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Regional ecosystem Cradle2Cradle maturity analysis Slovenia

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Executive Summary

This deliverable documents the results of the analysis of the ecosystem for Slovenia with respect to circular economy in general and the cradle to cradle principles in particular.

The analysis has been performed in the 3 dimensions covered by the Cradle-ALP project:

- Policies and business support
- Technologies
- Business models

With the aim to take stock of the status quo, identify gaps and barriers for the circular transformation of the economy, as well as opportunities for fostering this transformation.

In each region, the analysis focused on the industrial sectors to be involved later in the project in industrial transformation pilot activities. In the case of Slovenia, those sectors are: textile, chemistry, packaging.

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1. Introduction to the Cradle-Alp project

Cradle-ALP aims for mainstreaming cradle to cradle (C2C) approaches, circular design and circular substitutions (from the alpine region) for linear products in industrial processes, in different industrial sectors. The Alpine Space has many natural resources and the technologies to substitute fossil raw materials and toxic substances from production with circular and environmentally friendly alternatives. This should lead to the fact that materials and products can be led back into a healthy cycle after use. The focus of this project shall be on the substitution of chemical and fossil based/unsustainable materials with more circular, sustainable and bio-degradable ones.

First, the partners will build a broad awareness and understanding in the public, the relevant industries as well as among stakeholders from policy and innovation intermediaries, for the opportunities, barriers and mechanisms of the transformation of industrial products towards higher circularity by means of C2C approaches, circular design and circular substitutions. Business support providers shall be trained to accompany the transformation of businesses along more circular value chains.

In a second step, the partners will explore in details and test opportunities for implementing C2C approaches, circular design and circular substitutions along specific value chains in the chemistry/plastics and wood/forestry sectors supported by digital technologies. Building on a thorough multidimensional (technology, policy, economy, etc.) roadmapping exercise, transnational groupings of stakeholders – including businesses – will be installed, with the aim to transfer the C2C roadmaps into industrial practice along exemplary value chains.

Finally, the partners will work towards ensuring a transnational policy convergence towards transnational S4 strategies in the priority sectors of the project and initiate common cross border funding instruments for the industrial C2C transformation.

2. Objective and scope of the regional ecosystem Cradle2Cradle maturity analysis

The regional ecosystem maturity analysis performed in each project region is part of a larger set of activities, building together a transnational ecosystem Cradle2Cradle maturity analysis. The latter comprises:

- A regional ecosystem maturity analysis, performed in each project region,
- A transnational survey on the consumers' perspective on Cradle2Cradle in the Alpine Space,
- A transnational comparison/benchmarking in the dimensions policies/business support, technologies and business models.

The overarching aim of the transnational ecosystem maturity analysis is to understand the relevance of circular economy and more specifically the Cradle 2 Cradle principles in each of the project region within the triangle: policies/business support, technologies/knowledge, and business models/practices.

Practical implementation in the context of the Cradle-ALP project

In order to ensure a high relevance of the regional ecosystem maturity analysis for a successful implementation of the Cradle-ALP activities, the partners decided to focus the analysis on the

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industrial sectors to be addressed in the roadmaps to Cradle2Cradle transformation. Those sectors are: polymers/plastics, wood/furniture, chemistry/materials, fibres/textiles, packaging.

The results of the analysis shall provide the basis for the development of sectoral Cradle2Cradle industrial transformation roadmaps in the five selected sectors (WP2), thus ensuring a smooth transition between WP1 - Capacity building for Cradle2Cradle transformation and WP2 - Roadmaps to Cradle2Cradle transformation.

Remark: this practical approach represents a deviation from the Application Form, where the analysis was described as more generic and meant to provide input for capacity building activities to be performed in WP1.

Scope of the analysis in the Cradle-ALP project

The analysis integrates status quo, gaps and barriers, potentials for transformation, as well as good practices and failures to learn from within the triangle policies/business support, technologies/knowledge, and business models/practices.

It has been performed through a combination of desktop research, building on the knowledge already available among project partners and the previously performed identification of good practices, and interviews/workshops with regional experts and representatives of companies.

