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Diagnostic Analysis for Circular Economy Interventions in Poland





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Acronyms and Abbreviations

BGK	Bank Gospodarstwa Krajowego (Polish National Development Bank)
CATI	Computer-Assisted Telephone Interview
CE	Circular Economy
DPP	Digital Product Passport
DRS	Deposit-Return System
EC	European Commission
EEA	European Environmental Agency
EIB	European Investment Bank
EIT	European Institute of Innovation and Technology
EMAS	Eco-Management and Audit Scheme
EPD	Environmental Product Declaration
EPR	Extended Producer Responsibility
ESG	Environmental, Social, and Governance
ESIF	European Structure and Investment Funds
ESPR	Eco-design for Sustainable Products Regulation
EU	European Union
FMCG	Fast-Moving Consumer Good
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPP	Green Public Procurement
GUS	Główny Urząd Statystyczny (Statistics Poland)
INNOWO	Instytut Innowacji i Odpowiedzialnego Rozwoju (Institute of Innovation and Responsible Development)
KIG	Krajowa Izba Gospodarcza (Polish Chamber of Commerce)
KIS	Krajowa Inteligentna Specjalizacja (National Smart Specialization)
LCA	Life Cycle Assessment
MARR	Małopolska Agencja Rozwoju Regionalnego (Małopolska Regional Development Agency)
MBT	Mechanical Biological Treatment
MEDT	Ministry of Economic Development and Technology
MGL	MakeGrowLab
NGO	Nongovernmental Organization
NIK	Najwyższa Izba Kontroli (Supreme Audit Office)
NIMBY	Not in My Backyard
NSRD	National Strategy for Regional Development
OEFSR	Organization Environmental Footprint Sector Rule
PARP	Polska Agencja Rozwoju Przedsiębiorczości (Polish Agency for Enterprise Development)
PEFCR	Product Environmental Footprint Category Rule
PESTEL	Political, Economic, Social, Technological, Environmental, and Legal
PIPC	Polska Izba Przemysłu Chemicznego (Polish Chamber of Chemical Industry)
PLGBC	Polish Green Building Council
PPWR	Packaging and Packaging Waste Regulation
PROM	Program for Food Waste Rationalization and Reduction
6R	Reduce, Reuse, Recycle, Recover, Remanufacture, and Redesign
R&D	Research and Development
R&I	Research and Innovation

RES	Renewable Energy Sources
ReSOLVE	Regenerate, Share, Optimize, Loop, Virtualize, and Exchange
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
VAT	Value Added Tax
WEEE	Waste from Electrical and Electronic Equipment

Executive Summary

Over the past decade, material efficiency and resource productivity have surfaced on the global policy agenda. The rise of the circular economy (CE) agenda reflects the objective of moving away from the current systems of production and consumption based on the ‘take-make-use-waste’ linear economic model toward economies centered on minimizing the use of virgin materials without adversely affecting welfare. The focus is on a life-cycle approach to resource management, which starts with reducing raw material demand by looping resources back into consumption and production systems, through innovations in material design, production, and reutilization processes. In addition to reducing pollution and other environmental pressures, CE can be a driver of private sector growth and jobs, and can increase the strategic autonomy of countries by reducing dependence on raw material imports.

Objectives and Approach

The objective of this rapid analysis is to identify the CE-related priority areas/sectors in Poland and potential areas of focus for follow-up interventions. The study also aims to highlight barriers that prevent the national and local governments from undertaking these interventions as well as enabling factors and approaches to overcome them. This report is not intended to be an in-depth analysis but rather an overview of the status of CE implementation in Poland that provides some recommendations to policy makers on how to accelerate progress toward a CE in Poland.

This study is based on a literature review, economic and environmental data collection, a survey among regions, and interviews with CE stakeholders. The study also involved consultations with the Republic of Poland Ministry of Economic Development and Technology (MEDT), which is the key ministry responsible for implementing the country's CE Roadmap.

This report uses the European Union (EU) definition of the circular economy: CE aims to maintain the value of products, materials, and resources for as long as possible by returning them into the product cycle at the end of their use while minimizing the generation of waste.¹ Fewer products discarded means fewer materials extracted and higher benefits for the environment. This process starts at the beginning of a product's life cycle: smart product design and production processes can help save resources, avoid inefficient waste management, and create new business opportunities.

Progress Toward CE in Poland

The analysis of selected indicators shows that Poland continues to perform significantly below the EU average in terms of resource productivity and waste intensity. While the overall circular use rate of the economy (9.1 percent) was in the range of the EU average (11.7 percent) in 2021, Poland performs far below the EU average in terms of resource productivity.² In 2020, Poland generated €0.8 per kg of material consumed, compared to the EU average of €2.1 per kg.³ Similarly, waste intensity remains high, with 150 kg of waste generated per €1,000 of GDP compared to the EU average of 65 kg (excluding major mineral waste). In addition, Poland is among the countries that have consistently scored low on the European Eco-Innovation Scoreboard.⁴

Several barriers to the transition toward a CE were identified. Key barriers to the CE transition include the lack of knowledge and resources among market participants, as well as ineffective and often-changing environmental legislation, and a ‘not in my backyard’ (NIMBY) attitude—particularly in rural areas and smaller towns in response to new infrastructure such as mining, recycling, or renewable energy sources (RES).

Since the *Roadmap for the Transformation towards a Circular Economy* (the CE Roadmap) was adopted in 2019, most strategic documents in Poland include CE as an important horizontal objective

¹ Codified in the EU Taxonomy Regulation, available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852>.

² <https://ec.europa.eu/eurostat/web/circular-economy/monitoring-framework>.

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0269>.

⁴ https://green-business.ec.europa.eu/eco-innovation_en.

at the central and regional levels. In 2019, Poland also introduced a so-called ‘smart specialization’ (that is, socioeconomic priority) dedicated to CE, with a focus on water, fossil raw materials, and waste. An updated law on waste was introduced on January 1, 2022 aimed at implementing EU CE directives and the Waste Framework Directive.⁵ Key issues include a new definition of various waste categories, instruments for the promotion of the waste hierarchy and green public procurement (GPP), and new targets for reducing landfilling of municipal waste from 30 percent (2025–2029) to 20 percent from 2030 and 10 percent from 2035. However, some important executive acts are still under public discussion, including those related to extended producer responsibility (EPR) and the deposit-return system in Poland.

This analysis identifies several shortcomings of the regulatory and institutional framework for the CE transition in Poland. Most of the tasks in the CE Roadmap were planned for implementation in 2020-2023. Barriers to implementation include a challenging work culture that does not foster institutional cooperation and collaboration (silo mentality). Furthermore, current regulations do not effectively support selective waste collection and recycling—a basic CE process—and are not set up to support the introduction of new circular business models and technologies. The frequent changes in both the legislation and environmental requirements have been criticized by stakeholders as hindering CE rather than supporting it. Similarly, the country has no requirement or structure for GPP, which, if implemented, could accelerate circularity.

Numerous funds are available to support the CE transition. These include EU Structural Funds, potentially the National Recovery and Resilience Plan, and the National Fund of Environmental Protection and Water Management (based on environmental fee and fine), which was established in 1989 and still operates as a state legal entity as per the Act on Environmental Protection.

The Way Forward: Proposed Initiatives for a More Circular Poland

This report references a previous study (oto-GOZ Project⁶ coordinated by the MEDT and co-financed by the National Centre for Research and Development), which identified five priority sectors for the transition toward a CE, based on criteria such as resource consumption, material and energy costs, and the volume of waste generated. These sectors include construction, energy, food and agriculture, mining, and chemicals. In addition, the recycling industry should be considered because it is the largest beneficiary of the CE transition.

Based on the desk research of strategic documents and initiatives in Poland, as well as consultations with industry representatives and the central and regional administration, seven potential follow-up interventions are suggested. They have been selected based on various criteria, including existing gaps between current and required legislation; their relevance to the regenerate, share, optimize, loop, virtualize, and exchange (ReSOLVE) model and reduce, reuse, recycle, recover, remanufacture, and redesign (6R) principles (as proposed in some Polish policy documents); and the results of the PESTEL⁷ and SWOT⁸ analyses presented in this report. In addition, the proposed initiatives reflect the results of the surveys and interviews conducted for this assessment.

⁵ Under EU law, transposition is the process of an EU member state passing appropriate measures to make an EU law enforceable under the legal system of the member state.

⁶ The oto-GOZ Project (<https://www.gov.pl/web/rozwoj-technologie/projekt-oto-goz>), was coordinated by the MEDT and co-financed by the National Centre for Research and Development in the first competition of the program "Social and economic development of Poland under conditions of globalizing markets" (GOSPOSTRATEG).

⁷ PESTEL = Political, Economic, Social, Technological, Environmental, and Legal.

⁸ SWOT = Strengths, Weaknesses, Opportunities, and Threats.

Table 1. Proposed follow-up interventions based on the rapid assessment of the CE potential in Poland

Intervention	Description
<p>Circular Poland 2040: Circularity Gap Report and Foresight Study with a focus on national/central, regional, and sectoral levels</p>	<p>Poland’s CE Roadmap only covers a time horizon until 2023. This intervention aims to establish a long-term strategic approach to the circular transition in Poland, focusing on the national, regional, and sectoral levels. A recently published Polish Circularity Gap Report (financed by the European Environmental Agency and Norway Grants)⁹ will serve as the basis for this intervention, with the aim to extend the analysis to the regional and sectoral levels. The Foresight Study, with a perspective until 2040, would identify specific actions for the CE transition of the economy and the expected effects, costs, and benefits of these actions. An important element of the document could be the analysis of industrial symbiosis in various value chains. Its intention is to provide a holistic approach, with clearer targets for increase in resource efficiency, decoupling, CE business model implementation, and data analysis.</p>
<p>Circular Regulation: Adjustment of the national legal framework</p>	<p>This intervention would address the inadequacy and fragmentation of the existing legal framework with respect to promoting high-quality products from recycling. It supports the adjustment of the legal framework, including long-term targets. A potential focus could be on the rational use of resources (including critical raw materials and their recycling) and waste management regulations, which are still insufficient for promoting CE, to strengthen the reuse and the prevention, recycling, and other recovery of waste. Current waste legislation is very strict, especially for recycling companies and without clear and consistent interpretation by different entities, as the Polish waste management system involves many actors on different levels. This activity could support the modification of the definition of recyclable material and the development of clear practice and rules for end-of-waste status criteria. In addition, it could support fiscal reform to change the price ratio between primary and secondary raw materials. A potential focus could be on different ‘types’ (textile, building, and so on) of waste management regulations.</p>
<p>Circular Consumers: Building consumer awareness for circularity and greening education system</p>	<p>Building consumer awareness through a Sharing Economy Action Plan, labeling of circular products, and education campaigns on the benefits of CE. A potential focus of this activity could thus be on the development of a Sharing Economy Action Plan designed to enable cities, businesses, and residents to reap the benefits from sharing platforms while also identifying and mitigating unintended risks. The activity could also aim to create and promote a clear system of certificates and labelling of sustainable and circular high-quality products, which facilitate consumer purchasing or lending decisions (adopt product-as-a-service system). Other elements could include consumer observation studies, as well as an education campaign about CE and its benefits and solutions. The sustainability and circularity idea should also be included in higher education, especially in technical programs, focusing also on eco-design, eco-innovation, corporate social responsibility, and environmental, social, and governance (ESG) financing.</p>
<p>Circular Business: Creation of an ecosystem of support for enterprises</p>	<p>A major barrier to the CE transition is a lack of knowledge and competences among entrepreneurs and business advisers; therefore, there is an urgent need to create an ecosystem of business support. This activity could include: (a) creation of a system of institutions offering consulting services for enterprises with a qualified and competent team of consultants; (b) harmonization and development of circular audit procedures together with an instrument cluster (including IT application mainly for small and medium enterprises [SMEs]); and (c) creation of regional advisory hubs where entrepreneurs will be able to gain/exchange knowledge about CE through workshops, seminars on changing business models, circular audits with individual consulting, support in building partnerships between value chains, and support to the emergence of industrial symbiosis. As part of this initiative, an enterprise education campaign on the benefits (environment, economy, and social well-being) of CE could be conducted.</p>

⁹ <https://www.circularity-gap.world/poland>.

Intervention	Description
Circular Accelerator: Creation of a government support system with economic and fiscal instruments	Help is needed in financing, at least at the initial stage, of the changing business models. This intervention would support different economic and financial instruments (tax incentives, EPR, GPP, and others) promoting the highest levels of the waste hierarchy. It would support the development of innovations, technologies, and circular processes and assistance in their scaling through the creation of accelerators (for example, focusing on IT systems, CE criteria in research and development [R&D] and investment projects, and large public/private funds dedicated to CE or eco-innovative solutions).
Circular Products: Eco-design, cost-benefit analysis and life cycle assessment (LCA) tools	Scaling up tools for eco-design by establishing an education system on eco-design in cooperation with universities and designers, especially for implementing innovative solutions and products. Focus on training in LCA; applications pointing to and tracking eco-design advances; cost-savings analysis; and other tools fostering measurable, competitive, and continuous eco-design improvements. Educational and consultancy services for enterprises and local administration in the field of carbon and environmental footprint calculation and interpretation and LCA, including funding and database development. To ensure consistency, these activities would need to be in line with EU legislation currently being negotiated in the areas of eco-design for sustainable products (ESPR) and packaging and packaging waste (PPWR).
Circular Raw Materials and service platform	An online platform to connect supply and demand for high-quality secondary raw materials for various economy sectors and promote sharing/lending of products and services. The platform will facilitate cooperation between different value chains and support building industrial symbiosis. This could be a pilot project with products and services introduced in several stages—ultimately covering all types of waste and products. It could be supported by a broad communication campaign to reach all relevant actors and promote the use of this tool in their everyday operations. The pilot could be set up for the construction sector, covering the entire value chain of construction and demolition waste. In the context of preparing for such a platform, the MEDT is currently planning a comprehensive assessment of the industrial waste market in Poland.

1. Introduction

Over the past decade, material efficiency and resource productivity have surfaced on the global policy agenda. The rise of the circular economy (CE) agenda reflects the objective of moving away from the current systems of production and consumption based on the 'take-make-use-waste' linear economic model toward economies centered on minimizing the use of virgin materials without adversely affecting welfare. The focus is on a life-cycle approach to resource management, which starts with reducing raw material demand by looping resources back into consumption and production systems, through innovations in material design, production, and reutilization processes. In addition to easing the environmental pressures, CE can be a driver of private sector growth and jobs, and can increase the strategic autonomy of countries by reducing dependence on raw material imports. CE has been on top of the European Union (EU) policy agenda since 2015 and is now a firm component of its growth strategy, the European Green Deal.

This study aims to identify CE-related priority areas/sectors and follow-up interventions, including measures, initiatives, and programs. This study was undertaken in June 2021 and updated regularly through August 2023. It is not intended to be an in-depth analysis but rather an overview of the status of the CE implementation in Poland that provides some recommendations for policy makers on how to accelerate progress toward a CE in Poland.

For years, Poland's strategies and policies have called for the development of a sustainable economy based on the efficient use of resources, respect for the environment, achievement of higher competitiveness through technologies demanding less raw material and energy, and use of recyclable raw materials and renewable energy, along with waste prevention. As a result, over the past 30 years, Poland has seen steady improvement in both resource efficiency and environmental quality. Yet, resource productivity remains significantly below the European average.¹⁰

In Poland, CE is gaining importance due to EU requirements and legislative changes. The Republic of Poland Ministry of Economic Development and Technology (MEDT) first established an inter-departmental CE group in 2016. This was followed in 2018 by an inter-ministerial CE Working Group established and appointed by the Minister of Economic Development and Technology. In 2019, the Council of Ministers adopted a *Roadmap for the Transformation towards a Circular Economy*.¹¹ As a result, most strategic documents at both the central and regional levels in Poland began to include discussion of CE. Even with the Polish Agency for Enterprise Development (PARP), a state body, recognizing legislation as one of the most effective stimulants for introduction of the CE-based solutions, in many cases, laws are either lacking or are inadequate or fragmented across the legislative framework. Other significant stimulants for the introduction of solutions consistent with CE include market conditions and public sector activities (circular procurement) through the promotion of eco-design among manufacturers and improvement of the level of recovery of secondary raw materials from waste and reduction of resource consumption in the economy.

However, two key barriers hinder CE in Poland:¹²

- **Low environmental awareness on the part of market participants.** Shifting the business model to CE requires highly qualified staff, frequently with new skills and comprehensive expertise, resulting in competence gaps often experienced by market participants.
- **Financial, organizational, and technical and technological resource investment in CE takes a relatively long time to pay off.** On a similar note, identifying and implementing new applications for existing solutions (adaptation) and generating new solutions (innovation) present a challenge.

¹⁰ European Commission. 2019. "The EU Environmental Implementation Review 2019 Country Report - POLAND." Commission Staff Working Document, Brussels, 4.4.2019 SWD(2019) 128 final. https://ec.europa.eu/environment/eir/pdf/report_pl_en.pdf.

¹¹ Rząd Rzeczypospolitej Polskiej. 2019. *Mapa drogowa transformacji w kierunku gospodarki o obiegu zamkniętym*.

¹² PARP. 2021. *Ocena zapotrzebowania na wsparcie przedsiębiorstw w zakresie gospodarki o obiegu zamkniętym*. <https://www.parp.gov.pl/component/publications/publication/ocena-zapotrzebowania-na-wsparcie-przedsiębiorstw-w-zakresie-gospodarki-o-obiegu-zamkniętym-circular-economy>.

This report describes the current situation with implementation of CE in Poland, examines national and regional policies, and identifies both the drivers (challenges and barriers) and the mechanisms adopted by Poland in the transformation of the economy toward the CE model. It also proposes concrete recommendations for follow-up interventions (including policies and measures) to support and scale up the transition to CE in the country, adjusted to the demands of key stakeholders as well as to EU policies. The conclusions and recommendations are based on a detailed CE performance review carried out in Poland. They include recommendations proposed by regional authorities, different organizations (including industry associations, nongovernmental organizations [NGOs], and ad hoc CE groups), and independent experts. The report assesses the policy as well as the institutional and legal framework, including the degree and structure of intersectoral collaboration and the tools available for CE support. Using CE performance reviews, the report identifies investment and performance gaps in CE implementation and proposes effective solutions to reform and upgrade material flow system management in different sectors, regions, or cities. The report also proposes ways to minimize the impact of the economy on the environment, increase resource efficiency, and support economic and social development in Poland.

The report follows a 'general-to-specific' approach. While the legislative and institutional analysis provides a cross-sectoral overview, the report also focuses on specific sectors identified based on stakeholder inputs and literature review. These focus sectors also determine the selection of priority actions.

After presenting key indicators describing the state of CE in Poland, the report lists key actors and strategic documents in the area of CE, identifies priority sectors, and develops a PESTEL/SWOT analysis which serves as the basis for the proposed areas of intervention. Chapter 3 introduces the CE concept, including definitions and benefits while some related key indicators for Poland are presented in Chapter 4. Chapter 5 covers the current institutional, strategic, and regulatory landscape related to CE in Poland while Chapter 6 gives an overview about priority sectors for the circular transition. The PESTEL/SWOT analysis in Chapter 7 is followed by an overview about private sector readiness to implement circular business models in Poland in Chapter 8. Finally, Chapter 9 presents a list of proposed priority actions which may provide the basis for potential future follow-up technical and/or financial assistance.

