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CURIOST

# Circular design and development of sustainable products in 4 key sectors in Central Europe

Version 1

05 2025



# Joint development of strategy for sustainable product development in SME and small midcaps

# Deliverable 1.3.2

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# 1. Common understanding of the strategy

CURIOST project partners focus on the following common understanding of the present strategy:

To secure Europe's industrial and economic position and achieve the EU's climate goals and aims of the UN Agenda 2030, CURIOST pilots the development of (digital) circular products, services, and technologies in the manufacturing sector. In particular, European SMEs and small midcaps in mechanics and mechatronics, plastics, packaging and building and construction sector must focus significantly on the effectiveness and expansion of (digital) circular product development to expand their technological lead.

The cross-sector strategic approach ensures consensus building regarding the objectives within the framework of CURIOST and beyond. The strategy particularly highlights technological and business model best practices in all four sectors and partner regions and addresses challenges as well as lessons learned. This helps to overcome barriers in sustainable product development for future product and business model designs.

Existing regional and European networks provide a foundation to reshape value chains in the manufacturing sector using the most advanced (digital) technologies in the future. Nevertheless, many companies in the four manufacturing sectors face challenges in effectively designing their technology and product planning, especially when formulating and implementing medium- and long-term strategies. The strategic anchoring of sustainable product development in SMEs and small midcaps 2030+ is just as important as the end product itself: The more effectively relevant stakeholders are involved in the strategy uptake, the more binding the achievement of goals will be for them. The CURIOST project therefore foresees uptake workshops with 140 SMEs and small midcaps in the partner regions as a next step (A1.4). Additionally, a Joint Regional Action Plan will be developed to identify regional needs in the partner regions and involve the political level (A3.3).

**Common understanding of the CURIOST joint strategy**

- Secure Europe's industrial and economic position, especially in the manufacturing secor, and support the achievement of reaching the EU's climate goals and aims of the UN Agenda 2030
- Be aware of the challanges and gaps the manufacturing industry is currently facing
- Highlight technological and business model best practices and address challenges as well as lessons learned
- Focus significantly on the effectiveness and expansion of (digital) circular product development
- Define ways to overcome barriers in sustainable (digital) product development and design
- Force the strategic anchoring of sustainable product development in SMEs and small midcaps 2030+

The process of setting up the joint strategy within CURIOST can therefore be described as the following graph shows:

**Current situation and challenges**

To set the starting point for the strategic framework and goal setting, a clear picture of the situation in (digital) circular product development in the four sectors will be drawn. Furthermore, the strategy gives an overview of identified gaps and challenges that SME and small midcaps in the four sectors are challenging with when fostering (digital) circular design in sustainable product development (D1.1.2). To analyse them helps to develop appropriate steps and achieve transferability.

**Current EU directives and regulations**

To ensure that the strategy is in line with the current EU directives and regulations (D3.1.2) the current regulatory framework is examined. Knowledge of the legal framework also helps to identify potential risks and to set appripriate goals. Furthermore, companies that are aware of the current legal framework and objectives can better prepare for change and gain a competitive advantage through (digital) circular product development.

**Key success factors for SMEs and small midcaps for driving (digital) circular product development forward**

The strategy gives an overview of identified best practices with a focus on their capitalization in the four sectors. The analysis of those best practices, the lessons learned and the intended strategy uptake should make a contribution for SMEs and small midcaps to learn from successful (digital) circular product development, avoid common mistakes and pitfalls, promote innovation and new business approaches, increase efficiency by implementing proven methods and benefit from collaboration and networking with other companies and experts.

**Steps for achieving circular ecnonmy 2030+ and transferability**

The strategy's aims to create a unified perspective for SME and small midcaps on circular (digital) business model development and design in the four manufacturing sectors and to identify a specific path 2030+ that can be taken on a local and national level by involving SMEs and small midcaps into cross-industrial collaboration.

Current situation and challenges in the seven partner regions and four sectors regarding (digital) circular product development

Within the framework of CURIOST, the following two initial deliverables D1.1.1 (State of the art in sustainable and circular product development) and D1.1.2 (Gap and challenges analysis for digital and circular design in sustainable product development) are the basis for a more far-reaching analysis of the current situation and challenges in the seven partner regions and four sectors mechanics and mechatronics, plastics, packaging and building and construction.

In D1.1.1, the consortium interviewed in total of 61 SMEs and small midcaps from all seven partner regions to get information about their transformation level in (digital) circular product development:

- Transformation level 0: no activities in the circular economy
- Transformation level 1: First partial ideas / experiments on the circular economy
- Transformation level 2: Circular economy topics introduced in the industry (technical, organizational)
- Transformation level 3: Fully integrated circular economy established

It is clear that SMEs and small midcaps in all four sectors and partner regions are on the path to transformation and are aware of the need for change towards circular product development (= transformation level 0). Nevertheless, progress is evident in all sectors, as *figure 1* shows. There remains potential for all companies to achieve transformation level 3 (= fully integrated circular economy established):

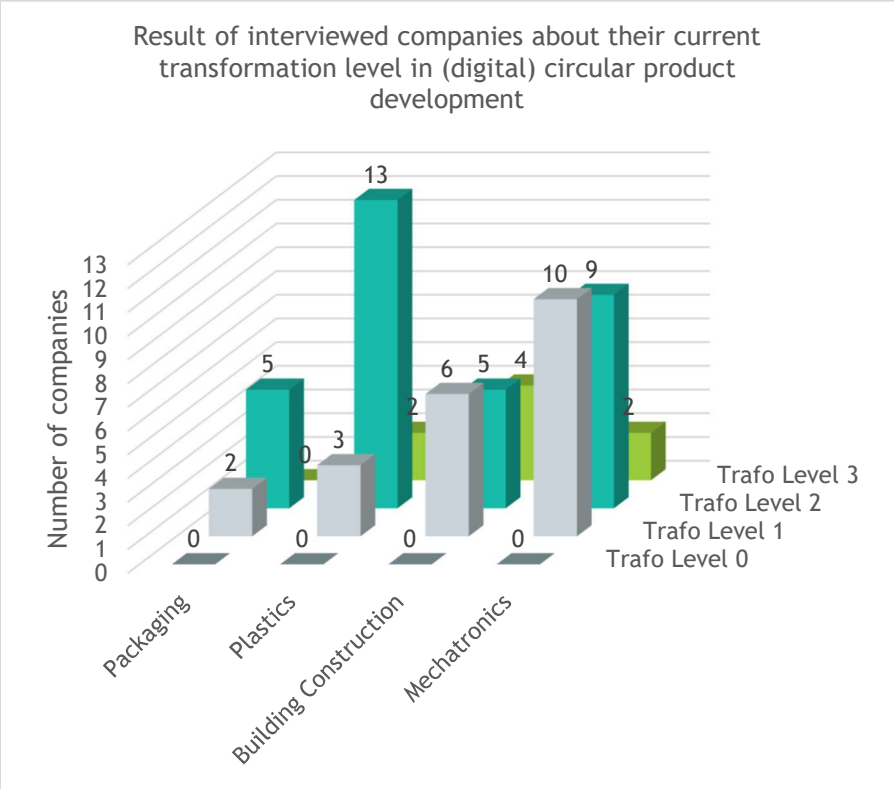



*Figure 1 – Result of interviewed companies about current trafo level in digital circular product development D1.1.1, page 11*

Within D 1.1.2, the project consortium carried out a comprehensive SWOT analysis in the four sectors and seven partner regions. It's aim was to identify gaps and challenges those SMEs and small midcaps are currently dealing with.