▪ Status quo and good practices analysis

The scope of the status quo and good practices/failures analysis in the dimensions policies/business support, technologies/knowledge, and business models/practices was aligned with the topics identified as a result of the identification of good practices and lessons learned (D.1.1.2) and the capitalisation workshops (D.1.1.3).

The following table shows the scope of the status quo analysis for the transnational ecosystem maturity analysis:

Policies and business support	Technologies	Business models and practices
<ul style="list-style-type: none"> ▪ Regional strategies/policies fostering circular economy and more specifically C2C principles (fully closed loops). ▪ European and national/regional strategic documents (e.g. technology roadmaps). ▪ Funding schemes ▪ Further business support measures 	<ul style="list-style-type: none"> ▪ Significant technology and knowledge providers (Higher education and research organisations, technical centers, pilot infrastructures, innovation platforms, etc.) located in the project regions 	<ul style="list-style-type: none"> ▪ Role model companies ▪ Relevant industrial clusters and industrial networks

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The partners performed a mapping for each project region according to the items listed here above.

▪ **Gaps and barriers – potentials for transformation**

At project level, the identification of gaps and barriers for a better uptake of the cradle to cradle principles in industrial practices, as well as the identification of potentials or opportunities for such a transformation is a core result of the transnational comparison/benchmarking in the dimensions policies/business support, technologies and business models.

The partners collected input for the transformation ecosystem analysis by collecting such gaps and barriers as well as potentials for transformation at the regional level. This was done through a series of direct interaction with regional experts and representatives of companies, either in bilateral discussions (interviews) or in the context of event, such as workshops, group discussions and fairs. The partners in each region organized those activities according to their local context. For example, industrial fairs could be used to interview several companies on the same day, cluster board meetings or awareness could be used to have a group discussion with the participants.

Scope of the regional analysis in Slovenia

The analysis in Slovenia focused on the following sectors: textile, chemistry, packaging. The results of the analysis are displayed in the following chapters of this deliverable.

3. Policies and business support

Policies

The following relevant policies were identified:

Generic level	<ul style="list-style-type: none"> ▪ Circular economy action plan ▪ Zakon o varstvu okolja (Environmental Protection Law) ▪ Uredba o odpadkih (Waste regulation)
Textile	<ul style="list-style-type: none"> ▪ Circular Economy Action Plan - As part of the Circular Economy Action Plan, the European Commission presented a new strategy in March 2022 to help make textile products more durable, easier to repair, reuse and recycle, to face the challenges of fast fashion and to stimulate innovation in sector. ▪ Directive (Eu) 2018/851 Of The European Parliament And Of The Council - According to the directive on waste (approved by the Parliament, amended in 2018), EU countries must collect textiles separately from 2025. The Commission's new strategy also includes action on hazardous chemicals, calls on producers to take responsibility for their products throughout the value chain, even when they become waste, and action to help consumers choose sustainable textiles.
Chemistry	<ul style="list-style-type: none"> ▪ Zakon o kemikalijah (Chemicals law) - This law regulates the trade in chemicals, determines measures to protect human health and the environment from the harmful effects of chemicals and prescribes obligations and procedures that must be met by legal and natural persons who produce or store chemicals in the Republic of Slovenia, trade in them or use them.
Packaging	<ul style="list-style-type: none"> ▪ Uredba o embalaži in odpadni embalaži (Decree on packaging and packaging waste (Slovenia)) - The aim of this regulation is to ensure a high level of environmental protection and to prevent or reduce any impact of packaging and packaging waste on the environment and to ensure the functioning of the internal market and prevent trade barriers and distortions and restrictions of competition: https://www.gov.si/en/news/2021-04-08-more-efficient-implementation-of-the-packaging-waste-management-system/

National/regional strategic documents

The following relevant European and national/regional strategic documents identified:

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Gene ric level	<ul style="list-style-type: none"> ▪ Slovenian smart specialization strategy S4 https://www.gov.si/assets/ministrstva/MKRR/S4-Slovenska-strategija-pametne-specializacije/Slovenska-strategija-pametne-specializacije.pdf ▪ Roadmap towards the circular economy in Slovenia https://static1.squarespace.com/static/5b97bfa236099baf64b1a627/t/5c63ed7f9140b7162bf51e9f/1550052836808/kazipot_ENG_26apr_FINAL.pdf ▪ Slovenian industrial strategy 2021-2030 https://www.gov.si/en/news/2022-05-03-slovenian-industrial-strategy-2021-2030/ ▪ EU Ecolabel https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home_en (It can be used by producers who comply with ecological criteria for products in which the limited use of harmful substances and less water and air pollution are guaranteed.)
Texti le	<ul style="list-style-type: none"> ▪ EU strategy for sustainable and circular textiles - The EU Strategy for Sustainable and Circular Textiles, presented by the Commission in March 2020, aims to ensure that by 2030, textile products on the European market are durable and recyclable, made as far as possible from recycled fibers and free of hazardous substances. MEPs also want new measures against the loss of microfibers and stricter standards for water use.
Che mistr y	<ul style="list-style-type: none"> ▪ Chemical transition pathway In January 2023, the European Commission published the transition pathway for the chemical industry. The pathway is an actionable plan co-developed by the European Commission with EU countries, chemical industry stakeholders, NGOs and other interested parties. It identifies the actions and conditions needed to achieve the green and digital transition and improve resilience in the chemical industry, in line with the updated EU industrial strategy. Slovenia must prepare a national Chemical transition pathway, having in mind the concept “Safe and sustainable-by-design” deriving from the Chemicals Strategy for Sustainability (CSS), it means that chemicals are produced/used in a way that maximizes their benefits to society while avoiding harm to planet & people and production and use of safe and sustainable chemicals in Europe. ▪ Chemicals Strategy for Sustainability (CSS) - EU strategy https://cefic.org/policy-matters/chemicals-strategy-for-sustainability-css/
Pack aging	<ul style="list-style-type: none"> ▪ European strategy for plastics https://environment.ec.europa.eu/strategy/plastics-strategy_en This is an important EU document, containing new rules on packaging to improve the recyclability of plastics and increase the demand for recycled plastic content. Its goal is to include 10 mio tones of recycled plastics in new products.

Funding schemes and further business support measures

The following relevant funding schemes were identified:

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Generic level	<ul style="list-style-type: none"> ▪ SPIRIT Slovenia, Public Agency for Investment, Entrepreneurship and Internationalization: Public call - Support for start-ups, micro, small and medium-sized enterprises in strategically sustainable and circular business transformation in 2022-2025 ▪ SRIP – Circular Economy: Annually, they publish tenders for the financing of selected circular investments. The total amount is €500,000, 50% is public funds, and 50% is contributed by companies.
Textile	/
Chemistry	/
Packaging	/

The following relevant business support measures were identified:

Generic level	<ul style="list-style-type: none"> ▪ Chamber of Commerce and Industry of Slovenia: it offers their members from different sectors consultations and workshops on circular economy and green transition. It also offers a participation in different European or national projects with an aim of helping them to implement green transition. E.g.: <ul style="list-style-type: none"> - CIRCI (Norwaygrants): Awarding 8 vouchers for the transition of companies to the circular economy. - CIRCOTRONIC (Interreg CE): developing solutions for more circular value chains and design a policy framework for circular production in EEE. Piloting with the companies, working together on a project with companies (financial support) <p>etc.</p> ▪ SPIRIT Slovenia, Public Agency for Investment, Entrepreneurship and Internationalization: public calls for companies embarking on the path of sustainable strategic business transformation. ▪ ECO sklad (Eco Fund, Slovenian Environmental Public Fund): Initial investments in environmental technologies.
Sector 1	/
Sector 2	/
Sector 3	/

4. Technologies and knowledge providers

Technology and knowledge providers

The following relevant technology and knowledge providers were identified:

Generic level	<ul style="list-style-type: none"> ▪ 3ZEN d.o.o. - https://3zen.si/ They cooperate with companies from various industries throughout Slovenia. Recently, they have more and more customers abroad. Their references are steadily increasing. Larger companies with which they cooperated or are cooperating in Slovenia. Education and assistance in the implementation of the Cradle-to-Cradle model. ▪ MOVECO platform: https://danube-goes-circular.eu/ Companies and research institutions from the countries of the Danube region are able to exchange products, materials and resources for reuse on an online platform, and to build cooperation networks to promote the circular economy. This platform (www.danube-goes-circular.eu) includes a virtual marketplace. ▪ CIRCI:https://www.norwaygrants.si/projekti/projekti-programa-blazenje-podnebnih-sprememb-in-prilagajanje-circi/ Preparation of a database for 3 selected industrial branches (metal processing industry, processing of recyclable plastics and electrical industry). ▪ Circular Change platform- https://www.circularchange.com/ This platform was founded with the mission of enabling the transition to a circular economy by connecting various stakeholders.
Textile	<ul style="list-style-type: none"> ▪ IRSPIN platform https://www.irspin.si/index.php?page=tpl&lang=sl Example 1
Chemistry	<ul style="list-style-type: none"> ▪ National Institute of Chemistry - https://www.ki.si/en/ National Institute of Chemistry offers services to partners from industry at the following fields: chemical analyses, GMP (service according to Good Manufacturing Practice), biological and biochemical research, chemical technology and engineering and materials. ▪ University of Maribor – Faculty for chemistry and chemical technology - https://www.fkkt.um.si/en/ ▪ University of Ljubljana – Faculty for chemistry and chemical technology - https://fkkt.uni-lj.si/en/
Packaging	<ul style="list-style-type: none"> ▪ Faculty of Polymer Technology - https://www.ftpo.eu/en FTPO strives to carry out primarily high-quality applied and developmental research in accordance with the highest international standards. It promotes innovation and strives for the applicability and

	<p>transfer of research results for commercial purposes.</p> <ul style="list-style-type: none"> ▪ TECOS - https://tecos.si/en/ <p>Technological centre in the area of the development of new products, moulds and technologies.</p> <ul style="list-style-type: none"> ▪ ICP- https://icp-lj.si/ <p>Pulp and Paper Institute creates knowledge, services and strategies for raising competitiveness of paper and related industries. It is a research and development center, which supports companies with a comprehensive portfolio of services and strategic networks at national and international levels.</p> <ul style="list-style-type: none"> ▪ IOS Maribor - https://ios.si/ <p>In the field of environmental protection, they combine knowledge from ecology and engineering with an emphasis on the topic of water.</p> <p>They develop technological concepts and equipment for "custom-made" solutions.</p>
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5. Business models and practices

Role model companies

The following role model companies were identified:

Textile	<ul style="list-style-type: none"> ▪ The 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. https://cordis.europa.eu/project/id/641942 ▪ BENEDETTI LIFE - designs sustainable fashion and uses natural, ecological materials in creation. They make clothes from, for example, pineapple leather, bamboo, organic wool and silk and knitwear, recycled bottles and cotton. https://www.benedetti.life/sl/trajnost/
Chemistry	<ul style="list-style-type: none"> ▪ AquafilSLO <p>AquafilSLO, is the largest producer of polymers and synthetic fibers in Slovenia, which enable the transition to a circular economy for the fashion, automotive and interior design industries.</p> <p>It is part of the Aquafil Group, which is a pioneer of the circular economy and a reference for quality and product innovation on a global scale. Its flagship product is ECONYL® nylon, which is a unique solution for closing the material loop in the synthetic fiber industry. AquafilSLO is a center of innovative technologies for obtaining materials from end-of-life products and pre-consumer</p>