Key findings of the report:

- Knowledge of CE at the central and regional levels has improved and CE is now treated more as a resource management strategy (productivity in Poland is below the EU average) and not only as a waste (mainly municipal solid waste) prevention approach.
- Poland's CE Roadmap and industrial policy identify well the sectoral potential for the transition to CE.
- There is huge potential for financial support for CE investments from EU Structural Funds, but to access these funds, Poland needs eco-innovative solutions. Currently, relatively few enterprises in the country are undertaking innovative activities in Industry 4.0 or green technology.
- Policy and regulations supporting compliance with international targets and commitments, and in line with EU accumulated legislation (for example for clean air), are well recognized and implemented, and create a nexus with CE.
- Not in my backyard (NIMBY) and environmental legislation pose significant barriers to CE investments. NIMBY objections often result in prolonged decision-making regarding infrastructure, especially surrounding mining and recycling.¹²
- Waste legislation is changed frequently and interpreted inconsistently. In practice, interpretation and definition of secondary materials is not clear.

¹² <http://www.pte.pl/pliki/2/1/Polityka%20surowcowa.compressed.pdf>, <https://www.mdpi.com/1996-1073/14/21/7008>, <https://www.mdpi.com/1996-1073/14/23/8052/htm>.

- Support for the CE transition is limited and obtaining the end-of-waste criteria and byproduct status can be a long and complicated process.
- Implementation of CE business models is low due to the focus of the legislation on municipal waste as the responsibility of local authorities (communes), absence of extended producer responsibility (EPR), absence of economic incentives for producers of ecological products, and a sluggish regulatory reform in favor of circular solutions such as industrial symbiosis.
- CE goals and indicators are not yet integrated sufficiently in policies and programs, both at the central and regional levels.
- Concrete CE instruments (for example, taxation and support to the CE business models) that facilitate and support long-term CE transition are lacking at the policy level, although some projects and initiatives exist to address this.
- There is no comprehensive foresight and full material flow study presenting a clear vision for the CE development and detailing its benefits for industry and society.
- CE programs supporting cooperation between science and industry and intersectoral collaboration, eco-design, industrial symbiosis, and innovative recycling are needed to attract investments to CE innovation.
- Capacity building and training in CE are not sufficiently developed.
- Poland does not have a governmental platform with a database of good practices dedicated to CE; however, an official website dedicated to the CE was created by the MEDT and is updated on a regular basis.¹³ It is planned to add content on good practices in cooperation with the Polish Working Party on Smart Specialization for CE.
- In April 2022, the Ministry of Climate and Environment appointed a Plenipotentiary for CE responsible for driving the Ministry's CE agenda, including the implementation of the Polish CE Roadmap.¹⁴
- Numerous organizations actively promote CE in Poland, including NGOs and industry associations.
- Start-ups offer many products and services, especially IT applications, in line with CE; however, there are no active large private funds of financial organizations focusing on CE support.
- Some large companies are testing CE by offering and/or promoting new products or process lines (often through mergers and acquisitions), but they are not prepared to undertake a structural transformation of their ongoing operation.
- A detailed analysis of educational needs of workers, including in the areas of recycling and CE, has been performed (mainly in PARP and coal regions, and as part of the Erasmus or Interreg Europe projects).
- More research (questionnaire/survey) is needed, focusing on customer behaviors, industry barriers, and challenges in the CE transition.
- Some of the recommendations which follow from these conclusions line up with activities proposed in the CE Roadmap; however, to support an effective transition to a CE, the implementation of the CE Roadmap needs to accelerate.
- As a consequence of COVID-19 and the Russian invasion in Ukraine, rising prices have stimulated a more efficient use of energy and raw materials. Supply concerns have also increased the deployment

¹³ <https://www.gov.pl/web/rozwoj-technologie/gospodarka-o-obiegu-zamknietych-1>.

¹⁴ <https://dziennikurzedowy.mos.gov.pl/skorowidz/powolanie-pelnomocnika/zarzadzenie-poz-18-zarzadzenie-ministra-klimatu-i-srodowiska-z-dnia-28-kwietnia-2022-r-w-sprawie-powolani/>.

of photovoltaics, especially of micro installations among prosumers. Rising inflation and increasing borrowing costs have supported markets for product-as-a-service.

- Revitalization of industrial areas and an increasing number of RES facilities supported by the EU just-transition funds create new jobs, reduce energy poverty, and also support CE.
- There is a lack of large CE leaders in the private sector who can show the economic benefit (short-term return and cost reduction) for conducting business in Poland. However, an increasing number of small and medium enterprises (SMEs) are entering the bio-economy (for example, organic food production and biocosmetics).
- Many CE activities still focus on low-value reuse (for example, backfilling) which usually involves the cycling of basic material streams (waste from electrical and electronic equipment [WEEE] scrap), whereas high value-added processing is generally conducted abroad. More investment in higher-value CE activities is needed.
- In March 2022, the Polish State Raw Material Policy was adopted with the main goal to ensure the raw material security, especially focusing on prevention and recovery of products containing critical raw materials (the first list of key raw materials has been proposed already in 2016).¹⁵

¹⁵ <https://min-pan.krakow.pl/wydawnictwo/en/ksiazki/surowce-kluczowe-dla-polskiej-gospodarki-2/>.

2. Methodology

The aim of this study is to identify the current state of CE implementation in Poland, explore expectations regarding CE policies in the country, and suggest policy recommendations, including a list of proposed actions, which would foster CE implementation. The research is based a literature review, economic and environmental data collection, a survey among regions, and interviews with CE stakeholders.

In the context of a comprehensive desk review of literature on CE implementation in Poland, the study team analyzed EU and national strategies and legislation, CE-related reports and projects, and statistical data. The information came primarily from official websites of ministries, regional authorities, portals of legal acts, and similar sources. The policy approaches to CE may be broadly divided into five categories: (i) fiscal framework (taxes and subsidies); (ii) regulatory policies (resource efficiency, energy, and waste strategy); (iii) education, information, and awareness (that is, communication and information); (iv) governance (public procurement and infrastructure); and (v) innovation support schemes and collaboration platforms (R&D programs, public-private partnerships, financial, technical and training support for businesses, and voluntary business collaboration platforms).¹⁶

Based on content analysis, the study identifies existing CE policy recommendations proposed in different reports, statements, and commitments by national and international organizations, such as EU, PARP, the European Environmental Agency (EEA)¹⁷, and United Nations Industrial Development Organization (UNIDO),¹⁸ as well as NGOs and associations.

The report provides a mapping of the competence of all actors responsible for CE implementation in Poland. The transition to a CE must be supported by policies of many institutions at both the central and regional levels. The report identifies activities of different stakeholders at the macro, meso, and micro levels, as well as at the regional and local (city) levels.

Learning from best practice can help ensure replication success elsewhere. The report identifies good practices for the CE implementation in different regions, cities, and organizations and identifies CE leaders based on awards or information promoted on various CE platforms.

Interviews of CE stakeholders from selected sectors and regions have been conducted to identify good practices, barriers, and challenges in the CE transition and monitoring (indicators). As CE has not been well recognized among public and private sector stakeholders, a proper identification of groups with a CE background, that is, clusters, NGOs, large organizations, and regional and central authorities is required. The semi-structured interviews revealed industry or geographic focus areas where CE has the potential to have a transformative impact or where existing momentum can help in scaling up activities supported by the engagement of key stakeholders and decision-makers. Based on these factors and on demand from stakeholders, recommendations have been developed as part of the study for follow-up interventions (including policies and measures) to be undertaken to support and scale up the CE transition in Poland. The study team conducted a total of 10 computer-assisted telephone interviews (CATIs) with representatives from the industry sectors, and major NGOs promoting CE, as well as with two leading employer associations: Employers of Poland and the Polish Employers Federation (May–June 2021).

The study team collected information from business sector representatives through a written survey which was sent to 14 organizations, 11 of whom responded (May–June 2021). Additionally, the team interviewed a representative of the MEDT. A list of survey respondents is presented in Annex 1. Survey and interview questions are included in Annex 2.

The institutions invited to complete the questionnaire are listed in Table 2.

¹⁶ Ekins, P., T. Domenech, P. Drummond, R. Bleischwitz, N. Hughes, and L. Lott. 2019. "The Circular Economy: What, Why, How and Where." Background paper for an OECD/EC Workshop on July 5, 2019, part of the workshop series *Managing Environmental and Energy Transitions for Regions and Cities*. OECD, Paris.

¹⁷ <https://www.eea.europa.eu/publications/circular-economy-in-europe>.

¹⁸ <https://www.unido.org/our-focus-safeguarding-environment/global-consultations-circular-economy>.

Table 2. Institutions invited to complete questionnaire

Sector	Institutions
Construction sector	PLGBC Polish Association of Sustainable Construction
Mining and energy sector	Association of Polish Copper, Fortum, Tauron
Chemical sector	Plastics Europe, Polish Chamber of Chemical Industry
Bioeconomy sector	Life Science Cluster, Polish Food Producer Federation
Recycling sector	Rekopol Organization of Packaging Recovery, Association of Polish Recycling, Polish Chamber of Recovery and Recycling of Packaging
Electrical and electronic sector	APPLiA Employers Association of Electronic Devices
NGO	World Wildlife Fund, WiseEuropa

The study team also interviewed central and regional authorities and CE experts. Questions were emailed to members of the Polish Network of Environmental Authorities: Managing Authorities Group, a national network of environmental authorities and managing authorities of EU funds. Representatives of all central and regional authorities responsible for the environmental policy are the members of this network, which was established in December 2010 by agreement of the Minister of the Environment, the Minister of Regional Development, and the General Director of Environmental Protection. In addition to written surveys, the study team held discussions with experts to gain additional granularity on issues and make final recommendations.

The study team sent out written surveys to regional authorities throughout the country. Out of the 16 regional authorities, eight provided written responses to the survey. After a review of all the regional strategies, in-depth follow-up interviews were conducted with representatives of selected regions (see interview questions in Annex 2).

Based on this research, analysis, and discussions with the representatives from the academia and private sector as well as policy makers and government officials, the team defined the main challenges and recommendations for the CE transition. Key opportunities and barriers were identified by integrating PESTEL and SWOT analyses, that is, by assessing strengths, weaknesses, opportunities, and threats for all six PESTEL categories: the political, economic, social, technological, environmental, and legal dimensions.

The interventions were proposed based on identified challenges, barriers, needs, and legal requirements and based on the 41 required but not yet implemented activities proposed in the Polish Circular Economy Roadmap for 2019–2023. The interventions were selected based on various criteria, including existing gaps between current and required legislation; their relevance to the regenerate, share, optimize, loop, virtualize, and exchange (ReSOLVE) model and reduce, reuse, recycle, recover, remanufacture, and redesign (6R) principles (as proposed in some Polish policy documents); as well as the results of the PESTEL and SWOT analyses presented in this report. In addition, the proposed initiatives reflect the results of the surveys and interviews conducted for this assessment, including with central and local authorities, industries, research institutions, and NGOs. The proposed interventions are in line with current policy and strategic goals focusing on decoupling, decarbonization, increased eco-innovation, and new and better job opportunities.

3. The Circular Economy: Definitions, Strategies, and Benefits

3.1 Definition

CE can be defined in numerous ways; this report uses the definition used by the European Commission (EC):

- A CE aims to maintain the value of products, materials, and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste. The fewer products we discard, and the fewer materials we extract, the better for our environment.
- This process starts at the beginning of a product's life cycle: smart product design and production processes can help save resources, avoid inefficient waste management, and create new business opportunities.¹⁹

3.2 Circularity Strategies and Circular Business Models

Several circularity strategies and approaches exist, as given in Table 3, ranked by level of circularity and, hence, environmental priority. The underlying logic of this circular hierarchy is that the higher a strategy is on the hierarchy, the more circular it is. While the debate around CE often focusses on recycling, Table 3 also shows that the recycling of waste is rather low on the circular hierarchy, with other strategies more promising in preventing waste and pollution in the first place. While recycling is a necessary component, a circular economy should thus focus on preventing waste rather than recycling it. The below classification is used when exploring potential future interventions.

Table 3. Circularity strategies within the production chain actors in order of priority

Smarter product use and manufacture	R0 Refuse
	R1 Rethink
	R2 Reduce
Extend the lifespan of products and its parts	R3 Reuse
	R4 Repair
	R5 Refurbish
	R6 Remanufacture
	R7 Repurpose
Useful application of materials	R8 Recycle
	R9 Recover

Source: Based on Potting et al. (2017).²⁰

In the context of this report, reference is often made to the '6R principles', which follows a similar approach as the 9R framework presented above and refers to reuse, reduce, recycle, redesign, remanufacture, and recover.

3.3 Benefits of a Circular Economy

Reducing material consumption leads to less pollution, waste, and related health impacts and is key to preserving vital ecosystem services and natural resources, including biodiversity. In the linear system, products eventually end up as waste, most of which is landfilled or incinerated. Globally, inadequate solid waste management contributes, among others, to climate change and (marine) plastic pollution. Locally, solid waste harms public health, putting millions at risk due to soil and water contamination and poor air quality. One of the principal aims of CE is to minimize waste and pollution by returning products, materials, and resources into the product cycle at the end of their use. Reducing waste and pollution and associated negative environmental impacts will thus have substantial benefits for public health, including through designing out toxic chemicals. In addition, it is estimated that the extraction and processing of natural resources are

¹⁹ Eurostat, <https://ec.europa.eu/eurostat/web/circular-economy/information-data/policy-context>.

²⁰ Potting J., M. Hekkert, E. Worrell, A. Hanemaaijer. 2017. "Circular Economy: Measuring Innovation in the Product Chain." <http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2016-circular-economy-measuring-innovation-in-product-chains-2544.pdf>.

responsible for more than 90 percent of biodiversity loss. Decreasing the need for virgin materials can thus make a major contribution to healthy ecosystems and biodiversity preservation.

Circular business models can help reduce greenhouse gas (GHG) emissions. The production of goods and services, including food, for the global economy accounts for nearly half of the global GHG emissions. Addressing GHG emissions from industry can be technologically challenging and costly, particularly in sectors such as iron, steel, aluminum, cement, and plastics, which are associated with hard-to-abate emissions related to high-temperature processes, production emissions, and end-of-life emissions. In the food system, food waste is a major source of GHG emissions. An increasing focus on material efficiency and circularity will help align the emissions trajectory of these sectors with the goals of the Paris Agreement.

Circularity can help address issues related to import dependencies and security of supply risks of critical raw materials. Ballooning resource consumption also has trade and security implications, raising concerns over resource shocks and supply failures worldwide. In a world of increased competition over access to materials, many advanced and emerging economies face dependency and supply risks. The EU imports 50 percent of the critical raw materials it needs. This increases to around 80 percent for certain materials required to achieve renewable energy targets, such as metals critical in the production of wind turbines, solar PV modules, and batteries. Returning products, materials, and resources back into the product cycle at the end of their use can thus help reduce import dependencies and supply risks.

In addition to easing environmental pressures, the circular transition can be a driver of private sector growth. Although there are still very few ex-post studies to verify growth and job creation potential of CE, technological innovation in resource efficiency can lead to productivity gains. What is certain is that the goal of decoupling natural resource extraction and use from economic output has already led to a range of concrete business applications aimed at closing resource utilization loops, slowing down material use, as evidenced by the growth of repair and remanufacture services, the birth of the sharing economy, or quite simply by an uptick in recycling and reuse rates. For example, an estimated 8 percent of the Dutch workforce is employed in the CE jobs, with the biggest concentration in activities that preserve and extend the value of materials already in use, such as reuse and recycling.




3.4 Monitoring Progress Towards the Circular Economy

Monitoring progress towards a circular economy is a challenging task; the European Commission in 2018 brought forward the so-called Monitoring Framework for the Circular Economy consisting of several indicators. Perhaps the simplest indicator to measure circularity is the Circular Material Use Rate, calculated as the contribution of recycled materials to overall material use. However, since circularity goes beyond recycling, the European Commission included numerous other indicators in its monitoring framework, grouped in five categories: production and consumption, waste management, secondary raw materials, and competitiveness and innovation, and global sustainability and resilience. The scores for Poland and the EU on each indicator are presented in the next chapter (Chapter 4).

4. State of the Circular Economy in Poland

This chapter presents an overview of the status of CE in Poland based on Eurostat's Circular Economy Monitoring Framework.²¹ The CE Monitoring Framework assesses CE progress at both the EU and national levels through a set of indicators that capture the main elements of CE. Indicators are presented in five categories: production and consumption, waste management, secondary raw materials, competitiveness and innovation, and global sustainability and resilience. Table 4 shows the most recent data for the CE indicators in the EU and Poland and compares them with EU targets.

Table 4. Indicators within the CE Monitoring Framework: Comparison of Poland and the EU

INDICATOR	EU 	Poland 	EU targets 
Production and consumption			
Material Consumption			
Material footprint (tonnes per capita)	14 (2020)	18 (2020)	
Resource productivity (index 2000 = 100)	135.5 (2021)	163 (2021)	
Green public procurement	n/a	n/a	
Waste Generation			
Total waste generation per capita (kg)	4,813 (2021)	4,492 (2020)	
Generation of waste excluding major mineral wastes per GDP unit (kg per thousand €, chain linked volumes (2010))	65 (2020)	150 (2020)	
Generation of municipal waste per capita (kg)	530 (2021)	362 (2021)	
Food waste per capita (kg)	131 (2020)	106 (2020)	
Generation of packaging waste per capita (kg)	177.9 (2020)	172.2 (2019)	
Generation of plastic packaging waste per capita (kg)	34.6 (2020)	34.2 (2019)	
Waste management			
Overall recycling rates			
Recycling rate of municipal waste (percent)	49.6 (2021)	40.3 (2021)	50 (2020) 65 (2035)
Recycling rate of all waste excluding major mineral waste (percent)	58.0 (2020)	52.0 (2020)	
Recycling rates for specific waste streams			
Recycling rate of overall packaging (percent)	64.0 (2020)	55.5 (2019)	65 (2025) 70 (2030)
Recycling rate of plastic packaging (percent)	37.6 (2020)	31.5 (2019)	50 (2025) 55 (2030)
Recycling rate of WEEE separately collected (percent)	83.4 (2020)	85.9 (2020)	
Secondary raw materials			
Contribution of recycled material to raw materials demand			
Circular material use rate (percent)	11.7 (2021)	9.1 (2021)	
End-of-life recycling input rates (EOL-RIR), aluminum (percent)	32.0 (2022)	n/a	
Trade in recycling materials			
Imports from non-EU countries (thousand tonnes)	41,388.1 (2021)	3,282.8 (2021)	
Exports to non-EU countries (thousand tonnes)	37,616.2 (2021)	1,614.9 (2021)	
Intra EU trade (thousand tonnes)	91,655.6 (2021)	3,012.7 (2021)	
Competitiveness and innovation			

²¹ <https://ec.europa.eu/eurostat/web/circular-economy/monitoring-framework>.