The overall SWOT analysis for all four sectors and regions shows the following results:

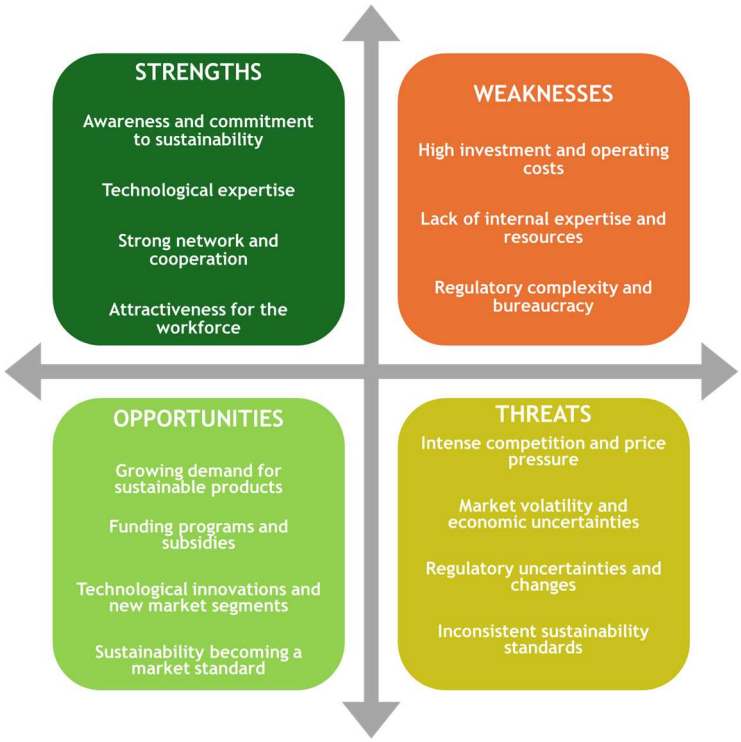



*Figure 2- Overall SWOT analysis of all four sectors and partner regions (D1.1.2)*

There is a growing awareness in (digital) circular product development and demand for sustainable products which includes an increased focus on sustainable practices and a willingness to implement measures that contribute to a more sustainable economy, e.g. the integration of technological innovations into processes to boost efficiency and promote sustainability. Furthermore, companies register an increasing demand for environmentally friendly products and the need of sustainable solutions from customer's side. As a result, new business opportunities open up new markets and enable the expansion of (digital) circular products and services. This transformation is an opportunity to enhance internal strategic processes and drive innovation forward.

The adherence to legal requirements and support from a regulatory framework can be seen as key factors to ensure the implementation of circular practices. At the same time, those regulations minimize legal risks and gain trust from stakeholders. Additionally, national and EU-supported funding for innovation and research can be seen as significant incentive for companies aiming to implement circular measures. On the other hand, complex and unclear regulations in the circular economy can lead to a fear of bureaucratic effort. Regulatory complexity as well as their inconsistency makes it difficult to implement sustainable measures effectively.

At the same time, companies often face financial barriers and dependence on external funding such as high investment, production and compliance costs. These financial barriers can prevent companies from investing in sustainability. Furthermore, there is a lack of nternal strategic focus and expertise on sustainability which leads to a failure in implementing circular economy strategies. Beside those internal hurdles, SMEs and small midcaps are focusing on a strong competitive pressure from the market that can offer cheaper alternatives, making it challenging to implement sustainable practices and compete effectively. Companies of each sector deal with global market uncertainties, which can endanger the profitability of sustainable practices and affect competitiveness.

The following sections provide a sector-specific analysis that builds on the general overview presented above.

## 1.1. Mechanics and mechatronics sector

In the mechanics and mechatronics sector, the consortium focused on the regions AT, IT, HR, HU, PL and DE for the SWOT analysis but also interviewed SMEs and small midcaps from SK. The current situation and challenges can be described as follows:

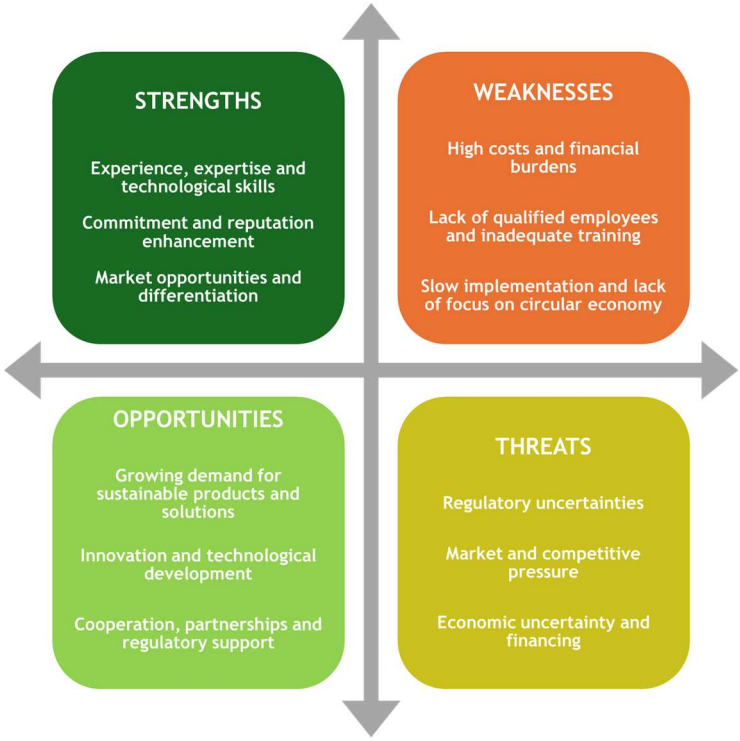



*Figure 3 - SWOT analysis mechanics and mechatronics sector in AT, IT, HR, HU, PL, DE (D1.1.2)*

Experience, specialists with expertise in circular product development and advanced technological skills are seen as crucial for economic success. This includes years of industry experience and skills in areas like metalworking, mechatronics, and digitalization. Furthermore, a strong internal commitment to sustainability positively impacts a company's image and reputation. In this sector, companies that are dedicated to circular economy can gain stakeholder trust and position themselves as reliable players.

Nevertheless, most of the interviewed companies are at transformation levels 1 and 2. However, most of the interviewed companies are currently at transformation levels 1 or 2, indicating that this sector is lagging behind others in its shift toward a circular economy. This delay is partly due to a later start in addressing sustainability and circularity. For this reason, it is especially important for companies in this sector to foster cooperation, build strategic partnerships, and engage in collaborations that provide regulatory guidance and access to subsidies.

Regarding financial issues, investing in innovative technologies is key for this sector and a significant hurdle at the same time. This includes e.g. advancements in production or investing in the development of new (digital) business models.

Furthermore, there is a lack of qualified employees and insufficient training related to the specific requirements of this sector. Many companies have not yet prioritized the circular economy on a strategic level which leads to a slow implementation of necessary changes and innovations. Traditional mindsets and a slow adaptation of processes hinders a rapid adoption of sustainable practices. Economic fluctuations and uncertainties in financing sustainable measures cause significant obstacles. Companies frequently encounter market volatility, price pressure due to economic downturns, and overall economic uncertainties.

## 1.2. Plastics sector

In the plastics sector, the consortium focused on the regions AT, IT, HR, HU, PL, DE and SK for the SWOT analysis and the interviewed SMEs and small midcaps. The current situation and challenges can be described as follows:




*Figure 4 - SWOT analysis plastics sector in AT, IT, HR, HU, PL, DE, SK (D1.1.2)*

Many companies are dedicated to sustainable practices and integrating circular economy principles into their business processes. This includes e.g. using recycled materials, initiating recycling programs, and prioritizing sustainable technologies and production methods. A considerable number of companies are at transformation level 2, with some even reaching level 3.

Companies are focusing on technological innovations (e.g. digitalization, sensors, innovative materials). Modern production facilities and the adoption of new technologies help companies to stay competitive. On the other hand, this sector is dealing with low acceptance of recycled materials and concerns about the quality compared to virgin materials which hinders the adoption of a wider range of circular economy solutions. The efficiency of recycling is also significantly impaired by material mixtures and impurities, which makes it difficult to implement a functioning circular economy.

Nevertheless, the plastics sector has years of industry experience in production and recycling which fosters trust and stability. The rising demand for sustainable products creates new (digital) business opportunities such as bio-based materials or sustainable 3D printing solutions.

At the same time, companies faced the need of investments in technology and innovation which can lead to financial shortfalls and hinders the ability to improve sustainable practices even more. A lack of technological infrastructure and limited availability of materials also make it difficult to scale up sustainable solutions. Simultaniously, there are considerable gaps in knowledge about the properties and potential applications of alternative materials. The profitability of sustainable packaging is another hurdle, as it often incurs higher costs than conventional alternatives. There is also a lack of scalable upcycling and reuse models that could make sustainable packaging solutions more economically attractive.

National and EU-wide regulations for circular solutions create additional market opportunities and competitiveness. On the other hand, uncertainties in regulations pose significant obstacles as those inconsistencies lead to difficulties in planning and implementing long-term strategies.

Another problem is the lack of public awareness of correct waste separation, which reduces the efficiency of recycling processes. Requirements for carbon footprints and sustainable material procurement also present additional regulatory hurdles. Finally, the establishment of closed-loop systems requires considerable investment, which could be facilitated by financial incentives and support programmes.