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	<p>waste and their regeneration into new ECONYL®. This has made it an important research and development center for the circular economy. AquafilSLO holds 23 certificates: https://www.aquafil.com/certifications/. The company is also the first in the world to produce bio-based nylon 6 from renewable sources of plant origin. The innovation opens a new market potential in the field of bioeconomy and circular economy, and represents a revolutionary innovation in the production of nylon 6 from sugar.</p>
Packaging	<ul style="list-style-type: none"> ▪ PLASTA d.o.o. The company's core activity is the production and processing of plastics. The company became one of the leading companies in Slovenia in the field of recycling waste polyethylene (PE) packaging and the production of blown films and bags. With its own development, innovations and constant investment in modern technologies, all products of PLASTA d.o.o. can be 100% recycled and reused. The company holds a TUV SUD certificate. ▪ KIMI d.o.o. In the field of professional hygiene, they are one of the few manufacturers/suppliers who collect empty packaging from their clients and actively include it in the circular economy system. All returned packaging is checked, washed undamaged and reused. Packaging is not reused just once. On average, they use the canister at least three times. Last year, 8,300 kg of packaging was reused in production. https://www.kimi.si/krozno-gospodarstvo-kimi/ ▪ EVEGREEN d.o.o. has launched a series of 100% biodegradable flowerpots, which are easily decomposed in the soil. pot, planted in the garden, first protects the seedling from parasites, and after 22 weeks it becomes fertilizer, and the plant do not need additional fertilization. ▪ Making paper from Japanese knotweed- www.ljubljana.si/applause <p>Within the framework of the "Applause" project, the Municipality of Ljubljana joined forces with the RE-GENERACIJA association, the Botanical Garden of the University of Ljubljana, the Institute for Pulp and Paper and Snago and was the first in the world to produce paper from Japanese knotweed on a semi-industrial level.</p>

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Relevant industrial groupings and networks

The following industrial groupings and networks were identified:

Generic level	<ul style="list-style-type: none">▪ SRIP Circular economy: SRIP - Circular Economy (srp-circular-economy.eu) SRIP - Circular economy is managed by the Chamber of Commerce and Industry of the Štajerska region of Slovenia. The Chamber is a voluntary connection within the business community with the aim to maximise the effect on shaping economic conditions which will enable faster growth, development, and competitiveness.▪ SRIP MATPRO: https://matpro.gzs.si/vsebina/ENG The key objective of the Strategic Research and Innovation Partnership MATerials as end PROducts (SRIP MATPRO) is to create value chains with a focus on the production of materials for use in complex products with high added value and a strong potential for positioning within global value chains. It is managed by CCIS.
Textile	/
Chemistry	/
Packaging	<ul style="list-style-type: none">▪ TECOS - https://tecos.si/en/ Technological centre in the area of the development of new products, moulds and technologies.

6. Gaps and barriers – potentials for transformation

The following table summarizes the gaps and barriers as well as potentials for an industrial transformation towards an economy following the cradle to cradle principles in Slovenia.

Sector	Gaps and barriers	Potentials for transformation
	<ul style="list-style-type: none"> ▪ Compared to other European countries, Slovenia is too small for the development and introduction of more advanced and more cost-effective models, such as Cradle to Cradle in our case. For Slovenian companies, the certificate represents a large cost considering their sales and the small Slovenian market, the sale of Slovenian products on the EU market is also too small. ▪ The renovation of existing industrial processes and the adoption of environmentally friendly technologies often require significant financial investments. Many companies face challenges in obtaining the necessary capital. ▪ Achieving green industrial transformation requires adequate technological infrastructure. Some sectors may not have access to advanced environmentally friendly technologies. ▪ Obtaining C2C certification can be expensive and time-consuming for businesses, especially if they are struggling financially or are smaller enterprises. 	<ul style="list-style-type: none"> ▪ It is only possible that the company would obtain the certificate on the basis of a customer request. ▪ Provide financial incentives, grants, or subsidies to support businesses, especially smaller enterprises, in implementing C2C practices. ▪ Establish green financing programs that offer favorable terms for C2C projects and innovations. ▪ Offer technical and financial support to companies seeking C2C certification by, for e. g., creating certification programs and resources that are accessible and affordable for small and medium-sized enterprises.
Textile	<ul style="list-style-type: none"> ▪ The complexity of textile supply chains, including the sourcing of materials and outsourcing of production, can make it challenging to ensure C2C compliance across the entire chain. ▪ A lack of adequate infrastructure for textile recycling and collection points can hinder the circular economy model, making it difficult for consumers to recycle 	<ul style="list-style-type: none"> ▪ Encourage textile recycling facilities that collect and process used textiles into new materials or products. ▪ Educate consumers about the importance of responsible textile consumption, care, and disposal. ▪ Introduction of incentives such as discounts or trade-in programs for customers who return old textiles