Private investment, jobs and gross value added related to CE sectors			
Private Investments (percentage of GDP at current prices)	0.8 (2021)	0.7 (2021)	
Persons employed (percentage of total employment)	2.1 (2021)	2.7 (2021)	
Gross value added (percentage of GDP at current prices)	2.1 (2021)	1.8 (20121)	
Innovation			
Patents related to waste management and recycling (number)	295.3 (2019)	15.3 (2019)	
Global sustainability and resilience			
Global sustainability from circular economy			
Consumption footprint (index 2010 = 100)	104 (2021)	120 (2021)	
GHG emissions from production activities (kg per capita)	6,412 (2021)	9,554.1 (2021)	
Resilience from circular economy			
Material import dependency (percent)	22.9 (2021)	19.3 (2021)	
EU self-sufficiency for raw materials, aluminum (percentage)	11.0 (2022)	n/a	

Source: Eurostat.

Most CE related indicators for Poland are in the range of the EU average, with the exception of waste generation per unit of GDP, which is significantly above the EU average. While the generation of waste per capita is below the EU average, the generation of waste per unit of GDP is very high, showing that Poland is a waste intensive economy. Overall, however, its circular material use rate was at 9.1 percent in 2021, which is a reduction from 2010, but still ranks Poland in EU's midfield.

Polish resource productivity is some 60 percent below the EU average. The Polish economy remains very inefficient in using material resources to produce wealth. In 2020, Poland generated €0.8 per kg of material consumed, compared to the EU average of €2.1 per kg.²² Increasing resource productivity is not only important from an environmental point of view, but also reduces dependency on imports and volatile raw material markets.

²² <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0269>.

5. Governance and Strategic Documents Relevant to the Circular Economy in Poland

5.1 Governance and Actors

This chapter was developed based on an analysis of CE activities from governmental web pages and legal documents of different institutions and actors in Poland. A more in-depth identification of responsibilities and tasks has also been done during interviews conducted with stakeholders to assess direct economic and environmental impacts.

Public Institutions

The Polish waste management system involves many actors at different levels. The Ministry of Climate and Environment is responsible for the preparation of crucial legislation governing the waste management system. Marshal Offices are responsible for the preparation of regional waste management plans, registration of entities placing products on the market and managing waste, verification of waste management reports submitted by individual entities (communes and businesses), preparation of summary reporting submitted to the Ministry of Climate and Environment, verification of correct calculation and payment of product and recycling fees by businesses, and verification of correct conduct of educational campaigns by businesses. Voivodship Inspectorates of Environmental Protection perform inspections of entities required to comply with environmental protection regulations, including if they meet their waste management obligations. Municipal and communal offices are responsible for the implementation of measures provided for in the regional waste management plan, coverage of all property owners with the municipal waste management system, achievement of the required municipal waste recycling rate, and education activities on proper waste management.²³

Public Institutions: National Level

CE requires an efficient flow of materials and reduction of waste through the entire value chain. It is a complex social, economic, technological, institutional, and behavioral system. For CE to function, it must be supported by policies of many institutions at both the central and regional levels. The role and responsibilities of each institution in CE should be clearly defined.

The MEDT is responsible for the development and implementation of CE. However, all issues related to packing waste, EPR, and waste management are the responsibility of the Ministry of Climate and Environment. The Ministry of Development Funds and Regional Policy is responsible for management of the system for implementation of European funds and regional policy. Cooperation among these three ministries requires new internal rules and regulations to identify priorities and clarify the decision-making process on instruments which support CE implementation.

Unfortunately, as seen from stakeholder interviews, Poland retains a silo approach in many sectors with no multisectoral cooperation on CE. Therefore, cooperation needs to be enhanced to develop and enact regulations focusing on end-of-waste criteria and byproduct waste policy.

Table 4 shows all public institutions which, to a greater or lesser extent, affect the CE transition and development of CE in the environmental and economic arena. Green indicates a large impact on the development of CE, yellow a medium impact, and red a low impact.

²³ <https://www.nik.gov.pl/plik/id,25757,vp,28530.pdf>.

Table 5. Public institutions that affect environmental regulations

Institution	Department	Competence	Direct Economic Impact	Direct Environmental Impact
Ministry of Economic Development and Technology	Department of Innovation and Industrial Policy	Implementation of the CE Roadmap, industrial policy development and implementation, business model transformation, eco-design, and national smart specialization (KIS)	Green	Red
Ministry of Economic Development and Technology	Architecture, Construction, and Geodesy Department	Investment and construction process; market of construction products; technical and construction regulations	Yellow	Yellow
Ministry of Climate and Environment	Department of Waste Management	Waste management; EPR; deposit-return system (DRS); end-of-waste status	Green	Green
Ministry of Climate and Environment	Department of Geology and Geological Concession	Raw material policy	Yellow	Yellow
Ministry of Climate and Environment	European Fund Department	Provision of funding	Green	Green
Ministry of Climate and Environment	Department of Education and Communication	Educational campaigns to raise awareness of environmental issues	Red	Green
Ministry of Development Funds and Regional Policy		Implementation of EU funds, national recovery plan	Green	Yellow
Ministry of Agriculture and Rural Development	Environment and Climate Department Common Agriculture Policy Department	Environmental protection in rural areas, water resources, RES, bioeconomy	Yellow	Yellow
Ministry of Finance	Tax Analysis Department	Fiscal policy	Green	Yellow
Ministry of Science and Higher Education		Support of research and innovation (R&I) projects	Red	Red
Inter-ministerial CE Working Group ²⁴	Team members are representatives of different ministries	Assessment of the following: low-emission economy; legal regulations, programs, projects and documents; CE negotiations with the EU; technological development in the field of CE	Yellow	Yellow
National Fund for Environmental Protection and Water Management and its regional branches		Financial support (that is, infrastructure and environment); operational, Norwegian and European Economic Area funds; Green Investment Scheme; education and promotion	Yellow	Green
Polish Agency for Enterprise Development (PARP)		Support for the development of entrepreneurship	Red	Red
General Directorate for Environmental Protection		Implementation of environmental protection policy	Red	Yellow
GIOS Chief Inspectorate of Environment Protection		Control over implementation, and enforcement of environmental protection regulations	Red	Yellow

²⁴ <https://www.gov.pl/web/rozwoj-technologie/zespol-ds-gospodarki-o-obiegu-zamknietych>. This working group is no longer active, as its objective was only to create the CE Roadmap.

Moreover, there are support groups of experts established by different ministries and agencies. For example, the CE smart specialization group includes MEDT team members and different nominated experts. These support groups promote CE, develop the scope and range of subjects which can be supported by structural funds, propose legal and organizational solutions, and so on.

At the national level, both governmental agencies and the operators of national funds support the ministries responsible for CE. Moreover, academia, NGOs, and business associations actively cooperate with central administrations, for example, governmental advisory councils, councils of competences, ad hoc expert groups, and groups created by industry, for example, Pracodawcy Rzeczypospolitej Polskiej²⁵ and Konfederacja Lewiatan. Many other governmental bodies such as the Polish Development Fund, S.A. and the Agency for Industry Development support the development of innovative solutions.

Figure 1 shows the most important public institutions and stakeholders involved in the CE transition at the national, regional, and local levels.

Figure 1. Public institutions and stakeholders involved in the CE transition at the national level



Source: Original elaboration for this publication.

As a horizontal strategy, CE is within the responsibility of many departments in regional authorities, including Strategy, Policy, Environment, and Structural Funds. Individual departments create policies for CE implementation through their regional strategic documents such as the Regional Waste Management Plan and Regional Development or Innovation Strategy, and in some regions, CE programs are under development (that is, Małopolska). The horizontal principle of the CE transition means that implementation of the Regional Innovation Strategy will support the development and dissemination of production and consumption models aimed at lower resource consumption, waste prevention, and the reuse of materials and products. The approach will be holistic and systemic, considering the potential of all sectors, new behavior patterns in society, entrepreneurial activity including innovation and eco-design, and the activity of the public and social sectors. The implementation of the horizontal principle means that projects identified as strategic will be analyzed from the perspective of sustainable production and consumption.

²⁵ www.wlaczczystaenergie.pl.

The Regional Development Agency and the European Climate and Health Observatory support regional authorities in identifying regional market needs and entrepreneurship development trends. Some regions cooperate closely with clusters and NGOs on CE development.

Public Institutions: Regional Level

The Marshal Office is a self-governing organization in each of the 16 regions (called voivodeships) and is the regional authority responsible for the design, implementation, and monitoring of regional policies. It includes a directly elected Regional Assembly (Sejmik), an executive body that includes five members, including the Marshal, who is appointed by the Regional Assembly. As shown in Figure 2, the Marshal Office links with the various departments (such as agriculture, waste management, and environmental policy) to coordinate policy and implementation.

Figure 2. Public institutions and stakeholders involved in the CE transition at the regional level



Source: Original elaboration for this publication.

All of Poland's 16 regions have an approved Development Strategy in place. These strategies, developed since 2020, mention CE as a horizontal objective linked to strategic activities in areas such as the environment (waste management), agriculture, infrastructure, and innovation. The strategies also set goals which depend on the characteristics of the region, for example, the correlation of CE with air quality and bioeconomy, the need for cooperation in the value chain, implementation of the CE business model, or closer cooperation between science and business. Each strategy highlights the need for public education and promotion. Some activities in the strategy are defined in more detail in the Innovation Strategy, the Plan for Environmental Protection, or the Waste Management Plans. In the Regional Innovation and Operational Plans, which are currently under development in many regions, CE tasks have been identified and proposed for support with the EU funds. Most of the regions in Poland are classified as so-called *Region A*, meaning they qualify for EU regional funds. Poland's eastern regions, with a gross domestic product (GDP) lower than the country average, also have an additional Strategy for Eastern Regions, which addresses CE under many of its activities.

Poland's regional leaders in CE implementation are Łódzkie, Małopolska, Mazowieckie, Podkarpackie, and Wielkopolska regions. Some regions (Łódź, Małopolska, and Wielkopolska) were involved in Interreg Europe or H2020 projects, and as a result, CE concepts are much better developed among both the administration and the public. However, all regional authorities face barriers and challenges in the CE

transition. Regions have taken actions to address these barriers and challenges in line with regional needs. Opportunities, barriers/challenges, and actions to address them are described in Annex 4 for some of Poland's 16 regions.

5.2 Strategic Documents²⁶

This section provides an overview of the key strategic and legislative documents on the national and regional level. The existence of strategies, laws, and regulations does not necessarily always entail change on the ground. This is due to a gap between *de jure* and *de facto* implementation of policies, which may exist due to issues related to monitoring, reporting, and enforcement. The following subchapters do not assess this gap between *de jure* and *de facto* implementation of policies, but give an overview of the regulatory framework put in place by Polish authorities to facilitate a discussion on additional measures that may be needed to implement the regulatory framework – with a focus on priority areas of intervention.

Most sectoral documents mention CE development as a horizontal strategy, though without concrete measures and long-term policy goals. National strategic plans and the legal framework do not fully consider or convey the opportunities that CE implementation would create, including development of enterprises, jobs creation, increased innovation and, above all, the quality of the environment. Nowhere in government documentation do we see clear signals to indicate the most promising directions for development and ensure that these directions will receive state financial and regulatory support in the long term.

Regulatory measures primarily focus on waste management and, to a lesser degree, on waste prevention and increased resource efficiency in the value chain. Legal acts are not referenced, and the inadequacy and fragmentation of regulations cause problems. Regulations often impose overly strict requirements, especially for recycling companies. For example, current regulation requires that before obtaining a permit for the collection or processing of waste, a holder of waste must establish a fund to cover any costs of removal of waste from a place not intended for its storage or removal of waste and repair of negative effects and any damage to the environment if the waste removal authorization is revoked.

Another gap which hampers the transition to CE is outdated laws which have not kept up with technological development and innovation. For example, a new technology was developed to allow for the return to the value chain of many materials which already had waste status; however, such return of materials to the value chain is not permitted under current legislation. Some products and materials that end up at municipal waste collection points also face a similar problem; they cannot be repaired and returned to the system, because once they arrive at one of the many collection points for municipal waste, they are deemed to have a 'waste status.'

The first document in Poland to mention CE was the Sustainable Development Strategy of 2017. It proposes the development of three strategic policy documents: the CE Roadmap, Raw Material Policy, and Raw Material Action Plan.²⁷ The first two have been adopted in 2019 and 2022, respectively, and are described below. Another document described below—the Productivity Strategy (published in May 2021 and adopted in July 2022)—focuses more on CE implementation and the EU Green Deal. In addition, the Polish National Recovery and Resilience Plan is described below, which was submitted to the EC in May 2021.

5.2.1 Roadmap Towards the Transition to a Circular Economy²⁸

The most important government document directly referring to the CE transition is the Roadmap for the Transformation Towards a Circular Economy,²⁹ which was developed based on broad

²⁶ A list of strategic documents is included in Annex 3.

²⁷ <https://bip.mos.gov.pl/strategie-plany-programy/polityka-surowcowo-panstwa/>.

²⁸ https://circulareconomy.europa.eu/platform/sites/default/files/md_goz_final_en_r4_4.pdf.

²⁹ Rząd Rzeczypospolitej Polskiej. 2019. *Mapa drogowa transformacji w kierunku gospodarki o obiegu zamkniętym*.

consultations with a vast group of different stakeholders. Moreover, to implement the roadmap, the government established an inter-ministerial CE Working Group representing 10 ministries.

The roadmap highlights the following priorities:

- Implementation of innovative solutions in the economy by strengthening cooperation between industry and the science sector
- Creation of a European market for secondary raw materials
- Ensuring high-quality, secondary raw materials
- Development of the service sector.

The roadmap also indicates five main areas, which include a total of 41 concrete actions to be undertaken by the government toward CE transition. These are described in Table 6.

Table 6. CE Roadmap focus areas

Area	Examples of Actions
Sustainable industrial production	Analysis of potential and proposed legislative changes to increase the economic use of combustion byproducts (2020–2021); Feasibility study for creating a dedicated platform for secondary raw materials (2021); Analysis of the potential for opening and using heaps of waste from the processing industries (2021–2022); Analysis of strengths and weaknesses as well as opportunities and threats in the scope of control and reporting under the EPR (2019–2021); Information campaign on the benefits of using the EPR to affect the image of an entrepreneur (2021–2022).
Sustainable consumption	Information campaign to disseminate the knowledge on preventing food waste among consumers and producers (2020–2021); Development of the concept of distribution mechanisms and appropriate handling of products with the date of minimum durability (2020–2021); Development of the concept of a system of incentives and obligations for entrepreneurs to counteract food waste (2019–2020); Development of the concept of the government information platform on CE (2020–2021).
Bioeconomy	Review of applicable regulations and creation of uniform requirements/standards for biomass (2021–2022); Analysis of the biomass supply potential at the national and regional level, preceded by the development of appropriate methodologies (2021–2022); Identification of local value chains (2021–2022); Feasibility study for the creation and development of local biorefineries (2021–2023).
New Business Models	Analysis of the possibility of introducing changes in the tax system, which would allow increasing the competitiveness of enterprises operating on the basis of CE models (2019–2021); Analysis of the possibility of introducing reporting and control allowances for entities applying environmental standards (2020–2022); Development of a support ecosystem concept for enterprises operating on the basis of CE business models (2020–2021); Development of the concept for the creation of a nationwide multi-industry internet platform enabling product rental and sharing products with low frequency implementation, monitoring, and financing of CE (2022–2023).
The fifth section of the roadmap focuses on implementation, monitoring, and financing of CE.	

Poland has set quite ambitious goals and tasks for the development of CE and is consistently, albeit slowly implementing them. One of the most important tasks is the creation of a country-level CE platform. The MEDT is planning to undertake conceptual work towards the preparation of such a platform after a comprehensive review of the industrial waste market in Poland, the results of which should be available in the first half of 2024. Moreover, the MEDT is closely following the CE agenda on the EU level, which currently focuses on eco-design for sustainable products (ESPR) and packaging and packaging waste (PPWR). Also, with the Russian invasion of Ukraine, increasing priority is given to the security of raw materials. Therefore, it has become necessary to prioritize tasks included in the CE Roadmap in the context of the EU CE agenda and the geopolitical situation in the region.

The vast majority of measures included in the CE Roadmap are in the form of concepts, guidelines, or proposals for legal solutions, meaning that even full implementation of the planned activities will not automatically improve waste management. To improve implementation of the CE Roadmap, the Department of Innovation and Industrial Policy of the MEDT is regularly sending letters to the involved ministries requesting contributions — within the scope of their competence — to the actions identified in the CE Roadmap.

Tasks which have been implemented include the establishment of the National Smart Specialization (KIS) for CE and a draft of the government CE platform.³⁰ The role of KIS 7: Circular economy — Water, Fossil Resources, and Waste is to indicate preferential support areas for research, development, and innovation, facilitating the transformation of the Polish economy toward a CE model including technical and technological solutions, tools, models, methods, processes, legislation, organizational, financial, and educational changes.

Additionally, Poland still urgently needs a comprehensive long-term CE implementation strategy that reflects EU objectives and ambitions. This should be integrated in a much-needed revision to Poland's CE Roadmap which has a very short time horizon (only until 2023) and was prepared before the new EU Circular Action Plan (adopted in February 2021). The roadmap should now be revised in line with the new CE Action Plan and set long-term objectives (until 2040). The new roadmap needs to take a more sectoral approach and include an action plan for at least the construction, chemical, and energy sectors. In addition, a new roadmap would serve as a strategic document with clear guidelines for investors. This would facilitate and accelerate the development of the CE sector in Poland, especially in the newly adopted Polish Industrial Policy, and Productivity Strategy, which address these issues. But, so far, the policy is not supported with specific implementation tools or instruments.

In some regions, CE strategies or plans are currently under development, such as in Małopolska; other regions are conducting analyses on CE as a tool for innovation and competitiveness, such as in Podkarpackie.³¹

5.2.2 National Raw Materials Policy

In March 2022, the Polish National Raw Materials Policy was adopted with the main goal to ensure the raw material security. The policy focuses on prevention and recovery of products containing critical raw materials (the first list of key raw materials has been proposed already in 2016).³² The National Raw Materials Policy aims to ensure the country's raw material security by guaranteeing access to required raw materials (domestic and imported), both in the near and long term considering the changing needs of future generations. Access to raw materials should secure the country's long-term economic needs, resulting from the adopted priorities of economic development, thus ensuring a high living standard for citizens. Strategic and critical raw materials have been determined and a set of eight specific objectives, some of which are in line with the CE target, that is, specific objective 6: Acquiring raw materials from anthropogenic deposits and supporting the development of the CE, including special measures:

- Measure 1: Inventory of mining waste landfills and assessment of potential for their use performed by the Polish Geological Survey
- Measure 2: Construction of the knowledge base on sources of raw materials from waste, with their proper classification and indication of directions of their use
- Measure 3: Measures to increase recovery of raw materials from waste (in particular, strategic and critical raw materials), including the development of processing technology for such waste.³³

³⁰ <https://krajoweinteligentspecjalizacje.pl/>.

³¹ <https://rsi.podkarpackie.pl/gospodarka-obiegu-zamknietego-w-przedsiębiorstwach-województwa-podkarpackiego-raport-koncowy/>.

³² <https://min-pan.krakow.pl/wydawnictwo/ksiazki/surowce-kluczowe-dla-polskiej-gospodarki-2/>.

³³ Annex to Resolution No. 39 of the Council of Ministers of 1 March 2022 (item 371), National Raw Material Policy, 2022.