## 1.3. Packaging sector

In the packaging sector, the consortium focused on the regions AT, IT, HU, PL and SK for the SWOT analysis and the interviewed SMEs and small midcaps. The current situation and challenges can be described as follows:

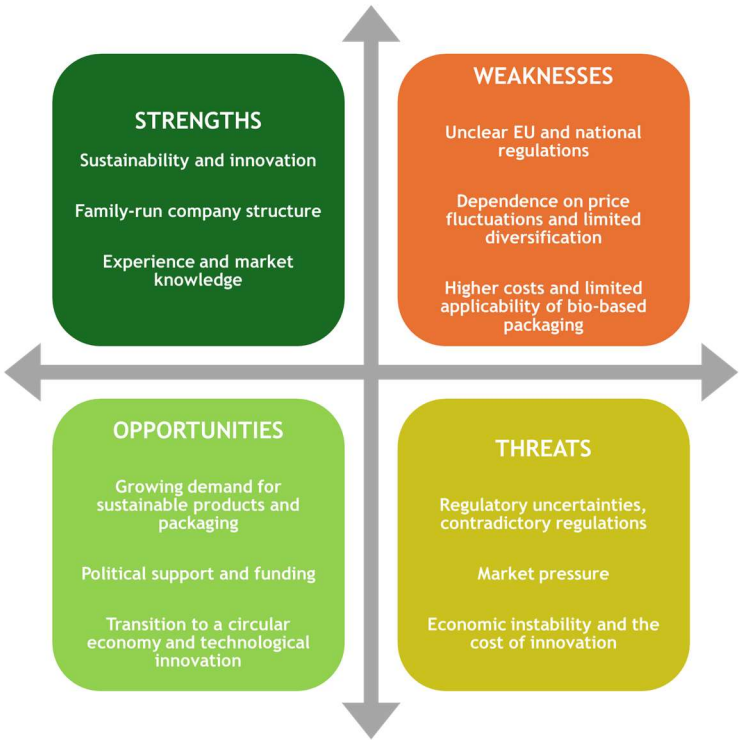



*Figure 5 - SWOT analysis packaging sector in AT, IT, HU, PL, SK (D1.1.2)*

Companies are often family-run businesses with regional roots that tend to integrate ESG (Environmental, Social, Governance) requirements and can act as flexible trendsetters in niche markets. This strengthens their market position and promotes innovation. Those companies benefit from years of experience and established production processes which builds trust and reliability. Most interviewed companies are at transformation levels 1 and 2, with the majority at level 2.

There is an increasing demand from both consumers and regulators for sustainable packaging and products. EU and national fundings for circular economy initiatives offer significant opportunities for companies, e.g. in environmentally friendly packaging such as bio-based materials. At the same time bio-based packaging is more expensive than conventional alternatives and can only be used in certain applications which is limiting its broad marketability and scalability.

Factors like strongly fluctuating energy prices or a limited diversification of products and customers make companies vulnerable to market fluctuations. Price pressure from cheaper alternatives and competition from large, established suppliers and foreign companies pose significant obstacles as well. SMEs are often hindered by high financial costs of developing new technologies and innovations.

EU and national policy frameworks typically incentivize this sector and foster long-term investment in circular economy initiatives. On the other hand, unclear or inconsistent regulations (e.g. regarding the end-of-waste criteria) cause struggles in the implementation of circular economy strategies. There is also a lack of binding standards for sustainable packaging, which makes comparability and transparency within the industry more difficult. Greenwashing remains a key problem here too, which must be curbed through stricter regulations and consistent enforcement. The fragmentation of national and international law causes a high level of bureaucracy for companies and makes it difficult to implement sustainable measures.

## 1.4. Building and construction sector

In the building and construction sector the consortium focused on the regions HR, HU and DE for the SWOT analysis but also interviewed SMEs and small midcaps from AT and PL. The current situation and challenges can be described as follows:

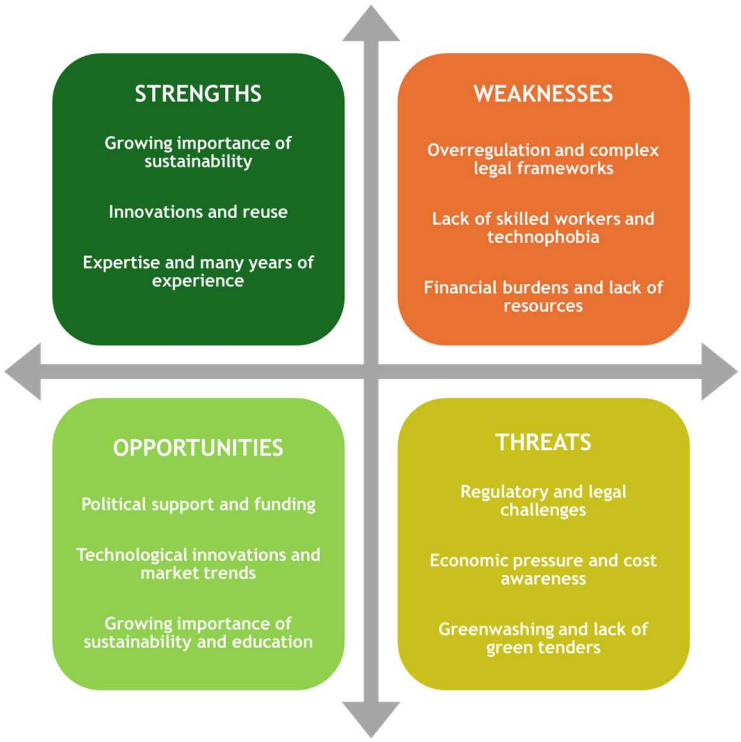



*Figure 6 - SWOT analysis building and construction sector in HR, HU, DE, AT, PL (D1.1.2)*

This sector shows the greatest diversity, with companies spread across transformation levels 1 to 3. Sustainability is becoming a crucial issue helping to attract young talents and promote a positive industry image. Internal sustainable practices as well as products and services are seen as a strategic strength that enhances both the company and its brand.

Companies with extensive expertise, e.g. in areas like soil recycling, own valuable knowledge and skills that position them at the forefront of the industry. Developing innovative technologies that reduce $CO_2$ emissions and improve energy efficiency offers substantial economic opportunities. Integrating waste materials into new products and continuously optimizing recycling technologies are viewed as a market boost. Trends like timber construction and the use of recycled materials open up new business opportunities.

On the other hand, many skilled workers move to other industries. This issue is worsened by a technophobic environment and lack of political support, making it difficult to introduce new technologies and sustainable innovations. At the same time, customers focus on low-cost products without considering the environmental impact. Price fluctuations and rising raw material costs endanger the profitability of circular initiatives.

Increasing policy measures, financial incentives such as fundings (e.g. for recycling projects or renovations) support companies in implementing sustainable and resource-efficient practices and accelerate the transition to a circular economy. But the building and construction sector also complies to a multitude of standards, regulations, and approval procedures that cause high costs, especially for small companies. Complex legal frameworks increase administrative burdens, limit flexibility and can slow down circular innovation. Dependence on EU funding for sustainable projects makes companies vulnerable to changes in funding policy. The lack of "green tendering" to support sustainable materials and practices in construction and other sectors is a significant issue.

# 2. Overview of current directives and regulations on EU level regarding the four sectors

This section lists and briefly describes the current legal and policy regulations at EU level. These are relevant for the four sectors in CURIOST. For future reference, it is expressly pointed out that the current status (May 2025) is described here as an overview. A detailed analysis was carried out as part of *D2.1.3 Analysis of latest legal and policy framework on EU level*.

| **Legal and policy regulation on EU level and partner regions** | **Type** | **Brief description** |
|---|---|---|
| New Circular Economy Action Plan | action plan | Facilitation of the transition to a circular economy in the EU. Key measures include:<br>▪ Electronics: Extending product lifetimes, implementing the "right to repair," and restricting hazardous substances.<br>▪ Plastics: Reducing microplastics, promoting bio-based and biodegradable plastics, and ensuring accurate labeling.<br>▪ Packaging: Mandatory requirements to reduce packaging waste, enhance reusability and recyclability, and simplify packaging materials.<br>▪ Construction: Improving durability and adaptability of buildings, revising material recovery targets, and promoting sustainable use of excavated soils. |