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	<p>old textiles.</p> <ul style="list-style-type: none"> ▪ Consumer demand for cheap and fast fashion often contradicts the principles of longevity and sustainability in C2C, making it challenging to change consumption habits. This also effects demand for sustainable and C2C-certified textiles that is not strong enough to drive market transformation. 	<p>for recycling or repurposing.</p> <ul style="list-style-type: none"> ▪ Highlighting and supporting local, sustainable textile brands and businesses that prioritize C2C practices to boost demand for their products.
Chemistry	<ul style="list-style-type: none"> ▪ The chemistry sector involves complex global supply chains, making it challenging to ensure C2C compliance across the entire chain, especially when sourcing raw materials from different regions. ▪ Current regulations and policies may not be fully aligned with C2C principles, making it difficult for companies to implement them without regulatory support. 	<ul style="list-style-type: none"> ▪ Encouraging the development and use of sustainable and C2C-compliant materials in the chemistry sector and establish partnerships with suppliers and manufacturers that prioritize eco-friendly materials. ▪ Providing financial incentives, grants, or subsidies to support businesses, especially smaller enterprises, in implementing C2C practices. ▪ Collaborating with educational institutions to integrate C2C principles into chemistry-related curricula. ▪ Collaborating with regulatory bodies to review and update existing regulations to align with C2C principles.
Packaging	<ul style="list-style-type: none"> ▪ Competition from international packaging companies that may not prioritize sustainability can be a challenge, especially for domestic companies. ▪ Consumer demand for convenient and single-use packaging. 	<ul style="list-style-type: none"> ▪ Collaboration with international organizations, chambers of commerce, and industry associations to create global standards for C2C compliance in the packaging sector. ▪ Develop consumer education campaigns to promote the value of C2C-compliant products and influence purchasing decisions. ▪ Supporting local and sustainable packaging producers.

7. Conclusions

There is a growing awareness of circular economy and Cradle2Cradle principles in Slovenia, but there are still a number of gaps and barriers that need to be addressed in order to accelerate the transition to a circular economy in Slovenia, including the lack of funding, need for better coordination between different stakeholders (including businesses, government agencies, research institutions, and consumer organizations), need for infrastructure development and the alignment of existing regulations and policies with C2C principles.

There are some sector specific conclusions:

Textile: The Slovenian textile industry navigates a fiercely competitive environment, grappling with challenges presented by low-cost manufacturing countries. Sustaining competitiveness and aligning with the C2C principles necessitate a multi-faceted approach. First, there is a need for subsidies or other financial incentives to facilitate the renovation of existing industrial processes and the adoption of environmentally friendly technologies. Second, enacting legislation that aligns with the green transition guidelines and specifically targets the textile industry in Slovenia is crucial, considering that the current situation involves the adoption of European legislation to varying degrees. Lastly, fostering an environmentally conscious consumer base is pivotal. Encouraging consumers to prioritize local products and demonstrating a willingness to pay a premium for sustainable choices will contribute significantly to the industry's viability and the broader adoption of eco-friendly practices.

Chemistry: To successfully implement C2C principles in the Slovenian chemistry industry, it's crucial for companies to invest in research and development, engage in collaborative initiatives, and actively communicate their commitment to sustainability to consumers and stakeholders. Additionally, regulations should not only permit, but actively support sustainable practices, prompting operational adjustments and the integration of new, environmentally friendly technologies. For that, substantial investments in research, development, and technology are required. Since this can be a big challenge for some companies, subsidies or other financial incentives are needed. Finally, the importance of transparency across the entire supply chain is crucial in the context of C2C practices. Yet, ensuring suppliers' adherence to sustainable and ethical standards may pose difficulties, especially when the parts of value chain are outside EU.

Packaging: The Slovenian packaging industry confronts distinctive challenges and opportunities in its pursuit of integrating C2C principles. While regulatory alignment to C2C principles is essential, the competition from international packaging companies that may not prioritize sustainability poses a significant threat to domestic firms. To address this challenge, Slovenian companies require subsidies or other financial incentives to facilitate the renovation of existing industrial processes and the adoption of environmentally friendly technologies. This need is especially pronounced in small markets like Slovenia, where the demand for sustainable packaging is not high in absolute terms, and the investment may be too costly for companies to bear. Consequently, consumers' awareness and demand for sustainable packaging are crucial, as customer pressure can play a pivotal role in driving the transformation of companies.