5.2.3 Productivity Strategy

Poland's Productivity Strategy,³⁴ aims to achieve a progressive (and sustainable) increase in productivity under climate-neutral, CE, and data-driven economic conditions. It covers seven areas:

1. **Natural resources (land and raw materials):** (a) increased resource efficiency of the economy and (b) increased use of renewable raw materials and biomass in the economy.
2. **Work and human capital:** (a) rapid development of practical education throughout life and (b) preparation of competent personnel for the needs of the digitized economy.
3. **Investments (fixed and financial capital):** (a) sustainable increase in the private investment rate and (b) automation, robotization, and digitization of enterprises.
4. **Organization and institutions:** (a) improving the quality of management in enterprises and public institutions and (b) stimulating cooperation mechanisms between economic entities.
5. **Knowledge:** Increased intensity in the use of knowledge and new technologies in the economy.
6. **Data:** Rapid development of algorithmic data economy.
7. **Internationalization:** (a) increasing the number of exporters, particularly to non-European markets and (b) increasing the export of goods in the area of high technologies and through e-commerce channels.

5.2.4 National Recovery and Resilience Plan

Poland's National Recovery and Resilience Plan (submitted to the EU in May 2021) places great emphasis on increasing productivity and developing innovation, human resources, and the competitiveness of the economy. While the plan calls for increased productivity and innovation, it does not address the issue of sustainable development in accordance with CE principles.

The plan includes four components:

- A. Economic Resilience and Competitiveness - €4,133 million
- B. Green Energy and Reduction of Energy Consumption - €6,347 million
- C. Digital Transformation - €3,034 million
- D. Availability and Quality of the Health Care System - €4,262 million.

The plan includes only one reform path directly related to CE: A2.1. Structural transformation in areas of key importance for the development of the Polish economy, including Industry 4.0 and CE. It has a total dedicated budget of €871 million, of which only €162 million is for actions related to CE.

The plan's timeframe, 2021–2026, assumes the implementation of measures and actions provided in the existing Roadmap for Transformation towards a Circular Economy, including:

- Support for the use of secondary raw materials
- Investments in R&D infrastructure to support the development of technologies that allow waste to be used as secondary raw material and thus contribute to making the economy more efficient
- Investments to support the implementation by SMEs of environmental technologies, including those related to the CE pilot study of the morphological composition of selected post-industrial and post-mining waste dumps.

³⁴ <https://www.gov.pl/web/rozwoj-technologie/konsultacje-publiczne-projektu-strategii-produktywnosci-2031>.

The plan assumes full legislative changes, including secondary material trade allowances, by the end of 2024. The plan does propose some very specific actions, such as a competition for enterprises with the best investment green technology projects, and with an estimated budget of PLN 350 million. A large section of the plan focuses on the green transition of the economy and the development of green, intelligent mobility. However, in this area, the document's focus is on decarbonization, increased use of RES, improvement in energy efficiency, development of hydrogen technologies and other alternative fuels, and air protection. In its economic development priorities, the plan does not consider sustainable use of raw materials and the implementation of CE principles.

The expected result of the implementation of the National Recovery and Resilience Plan is to increase economic productivity, to create high-quality jobs for more people. The document identifies productivity as one of the indicators for measuring the effects of plan implementation. None of the indicators relates to the assessment of the circularity of the economy or its sustainable development.

The plan does not include a separate component related to CE, and only one component of the plan includes a reform which is being implemented based on the assumptions of the CE Roadmap. The National Recovery and Resilience Plan does not convey a full understanding of the importance of sustainable circular development for increased competitiveness and economic productivity.

5.3 Alignment of National Legislation with EU Waste Legislation

The National Waste Management Plan 2028 was published in June 2022,³⁵ focusing on CE and waste hierarchy implementation, including food waste. Most CE activities that focus on prevention and elimination of toxic materials, create and improve the market for high-quality secondary materials, waste collection, and recycling.

The government is currently working on the transposition of amendments to six EU CE Package Directives into national law, with the transposition of the Waste Framework Directive being the most advanced. The main targets call for at least 55 percent of municipal waste to be recycled by 2025, 60 percent by 2030, and 65 percent by 2035.

In June 2023, the European Commission published an Early Warning Report for Poland³⁶ indicating that the country is at risk of missing several EU waste targets. The EC considers Poland at risk of missing the 2025 targets of: 55 percent of its municipal waste to be prepared for re-use and recycling 65 percent of its packaging waste to be recycled. Similarly, the report voices concerns over the distance between Poland's current landfilling rate and its 2035 target to landfill no more than 10% of its municipal waste. To put things into perspective, only nine EU member states are on track to meet the 2025 targets, while 18 member states, including Poland, are considered at risk of missing one or both of the targets.

Key challenges facing waste management in Poland include low capture rates of biowaste, high rates of landfilling and incineration, and low capture rates of packaging waste. The Early Warning Report identifies the low capture rates of biowaste in the separate collection system as a major challenge, together with the insufficient recycling capacity for separately collected biowaste. The report also criticizes that landfilling and incineration remain the predominant forms of waste treatment in Poland. Another challenge is the low capture rate of packaging waste in the separate collection system, in particular of challenging fractions like plastic.

Municipalities face a big problem with selective collection of biowaste. This is both because there are not enough compost facilities and due to the low level of awareness of both consumers and decision-makers.

³⁵ <https://bip.mos.gov.pl/strategie-planu-programy/krajowy-plan-gospodarki-odpadami/projekt-uchwaly-rady-ministrow-w-sprawie-krajowego-planu-gospodarki-odpadami-2028/>.

³⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023SC0196>.

There are currently nine incinerators in Poland, three are under construction, and another 10 cities are planning to invest in incinerators. Incineration plants are perceived by some local governments as the best solution in waste management to replace landfilling, as in Poland there is still a relatively low percentage of municipal waste incinerated (22 percent of generated waste in 2020), compared to other EU member states.

The EC's Early Warning Report of June 2023 highlights four priorities for Poland to increase its performance in waste management:

1. Support preparing for re-use of municipal waste and re-use systems for packaging.
2. Further develop waste treatment infrastructure associated with the higher steps of the waste hierarchy (such as increasing treatment capacity for biowaste and supporting home composting).
3. Increase the efficiency of separate-collection systems and swiftly implement a national deposit-refund scheme for beverage packaging (including by promoting multi-use systems among local bottlers).
4. Extend a pay-as-you-throw system to all households, and fully introduce the cost-coverage rules as part of extended producer responsibility for packaging.

One of the main objectives of the EU Waste Framework Directive is to introduce EPR programs. In Poland, the Ministry of Climate and Environment is responsible for the introduction of this new legislation. The first draft of the legislation was presented in May 2021, almost a year late. The topic of a deposit-return system (DRS) arises in the context of EPR. DRS is highly controversial and of interest to a variety of stakeholders. The main issue of debate is by whom and how waste is to be collected.

At the end of 2020, the Ministry of Climate and Environment identified industry needs in waste management for reuse and repair until 2028: PLN 18,725 million will be needed for initial investment, with another PLN 5,835 million needed until 2034. Amongst others, the plans call for 814 new facilities for mechanical biological treatment (MBT), 200 waste sorting installations (100 new and 100 modernized), facilities for biowaste and so on.³⁷

³⁷https://bip.mos.gov.pl/fileadmin/user_upload/bip/strategie_plany_programy/DGO/Konsultacje/Projekt_zalacznika_do_uchwaly_RM_z_mieniajacej_KPGO_2022_-_Ocena_luki_inwestycyjnej.pdf.

6. Priority Sectors for the Circular Transition

To choose priority sectors for CE interventions, a statistical data analysis was conducted to identify the sectors with the highest consumption of raw materials and waste generation. In a next step, market and economic data (such as share in Polish economy, material costs in total cost of production, and relevance to smart specialization) and legal requirements were identified. Based on expert judgment as reflected in the oto-GOZ Project,³⁸ the priority sectors for the circular transition were identified.

A prioritization of economic sectors with the highest potential for the transition to sustainable production has been undertaken by the oto-GOZ Project (see Annex 5), which was run by the MEDT with scientific leadership of the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences. Criteria for prioritization included environmental and economic impact as well as political and strategic importance. Project designers conducted diagnostic surveys and reviewed relevant source materials, including country strategic and policy documents and statistical data on the role of the sector in the Polish economy, based on share of GDP and employment using data from Statistics Poland (GUS). Using this data, the team assessed sectors based on the following criteria:

- Use of resources (material, energy, and water) in relation to value added (GUS)
- Share of cost of material and energy in the total cost of production in the sector (GUS)
- Volume of waste generated (GUS).

Additionally, the oto-GOZ Project convened an expert group to assess the opportunity of each sector to use available natural resources more efficiently and reduce waste generation.

As a result, the oto-GOZ Project selected five sectors for inclusion in the project based on their potential for sustainable production:

- Construction
- Food and agriculture/bioeconomy
- Chemicals
- Energy
- Mining and metals.

In addition to these five sectors, the recycling industry is significant as it is expected to be the largest beneficiary of the transformation.

6.1 Construction

When it comes to CE transition in the construction sector, attention should be paid to the lack of transparency in the flow of raw materials, lack of material passports, and lack of an effective system of construction waste recovery. However, the number of buildings with green certificates has been systematically growing. A good example is the appearance of many certified offers from Polish producers of building materials. In addition, in recent years, support systems such as thermal modernization and IT have been developed for public construction, but such activities have not translated to the private construction system. A major legislative barrier is the lack of clear criteria for end-of-waste status and the fact that many valuable materials as such as concrete and concrete rubble, bricks and brick rubble, unpolluted soil and earth, and track gravel (aggregate) cannot be marketed for 'use' as products.

6.2 Food and Agriculture/Bioeconomy

The food sector, especially beverages, is actively involved in the discussion on EPR and Deposit-Return System (DRS) and is raising serious concerns about increasing fees associated with EPR introduction. Industry representatives are concerned that EPR fees will become just another state tax. They

³⁸ <https://stat.gov.pl/en/experimental-statistics/gospostrateg/oto-goz/?pdf=1>.

want this money to directly support the development of the waste management system. It is therefore necessary to develop an efficient system, as demanded by many organizations.³⁹ While some public debate about food waste has taken place, so far only a single policy measure has been introduced: the Act on Counteracting Food Waste (July 19, 2019), which defines rules for food retailers. The act aims to prevent local retailers from throwing away unsold food that is still suitable for consumption. Several obligations have been placed on some food business operators, requiring them to donate such food to charities, with fines imposed for food that is deliberately discarded.

Some action has taken place in the area of eliminating food waste. For example, food banks delivered 58,000 tons of food assistance to 1.5 million people in 2021.⁴⁰ Companies in the food and bioenergy sector are active in taking steps to reduce packaging and increase bio- or recyclable packaging material. Introduction of CE principles in the bioeconomy, such as cascading use of wood, holds significant potential, especially because bioeconomy is one of the national smart specializations and is indicated as a key area in the CE Roadmap. According to the GUS, in 2017, the area of agricultural land in Poland equaled 14.6 million ha (about 47 percent of the country's total land area), which translates into significant potential for the development of a bioeconomy based on this source of biomass.⁴¹ Currently, apart from food production, biomass is most often used for energy generation, mainly for direct combustion and, to a relatively small extent, for production of liquid fuels. According to the United Nations Environment Programme (UNEP) Resource Panel, the biomass sector contributed a minor share to value added (10 percent), although more than 20 percent of Poland's workforce was employed for biomass production.⁴² Many eco-innovative companies have already been created and have developed new solutions,⁴³ and large Polish companies such as Maspex are investing in eco-friendly solutions⁴⁴ and actively participate in European Institute of Innovation and Technology (EIT) Food.

Poland has vast surfaces of arable land available for investors. Most of the farms are small and use relatively old methods of production, characterized by respect toward resources. This offers the possibility of using current farms as a blank slate, for applying circular solutions. Due to the high fragmentation of farms in Poland, there is a huge untapped potential for companies that seek synergies through cooperation. This concerns sustainable agricultural production in particular. Poland's agriculture and food industry is skewed toward low value-added produce. To process produce, additional infrastructure is needed. Cooperation on improving quality and scaling supply for processing activities is possible owing to vertical integration and clustering.

6.3 Chemicals

Chemical industry companies demonstrate great interest in bio-development and chemical recycling. However, despite intensive work on the part of industry organizations, such as Plastic Europe and Polish Chamber of Chemical Industry (PIPC), there is no evident cooperation across the entire supply chain nor evidence of true industrial symbiosis. No complete analyses of the product life cycle or industrial symbiosis have been carried out. The companies themselves note the lack of information and know-how in this area and the need for expert support.

6.4 Energy

The energy sector is the most regulated due to safety and environmental concerns. Although energy production in Poland is still based mainly on fossil fuels, their impact is significantly decreasing every year.

³⁹ <https://www.teraz-srodowisko.pl/media/pdf/aktualnosci/9584-Stanowisko-w-sprawie-systemu-kaucyjnego-na-opakowania-pojach-w-Polsce.pdf>.

⁴⁰ <https://bankizywnosci.pl/o-bankach-zywnosci/informacje-ogolne/>.

⁴¹ Poland, with 895 PJ, has one of the highest biomass potentials in the EU. Biomass could generate more than 20 percent of Poland's total energy consumption.

⁴² https://www.resourcepanel.org/sites/default/files/documents/document/media/irp_natural_resource_use_in_poland_factsheet_21april.pdf.

⁴³ More information on this topic is available in the book: Bio#Futures: Foreseeing and Exploring the Bioeconomy by Emmanuel Koukios and Anna Sacio-Szymańska.

⁴⁴ <https://maspex.com/zrownowazony-rozwoj/ekologia/>.

The share of hard coal in electricity production declined to 46 percent in 2020, while the share of lignite decreased to 24 percent. In total, coal accounted for 70 percent of national electricity generation in 2020, the lowest in the over 100-year history of the Polish power industry.⁴⁵ Moreover, with the transition to a low-carbon economy, a new Energy Policy 2040 was approved in February 2021, where a diminishing share of coal is foreseen in energy generation and heating, with a coal exit planned in 2049.

Electricity production from RES increased in 2020. Spectacular growth was recorded, above all, by photovoltaics, especially from prosumers, due to both regulation (financial support) and as a consequence of significantly increasing energy prices connected with COVID-19 and, later, the Russian invasion of Ukraine. Solar power plants supplied the system with 176 percent more energy year-on-year, for a total of two terawatt hours (TWh). The co-combustion of biomass with coal increased by 20 percent (to 2.2 TWh), supported by the high price of CO₂ emission rights. The third and fourth place in terms of growth dynamics among the 'green' power plants went to biogas and hydropower plants with an increase of 10 percent to 1.2 TWh and 8 percent to 2.1 TWh, respectively.

6.5 Mining and Metals

The extraction and processing of natural resource contribute significantly to climate change. According to the UNEP International Resource Panel, non-metallic minerals such as sand and gravel contributed the most to Polish domestic extraction (43 percent) and material footprint (54 percent) but were responsible only for a minor share of environmental impacts (≤5 percent for all impact categories). The extraction and processing of resources contributed to roughly 30 percent of climate change impacts.⁴⁶

With stricter climate regulations, large Polish companies in the mining and energy sector have a slightly different approach than companies in other sectors. They conduct communication and public relations activities on a much smaller scale, but they try to close the cycle of their production processes based on industrial symbiosis and cooperation between science and industry. The latter includes initiatives such as the European Institute of Innovation and Technology Raw Materials Program (over 120 entities from the EU)⁴⁷ or the CuBR dedicated to innovative solutions in copper.⁴⁸ A good example is the investment of ZGH Bolesław S.A. with the support of the National Fund of Environmental Protection and Water Management in reuse of their own tailings dams for Zinc and Lead recovery.⁴⁹ However, the industry often faces many barriers on the path to CE connected with NIMBY and legal regulations,⁵⁰ including unclear information about waste management from the extractives industry.⁵¹

6.6 Recycling, Waste Management, and Repair

While they are not part of the oto-GOZ analysis, the waste management, recycling, and repair sectors will play an important role in and will be affected by the CE transition. CE will create demand for new business services in the recycling sector, such as:

- Collection and recovery logistics to allow used products to be reintroduced into the economy
- Sales and remarketing platforms that promote longer life or greater use of products

⁴⁵ <https://wysokienapiecie.pl/35619-zrodla-energii-w-polsce-w-2020-mniej-wegla-wiecej-gazu-oze/>.

⁴⁶ https://www.resourcepanel.org/sites/default/files/documents/document/media/irp_natural_resource_use_in_poland_factsheet_21april.pdf.

⁴⁷ The EU's European Institute Raw Materials Program connects industry, research, and education with the goal of significantly enhancing innovation in the raw materials sector. Source: <https://eit.europa.eu/our-communities/eit-raw-materials>.

⁴⁸ CuBR is a joint initiative of the National Centre for Research and Development and the KGHM Polska Miedź, a leading copper and silver producer. The initiative provides funding for scientific R&D work for the non-ferrous metal industry to enhance development and technological progress. The fourth round of CuBR funding focused specifically on CE. Source: <https://kgm.com/en/our-business/innovation-and-technology/rd>

⁴⁹ <https://www.interregeurope.eu/good-practices/recovery-of-zinc-and-lead-ores-from-post-flotation-waste-in-zgh-boleslaw-poland>.

⁵⁰ *The NIMBY Syndrome in Rural Areas. The Case of Poland. A Research Report.* Available at:

https://www.researchgate.net/publication/320284095_The_NIMBY_Syndrome_in_Rural_Areas_The_Case_of_Poland_A_Research_Report; <http://www.pte.pl/pliki/2/1/Polityka%20surowcowa.compressed.pdf>; <https://www.pgi.gov.pl/dokumenty-pig-pib-all/publikacje-2/przeglad-geologiczny/2018/marzec-6/5717-mineralne-surowce-wtorne-problemy/file.html>.

⁵¹ <https://op.europa.eu/en/publication-detail/-/publication/3f161749-5192-11ec-91ac-01aa75ed71a1/language-en>.

- Regeneration of parts and components and refreshment of products using specialized knowledge and skills
- New eco-friendly technology and eco-innovation.

The development of the recycling sector faces many challenges and barriers. The Council of Entrepreneurship indicated that development of economic and environmentally friendly waste management system based on CE rules with transparent and stable legislation and the EPR system is one of the most important priorities for the economy. It also indicated five main barriers for the waste management sector: (1) instability of the relevant law, which is being continuously amended; (2) instability of the sector and lack of incentive to invest in the sector; (3) lack of integrated approach to the waste management system; (4) the system needing an approach based on economic and environmental effectiveness, including the use of existing economic instruments; and (5) huge bottlenecks in issuing or amending sectoral decisions and permits at the level of Marshal Offices, including complicated, time-consuming, and expensive procedures with a short time for storage, financial guarantee requirements, permit timelines, and varying interpretations of legal requirements in different regions of the country. Additionally, the sector faced issues in operation during the COVID-19 pandemic, including the lack of both reliable problem analysis and dedicated support for waste management companies. As a consequence of COVID-19 and the Russian invasion of Ukraine, higher prices of energy and raw materials stimulate more efficient use of raw materials and increasing recycling.

6.7 Other Sectors

The start-up environment is actively developing and is providing innovative technological solutions for waste management. For example, Kumin.Sys is an IT tool for gastronomy that analyzes information on discarded food while facilitating production planning, cost optimization, and reduction of food waste.⁵² However, no active, large private funds are dedicated to CE start-ups or eco-innovative solutions. Some grants, subsidies, loans, and other public financial incentives for circular business activities are available at the EU (Life, EIT) and at the national level (National Fund of Environmental Protection and Water Management). Many activities are also planned in programs for 2021–2027 as Poland will be the biggest beneficiary of the EU financial framework.