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| **Eco-design for Sustainable Products Regulation Proposal** | regulation | Improving the durability, reliability, reparability, upgradability, reusability and recyclability of products. The regulation addresses hazardous chemicals, improves energy and resource efficiency, reduces waste and increases recycled content. It ensures that products do not become obsolete prematurely and that spare parts and repair information are readily available. The most important features are:<br>▪ Repairability/durability assessment provides environmental benefits and clearer consumer information.<br>▪ Digital Product Passport: Ensures accurate, complete and up-to-date information along the value chain.<br>▪ CE marking: Marking the conformity of products with regulations.<br>▪ Green procurement: promoting sustainable practices. |
| **European strategy for plastics in circular economy** | regulation | Focus on creating a smart, innovative, and sustainable plastics industry. Its aim is to reduce greenhouse gas emissions and dependence on fossil fuels while promoting growth and jobs in Europe. Key goals include:<br>▪ Reusable/Recyclable Packaging: By 2030, all plastics packaging in the EU should be reusable or recyclable.<br>▪ Increased Recycling: Aim to recycle over half of Europe's plastic waste.<br>▪ Modernizing Recycling Capacities: Investing in and upgrading recycling facilities.<br>▪ Collaboration with Chemical Industry: Enhancing applications for recycled plastics.<br>▪ Sustainable Consumption and Production: Supported by citizens, governments, and industry. |
| **Construction Products Regulation (CPR)** | sector specific (construction) | Ensurance of smooth functioning of the single market and free movement of construction products in the EU through harmonized technical specifications. Key objectives include:<br>▪ Single Market: Achieving a well-functioning market for construction products.<br>▪ Green and Digital Transition: Contributing to a modern, resource-efficient, and competitive economy.<br>▪ Environmental Sustainability: Developing assessment methods for the environmental impact of construction products.<br>▪ 3D Printing Safety: Ensuring 3D printed construction products meet safety standards. |
| **Packaging and packaging waste regulation proposal** | sector specific (packaging) | Reduction of packaging waste and promote a circular economy by supporting sustainable practices and harmonizing national |

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| | | measures to avoid trade obstacles and environmental harm. Key points include:<br>▪ Reusability/Recyclability: All packaging should be reusable or recyclable by 2030.<br>▪ Waste Reduction: Measures to minimize packaging waste and complexity.<br>▪ Recycled Content: Mandatory targets for recycled content in plastic packaging.<br>▪ Lifecycle Impact: Ensuring packaging is designed for minimal environmental impact throughout its lifecycle.<br>▪ Penalties: Effective penalties for noncompliance to increase public trust. |
| **Regulation on machinery** | sector specific (mechanics & mechatronics) | Regulation (EU) 2023/1230 enhances machinery safety in the EU, replacing the Machinery Directive 2006/42/EC on January 20, 2027. This regulation aims to create a safer working environment and facilitate international trade. Key points include:<br>▪ Expanded Scope: Covers more machinery products, including emerging technologies.<br>▪ Stricter Risk Assessment: Detailed hazard evaluation and risk mitigation.<br>▪ Technical Documentation: Comprehensive reference for manufacturers and users.<br>▪ Streamlined Compliance: Various means to demonstrate compliance, reducing administrative burdens.<br>▪ Enhanced Market Surveillance: Rigorous checks to ensure safety standards. |
| **Omnibus Package:**<br>**Clean Industrial Deal** | Directive, act | Under the newly presented Clean Industrial Deal, significant changes are expected to amend the CSRD and CSDDD directives. The Deal presents measures to boost every stage of production, with a focus on<br>▪ energy-intensive industries such as steel, metals, and chemicals, that urgently need support to decarbonise, switch to clean energy, and tackle high costs, unfair global competition, and complex regulations<br>▪ the clean-tech sector which is at the heart of future competitiveness and necessary for industrial transformation, circularity, and decarbonisation.<br><br>The package includes amendments to the **Corporate Sustainability Reporting Directive (CSRD):** |

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| | | ▪ The reporting requirements would only apply to large undertakings with more than 1000 employees (i.e. undertakings that have more than 1000 employees and either a turnover above EUR 50 million or a balance sheet total above EUR 25 million).<br>▪ This means that the number of companies in scope will be reduced by about 80%. The new scope will be more closely aligned with the key scope thresholds of the CSDDD.<br><br>**'Value chain cap'**<br>For companies which will not be in the scope of the CSRD anymore (up to 1,000 employees), the Commission will adopt by delegated act a voluntary reporting standard, based on the standard for SMEs (VSME) developed by EFRAG. That standard will act as a shield, by limiting the information that companies or banks falling into the scope of the CSRD can request from companies in their value chains with fewer than 1,000 employees.<br>**Corporate Sustainability Due Diligence Directive (CSDDD):**<br>▪ Giving companies more time to prepare for implementing the new framework by postponing the transposition deadline, with first phase of applications of the sustainability due diligence requirements covering the largest companies should start in July 2028.<br>▪ Simplify other aspects of sustainability due diligence requirements so that companies avoid unnecessary complexities and costs with intervals between two regular periodic assessments being prolonged from one year to five years. |
| **The Reduction of the impact of certain plastic products on the environment** | directives, measures | **Austria**<br>▪ Single Use Plastics Directive: Bans various single-use plastic products and supports innovation in sustainable packaging.<br>**Slovakia**<br>▪ Directive Revision: Proposed revision to make all packaging reusable or recyclable by 2030.<br>▪ Plastic Reduction Measures: Includes charging for plastic bags (since 2018), PET bottle deposits (since 2022), and banning single-use plastic packaging (since 2021).<br>**Croatia**<br>▪ Single Use Plastics Directive: Incorporated into national legislation, banning several single-use plastic products since July 31, 2021.<br>**Italy** |

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| | | ▪ Single Use Plastics Directive: Transposed through Legislative Decree No. 196/2021, driving a shift towards biodegradable materials and innovation.<br>**Germany**<br>▪ Single-Use Plastics Ordinance: Implements Directive (EU) 2019/904, banning certain single-use plastic products to reduce environmental impact.<br>**Poland**<br>▪ Plastics: Directive (EU) 2019/904 aims to reduce plastic waste and its environmental impact, including reductions in plastic use, market bans on certain products, labeling requirements, and financing waste management costs.<br>**Hungary**<br>▪ Single-Use Plastics Directive: Implemented through Regulation 301/2021, promoting extended producer responsibility and reducing plastic waste. |
| **Common rules on promoting the repair of goods** | programs, rules, strategies, bonus | **Austria**<br>▪ Repair-Bonus Program: Offers financial support for repairs, making sustainable options more attractive.<br>**Slovakia**<br>▪ Repair Rules: Emphasizes repairs to transition to a circular economy, supported by national legislation and consumer protection laws.<br>▪ National Strategy: Promotes recycling, reduces single-use products, and supports SMEs in repairs and renovations.<br>**Italy**<br>▪ Repair of Goods: Encourages repair and reuse through national initiatives, aligning with the circular economy.<br>**Germany**<br>▪ Right to Repair: Draft law to ensure availability of spare parts and repair instructions, enhancing product lifespan and sustainability.<br>▪ Repair Bonus: Publicly funded program to incentivize repairs of electronic devices, reducing waste and supporting local businesses. |
| **Energy performance of buildings** | directives, acts | **Austria**<br>▪ Energy Performance of Buildings Directive (EPBD): Aims to accelerate building renovations, reduce energy consumption, and promote renewable energy use, with specific goals for 2030 and 2050.<br>**Slovakia** |

| | | |
|---|---|---|
| | | ▪ Energy Performance of Buildings Directive (EPBD): Focuses on improving energy efficiency in buildings, promoting sustainable construction practices, and supporting the transition to a circular economy.<br>**Croatia**<br>▪ Energy Performance of Buildings Directive (EPBD): Aims to accelerate building renovations, reduce energy consumption, and promote renewable energy use, with specific goals for 2030 and 2050.<br>**Germany**<br>Building Energy Act: Based on the EPBD, aims to phase out fossil fuels for heating by 2045, promoting renewable energy use in buildings.Poland<br>▪ Energy Performance of Buildings Directive (EPBD): Aligns with EU standards, emphasizing energy efficiency, waste reduction, and sustainable building materials.<br>**Hungary**<br>▪ Energy Performance of Buildings Directive (EPBD): Aligns with EU standards, emphasizing energy efficiency, waste reduction, and sustainable building materials. |

*Table 1 - overview of current EU directives and regulations regarding the four sectors (D3.1.2)*

# 3. Key success factors for SMEs and small midcaps for driving (digital) circular product development forward

SMEs and small midcaps play a crucial role in driving innovation and sustainability. As the global economy shifts towards more environmentally conscious practices, the adoption of (digital) circular product development has become essential. Regarding the four sectors mechanics and mechatronics, plastics, packaging and building and construction this chapter of CURIOST joint strategy focuses on the key success factors that enable SMEs and small midcaps to effectively implement and advance circular product development across the seven partner regions. CURIOST project partners already analyzed and delivered the following results that are now the foundation of the identified key success factors:

- *D1.1.1 State of the art in sustainable and circular product development*
- *D1.1.2 Gap and challenges analysis for digital and circular design in sustainable product development*
- *D1.1.3 Capitalization of best practices and benchmark in sustainable product design in Central Europe*
- *D3.1.2 Analysis of latest legal and policy framework on EU level*

## 3.1. Market-related, economic and financial and circular economy key success factors for SMEs and small midcaps – lessons learned from best practices

This analysis focuses on the market-related, economic and financial and circular economy key factors that contribute to SMEs and small midcaps' success regarding the development of (digital) circular products and design.

