KPIs and monitoring practices need to be explored.

**Examples**

1. **Ecological criteria for all procurement processes (Berlin, Germany).** The House of Representatives of the city approved an internal regulation establishing that all procurement processes needed to include ecological criteria in their contracts, including life cycle costs. This regulation was later followed by others setting new criteria on specific products or services (such as for equipment, events, etc). After several years of implementation, these regulations are estimated to have reduced the city consumption of 12 tonnes of diesel soot, and reduction of 350 000 tonnes of $CO_2$.
2. **Circular School catering (Turin, Italy).** In the framework of the implementation of the Smart City Master Plan, the Department of Instruction of the City, in partnership with Turin's Smart City Foundation, introduced several new criteria for the procurement of school catering contracts with the objective of reducing carbon footprint. These criteria included regulating how providers needed to use tap water, use sustainable transportation, select food packaging and the type of cutlery used for the services. After the first year of contract, 152 tonnes less of plastic were used.
3. **Report: ICLEI Circular Procurement: Best Practices Report**. How to guide circular procurement with best practices? With the aim of offering inspiration for transitions to circular procurement, this report provides examples of circular procurement models, outlines the multiple benefits of circular procurement and points readers to case studies of successful examples in practice.

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URBANWINS (H2020) best practices: https://www.urbanwins.eu/sustainable-public-procurement-of-school-catering-services/

Circular Procurement: Best Practices Report: https://circulars.iclei.org/resource/circular-procurement-best-practice-report/

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Setting the methodological basis of the Circular Cities and Regions Initiative (CCRI), this document provides policy- and decision-makers with operational guidance to accelerate the development and implementation of Circular Systemic Solutions at the local or regional level. The document organises existing guidance on circular economy implementation in cities and regions into a modular, systematic, and actionable methodology.

The methodology distinguishes between three main phases that reflect the maturity level of cities and regions with respect to their circular solutions. These are: MAP the territory and understand its metabolism; DESIGN the circular systemic solution; and IMPLEMENT the circular systemic solution. Along these three phases, the methodology presents and details all the aspects to be addressed for bringing forward an effective and systemic circular solution, including, *inter alia*, the use of a value-chain perspective, the prioritisation of intervention areas, the identification of CE opportunities and their impacts evaluation. In doing so, the document also showcases a list of Circular Systemic Solutions implemented in Europe that can serve as a source of inspiration for cities and regions that have just started their circular transition.

The CCRI Methodology is a reference document that helps key stakeholders to use a common language for circular transitions and Circular Systemic Solutions implementation. Achieving this objective would help scaling up Circular Cities and Regions Initiatives and foster a more efficient transfer of knowledge and know-how between EU cities and regions.

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