Enterprises actively implementing CE in the municipal services sector contribute to building a competitive advantage for the regional economy. CE in enterprises providing municipal services—often using EU funds—improves the quality of public services while contributing to the environmental protection and improving the quality of life in the region. At the same time, these companies contribute to the creation of a competitive economic environment for other enterprises in the region and improve their development opportunities.

Product-as-a-service has been developing in Poland.⁵³ There is further potential for rapid growth, mainly due to a lack of products and difficult access to finance these products.

CE is an area of interest for many NGOs and business associations. There are many so-called CE councils, for example the Council of the CE of the Lewiatan Confederation or the Sectoral Council for Competences of the Material Recovery Sector of the Polish Chamber of Commerce, Waste Management and Recycling Cluster - Key National Cluster in Poland, Pracodawcy PR (*Włącz Czystą Energię*). The purposes of their activity are to consult on changes in regulations, develop common positions, and help entrepreneurs prepare for the circular transition. NGOs mainly focus on communication and education activities to raise awareness and further exchange of knowledge and good practice.

⁵² <https://culture.pl/en/article/7-polish-upcycling-brands-you-need-to-know>.

⁵³ <https://przemyslprzyszlosci.gov.pl/produkt-jako-usluga-czyli-jak-nowe-technologie-zmieniaja-przemysl/>.

7. PESTEL/SWOT Analysis

The aim of this chapter is to summarize the CE transition process as presented in previous chapters, focusing on key opportunities and barriers. This is done by integrating PESTEL and SWOT analyses, that is, by assessing strengths, weaknesses, opportunities, and threats for all six PESTEL categories: political, economic, social, technological, environmental, and legal, as shown in Table 7. The analysis is based on policy and literature review, as well as consultations with key stakeholders from public and private sectors.

A PESTEL analysis was conducted to assess the potentials of the CE transition in Poland.⁵⁴ The PESTEL model is widely used in strategic analysis and provides an overview of the key external factors that influence a region, company, or activity. Similar to a SWOT analysis, the PESTEL methodology helps in strategic decision-making and creating long-term plans and indicates opportunities and threats. This PESTEL analysis is based on strategic documents and statistical data as well as the information gathered from other parts of this study, including interviews and survey. The study team combined the PESTEL methodology with the SWOT analysis and focused on activities supporting CE or identified barriers in transition toward CE, across the six PESTEL categories.

Table 7. Structure of the PESTEL analysis

PESTEL Category	Category Description
Policy and governance — central and regional level	Strategy at different levels (national, regional, and firm level) and its impact on regulations, promotion, and behavior
Economic/financial — sectors and economy	Market, businesses' expectations and experience, and economic instruments supporting CE
Social/education	Changes in mindset: reluctance to acknowledge that the current way cannot be continued
Technology and market access	Issues connected with specific technologies and processes
Environmental/innovation	Impact of the surrounding environment and specifically of climate change
Legal — regulations and legislation	Complexity of regulations; discrepancies between Polish and EU regulations

The results of this analysis are presented in Tables 8–13. A key conclusion of the analysis is that a shift to a longer term perspective is required to eliminate barriers and allow for CE implementation.

⁵⁴ <https://blog.oxfordcollegeofmarketing.com/2016/06/30/pestel-analysis/>.

Table 8. SWOT analysis for Policy and Governance (PESTEL)

Policy and Governance: Central and Regional Level	
Strengths	Weaknesses
CE Roadmap was developed and approved in September 2019, with a clearly defined role of the business model, holistic approach, and ambitious tasks for the next two years; tasks were dedicated and divided clearly among different authorities.	Lack of clear long-term goals dedicated to CE (resource efficiency) in environmental policy or other strategies.
CE as a horizontal approach was mentioned in most strategies/plans and thematic programs developed by various ministries since 2019.	The role of CE in most public/central/regional documents is not sufficiently identified and not supported by objectives and indicators; some only focus on waste management (mostly municipal).
The MEDT coordinates and is responsible for CE implementation through the Inter-ministerial CE Working Group.	Historical 'silo mentality' in government has hindered communication and cooperation among institutions, making holistic implementation, monitoring, and governance difficult.
Access to good comprehensive databases (that is, central waste database and others developed by the GUS, PIG-PIB, ⁵⁵ and Marshal Offices) for monitoring resources, activities including SDGs, green economy, and innovation.	Lack of central database and activity promoting circular products and ecofriendly materials and products, including product from waste or climate neutral (which can promote carbon contracts, or pricing, ETS, and carbon embodied in materials).
Many activities in the public sector stimulating the development and implementation of CE (meetings, conferences, and programs).	Lack of one central web platform dedicated to CE, lack of transparent system of CE financing and CE promotion (terms are confusing and inconsistent, contributing to lack of transparency, that is, environmental footprint, ETV, ⁵⁶ carbon footprint, Eco-Management and Audit Scheme [EMAS], CE declaration).
Smart specialization dedicated to CE established in 2019 to support innovation.	Lack of CE criteria for selecting eco-innovative projects for support under various programs and lack of one national program to support R&D focusing on CE and eco-design.
State procurement policy focusing purchases on innovative and sustainable products and services provided to public institutions, in line with GPP.	Insufficient research and surveys focusing on consumer and industry expectations.
National Fund for Environmental Protection and Water Management implements many priority programs and projects supporting innovation, R&D, the low carbon economy, and CE.	Lack of foresight and vision for a CE scenario and the socioeconomic and environmental benefit of CE.
CE as a main horizontal aim for many regional policies (with Industry 4.0, climate neutrality and digitalization).	Tasks for and effects of CE transition are not identified and measured at the regional level.
Appointment of a new Director of the Waste Department in the Ministry of Climate and Environment.	Legislation cannot be adjusted/introduced by local governments to meet local needs.
Opportunities	Threats
CE policy in line with other strategies which are on top of the EU agenda, that is, clean air, waste plan, and EU Taxonomy Regulation (EU 2020/85).	Insufficient capacity of central institutions in charge of supporting the CE transition.
Clear vision and planning for economic and financial support for CE implementation from EU and national funds and funds, banks, and so on.	Too many competing and different new programs and requirements in different policies.
Active support for entrepreneurship and enterprise development (streamline investment process and business constitution packages) in Poland.	Unclear policy for R&I support and cooperation between science and industry to support CE.

⁵⁵ PIG-PIB is The Polish Geological Institute – National Research Institute

⁵⁶ ETV is Environmental Technology Verification, <https://www.gov.pl/web/klimat/etv>.

Policy and Governance: Central and Regional Level	
Increasing role and activity of network and voluntary working group (quadruple helix, that is, culture- and media-based public and civil society) focusing on exchange of information and best practice and policy proposals on the environment and CE.	
Increasing support for CE policy promotion from NGOs, clusters, associations, financial institutions (banks), and some universities.	
Some central activities promoting CE and green products abroad, that is, GreenEvo – Technology Accelerator.	

Table 9. SWOT Analysis for Economic/Financial Sectors and Economy (PESTEL)

Economic/Financial Sectors and Economy	
Strengths	Weaknesses
EU projects and programs supporting CE have been increasing and many activities are planned for 2021–2027.	Risk due to long-term horizon for return on CE investment.
Role of CE in GPP has been increasing. Public sector is at the forefront in promoting the development and implementation of CE.	Financial system is fragmented; no comprehensive financial support for CE.
Increasing role of repair and maintenance sector with more employment in this sector.	No proper and innovative infrastructure in most SMEs for conducting R&I.
High potential in bioeconomy and agri-food sectors in Poland.	Number of enterprises cooperating in the field of innovative activities is relatively low.
Cooperation of Polish National Development Bank (<i>Bank Gospodarstwa Krajowego</i> , BGK) with the European Investment Bank (EIB) and clear criteria and guidance for CE support proposed by EIB. ⁵⁷	Higher market and commercial risk: lack of good circular business model contracts which incorporate incentives for all parties involved to continue business activities and dissuade contract termination.
High energy and material cost in industry cost structure, that is, 66.5 percent, which can be a driver for CE solutions.	No interest in the transition to CE due to relatively low salaries (average salary in CE area much lower compared to industrial production).
Opportunities	Threats
High potential for financial benefit for the Polish economy from increasing resource efficiency (which is currently much below the EU average) and prevention of industrial waste.	Fear of decrease in demand and limited consumption created a lower turnover.
Increasing cost of waste management and environmental tax and fee.	Increased cost of production due to higher CE and environmental requirements.
The competitive advantage of Polish enterprises—the whole of Poland has become an economic zone owing to which companies investing anywhere in the country can count on income tax exemptions.	Insufficient and improperly allocated funds as the CE transition in Poland will require more funds and time compared to other EU countries; Polish obligation to the EU due to a high gap in capacity for waste recycling, energy infrastructure, and so on.
New job opportunities, with open market for foreigners and for Polish and Ukrainian citizen (with social assistance and support).	Increasing access to raw materials and high inflation in 2022.

⁵⁷ https://www.eib.org/attachments/thematic/circular_economy_guide_en.pdf.

Table 10. SWOT Analysis for Social/Education (PESTEL)

Social/Education	
Strengths	Weaknesses
Participation of regional and local authorities in EU projects dedicated to resource efficiency and CE (Interreg Europe).	Lack of knowledge and education of CE, lack of experts supporting CE implementation, and the scope of cooperation between entrepreneurs and the R&D specialists is not sufficient, also in the area of CE.
Increasing numbers of websites, portals, awards, studies, and networks focusing on CE promotion and education carried out by NGOs, clusters, ad hoc groups, and similar entities.	There is no institution (entity, platform, or initiative) in the Polish education/science system that connects the worlds of science and business to create CE solutions.
Polish municipalities involved in EU initiatives to improve environmental protection, address climate change, and transition to CE.	Public consultations on draft legislation often suffer from insufficient communication, enforcing the NIMBY effect regarding investments, for example, for waste recycling facilities.
Opportunities	Threats
Increasing number of research institutions, projects, publications and scientific books devoted to CE.	Low interest in environmental and CE education.

Table 11. SWOT Analysis for Technology/Market Access (PESTEL)

Technology/Market Access	
Strengths	Weaknesses
Access to different local and national raw materials, including anthropogenic resources.	Slow pace of adoption of the circular business models.
Some large companies are interested in CE implementation and development of sustainable value chains.	Low level of anthropogenic resources and byproducts used in technological processes and low level of bioproducts on the market.
Product-as-a-service—high potential for new business mainly for the younger generation.	Very low number of products with eco-label, EMAS, and other CE declaration.
Many active SMEs in the local market—potential for local value chain creation.	Poorly promoted CE market (lack of good examples of large industrial symbiosis, sharing economy, and retail).
Increasing offer of new, eco-friendly technologies from science institutes.	No methodology for implementation of CE rules in business plans and investments.
Good technological examples in some sectors, for example, ZGH Boleslaw or upcycling.	Lack of well-established hubs/hotspots/cooperation platform.
Opportunities	Threats
Increasing demand for CE products.	Quality and price of waste material.
Bank activities for CE investment—procedure and process are in place.	Quasi-monopolization of the sharing economy.
Increasing value of GPP but still relatively low—only about 3 percent of total value.	Low consumer awareness.

Table 12. SWOT Analysis for Environment/Innovation (PESTEL)

Environmental/Innovation	
Strengths	Weaknesses
Financial support from National Funds and EU funds.	Poland among the countries persistently scoring low on the European Eco-innovation Scoreboard since 2010.
The share of green products and services offered by SMEs is on the rise; it is now slightly above the EU average.	The environmental factor not motivating companies to undertake innovative activities.
Opportunities	Threats
Higher environmental consciousness on the part of the young generation.	Insufficient funds to support CE solutions.
More environmental criteria in bank investment strategies.	Strong NIMBY for new infrastructure
Many active SMEs offering eco-friendly IT applications.	Decarbonization — slow to move away from its heavy dependence on coal and still has a carbon-intensive energy system. ⁵⁸

Table 13. SWOT Analysis for Legal/Regulations and Legislation (PESTEL)

Legal/Regulations and Legislation	
Strengths	Weaknesses
Many working groups created by ministries (NGO, industry, and science) to support improved legal solutions to CE and waste management.	Many institutional changes and requirements in environmental legislation, especially in enforcement of waste legislation.
Effective and clear regulations and information about EU funds and support.	Regulations focusing mostly on waste management and less on waste prevention and increasing resource efficiency in the value chain.
More transparent and friendly (virtual) legal system with more clear responsibility.	Legal acts not identified — the problems caused by their inadequacy and fragmentation (with regulations not collected in one place). They pose overly strict requirements, especially for recycling companies.
	Outdated law does not keep up with technology and innovation development.
	Insufficient regulation and incentive supporting selective waste collection and recycling as the basic process of CE.
	Insufficient support and requirements to meet GPP criteria (traditional 100 percent price).
	Insufficient regulations and incentives supporting end-of-waste criteria and byproducts (lack of country good practice and regulation of chosen product category) create risk for misinterpretation and companies' resistance and non-consistent statistics.
	Insufficient regulations on recovery of substances from industrial waste, for example, Article 19.1 of the Waste Law provides only for management of reuse or preparation for reuse but not tailings and so on.

⁵⁸ <https://iea.blob.core.windows.net/assets/b9ea5a7d-3e41-4318-a69e-f7d456ebb118/Poland2022.pdf>.

Legal/Regulations and Legislation	
Opportunities	Threats
Decreasing illegal trade of waste and dumping of waste.	Low acceptance of collaborative and sharing approach due to lack of good practice, regulations, and clear rules for benefit.
EU further harmonized work on end-of-waste and byproduct criteria and CE regulation.	Permanent changes in regulations and increasing environmental requirements without any economic benefit (tax reduction).
EU regulation on taxation, investment in CE products, and CE label.	Officials may fear taking responsibility for support of new, green solutions or GPP process.
	Regulations supporting the transition to a CE are relatively new for most stakeholders (no good practice in Poland), especially in the areas of eco-design, circular business models, and new technologies.

8. Private Sector Readiness to Implement Circular Business Models

The views of the private sector presented in this chapter are based on a previous study complemented with additional in-depth stakeholder interviews. The "Assessment of the Need for the Support of Enterprises in the Circular Economy Field," finalized by PARP in December 2020 in collaboration with Bluehill LLC aimed to gather relevant knowledge on the CE from a financial perspective for 2021–2027. The study was conducted on a national scale accounting for the specificity of the Eastern Poland macro-region. To complement the findings of this study, 12 in-depth stakeholder interviews were conducted in the context of this report with representatives of entrepreneur/business associations and NGOs. These interviews focused on the identification of CE megatrends, barriers to the implementation of CE, and the need for support measures in the area of CE. They resulted in additional recommended actions for the implementation of co-financing programs for 2021–2027 with a focus on CE. A detailed list of the organizations surveyed as part of this assessment is provided in Annex 1.

Key findings and recommendations from the assessment are outlined in Tables 14 and 15.

Table 14. Megatrends in the circular economy

Megatrends	Description
New energy sources and energy efficiency	Mainly renewable energy as clean, cheap, and affordable energy for everyone; every entrepreneur and household may become a producer of this kind of energy.
Selective waste collection and recycling	The basic process of CE; only effective methods of obtaining raw materials enable further processing and sales.
Changes in consumer behavior	Increased responsibility in handling waste and pro-environmental purchasing decisions are the basis for changes; purchasing decisions can force manufacturers to change their approach as effectively as fiscal and legislative regulations.
Searching for new business models	Extending the life cycle of products and sharing existing resources and changing the consumption and sales model from ownership to service are economically justified and result in profitability of producers and satisfaction of consumer needs (the 'win-win' model for both sides of the market).
Eco-design	The trend of introducing fully recycled products to the market; according to the concept behind the trend, each element of the product should be recoverable/repairable and reusable; this can be achieved through design and selection of appropriate materials to facilitate collection and recycling. EPR regulations may support this trend.
Changes in the policy area	Changes in legislation and public policies supporting or codifying the CE transition: the Green Deal, CE Package, and CE Roadmap.
Green public procurement	An expression of the state responsibility in purchases; the state, as a significant consumer in the market, can radically change the market for goods and services by appropriately defining the directions and criteria of the procured supplies, services, and work.

Table 15. Most significant barriers to CE implementation:

CE Barrier	Description
Low awareness of market participants	Entrepreneurs are aware of the impact on the environment, but they do not undertake sufficient actions to limit the negative impact of the company; this is because they lack sufficient knowledge about what actions to take and because solutions are costly.
Knowledge (competence gaps)	Shifting to a CE business model requires highly qualified staff; deficiencies in this respect block both initiation and launch of new CE business models.
Long-term investment	Large gap between investments in CE and business benefits; larger companies in a better economic situation, with a larger scale of operations can, in principle, afford a longer period of waiting for a return on investment.
Legal conditions	Fragmentation of CE regulations across many normative acts is problematic; legal issues can be considered the most effective stimulants for implementing CE solutions; adjustment resulting from legislation, in principle, should result in wide implementation of a given solution.

Survey respondents recommend the following types of CE support:

- Covering part of the costs of consultancy in the scope of implementing solutions compliant with CE and correcting (or re-developing) business models for enterprises, including elements of CE
- Supporting and stimulating start-ups' activity in the field of CE
- Promoting and rewarding new and innovative solutions in the field of CE produced on the domestic market
- Stimulating the creation and development of cooperation networks of enterprises based on industrial symbiosis
- Providing financial support for SMEs in the purchase of infrastructure related to the implementation of a new (or revised) business model consistent with the CE
- Setting up and developing companies operating in service or repair to extend the product life cycle.

Respondents emphasize that most companies see the CE transition more as an opportunity than a threat. Some just accept the change and consider it inevitable. The benefits mentioned are the access to new types of raw materials, development of new opportunities, and business niches. They see CE as an opportunity to increase income, create new jobs, and create new business models.

At the same time, however, respondents expressed concerns. They particularly emphasized concern about instability of regulations, unpredictability of the law, and delays in implementing changing EU regulations. They also noted the inappropriate adaptation of the regulations to the needs of the market, with no real consultation with the industry or response to the demands of various sectors. Virtually all industries stressed the lack of dialogue and not considering the needs of business when creating strategic documents and legal frameworks.

Respondents mentioned several opportunities to transform the direction of CE, including improved consumer awareness; growing customer requirements; and the need to use sustainable, ecological products and services. They noted that companies are also beginning to see a competitive advantage in implementing the CE principles and real savings, for example, in the use of water or energy.

As for barriers, respondents noted disproportionate pricing of primary and secondary raw materials, emphasizing that primary raw materials are priced much lower than secondary. As long as primary raw materials are cheaper, the industry will have no incentive to use secondary raw materials for production or to seek new technologies. The incentives and support systems for CE include: the introduction of an efficient

EPR, co-financing of Polish recycling plants and rewarding recycled products, tax breaks related to the reduction in the environmental footprint, and investment support at the initial stage of the CE transition. Respondents stated their belief that the state should provide additional sources of funding, whether in the form of loans, subsidies, funds for innovation, for investment in the collection and treatment of various types of waste to make the CE transition economically viable, including a bonus and penalty system.

Public education and increased social awareness of the benefits of CE were also noted as an important element of CE transition.