Market-related key success factors

Within CURIOST, project partners already assessed the market status in their regions and created a matrix of key performance indicators (KPI) relevant to their regions (Austria, Croatia, Germany, Italy, Hungary, Poland, and Slovakia).

The following table shows the conclusion regarding the analysis of the regions in consideration of each countries' market status and readiness for sustainable product development and design:

| Region / country | Description of current market status and readiness for sustainable product development and design |
|---|---|
| **Austria** | • Leading in sustainability due to long-term environmental policies and high investment in research and development<br>• Businesses are at the forefront of implementing green and innovative solutions, especially in manufacturing and technology<br>• Extensive sustainability programs and active involvement in international green innovation projects |
| **Germany** | • Leader in sustainability with strong environmental policies and significant R&D investment (similar to Austria)<br>• Businesses are highly engaged in green solutions and innovation<br>• Known for comprehensive sustainability programs and participation in international projects |
| **Croatia** | • Shows growing interest in sustainable development but faces obstacles due to limited investment and a less developed technological base<br>• Improvements are mainly driven by EU co-financed programs supporting SMEs in adopting sustainable practices |
| **Hungary** | • Growing interest in sustainability but struggles with limited investment and technological infrastructure (similar to Croatia)<br>• EU funding programs play a crucial role in supporting sustainable practices among businesses |
| **Poland** | • Trying to catch up with neighbour regions but faces challenges due to high dependence on traditional energy sources and slower adaptation to new technologies |

| | |
|---|---|
| **Italy** | • Diverse economy with some manufacturing sectors making significant efforts to reduce their ecological footprint through innovative solutions<br>• Industrial regions face challenges with traditional production methods and limited modernization initiatives |
| **Slovakia** | • Faces challenges with gradual adoption of sustainable development principles (similar to Hungary and Croatia)<br>• EU funding support is essential for implementing environmentally sound strategies |

*Table 2 - Description of current market status and readiness for sustainable product development and design*

Overall, Austria and Germany are the most prepared regions for sustainable design and product development. Italy is at an intermediate level of readiness. Croatia, Hungary, Poland, and Slovakia have potential but need more investment and improved legislative frameworks to support the green transition.
Regarding the analysis above, market-related key success factors across all partner regions that fundamentally drive (digital) circular product development forward are:

1. **Strong and long-term environmental policies on a national and european level** to cause significant investments in R&D
2. **(Inter)national sustainability programs and active involvement** in (inter)national green innovation projects
3. **EU funding and support by co-financed programs** in adopting sustainable practices, especially for SMEs in „green“ funding programs

Economic and financial key success factors

As the CURIOST partner countries are rather heterogeneous in terms of their economic and financial structure, the (promising) economic and financial key success factors are broken down by country as follows, based on the market-related analysis:

- Austria and Germany (most prepared)
- Italy (intermediate level)
- Croatia, Hungary, Poland, and Slovakia (potential but improvements needed):

| Partner region / country | Austria and Germany | Italy | Croatia, Hungary, Poland, Slovakia |
|---|---|---|---|
| **(promising) key economic and financial success factors** | ▪ **strong entrepreneurial activity**<br>▪ significant **investment in R&D**<br>▪ top **enterprises investing in R&D** | ▪ **significant turnover share of SMEs**<br>▪ **SMEs make up 99.8%** of enterprises<br>▪ highly **open economy** | ▪ Croatia and Slovakia: **high proportion of SMEs**<br>▪ Hungary and Slovakia: have **higher rates of** |

| | | | |
|---|---|---|---|
| | ▪ **robust support structures** and a strategic **focus on innovative technologies** | ▪ **Positive export performance in the manufacturing sector** | **start-ups** and total entrepreneurial<br>▪ Slovakia has several **accelerators and incubators** to support businesses and start-ups<br>▪ Croatia, Hungary, Poland: **significant foreign direct investment inflows** (Hungary having the highest in the EU, Poland higher than EU average)<br>▪ Poland: **Cohesion policy funds to enhance competitiveness and support entrepreneurs** |

*Table 3 - Key financial and economic success factors broken down by partner region (D1.2.1)*

Especially those partner regions that are located on an intermediate level or have potential in pushing (digital) circular product development forward, should be supported in growth, innovation and competitiveness, e.g. by building stakeholder partnerships, building economic and financial resilience (be prepared for uncertaincies), tracking progress with key performance indicators or adjust economic and financial strategies.

Circular economy key success factors per sector

To take in account especially the partner regions circular economy, the following key success factors have been identified on basis of the extensive analysis in D1.2.1. Additionally, the advantages and benefits of focusing the given key success factors can be pointed out:

| Circular economy key success factor | Advantages and benefits of focusing on given key success factos |
|---|---|
| **Strong policy framework:** All countries have comprehensive strategic documents and national plans that provide clear objectives and direction for circular economy practices. | provide clear objectives and direction, ensuring coordinated efforts across sectors |
| **Government support:** Strong policy frameworks and government initiatives support the implementation of circular economy practices across all countries. | facilitate the implementation of circular practices through funding and regulatory measures |
| **High recycling rates:** Austria, Germany, Italy, and Slovakia have set ambitious recycling | reduce waste and conserve resources, contributing to environmental sustainability |

| | |
|---|---|
| targets and achieved high recycling rates for various types of waste. | |
| **Focus on innovation:** Investments in research, innovation, and technology drive sustainable practices and support the transition to a circular economy. | drive the development of new technologies and sustainable practices, enhancing competitiveness |
| **Sector-specific initiatives:** Focused efforts in sectors such as construction, plastics, packaging, and electronics to promote circular practices and improve waste management. | address unique challenges by promoting efficient resource use |
| **Extended Producer Responsibility (EPR):** Implementation of the EPR principle to shift the burden of waste management to producers, encouraging sustainable product design and recycling. | shift the burden of waste management to producers, encouraging sustainable product design and recycling |
| **Educational and informational campaigns:** Conducting campaigns to inform and educate stakeholders about proper waste handling and sustainable practices. | raise awareness and engage stakeholders, fostering a culture of sustainability |

*Table 4 - Circular economy key success factor and their advantages and benefits (D1.2.1)*

Together, these factors create a robust foundation for a sustainable and resilient circular economy, benefiting the environment, economy, and society.

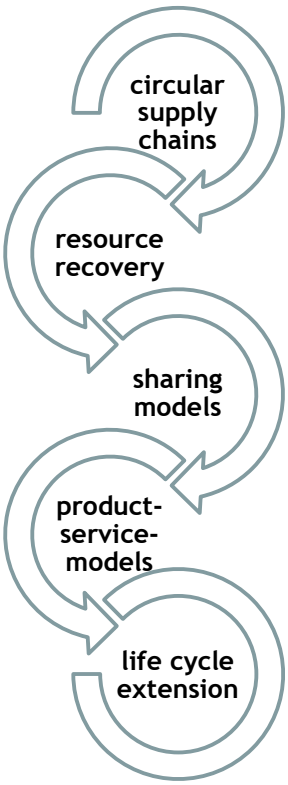
## 3.2. Key success factors of (digital) circular business models for SMEs and small midcaps – lessons learned from best practices

In the EU, the importance of circular business models has grown due to the need for sustainable practices as they aim to minimize waste and use resources efficiently throughout a product's life cycle. This strategy focuses on the characterization of business model best practices in the four sectors.