Respondents highlighted the lack of a comprehensive CE strategy covering all sectors of the Polish economy and the need for specific and measurable goals. Objective indicators proposed included level of recycling, carbon footprint, and life cycle assessment (LCA). According to business, the lack of strategy leads firms and the government to delay taking risk and to instead engage in inconsistent and uncoordinated actions and allocate less funding than needed for the development of the CE in Poland. In addition, a strategic document would be a clear guideline for investors, which would facilitate and accelerate the development of the CE sector in Poland. One gap in the legislation identified by respondents is the lack of an efficient EPR system that considers the specifics of particular industries. As currently designed, regulation is seen as a threat, which imposes additional and unnecessary obligations, reducing the competitiveness of Polish products on the European and international arenas.

Respondents also underlined the importance of putting in place regulations to facilitate the activity of enterprises that use and process secondary raw materials and byproducts and creating a new category of 'waste secondary raw materials' under the Act on Waste. The lack of a clear, transparent, and GPP law compliant with clear criteria was cited as a serious gap in the legislation.

It is necessary to educate enterprises on changing product management throughout the product life cycle and on transforming current business models into circular models. As reported by respondents, entrepreneurs have no knowledge of LCA calculation or indicators such as Product Environmental Footprint Category Rules (PEFCRs) and Organization Environmental Footprint Sector Rules (OEFSTRs). Knowledge transfer from units of scientific experts to the corporate sector is needed, to teach companies to manage and assess the life cycle of the product. Expert auditors with an educational mandate could audit companies' circularity and help them in their CE transition.

9. Findings and Recommendations

9.1 Findings

Many Polish CE-related strategy and policy documents fail to highlight the underlying benefits of CE implementation, especially regarding cross-sectoral potentials and solutions. This is largely because of a lack of long-term vision and strategy (the CE Roadmap’s horizon is only until 2023). Therefore, a gap analysis with policy scenarios until 2040 is considered necessary. All stakeholders assert that the current legislation fails to line up with the EU CE Action Plan and highlight the need to update legislation to support CE objectives. This is also important from the perspective of operationalizing the European Green Deal.

In addition to technical and legal priorities, stakeholders note the need to focus on a set of nontechnical priorities, especially on education and CE business models to foster incremental improvements in the existing linear model. Stakeholders emphasize the importance of cooperation between science and business in accelerating the transition; therefore, strategic action should be undertaken to promote cooperation between universities and research institutions, companies, policy makers, industrial associations, and clusters. One leading large institute (hub and platform) is needed to support and promote CE. Such a hub can serve as a base for public discussions and consultations on all CE transition activities to gain government and public support. The hub should promote tools needed for CE, including LCA and eco-design.

9.2 Proposed Interventions

Seven key interventions to accelerate Poland’s CE transition are proposed, as presented in Table 16. Each intervention is briefly described below, including objective, outcomes, and proposed indicators (where applicable).

Table 16. Proposed key interventions

Intervention	Description
Circular Poland 2040: Circularity Gap Report and Foresight Study with focus on national/central, regional, and sectoral levels	Poland’s CE Roadmap only covers a time horizon until 2023. This intervention aims to establish a long-term strategic approach to the circular transition in Poland, focusing on the national, regional, and sectoral levels. A recently published Polish Circularity Gap Report (financed by the European Environmental Agency and Norway Grants) ⁵⁹ will serve as the basis for this intervention, with the aim to extend the analysis to the regional and sectoral levels. The Foresight Study, with a perspective until 2040, would identify specific actions for the CE transition of the economy and the expected effects, costs, and benefits of these actions. An important element of the document could be the analysis of industrial symbiosis in various value chains. Its intention is to provide a holistic approach, with clearer targets for increase in resource efficiency, decoupling, CE business model implementation, and data analysis.
Circular Regulation: Adjustment of the national legal framework	This intervention would address the inadequacy and fragmentation of the existing legal framework in view of promoting high-quality products from recycling. It supports the adjustment of the legal framework, including long-term targets. A potential focus could be on the efficient use of resources (including critical raw materials and their recycling) and waste management regulations, which currently are still insufficient for promoting CE, to strengthen the reuse, prevention, recycling, and other recovery of waste. Current waste legislation is very strict, especially for recycling companies and without clear and consistent interpretation by different entities, as the Polish waste management system involves many actors on different levels. This activity could support the modification of the definition of recyclable material and the development of a clear practice and rules for end-of-

⁵⁹ <https://www.circularity-gap.world/poland>.

Intervention	Description
	waste status criteria. In addition, it could support fiscal reform to change the price ratio between primary and secondary raw materials. A potential focus could be on different 'types' (textile, building, and so on) of waste management regulations.
Circular Consumers: Building consumer awareness for circularity and greening education system	Building consumer awareness through a Sharing Economy Action Plan, labeling of circular products, and education campaigns on the benefits of the CE. A potential focus of this activity could thus be on the development of a Sharing Economy Action Plan designed to enable cities, businesses, and residents to reap the benefits from sharing platforms while also identifying and mitigating unintended risks. The activity could also aim to create and promote a clear system of certificates and labeling of sustainable and circular high-quality products, which facilitate consumer purchasing or lending decisions (adopt product as service system). Other elements could include consumer observation studies, as well as an education campaign about CE and its benefits and solutions. The sustainability and circularity idea should also be included in higher education, especially in technical programs, focusing also on eco-design, eco-innovation, corporate social responsibility and ESG financing.
Circular Business: Creation of an ecosystem of support for enterprises	A major barrier to the CE transition is the lack of knowledge and competences of entrepreneurs and business advisers; therefore, there is an urgent need to create an ecosystem of business support. This activity could have several components: (a) creation of a system of institutions offering consulting services for enterprises with a qualified and competent team of consultants; (b) harmonization and development of circular audit procedures together with an instrument cluster (including IT application mainly for SMEs); and (c) creation of regional advisory hubs where entrepreneurs can gain/exchange knowledge about CE through workshops, seminars on changing business models, circular audits with individual consulting, support in building partnerships between value chains and support to the emergence of industrial symbiosis. As part of this initiative, an enterprise education campaign on the benefits (environment, economy, and social well-being) of CE could be conducted.
Circular Accelerator: Creation of a government support system with economic and fiscal instruments	Help is needed in financing, at least at the initial stage of the changing business models. This solution would support different economic and financial instruments (tax incentives, EPR, GPP, and others) promoting the highest levels of the waste hierarchy. It would support the development of innovations, technologies, and circular processes and assistance in their scaling through the creation of accelerators (for example, focusing on IT systems, CE criteria in R&D and investment projects, and large public/private funds dedicated to CE or eco-innovative solutions).
Circular Products: Eco-design, cost-benefit analysis, and LCA tools	Scaling up tools for eco-design by establishing an education system on eco-design in cooperation with universities and designers, especially for implementing innovative solutions and products. Focus on training in LCA; applications pointing to and tracking eco-design advances; cost-savings analysis; and other tools fostering measurable, competitive, and continuous eco-design improvements. Educational and consultancy services for enterprises and local administration in the field of carbon and environmental footprint calculation and interpretation and LCA, including funding and database development. To ensure consistency, these activities would need to be in line with EU legislation currently being negotiated in the areas of eco-design for sustainable products (ESPR) and packaging and packaging waste (PPWR).
Circular Raw materials and service platform	An online platform to connect supply and demand for high-quality secondary raw materials for various economy sectors and promote sharing/lending of products and services. The platform will facilitate cooperation between different

Intervention	Description
	<p>value chains and support building industrial symbiosis. This could be a pilot project with products and services introduced in several stages—ultimately covering all types of waste and products. It could be supported by a broad communication campaign to reach all relevant actors and promote the use of this tool in their everyday operations. The pilot could be set up for the construction sector, covering the entire value chain of construction and demolition waste. In the context of preparing for such a platform, the MEDT is currently planning a comprehensive assessment of the industrial waste market in Poland.</p>

Annexes

Annex 1. List of interviewees by Sector and Organization

Ministry of Economic Development and Technology

- Expert, Department of Innovation and Industrial Policy

Construction Sector

- President of the Board, PLGBC Polish Association of Sustainable Construction

Chemical Sector

- Senior Expert
- President of the Board, PlasticsEurope Poland

Bioeconomy Sector

- President of the Board, Polish Food Producer Federation

Recycling Sector

- President of the Board, Rekopol Organization of Packaging Recovery
- President of the Board, Polish Chamber of Recovery and Recycling of Packaging
- President of the Board, Association of Polish Recycling

Electrical and Electronic Sector

- President of the Board, APPLiA Employers Association of Electronic Devices

Think Tank Wise Europa Institute

WWF

- Senior Specialist for Environment Policy

Konfederacja Lewiatan

- Director, Department of Energy and Climate Change

Polish Employers Federation

- Main Economist
- Dialogue Director

Annex 2. Survey and Interview Questions

Written survey for central and regional authorities

1. What are the 2–3 most important opportunities for the CE introduction in your region?
2. Identify 2–3 threats and existing barriers to the CE strategy implementation in your region.
3. Is the national policy environment supportive of the regional CE regional transition? What are the main gaps?
4. Indicate the actions that are needed most to facilitate the CE transition (for example, tax, other economic incentives, business model, procurement, and education).
5. What kind of strategies, programs, or similar activities that support CE models are being (or have been) implemented?

Follow-up interview questions for central and regional authorities

6. What regional CE programs and plans are considered in the near future (1–2 years)?
7. What would be the motivation for the regional/local authorities to 'go circular' and implement the CE measures and initiatives?
8. Have you ever conducted an assessment of the regional/local potential for a transition to the CE or are you planning to do so?
9. Which sectors in your region use the most primary resources and have a big circular potential? To what extent (for example, electric cars, packaging, tires, plastics, textiles, construction, food, waste treatment)?
10. To what extent have you worked with regional/local stakeholders involved in the transition to circular economy? Which actors/stakeholders should be involved?
11. Are existing administrative and institutional capacities sufficient to implement CE measures?
12. Has your region/municipality already conducted GPP, or has it included 'green' requirements in the regular public procurement procedures?

Written survey for business sector representatives

1. What is your current understanding of the CE and to what extent do you wish to get involved in it?
2. What kind of CE programs or concrete measures have you implemented in your company/sector?
3. If you have not undertaken any CE measures, why not? Are you planning to do so in the future? What would the first steps be?
4. What are the 2–3 most important opportunities for the CE introduction?
5. Identify 2–3 threats and existing barriers to the CE implementation.
6. Are there any national/regional legislations and policies that support circular business activities?
7. What are the main regulatory gaps to be addressed?
8. Which concrete policy measures would you recommend on the national/regional levels to support circularity in your business (for example, tax, other economic incentives, procurement, education)?
9. Which is the most important EU legislation proposal for your sector? Do you see it as an opportunity or threat?

Annex 3. Strategic Policy Documents: National Level

Strategic Document/Date of Adoption	Time Horizon	Main CE Message/Goal
Medium-term development strategy		
Sustainable Development Strategy February 14, 2017	2030	The state medium-term development strategy. The document identifies strategic projects: <ul style="list-style-type: none"> Roadmap for the Transformation toward a Circular Economy Action Plan 'Raw Materials for Industry' to secure the supply of non-energy mineral resources and minerals National Raw Material Policy to create an efficient and effective management system of all types of mineral resources.
National Strategy for Regional Development (NSRD) September 2019	2030	The basic strategic document of the state regional policy. The NSRD identifies seven challenges for regional policy, the first of which is the adaptation to climate change and reduction in environmental threats. However, the document does not specify an objective strictly devoted to CE.
Sectoral strategies		
National Environmental Policy July 2019 ⁶⁰	2030	Its role is to ensure Poland's ecological safety and a high standard of living. It will also become one of the bases for European funds absorption in the 2021–2027 EU financial framework. The strategic goals are increase in the resource efficiency and increased use of renewable resources and biomass. The strategic projects concern the development and implementation of a coherent and comprehensive National Raw Material Policy and support for investments in the field of proper waste management and recycling.
Productivity Strategy July 2022	2030	It is an update of the previously binding Strategy for Innovation and Efficiency of the Economy. The main goal is a progressive (also sustained) increase in productivity under the conditions of the economy: climate neutral, circular, and data driven. The detailed objectives set out in the document concern, among other things: increased resource efficiency, the use of renewable resources and biomass, stimulation of cooperation mechanisms between economic entities, and increased intensity of the use of knowledge and technology.
Poland Energy Policy February 2021	2040	The document is focused on energy and the environment and provides guidelines for Poland's Energy Policy. The main goals connected with resources management are development of RES, development of heating and cogeneration, and improvement in the energy efficiency.
Strategy for Sustainable Development in Transport September 2019	2030	The main goal is to increase the country's transport accessibility and improve the safety of road users. The strategy also includes provisions on the reduction of negative impact of transport on the environment.
National State Raw Material Policy March 2022		The main goal is to ensure the raw material security of the country now and in the future, focusing also on the prevention and recovery, especially products containing critical raw materials.

⁶⁰https://bip.mos.gov.pl/fileadmin/user_upload/bip/strategie_plany_programy/Polityka_Ekologiczna_Panstwa/Polityka%20Ekologiczna%20Pa%C5%84stwa%202030%20ENG_wersja%20internet.pdf

Strategic Document/Date of Adoption	Time Horizon	Main CE Message/Goal
The Strategy for Sustainable Development of Rural Areas, Agriculture and Fishing September 2019	2030	One of the pillars dedicated to quality of life and the environment includes an intervention measure called 2.8 CE and bioeconomy (including RES).
National Waste Management Plan June 2016 - new project from June 2022 - Waste Management Plan 2028	2022	The document defines goals in the field of waste management and sets out the directions of activities in the field of waste prevention and development of the waste management system. At the end of 2020, a draft resolution was prepared to amend the resolution on the National Waste Management Plan 2022. The supplement concerns the assessment of the investment gap in Poland in waste management and the information on income sources to cover the costs of maintenance and operation of the waste management infrastructure resulting from the need to meet one of the basic condition criteria established for the EU financial perspective 2021–2022.
CE Roadmap October 2019	2019–2023	The most important government document directly regarding the CE transition is the <i>Roadmap for the Transformation towards a Circular Economy</i> . ⁶¹ The roadmap identifies 41 concrete actions that the government needs to undertake to support the CE transition.
Polish Industrial Policy	June 2021	<p>This program is targeted at industrial sectors. It will complement the Productivity Strategy with its sectoral approach.</p> <ul style="list-style-type: none"> • Digitization - Streamlining industrial activities from product design to changing business models using digital technologies. • Security - In terms of technology and raw materials, include the reconstruction of the production capacity of key products necessary to ensure the safety of citizens, as well as pharmaceutical or medical products. • Location of industrial production - Ensuring economic autonomy, shortening supply chains, and diversifying sources of raw materials and semi-finished products. • Green deal - Accelerating the transformation toward a low-carbon economy, including the CE. • Modern society - Adjusting employees' competences to the needs of the labor market.

⁶¹ Rząd Rzeczpospolitej Polskiej. 2019. *Mapa drogowa transformacji w kierunku gospodarki o obiegu zamkniętym*.

Annex 4. The Regional Level: Strategic Policy Documents, Challenges, and Projects

Annex 4.1. Regional Strategic Policy Documents

Voivodeship (Region)	Date Strategy Adopted	Approach	Development Directions/Strategic Goals/Activities
Dolnośląskie	September 20, 2018	Horizontal approach: CE popularization and education	—
Kujawsko-pomorskie	October 21, 2020	Horizontal approach: CE popularization and education	<p>Development directions:</p> <p>The natural environment</p> <p>Development of CE. The direction concerns organizational, training, and promotional activities related to the efficient use of resources to minimize the scale of generated waste; the subsequent implementation of the closed loop concept, including the promotion of behaviors conducive to a sustainable consumption; implementation of pilot projects at the municipal level; and consultancy in the field of the CE economic development.</p> <p>Technical infrastructure</p> <p>Efficient waste management. Solutions for the implementation of the CE model; construction of new infrastructure and expansion and reconstruction of the existing infrastructure for waste management (including the implementation of waste composting equipment) and organizational activities aimed at effective waste management.</p>
Lubelskie	March 29, 2021	Horizontal approach: CE popularization and education	<p>Strategic goal: Development of strategic agricultural resources</p> <ul style="list-style-type: none"> • Operational goal. Development of entrepreneurship using agricultural raw materials. An important issue will be to optimize production processes, including the use of Industry 4.0 solutions on a larger scale as well toward a CE transition. • Operational goal. Protection of the values of the environment, with an emphasis on the limited use of nonrenewable resources. Promotion of solutions aimed at changing the energy mix, as well as popularizing the CE concept. <p>Strategic goal: Innovative development of the economy based on the resources and potential of the region</p> <ul style="list-style-type: none"> • Operational goal. Supporting the competitiveness and innovativeness of enterprises.

Voivodeship (Region)	Date Strategy Adopted	Approach	Development Directions/Strategic Goals/Activities
Lubuskie	February 15, 2021	Horizontal approach: CE popularization and education	<p>Strategic goal: Smart, green regional economy</p> <p>Development of a green economy, including environmentally friendly energy, supporting environmentally friendly production, and the transition to a CE, in particular, designing and implementing:</p> <ul style="list-style-type: none"> • Low-waste production technologies, • Economically effective and ecological recovery technologies (including recycling), • Neutralization (including thermal), and • Transformation of waste.
Łódzkie	May 6, 2021	Horizontal approach: CE popularization and education	<p>Strategic goal: Attractive and accessible space</p> <p>Operational objective: Rationalization of waste management:</p> <ul style="list-style-type: none"> • Development of infrastructure toward a CE • Improvement of the system of municipal installations for the processing of unsorted (mixed) municipal waste or residues from the processing of this waste • Biowaste processing installations and installations for thermal processing of municipal waste or waste from municipal waste processing with energy recovery, through their construction, extension, and modernization.
Małopolskie	December 17, 2020	Horizontal approach: CE popularization and education	<p>Strategic goal: Innovative and competitive CE</p> <p>Promoting the principles of CE:</p> <ul style="list-style-type: none"> • Promoting the idea of CE among residents, including repair and reuse of products • Actions for conscious consumption, including reducing the amount of food thrown away • Eco-managers for business: advisory support for entrepreneurs interested in the implementation of modern technologies in the field of environmental protection and the implementation of CE principles • Promoting good practices and model solutions in the field of CE in public administration. <p>Staff for the implementation of the CE rules.</p> <ul style="list-style-type: none"> • Activities aimed at educating staff in the field of CE • Activities for the implementation of the CE principles, including eco-design, in R&D departments as well as design and construction offices of enterprises. <p>Efficient use of products, raw materials, and waste.</p> <ul style="list-style-type: none"> • Actions to improve the quality of collected secondary raw materials obtained as a result of selective collection at source • Increase in the recycling of packaging waste • Creation of an effective waste recovery market and the use of secondary raw materials in accordance with the principle 'my waste is your raw material'

Voivodeship (Region)	Date Strategy Adopted	Approach	Development Directions/Strategic Goals/Activities
			<ul style="list-style-type: none"> • Actions for the use of reused industrial water, sewage, and sewage sludge in the economy • Implementing technologies that extend the life of products, including their repair and regeneration • Creating repair points and product reuse • Developing installations for recycling and recovery of raw materials from waste and for energy recovery of the energy fraction. <p>Regulatory solutions for CE.</p> <ul style="list-style-type: none"> • Effective system of integrated permits • Improving the waste management system (register of entities introducing products, packaged products, and waste management) • Promoting GPP that reduces environmental impact.
Mazowieckie	May 24, 2022	CE as challenge	<p>Area: Development of competitive region</p> <p>Transformation of organizations toward CE</p> <p>Area: Quality of the environment</p> <p>Waste management toward CE</p>
Opolskie	October 4, 2021	Horizontal approach mainly for waste and GHG reduction	<p>Area: Zeroemission Opolskie</p> <p>Innovative waste management, support for CE, efficient use of products and raw materials, landfill reclamations, and prevention of waste generation</p>
Podkarpackie	September 28, 2020	Horizontal approach: CE popularization and education	<p>Area: Economy and Science</p> <p>Objective: Strengthening the potential of the regional economy and increasing the share of science and research for innovative and sustainable socioeconomic development of regions 1.4. CE</p> <p>1.4.1. CE as a direction for further sustainable development of the region's economy:</p> <ul style="list-style-type: none"> • Use of new waste-free technologies, recycling, recovery, extending the life of products, and a closed circuit • Changes in the way products are designed to extend their life cycle • Reduction in waste generation along with a reduction in the consumption of raw materials and the level of emissions and energy use • Increasing the use of refuse-derived fuel (high calorific fraction from waste). <p>1.4.2. Promotion of CE as a form of counteracting the negative aspects of anthropogenization:</p> <ul style="list-style-type: none"> • Slowing down climate change through changes in the economy conducive to the improvement of the environment • Limiting the negative environmental impact of the technological processes of manufacturing products and their use, as well as the provision of services

Voivodeship (Region)	Date Strategy Adopted	Approach	Development Directions/Strategic Goals/Activities
			<ul style="list-style-type: none"> Supporting business models and projects aimed at reducing the consumption of raw materials and reducing waste generation in production processes Providing education in CE and opportunities to use good practice in sustainable economic activity in various sectors.
Podlaskie	April 27, 2020	Horizontal approach: CE popularization and education	<p>Strategic goal: A dynamic economy</p> <p>The energy revolution and CE; development and implementation of CE technologies in enterprises, institutions, and households</p>
Pomorskie	April 12, 2021	Horizontal approach: CE popularization and education	<p>Strategic goal: Sustainable security</p> <p>One of the priority challenges is counteracting the negative effects of the climate crisis, water pollution, and air quality deficits, ensuring access to quality drinking water and transforming waste management toward CE.</p> <p>Operational objective: Environmental security to meet these challenges, with the observed increase in the amount of waste; it is necessary to focus on activities that fit into the three directions of waste management which are at the highest in the hierarchy. In addition, the transition to the CE model is an opportunity to reduce the use of primary raw materials and the amount of generated waste, by the municipal as well as business sectors.</p>
Śląskie	October 19, 2020	CE promotion and implementation	<p>Strategic goal: A greener, low-carbon Europe</p> <p>A clean and fair energy transition, green and blue investments, CE, adaptation to climate change and risk prevention</p> <p>Building a CE beneficial for the natural environment, including a coherent concept and coordinated actions in the field of, among others, energy, education, and waste management</p>
Świętokrzyskie	March 29, 2021	Horizontal approach: CE popularization and education	<p>Strategic goal: Smart economy and active people</p> <p>Operational objective: Supporting transformation of key sectors of the region's economy</p> <p>Striving for sustainable development based on CE, including bioeconomy</p>
Warmińsko-mazurskie	February 18, 2020	Horizontal approach: CE popularization and education	<p>Strategic goal: Strong foundations</p> <p>Operational objective: Unique natural environment, improvement in the quality of the environment, and ecological safety:</p> <ul style="list-style-type: none"> Transition to CE (waste management, eco-innovation, resource-efficient economy, green entrepreneurship, cleaner production, extending of the life span of products on the market, and so on) Waste prevention and rational waste management, including selective waste collection, recycling, and recovery.
Wielkopolskie	January 27, 2020	Horizontal approach: CE popularization and education	<p>Strategic goal: Development of infrastructure respecting the natural environment of Wielkopolska</p> <p>Operational objective: Improvement of the condition and protection of the natural environment of Wielkopolska</p> <ul style="list-style-type: none"> Actions for rational waste management: promoting the CE transition

Voivodeship (Region)	Date Strategy Adopted	Approach	Development Directions/Strategic Goals/Activities
			<ul style="list-style-type: none"> • Modern waste management, development of municipal waste separate collection systems in municipalities in accordance with the waste management hierarchy, development of biowaste treatment installations, and recycling of recycled materials from waste and hazardous waste treatment installations • Informing, educating, and shaping appropriate attitudes of the region's inhabitants toward pro-ecological and sustainable consumption
Zachodnio-pomorskie	June 28, 2019	none	None — Green and blue economy

Annex 4.2. Circular Economy Challenges, Barriers, and Actions for Selected Polish Regions

Geographic Region	Eastern Poland (Polska Wschodnia area comprising five regions)	
Information Source	Information provided by the Ministry of Funds and Regional Policy about the role of CE in Eastern Poland.	
Opportunities	Saving raw materials and products needed for national production, decreased dependence on imports of critical raw materials (that is, rare earth elements), and broader implementation of environmental management system compliant with ISO 14001.	
Barriers	Low consumer knowledge of CE mechanisms, lack of financial support for consumers as well as industry, long-term investment processes, competence gap in case of the CE business model, and fragmented and inconsistent regulations.	
Action needed	GPP and promotion of the EU criteria for 19 products, eco-labelling and clear certification process, tax incentives, economic support, new business model, education, and support for SMEs as planned in the Eastern Poland program	
Status of CE in the region	Funds for Polska Wschodnia for upcoming years cover actions supporting CE by strengthening its competitive position and promoting innovation of SMEs in CE. The planned project should be complex, covering both the advisory aspect for the development of a CE business model and investment.	

Geographic Region	The Lubelskie	
Opportunities	Creation of a sustainable ecosystem to reduce material consumption; reuse of waste; job creation; fulfilling climate obligations, including proper food management; increased education on consumer behavior; and eco-certification for products and services	
Barriers	Lack of proper communication of initiatives mainly about CE solutions and legislation, skills gap — lack of qualified staff and employees with new skills required for CE implementation and lack of appropriate education and information activities to introduce the CE concept and promote good practices in this field.	
Action needed	<p>Better information about CE activities; CE needs to be regarded as a business model rather than a legal obligation; better cooperation along the value chain; education on new behavior with regard to waste segregation; implementation of EPR and plastic packaging guidelines; and increasing the role of GPP.</p> <p>For this region, the most important changes are connected with municipal waste management, which is under the responsibility of the regional administration, especially since the laws are stricter from ecological requirements and reporting (central waste database). The region can develop a regional strategy, a waste management plan, and an innovation strategy to cover aspects of green economy, biowaste, zero waste food, and so on.</p>	

Geographic Region	The Śląskie	
Opportunities	Great potential for development of industrial and mining waste, that is, mainly post-flotation and coal combustion products; proper management for a CE transition; increased innovation through closer cooperation between science and industry and implementation of new technological solutions; and diversification of production and modernization of the economy.	
Barriers	The energy sector based on conventional resources (coal) and a long transition process to renewable resources; slow-moving changes in waste management; waste should be treated as potential new source of resources.	
Action needed	Introduction of EPR policy, education of consumers aimed at a behavioral change for CE acceptance, and an increase in the business environmental responsibility. Many activities were planned in regional documents, such as Śląskie 2030, plan for waste management (2016–2020), and the energy policy up to 2030.	

Geographic Region	The Warmińsko-Mazurskie
Opportunities	Changing consumer behavior and new CE business models including eco-design and design for recycling; the CE policy is a new concept and has not yet been detailed at the regional level, but proper legislation could stimulate the CE development.
Barriers	Low awareness of CE, its economic potential, and benefits
Action needed	Education, the need to carry out campaigns to raise awareness of CE importance; policy aimed at behavioral changes (consumption model); good practice: support for new business models, including the sharing economy; and creation of a center for repair and reuse Improving environmental quality, ensuring proper waste management, and developing the green economy and energy and eco-innovation have been included in many regional strategies, including smart specialization, and such projects have already been supported by regional funds.

Geographic Region	The Wielkopolskie
Opportunities	New sources of energy and increasing energy efficiency; increased product durability; better waste segregation and recycling; consumer behavior change; new business models, including transfer waste to byproducts; eco-design; and GPP
Barriers	The most important barrier is the low awareness of market participants; entrepreneurs are aware of their impact on the environment, but they do not take required actions to reduce the negative impact of the company because costs are high, and their knowledge is insufficient. Other barriers include knowledge gaps, long-term nature of the investment, legal conditions, and other factors, as described below: <ul style="list-style-type: none"> • Knowledge/competence gaps about changing to a CE business model requires highly qualified staff; shortages in this area block the idea of CE both at the stage of initiating and implementing new business models. • The long-term nature of the investment: in the case of CE investments, it takes time for any business to reap benefits; as a rule, larger companies are in a better economic position and have a larger scale of operations and can thus afford a longer wait for return on investment • Legal conditions: while no shortage of relevant regulations is identified, the problem is the fragmentation of regulations concerning CE in many normative acts. Other important factors for the implementation of solutions consistent with the Sustainable Development Strategy include market conditions and public sector activities stimulating the development and implementation of the Sustainable Development Strategy.
Three sectors most affected by CE in this region	<ul style="list-style-type: none"> • Agriculture: Minimizing waste and losses in the entire value chain. • Furniture production: Needs careful waste management, furniture producers generate almost no pure waste, and nearly all materials currently used in the furniture industry contain chemicals (including organic halogen compounds), which release harmful substances into the atmosphere during the burning process. • Energy: The region is one of the most important producers of electric energy based on lignite; promotion of new sources, mainly hydrogen, is needed.
Action needed	<ul style="list-style-type: none"> • Make changes to enable financial support for SMEs in the purchase and implementation of CE solutions. • Target activities at SMEs: support should be offered for the purchase of infrastructure related to, for example, the implementation of a new (or revised) business model consistent with CE or other solutions contributing to the reduction of energy use or the reduction in resource consumption/waste generation (for example, photovoltaics, heat pumps, energy-saving lighting, energy management systems, and systems enabling process virtualization). • Change tax exemption policy to reduce tax burden if small businesses meet certain requirements, for example, if they use a certain amount of secondary raw materials in production or reduce the amount of waste generated. This type of solution was introduced in Poland in the Act on Counteracting Food Waste, which exempts enterprises that donate unsold food scraps to NGOs from paying for food waste. Solutions related to tax exemptions may be introduced in Poland on a larger scale under the Act on EPR, which is currently going through the legislative process. • Use product certification as an instrument to stimulate the transition to CE: certificates eliminate the element of discretion as they are based on specific standards and confirm

Geographic Region		The Wielkopolskie
		<p>that the company meets certain requirements. The most used certificate in the CE field is EMAS. All types of organizations, both private and non-profit, which are interested in implementing comprehensive environmental protection solutions can receive EMAS certification. Certification is a tool for creating a culture of sustainable development in organizations and for effective management of available resources and energy.</p> <ul style="list-style-type: none"> • Implement GPP to create demand for solutions related to CE by including CE specifics in requests for bids on public contracts. This will allow the procurer to obtain goods and services, including construction services, which will have limited environmental impact.
Key aspects of CE development for this region		<ul style="list-style-type: none"> • Entrepreneurs/manufacturers - Support for innovation, technology adoption, R&D, savings, competitiveness, demand for recycling, recycling market development, energy efficiency, and raw material/secondary product over primary. • Consumers: Extended product life cycle, repairability, sharing of products/services, savings — replacement instead of purchase of new products, visible purpose (currently unspecified recycling), greater opportunity to donate/return, and not throwing things away. • Local government: Increased consumer awareness — less mixed waste, building of mutual communication with the community, raw materials trading market, GPP, digitization, green offices (electronic document workflows).

Geographic Region		The Mazowieckie
Opportunities		Creation of a system for converting waste into products, waste prevention; exchange of good practices in the field of CE with other regions in the EU; improved collection and sorting of waste; new business model; eco-design; CE transition should focus on sectors with a high potential for implementing waste hierarchy, that is, plastics, textiles, and nanotechnology to reduce waste.
Barriers		<p>Cost consumption and the long-term nature of investments; a lack of pro-environmental behavior and lack of qualified staff and sufficient knowledge of the CE; legal conditions. Cost intensity: following CE investments, it takes time for business to experience benefits; larger companies with stronger financials can afford to wait longer for a return on investment. Low awareness of market participants: entrepreneurs are aware of their impact on the environment but do not take sufficient actions to limit this impact. Competence gaps: shifting to a CE business model requires highly qualified staff; deficiencies in staff competence prevent new CE ideas from being initiated and hamper the introduction of new business models. Legal conditions: while laws can effectively incentivize implementation of CE solutions, CE regulations are not contained in a single set of laws but rather are fragmented across many legal documents making it hard for anyone to understand the full CE-related legislation.</p>
Action needed		<ul style="list-style-type: none"> • Introduction of EPR: work is currently under way to introduce EPR into the legal system. The regulations will make producers responsible for the costs of subsequent waste management costs related to their products. • Support for recycling/recyclers: EPR revenue should be proportionally divided across the entire waste treatment system, including recycling, considering both presumed usage and environmental protection standards. • Support for recyclers should be introduced through tax breaks or similar to allow the creation of secondary raw materials of similar quality and price to primary raw materials. Only then can they compete on an equal basis. Currently, the recycled raw materials often cost more than primary raw materials. • Regulations introducing eco-design and limiting the introduction of difficult-to-manage and non-recyclable products are needed. Currently, not all segregated materials can be recycled. • The region is awaiting the updated National Waste Management Program and the amendment to the Waste Act.
Challenge		Fulfilling all obligations connected with the EU waste directives, for example, for different waste streams, and in legislation including end-of-waste criteria and byproduct status, and introduction of a repair system

Geographic Region	The Świętokrzyskie
Opportunities	Financial support for CE and eco-innovative technology; support for high-quality secondary materials and infrastructure; new CE business models, that is, in transport system; GPP, legislation based on life cycle thinking
Barriers	Lack of sufficient incentives for reuse of stored waste on heaps, lack of economic incentives for producers of ecological products; high prices of secondary materials (as this makes them hard to sell); strict waste regulations and their interpretation; CE not included in waste legislation
Action needed	Regulation of requirements for packing materials, ban on non-recyclable packing materials and high tax for their import, changes in legislation on waste from extraction industry, exclusion of some types of waste from the waste catalogue, tax policy, financial support for CE, and CE in GPP
Status of CE in the region	CE is included in the main regional strategy and will also be in waste management plan and environmental program which is under development.

Geographic Region	The Zachodniopomorskie
Opportunities	Access to critical raw materials at reasonable prices, resource efficiency (including water and energy), zero-waste landfilling (increase in the cost of reclamation), effective CE business model, and behavioral changes
Barriers	No industry interest in applying CE (not enough activities), lack of instruments supporting CE (taxation and lower environmental charges); dispersed CE legal system; lack of knowledge and experts, and lack of CE monitoring system (monitoring is limited to waste)
Action needed	Financial support; lower value added tax (VAT) for circular products; new compensation model for using CE business model; additional information (eco-label) about the level of recovery for packing materials or/and product (it can be helpful in GPP); developing a platform for green and circular products, including the information about the level of recovery; promotion of GPP; development of an advisory system based on waste audits (similar to energy audits); and creation of dedicated programs supporting CE, at least in the public sector.
Status of CE in the region	An increasing number of CE activities are included in regional documents as environmental policy and in strategy to support green and blue economy sector in the region.

Geographic Region	The Małopolskie
Information source	Internal reports and discussions
Opportunities	Consulting and funding support, including subsidies and loans for solar collectors, biomass boiler rooms, and heat pumps or photovoltaic panels
Barriers	Insufficient financial resources, legal restrictions, insufficient knowledge about CE on the part of the public and organizations; limited access of Polish start-ups to the Horizon Europe innovative consortia complicated procedures to access EU funds; and legal issues ⁶²
Action needed	Need to create a favorable environment for CE by addressing the following issues: <ul style="list-style-type: none"> • Insufficient financial resources — Lack of investment and funding for the cooperation of companies (value chain) to reduce material and energy costs and to save natural resources, lack of financial resources for innovation with technology readiness level (TRL) > 7. • Legislative challenges — Slow reforms of regulation (EPR; waste stream, for example for tires; legislation requires very low level of recycling); fostering circular solutions; lack of definition of waste and secondary materials in legislation; no clear and consistent rules, even within each region, for recycling and end-of-waste criteria. • Insufficient knowledge, expertise and awareness — Companies and policy makers have insufficient knowledge, expertise, and awareness of CE; there is insufficient support for cooperation between academia and business to promote CE on a large

⁶² The Horizon Europe Initiative is the EU's flagship Research and Innovation Program with a budget from 2021 to 2027.

Geographic Region	The Małopolskie
	scale. Some initiatives like virtual institutes, such as IATI, or clusters exist but lack sufficient regional or governmental support. ⁶³

Annex 4.3. Regional and Local Administration Projects

Regional and local administration projects lay the groundwork for CE, working in collaboration with the EU programs. Many Polish cities and regions are actively working toward the transition to CE through participation in the EU programs such as Horizon 2020 and Interreg Europe. Several examples of local Polish projects implemented under these programs are detailed in the following paragraphs.

The Wielkopolska region is a partner in two projects: EcoWaste4Food, to support green innovative solutions to reduce food waste and promote a more resource efficient economy, and SinCE-AFC, to enhance the Entrepreneurship of SMEs in Circular Economy of the Agri-Food chain.⁶⁴

Through these projects, the region is increasing awareness of CE-related challenges and solutions to tackle them. The Wielkopolska region is currently conducting research regarding key areas of CE development in the region. The research will be a starting point for the development of the region's CE strategy.



The Małopolska region is implementing SYMBI, Industrial Symbiosis for Regional Sustainable Growth and a Resource Efficient Circular Economy.⁶⁵ This project seeks to establish support for public policies in the pursuit of a CE model by promoting industrial symbiosis. In addition, the project aims to support the implementation of instruments and measures to reduce production costs and mitigate environmental pressures through increased resource efficiency and reduced GHG emissions. As a result, Krakow included industrial symbiosis development in its policy strategy. The Małopolska region is also implementing two large life projects focused on improved air quality. One of the projects, titled Małopolska in a Healthy Atmosphere, includes many activities to improve resource efficiency and reduce waste. Through its project work, Małopolska has created a network of eco-counselors who work to increase understanding of direct and indirect emissions and to support new business models not only for clean air but also focusing on CE.

The Małopolska Regional Development Agency (MARR) joined the project Fostering Collaboration through Mapping, Analyzing and Interlinking of the European Entrepreneurial Regions during Stage 2.⁶⁶ This project ran through January 2022. MARR has expressed interest in developing a CE Action Plan which would be implemented in the Małopolska with support from the next phase of the EU project.