The EU Industrial Strategy and Green Deal, as well as Clean Industrial Deal and Omnibus package, provide a framework to promote these models, pushing reduced resource consumption forward and extended product lifespans. Therefore, CURIOST first focused on existing circular business models for sustainable products in *D1.2.2 Evaluation of current circular business models*. Those best practices have been collected and analyzed in order to identify a significant number of key success factors

- for circular supply model,
- for reuse recovery model,
- for product life extension model,
- for sharing model,
- for product as a service model,

and assess their transferability to SMEs and small midcaps, as well as between the four sectors. Unlike traditional linear models, circular business models focus on reuse, recycling, and extending product life. These models foster innovation, reduce environmental impact, and support long-term economic sustainability. In any case, key business model types include:




The use of renewable and recycled materials

A recover value from waste through recycling or energy conversion

The promotion of resource sharing, like shared car rentals or coworking spaces.

The offer of products as a service, extending their lifespan through maintenance and updates.

The inclusion of repairs, refurbishments, and redesigns to keep products in circulation longer.

Regarding the four sectors, the following table shows the **summarized key success factors** for SMEs and small midcaps by implementing circular (digital) business models. Horizontal key success factors that apply to at least two of the four sectors are highlighted with colour:

| Mechanics and mechatronics | Plastics | Packaging | Building and construction |
|---|---|---|---|
| **Innovative Partnerships:** Collaborate with technology providers, recycling partners, and other SMEs. | **Innovative Design:** Invest in R&D for materials and products that facilitate recycling and reuse. | **Strong Partnerships:** Collaborate with stakeholders across the value chain, from suppliers to customers, to ensure a seamless circular approach. | **Cost Efficiency:** Reducing material waste and reusing resources can lower operational costs. |
| **Digital Integration:** Utilize IoT, AI, and predictive analytics for efficient maintenance and resource tracking. | **Collaboration:** Partner with stakeholders across the value chain for shared sustainability goals. | **Digital Integration:** Leverage digital tools for tracking packaging use, facilitating returns, and monitoring life cycles. | **Innovation and Flexibility:** Adoption of sustainable practices enhances brand reputation and competitiveness. |
| **Customer Engagement:** Educate clients on the benefits of circular practices and involve them in sustainable initiatives. | **Regulatory Compliance:** Adhere to environmental regulations and adopt standards like ISO 14001. | **Consumer Engagement:** Educate customers on the importance of participating in circular models and incentivize their involvement. | **Regulatory Compliance:** Proactive circular strategies help meet evolving environmental regulations. |
| **Regulatory Compliance:** Stay informed and compliant with environmental legislation and standards. | **Consumer Engagement:** Educate customers on the benefits of circular models to encourage participation. | **Regulatory Compliance:** Stay informed about packaging regulations and align business strategies with national and EU sustainability goals. | **Customer Engagement:** Demonstrates a commitment to sustainability, appealing to eco-conscious clients. |
| **Financial Planning:** Secure funding through green grants and sustainable investment programs. | **Digital Integration:** Use digital tools for tracking, collection, and efficient sorting of recyclable plastics. | **Innovation and Flexibility:** Review and adapt business models to integrate emerging sustainable technologies and practices. | |

*Table 5 – Summarized key success factors for SMEs and small midcaps of each sector by implementing circular business models*

As the analysis shows, horizontal key success factors that attract at least two of the four sectors are:

1. **Innovative, strong partnerships and collaboration:** Partnerships play a crucial role in implementing circular business models. They help companies enhance competencies, manage resources efficiently, secure funding, and conduct pilot projects. The future success of these models in the EU relies on transforming existing linear systems through economic and social innovations and changes in consumer behavior.
2. **Digital integration:** The implementation of advanced technologies (e.g. IoT, AI, predictive analytics) help SMEs and small midcaps to monitor and optimize resource use, product life cycles, and supply chains. These tools enable real-time tracking, efficient maintenance, and data-driven decision-making, ensuring resources are used effectively and waste is minimized.
3. **Customer engagement:** To actively educate and involve customers in sustainable practices by highlighting the benefits of circular models can help to build a community around sustainability and enhances customers loyalty and support. Therefore, SMEs and small midcaps must be aware of the use of digital platforms to communicate and engage with customers or offer incentives for participation in recycling programs.
4. **Regulatory compliance:** For SMEs and small midcaps it is absolutely crucial to stay informed about current and upcoming environmental regulations and standards on a national and EU level. This ensures that business practices are aligned with these regulations and avoids penalties. Regularly reviews and updated compliance strategies help to be in line with legislation.
5. **Innovation and flexibility:** Creating a corporate culture of continuous improvement and adaptability especially concerning sustainable technologies and practices is needed. This encourages innovation in product design, manufacturing processes, and business models to stay competitive. Flexibility allows businesses to quickly respond to market changes and sustainability trends, ensuring long-term resilience and growth.

In summary, circular business models present a promising way to merge environmental sustainability with economic efficiency. Nonetheless, broader implementation is necessary to fully realize their benefits; especially by being aware of and actively investing into the mentioned horizontal key success factors above.

# 4. Strategic recommendations for achieving a circular economy 2030+ and its transferability within and beyond the project framework

The following chapter outlines the overall strategic recommendations for achieving a circular economy 2030+. In addition, the transferability of the strategic approaches within the project and beyond is described by focusing strategic approaches economically, technically and politically. Furthermore, strategic recommendations for each of the four sectors will be drawn.

Through strategic implementation of the identified factors, SMEs and small midcaps can contribute significantly to the circular economy, paving the way for a more sustainable future.

## 4.1. Economic, technical and political strategic recommendations 2030+

These strategic recommendations 2030+ collectively contribute to create a robust foundation for pushing (digital) circular product development and design forward:

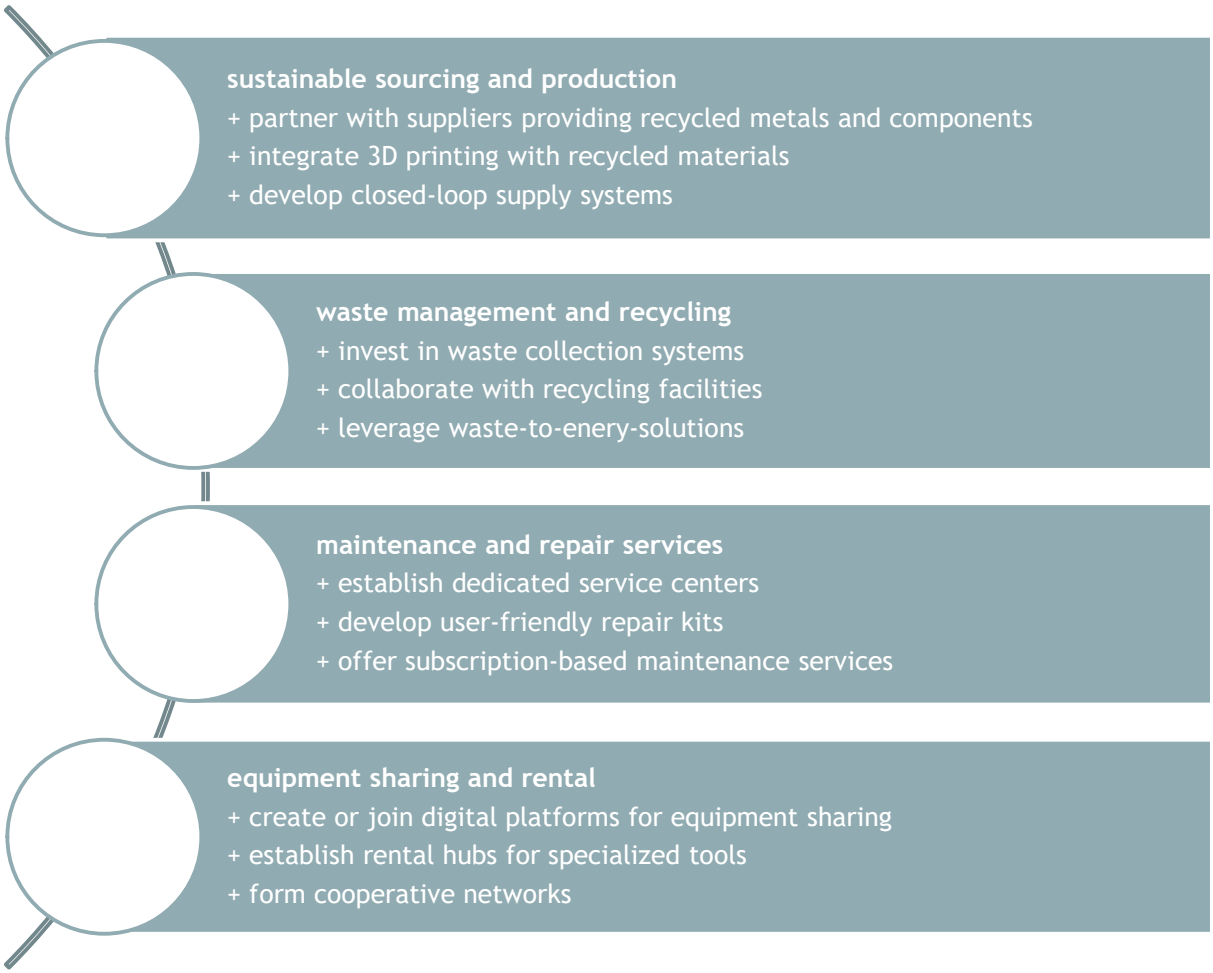
| Strategic recommendation | Required action | Required action for SMEs and small midcaps in particular |
|---|---|---|
| **Strong and long-term environmental policies** | National and European policies that drive significant investments in research and development (R&D) are crucial for fostering sustainable practices. | ▪ **Stay informed:** Keep up-to-date with national and EU regulations and policies related to the circular economy.<br>▪ **Align business practices:** Ensure that business operations are in line with the given regulations to avoid penalties and gain a competitive advantage. |
| **Government support** | Strong policy frameworks and government initiatives facilitate the implementation of circular economy practices through funding and regulatory measures. | ▪ **Leverage funding:** Apply for government grants and subsidies that support circular economy initiatives.<br>▪ **Engage with policy makers:** Participate in policy discussions and advocate for supportive regulations and incentives. |
| **EU funding and support** | Co-financed programs and EU funding play a vital role in supporting SMEs to adopt sustainable practices and drive innovation. | ▪ **Stay informed:** Keep up-to-date with the latest EU funding programs and initiatives that support SMEs.<br>▪ **Apply for grants and subsidies:** Regularly apply for relevant grants, subsidies, and co-financed programs that can provide financial support for sustainable practices and innovation.<br>▪ **Collaborate with partners and clusters:** Partner with other SMEs and small midcaps, research institutions, and industry stakeholders to strengthen applications, increase chances of securing funding and improving to learn from benchmarks.<br>▪ **Utilize advisory services:** Take advantage of advisory services and resources provided by the EU to help navigate the application process and improve the quality of submissions.<br>▪ **Monitor compliance:** Ensure that all funded projects comply with EU regulations and reporting |