The Łódzkie region joined the Improved Environment and Resource Efficiency through use of life cycle Instruments for implementation of regional policies of EU (LCA4REGIONS).⁶⁷ This project aims to improve the efficiency and use of regional policy instruments for natural resources by applying CE model assumptions using the product LCA method. Additionally, Łódzkie is participating in the H2020 screen project. This project seeks to develop a replicable, systemic approach to the transition to CE in the EU regions under their smart specialization strategies and, through the identification and implementation of operational synergies between R&I investments from H2020 European Structure and Investment Funds (ESIF), contribute to novel, future eco-innovative and horizontal business models across different value chains.



⁶³ <http://iati.pl/en/>.

⁶⁴ <https://projects2014-2020.interregeurope.eu/since-afc/>.

⁶⁵ <https://www.interregeurope.eu/symbi/news/news-article/11687/conference-on-circular-economy-malopolska/>.

⁶⁶ Final report: https://cor.europa.eu/en/news/Documents/EER%20II_Final%20Report%20-%20January%202022_FINAL.pdf.

⁶⁷ <https://www.interregeurope.eu/lca4regions/>.

Łódzkie has also developed several other CE projects including Łódzkie Green Hub⁶⁸, a Local Government Center for CE and Internationalization of Enterprises, which aims to enable enterprises in the region to compete on the international market in one of the areas of global development such as CE. By doing so, the region seeks to build a network of cooperation with entities from other EU regions. Project recipients include MSMEs interested in implementing the CE solutions, ready to change their business models from linear to circular, and interested in developing a market for CE goods in the international market. The projects in Łódzkie contribute to increased awareness of CE among entrepreneurs and local administrations and help establish cooperation between them.



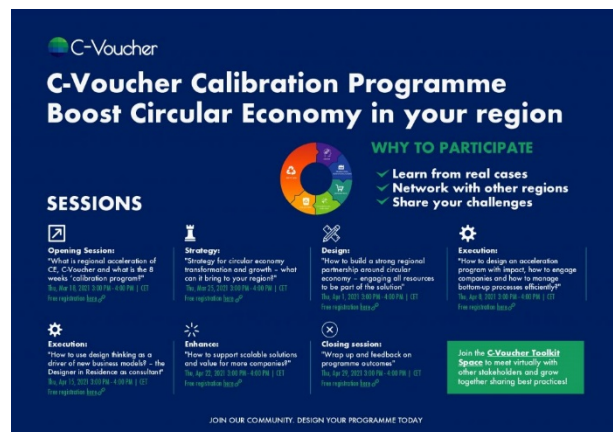
The Mazowieckie is implementing several projects to support CE and raise awareness of CE among entrepreneurs and the local administration.⁶⁹ The region organized a series of workshops for SMEs in the region about CE and the transformation to circular business models. So far, the region has trained 30 companies and plans to train more. The Marshal Office in the region is active in educating local government units. The office hosts conferences and workshops and since 2018, together with the Polish organization Institute of Innovation and Responsible Development (INNOWO), has co-organized the Mazovia Circular Congress, the biggest international conference in Poland on CE.

With Horizon 2020 funding, the Mazovia Agency for Regional Development is implementing a C-Voucher project as part of a consortium with other EU entities to provide SMEs with funding, on a competitive basis, for the development and implementation of new innovative CE solutions and the adaptation and/or replication of ready-made solutions, value chains, and/or business models. In total, the project will fund 66 EU companies. The C-Voucher project will support the scalability of promising circular solutions and establish cooperation between different group of stakeholders and value chains.



Dolnośląskie region is a partner of a large Interreg Europe project called CIRCE2020 (Expansion of the CIRcular Economy concept in the Central Europe local productive districts). The project aims to strengthen the diffusion of CE in Europe and help the involved partners increase the capability of their policy instruments to steer the economy toward a circular model.⁷⁰

CE is also included in several cross-border projects.⁷¹ For example, the new Poland-Belarus-Ukraine Cross-border Cooperation Program for 2021–2027 focuses on improved energy efficiency, sustainable water management, CE transition, and environment and landscape protection in a broad sense.



⁶⁸ <https://bruksela.lodzkie.pl/en/nasze-projekty/doradztwo-indywidualne-w-projeckie-lodzkie-green-hub/>.

⁶⁹ https://raport.togetair.eu/earth/raw-materials-and-circular-economy/mazovian-green-deal-towards-circular-economy?print_version=1.

⁷⁰ <https://www.interregeurope.eu/circe/>.

⁷¹ <https://www.europarl.europa.eu/news/pl/press-room/20201126IPR92517/agreement-on-eu-funding-for-cross-border-projects>.

Annex 5. Stakeholder Engagement and Ongoing Circular Economy Projects

Many stakeholders in Poland are involved in the CE transition. The list below profiles a few of the most visible and relevant cooperative initiatives and actions between businesses, public institutions, NGOs, and academia.

KIS 7 National Smart Specializations

Currently, 13 National Smart Specialization groups (KIS) focus to some degree on CE, including KIS 7 devoted to CE. Several others address some elements of CE, including KIS 5: smart and energy efficient construction; KIS 3: biotechnology, bioproduct and chemical processes; and KIS 2: innovative technologies, processes, and product of agricultural sector and forestry sector.⁷²



The KIS 7 CE working group is composed of scientists, researchers, NGOs, and business representatives. KIS 7 is structured into subgroups, as follows:

- Fossil resources
- Water and sewage
- Waste
- Development of assumptions for the Feasibility Study for the creation of a dedicated platform for secondary raw materials
- Development of the concept of the government information platform on CE
- Analysis of potential changes in the tax system that would facilitate increased competitiveness of enterprises operating on the basis of the CE models
- Development of proposals for changes in the public procurement law that would generate demand for products and services produced under the CE business models
- Development of guidelines for the increased role of CE in clusters in terms of the circulation of materials and waste from individual industry sectors, including the processing industry
- Identification of technological needs and key areas for the development and implementation of eco-innovation in Poland
- Preparation of recommendations for the verification of production processes in terms of reducing waste, including waste use in these processes;
- Work on the development of recommendations and conclusions with regard to the regulations specifying the conditions for the loss of the waste status.

In 2022, the working group developed a proposal for CE audits for SMEs, being one of the most active groups, as most of the work has been done on a voluntary basis.

oto-GOZ - Gospostrateg

The oto-GOZ Project⁷³ aimed to develop a set of measurement indicators (the so-called 'CE indexes') to assess progress in the CE transition and the impact of CE on socioeconomic development at the meso-economic level (regions) and macroeconomic level (national economy). The project was co-financed by the National Center for Research and Development in the first competition of the program "Social and economic development of Poland under conditions of globalizing markets" (GOSPOSTRATEG) and was implemented by a



⁷² https://www.fnp.org.pl/assets/List-of-the-National-Smart-Specialisation_NSSPL_KIS_V2.20151203-3-7.pdf.

⁷³ <https://stat.gov.pl/en/experimental-statistics/gospostrateg/oto-goz/>.

consortium led by the MEDT between 2019-2021, with participation of the Institute of Mineral and Energy Economy of the Polish Academy of Sciences, the GUS and the University of Economics in Cracow. In the implementation phase, where results of scientific research are used for practical application, the developed CE indexes were tested and implemented at the local level through various planning documents. For example, the indexes were included at the local level in the strategy of the city of Cracow and the strategy of Krakowski Holding Komunalny SA, and at the national level in the Productivity Strategy.

Project Prom - Gospostateg

The development of a food waste monitoring system and Program for Food Waste Rationalization and Reduction⁷⁴ is part of the Gospostateg strategic research and development program financed by the National Center for Research and Development.

The program is being implemented by a consortium composed of the Federation of Polish Food Banks, Institute of Environmental Protection — National Research Institute, Warsaw University of Life Sciences, the

National Center for Agricultural Support, and the Polish Society of Food Technologists. The aim of the research was to estimate the amount of food wasted in Poland in the entire food chain and to investigate the causes and directions of waste management. This is the first study in Poland that indicates the type of activities to be implemented to effectively counteract food waste and losses.



Polish Circular Hotspot

The Polish Circular Hotspot is a public cooperation platform to support the CE transition.⁷⁵ The forum brings together a variety of stakeholders including big and small businesses, local and national government, universities, and scientists in a wide range of disciplines and industries, including construction, food, packaging, electronics, plastics, logistics, transport, energy, and textiles. Through cooperation and exchange of resources, knowledge, and experience, participants implement complex projects and achieve far-reaching circular goals. The project has high potential and elicits great interest, but the stakeholders are struggling to find funding for the platform. In Poland, the platform is a private NGO initiative with no permanent funding. The entrepreneurs who join or want to become members are not ready yet to pay membership fees. By comparison, similar platforms in other countries, such as the Holland Circular Hotspot or the Nordic Circular Hotspot are government funded.

Circular Cities Program

The Circular Cities Program is implemented jointly by the Polish Circular Hotspot and Metabolic (an international, grassroots sustainability-focused organization based in the Netherlands), with co-financing from the MAVA Foundation.⁷⁶

The Circular Cities Program develops practical ready-to-implement circular strategies for Lublin, Kraków and Gdańsk. The aim of the program is to analyze the cities' current waste flow and to develop a CE transition strategy. A number of analyses and consultations with local communities were carried out as part of this one-year project financed by the MAVA Foundation. As a result, long-term circular strategies were developed, covering various areas of city management and ready-to-implement action plans for Cracow, Lublin and Gdańsk. Cracow and Lublin are planning to implement the CE strategy while Gdańsk has withdrawn from the project.



The program has demonstrated that cities are quite interested in the development of CE. However, it also reveals weaknesses and a lack of preparation of the authorities for the practical implementation of CE.

⁷⁴ <https://projektprom.pl/>.

⁷⁵ <http://circularhotspot.pl/>.

⁷⁶ <https://www.metabolic.nl/publications/circular-cities-program--krakow/>.

Outdated laws often restrict the introduction of innovative systemic solutions. Officials' fear of being held accountable for the failure to implement the new solutions also greatly hinders their development.

GreenEvo - Green Technology Accelerator⁷⁷

The Ministry of Climate and Environment leads the Green Technology Accelerator to promote Polish green technologies both in Poland and abroad. Its main task is to help Polish SMEs establish international contacts as well as provide them with knowledge and tools to enable dynamic development. The activities undertaken in the program comprehensively stimulate sustainable development and strengthen the position of innovative green technologies in building a CE. Seven rounds of the program have been carried out. Within the six rounds conducted in 2009–2015, a total of 74 solutions were selected for support. In 2018, the achievements of the previous winners were reviewed and verified; as a result, further assistance was provided to 33 entrepreneurs, offering in total 34 environmental technologies. This successful initiative could serve as a benchmark to launch similar programs devoted to circular solutions.



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Polish Plastic Pact⁷⁸

About 22 companies and 14 business-related institutions signed the Polish Plastic Pact, which developed a roadmap aimed at building a closed loop of plastic packaging in Poland by 2025. The roadmap sets out six common goals for the Polish market and priority directions for action:



- Identification and elimination of indicated excessive and problematic plastic packaging through redesign, innovation, and alternative delivery models
- About 30 percent reduction in the use of virgin plastics in the packaging placed on the market
- About 100 percent of plastic packaging on the Polish market to be reusable or recyclable
- About 25 percent of plastic packaging to be composed of secondary raw materials
- About 55 percent recycling rate through effective support for packaging collection and the recycling system
- Consumer education.

Włącz Czystą Energię dla Polski⁷⁹

An initiative of Employers of Poland, with the support of the strategic partner — Fortum, the project ‘Turn on Clean Energy for Poland’ was initiated in June 2020. It is open to all entities and organizations interested in introducing a CE in the energy sector in Poland. With support from industry and science community, the coalition publishes reports, organizes educational meetings for business representatives and decision-makers, promotes the competition GOZpodarz,⁸⁰ and so on.



⁷⁷ <https://greenevo.gov.pl/en/>.

⁷⁸ <https://paktplastikowy.pl/>.

⁷⁹ <https://www.wlaczczystaenergie.pl/>.

⁸⁰ <https://www.wlaczczystaenergie.pl/>.

Waste Management and Recycling Cluster - Key National Cluster⁸¹

The Waste Management and Recycling Cluster provides the full range of waste management services for most categories of waste throughout Poland and the EU countries and abroad as well. The core of the cluster is made up of SMEs with Polish capital, involved in the collection, removal, treatment, recovery,



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**GOSPODARKI ODPADOWEJ
I RECYKLINGU**

recycling, and transportation of all kinds of waste; manufacturers of machinery, equipment, and technological lines for processing, recycling, and disposal of waste; and the manufacturers of finished products using recycled material. The cluster is a platform and an area of cooperation for competing companies as a result of synergy and access to specific resources (knowledge, new technologies, people, and so on). The cluster is involved in many CE education and investment projects.

⁸¹ <https://klasterodpadowy.com/>.

Annex 6. Engagement of Polish Companies

Annex 6.1. Companies and the Circular Economy in Poland

Companies in Poland have generally accepted that the transition to the CE is inevitable and are trying to adjust to meet the new reality. This has become even more evident, as numerous foreign companies promote their CE strategies and require more information from suppliers about their impact on the environment like the carbon footprint calculation or environmental product declaration (EPD). Therefore, as both domestic policy and global business move toward the CE, companies in Poland increasingly engage in activities aimed at the CE transition and promotion. Companies are committed to making reports, analyzing, and assessing the benefits, barriers, and opportunities of CE. They conduct numerous educational and promotional activities, such as the Stena Circular Economy Awards, Pracodawcy RP award GOZpodarz, and Kraina GOZ by Fortum, an educational platform with materials for teachers on the CE, and the Włącz Czystą Energię CE portal by Pracodawcy RP, and by CSR Consulting.⁸² There is a journal dedicated to the CE - Energia i Recykling GOZ⁸³ issued by Abrys sp.z.o.o. Enterprises are also very active within their associations, clusters (Waste Management and Recycling Cluster), and chambers of commerce where they create dedicated Circular Economy Councils, which develop common positions and conduct consultations on the implementation of CE solutions in Poland.

Moreover, the business community is active in developing and adopting IT solutions for management and trading of waste and byproducts, for example, BDOmanager, which manages waste transfer cards on construction sites and the digital waste marketplace Cyrkl.com. Based on their activity, multinational companies appear to exhibit the greatest interest in the CE. Multinationals are involved primarily in reporting on CE-related activities; participating in various types of conferences, seminars, or educational activities and supporting such events; and undertaking product certification and labeling.

However, not many companies in Poland have implemented specific technological solutions in their production cycles or changed their business model. Some of them undertake pilot solutions aimed at increasing energy efficiency, closing the water cycle, cogeneration, or improvement of waste management. Instead of moving their entire production lines, companies release individual products created in accordance with the CE principles and base their promotional and communication activities on this. In some cases, they prefer to invest in new CE businesses by mergers and acquisitions rather than changing their core business. However, no strategic programs or support mechanisms exist to help companies transition their business models in relation to the CE.

In contrast to the broader business community, large corporations show great initiative and are active in seeking legislative consultations on CE-related regulations, both because they want to proactively keep up with the new directions and because they fear that projects designed without the newest regulations in mind may have an adverse effect on their business. For these reasons, large corporations tend to be active in many business forums and expert councils organized by business-related institutions such as Poland's National Chamber of Commerce (KIG) or Lewiatan (Polish Trade Network).

⁸² <https://gozwpraktyce.pl>.

⁸³ <https://energiairecykling.pl>.

Annex 6.2. Examples of Polish Companies Engaged in Innovative CE Approaches

This section features examples of innovation from various CE initiatives in Poland, primarily in the private sector.

Bohema Clothing⁸⁴ produces handmade shoes using 100 percent vegan materials, including innovative materials such as 'leather' made of pineapple leaves. All steps of the production are vegan and aim to have minimal environmental footprint. In addition, Bohema's process for producing fibers for shoes yields a biomass byproduct which farmers use as an organic fertilizer.

Circular Week⁸⁵ run by INNOWO is an international education campaign which consists in series of events and initiatives devoted to the subject of the CE and sustainable development that take place throughout Europe. The Circular Week goal is to promote the CE, support sustainable business models, and establish cooperation between interested stakeholders.

Deko Eko⁸⁶ is a pioneer on the Polish market which seeks to give new life to used products. Designers use materials that are renewable, recyclable, or come from recycling and give them a higher value, turning them into aesthetic, functional, and fully valuable products that companies use for educational, promotional, social, or sales purposes.

EcoBean⁸⁷ turns used coffee grounds into clean green energy. The product is called coffee briquettes. They are a renewable source of energy and are intended for use in fireplaces and barbecues.

MakeGrowLab⁸⁸ (MGL) seeks to reduce the use of petroleum products, such as plastic packaging, as well as non-animal skins and other textiles, by replacing them with renewable, 100 percent durable plastic-free and compostable biomaterials. MGL's main products include 'Scoby Packing Materials' and TransLeather. Scoby is composed of pure cellulose — a non-toxic material with unique barrier properties that protect against the external environment and oxygen. TransLeather is a leather alternative that is free from plastics and is vegan friendly and can be grown within a few weeks.

Olivia Prime⁸⁹ owns and operates the Olivia Business Center (Gdańsk) business park. The building was designed to follow the idea of 'biophilic design,' according to which the office should be friendly to employees and provide them with optimal conditions for work and rest. The office building is constructed in line with ecological standards. Its triple-glazed facade minimizes the need to heat the rooms in winter or cool them in summer. Windows open to enable ventilation without air conditioning.

Swapp!⁹⁰ is a new method of retail sales of fast-moving consumer good products (including yogurt, milk, shampoo, and liquid soap) in a closed loop, based on a network of vending machines, a mobile application, and reusable containers for consumers. The initiative seeks to significantly reduce the amount of plastic packaging produced and make it easier for the FMCG industry to adapt to new legal regulations restricting the use of plastics. Swapp! has introduced vending machines for its products in the Carrefour supermarket chain.

Syntoil S.A.⁹¹ is the originator and creator of a method for the cost-effective and environmentally friendly recycling of tires. The recycled products will be reused in the production of tires and rubber products. The company's main activity is the process of carbonization, conversion of contaminated soot from used tires to the form of technical carbon black, and the processing of rubber granulate (product) from tires in the process of safe, continuous pyrolysis in a small reactor.

⁸⁴ <https://en.bohemaclothing.com/>.

⁸⁵ <https://circulareconomy.europa.eu/platform/en/news-and-events/all-events/circular-week-back-october-2022>.

⁸⁶ <https://www.dekoeko.pl/>.

⁸⁷ <https://ecobean.pl/>.

⁸⁸ <https://www.makegrowlab.com/>.

⁸⁹ <https://www.oliviacentre.com/en/o-nas/nasze-budynki/>.

⁹⁰ <https://swapp.zone/o-nas/>.

⁹¹ <https://www.syntoil.pl/>.

'World without litter' is a cooperative effort of Coca Cola, Ekotech Group, the City of Warsaw, and the Nasza Ziemia Foundation, under which Coca Cola will provide 10 modern recycling machines for the residents of Warsaw. Recyclomats are integrated with an application that records each given raw material and in return awards ECO-points. ECO-points can be exchanged by residents for various types of benefits, such as cinema tickets or discounts on coffee or shopping. The recyclomats provided by Ekotech are a Polish innovative technology.

WoshWosh⁹² states that it is the first company in Europe that offers cleaning, restoration, repair, and customization of footwear. Since 2019, WoshWosh has offered solutions for business, including cleaning and disinfecting of work shoes while at the same time educating enterprises about CSR (pro-ecological activities related to hygiene and work comfort).

⁹² <https://woshwosh.com/>.