| | | |
|---|---|---|
| | | requirements to maintain eligibility for future funding. |
| **High recycling rates** | Setting ambitious recycling targets and achieving high recycling rates for various types of waste helps reduce waste and conserve resources. | ▪ **Set recycling targets**: Establish ambitious recycling goals for different types of waste.<br>▪ **Implement recycling programs**: Develop and promote recycling programs within the organization to reduce waste and conserve resources. |
| **Focus on innovation** | Investments in research, innovation, and technology are essential to drive sustainable practices and support the transition to a circular economy. | ▪ **Invest in R&D**: Allocate resources to research and development of new technologies and sustainable practices.<br>▪ **Adopt advanced technologies**: Utilize IoT, AI, and predictive analytics to optimize resource use and improve efficiency. |
| **Extended Producer Responsibility (EPR)** | Implementation of the EPR principle shifts the burden of waste management to producers, encouraging sustainable product design and recycling. | ▪ **Design for sustainability**: Create products that are easier to recycle and reuse.<br>▪ **Implement EPR programs**: Establish programs that shift the responsibility of waste management to producers, encouraging sustainable product design. |
| **Educational and informational campaigns** | Conducting campaigns to inform and educate stakeholders about proper waste handling and sustainable practices helps raise awareness and engage stakeholders. | ▪ **Strengthen digital skills**: Helps to adapt to new technologies and to enhance creativity and innovation as well as efficiency.<br>▪ **Raise awareness**: Conduct campaigns to educate employees, customers, and stakeholders about the benefits of circular economy practices (e.g. info-days, webinars).<br>▪ **Engage stakeholders**: Involve stakeholders in sustainability initiatives to foster a culture of sustainability. |

*Table 6 – overall economic, technical and political strategic recommendations*

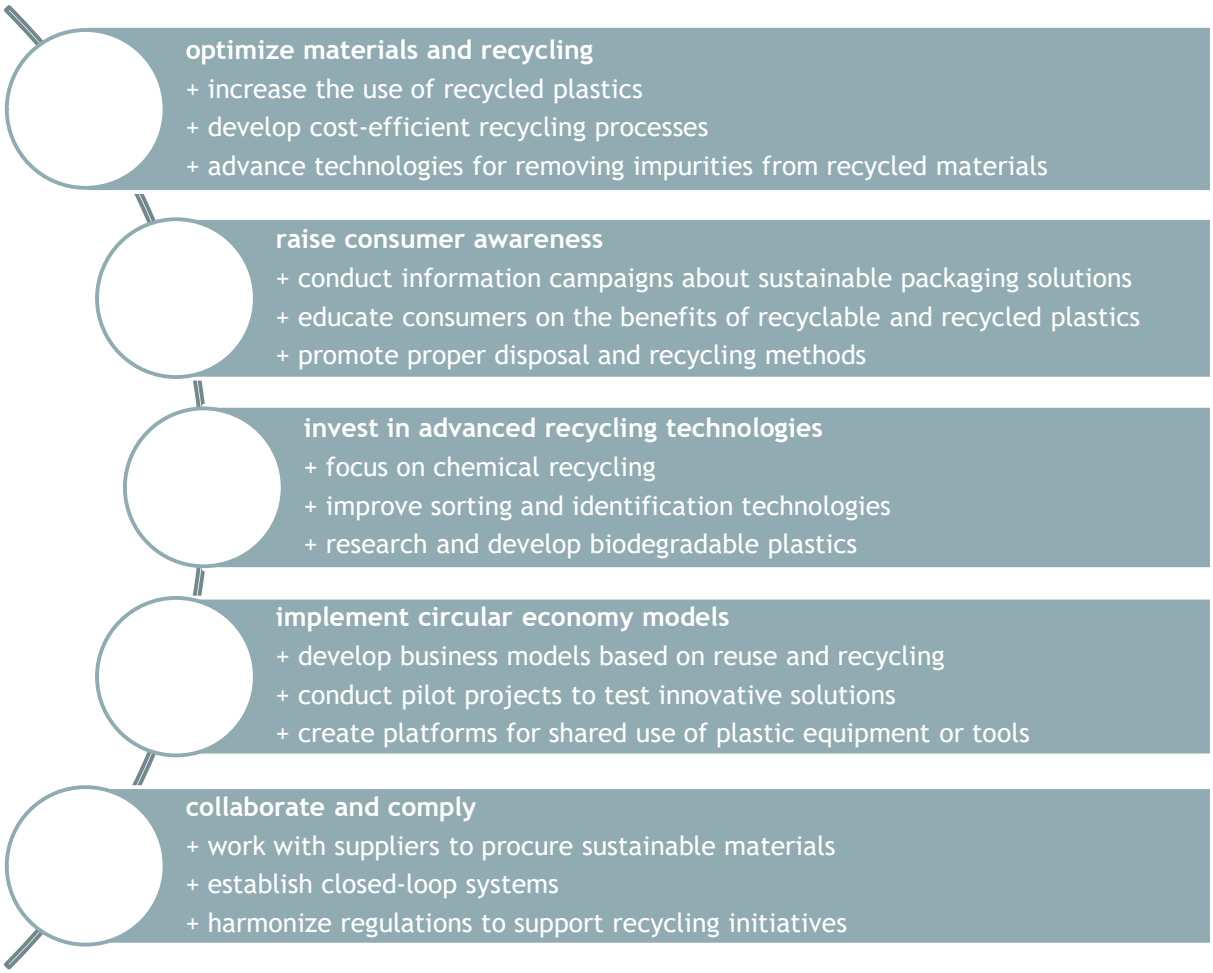
## 4.2. Mechanics and mechatronics sector

The following overview shows the strategic recommendations formechanics & mechatronics sector:



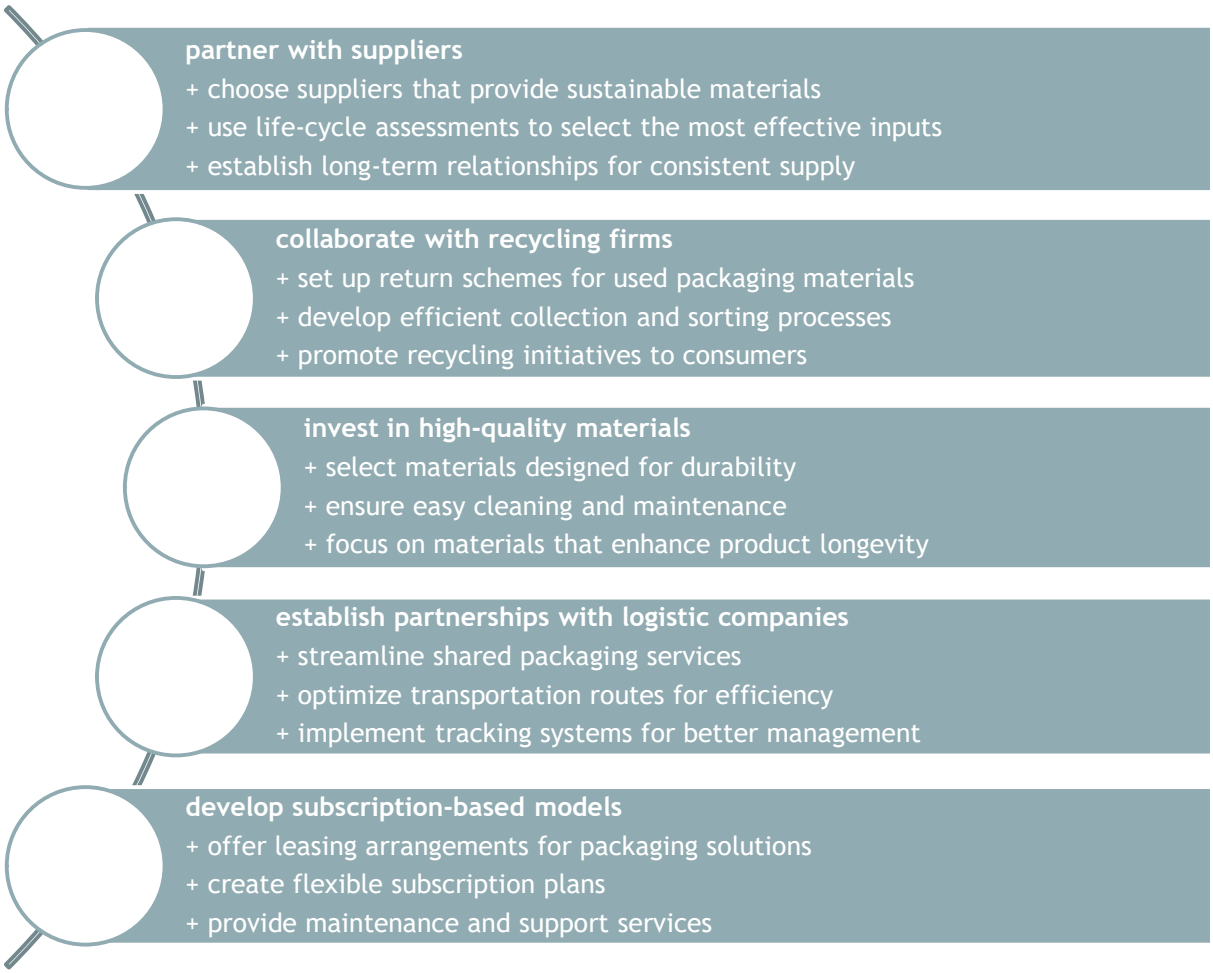
## 4.3. Plastics sector

The following overview shows the strategic recommendations for plastics sector:



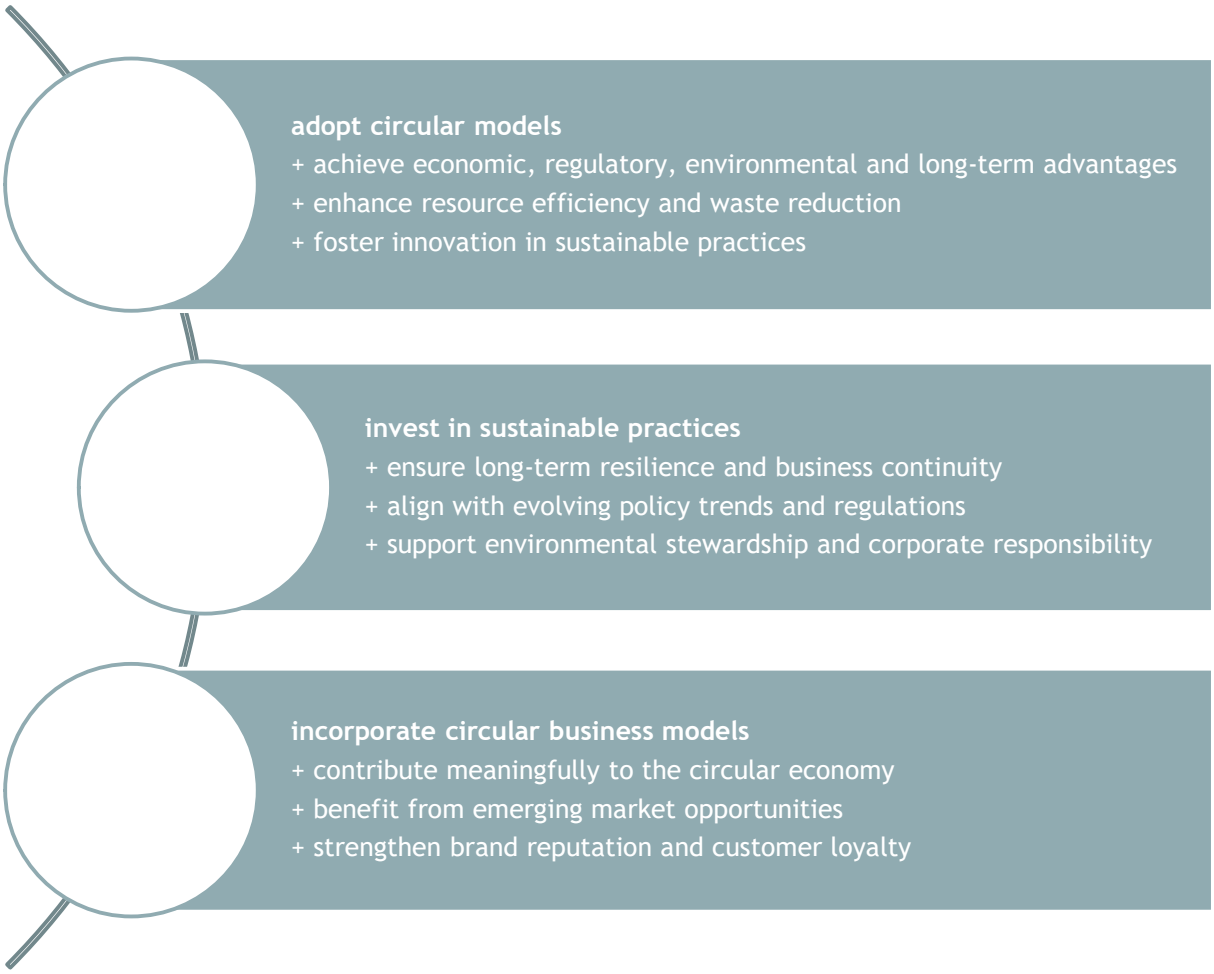
## 4.4. Packaging sector

The following overview shows the strategic recommendations for packaging sector:



## 4.5. Building and construction sector

The following overview shows the strategic recommendations for building and construction sector:




## 4.6. Transferability within and beyond the project framework

By **aligning with national and European policies** that drive investments in research and development, SMEs can ensure compliance, avoid penalties, and achieve a competitive advantage. **Government support** through grants and subsidies simplifies the implementation of sustainable practices, boosting business resilience and continuity.

**EU funding and support** provide essential financial resources for innovation and sustainable practices. **Collaborating with other SMEs, research institutions, and industry stakeholders** strengthens applications and increases funding opportunities. **Focusing on innovation through investments in R&D, adopting advanced technologies, and promoting collaboration** drives sustainable practices and supports the transition to a circular economy. These strategies not only **enhance resource efficiency and waste reduction** but also **strengthen market position**, ensure **long-term resilience**, and **support environmental responsibility**.

By implementing these practices, **SMEs and small midcaps can thrive in a low-carbon economy**, benefit from emerging market opportunities, and **build a strong reputation for sustainability**.

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