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Towards the Circular Economy Implementation in Poland

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Abstract:

Purpose: *The circular economy concept has been widely addressed in various research disciplines. It also has a practical dimension because European countries are facing the need to implement such a non-linear model, which is dictated by meeting the requirements of the new EU agenda. Since Poland is still not among the European leaders in this area, the paper aims to identify and analyze the most important problem areas, barriers, and actions conditioning the implementation of the circular economy in Poland.*
Design/methodology/approach: *The paper is theoretical and cognitive and is based on an in-depth literature review. Using empirical data contained in the EU circular economy monitoring framework in the Member States, the most important problem areas of the country in this respect have been identified. Further, by combining two separate sources of knowledge (academic literature and gray literature), the most critical barriers impeding Poland's economic transformation towards the circular economy have been identified and described, and measures leading to their limitation have been proposed.*
Findings: *The analysis carried out in the paper may constitute an essential contribution to the still-developing stream of scientific literature dedicated to the practical aspects of implementing the circular economy concept in EU countries. Although the substantive scope of the paper refers strictly to the Polish economy, it can be a methodological basis for conducting future empirical studies in other national contexts.*
Practical Implications: *The paper's findings provide valuable insights into the methods and strategies for fostering circularity in Poland. This understanding is crucial for developing effective policy guidelines and designing organizational strategies.*
Originality/value: *The paper's key scientific contribution is the development of a holistic conceptual approach that integrates barriers, shows their interrelationships, refers them to the country's identified most essential problem areas, and also considers several practical recommendations for removing barriers to Poland's transition to the circular economy model.*

Keywords: *Circular economy, policy analysis, circular society, sustainability.*

JEL Codes: *Q01, Q56.*

Paper type: *Research article.*

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1. Introduction

Despite the growing environmental degradation, most economies still operate based on a traditional linear model of economic activity, characterized by a one-way flow of materials: from raw materials, that are transformed into products and ultimately into waste (Pichlak and Szromek, 2022). An alternative to the linear model is the concept of circular economy (CE), the essence of which is to create feedback cycles (resource-product-resource) thanks to narrowing, slowing down or closing the loop of material flows (Brown *et al.,* 2021).

As a renewable and self-regenerating industrial system (Ellen MacArthur Foundation, 2013), the circular economy is increasingly attracting the attention of economic practitioners all over the world (Pieroni *et al.,* 2019), by representing one of the latest methods to cope with climate change, biodiversity loss, growing amount of waste generated and depletion of non-renewable resources (Lieder and Rashid, 2016; Prieto-Sandoval *et al.,* 2019; Tura *et al.,* 2019). As a result, from a little-known concept, currently the CE is considered to be an irreversible, global mega trend (Calisto Friant *et al.,* 2021).

Although many definitions of the circular economy have been developed in the literature (cf: a review of 114 definitions by Kirchherr *et al.* (2017)), researchers argue that CE is still an indeterminate concept (de Jesus and Mendonça, 2018), of a pre-paradigmatic nature (Brown *et al.,* 2019) and including – as an umbrella concept (Blomsma *et al.,* 2019) – a multitude of various problem areas. Therefore, it is so important to undertake studies leading to a better understanding of factors and barriers determining the economic transformation of countries towards the CE.

While plans for the practical implementation of the CE model in EU countries enjoy growing political support, as evidenced by initiatives and declarations supporting closed circle approach (Garrido-Prada *et al.,* 2021), the actual transformation of European economies is still at a very early stage (Rizos and Bryhn, 2022; Takacs *et al.,* 2022; de Pascale *et al.,* 2023).

Unfortunately, currently less than 10% of economic activity is of a circular nature, and EU countries generate more than 2 billion tons of waste a year (i.e., 4.8 tons per capita), of which only less than half is recycled (Circular Economy Overview, 2023).

Many researchers tried to explain this discrepancy by multidimensionally identifying critical barriers to undertaking circular activities (Rizos *et al.,* 2016; Ritzén and Sandström, 2017; de Jesus and Mendonça, 2018; Kirchherr *et al.,* 2018; Ormazabal *et al.,* 2018; Brown *et al.,* 2019; Scarpellini *et al.,* 2019; Tura *et al.,* 2019; Briguglio *et al.,* 2021; Grafström and Aasma, 2021; Takacs *et al.,* 2022).

As this developing research trend is still in the early stage of studies (Tura *et al.,* 2019; Rizos and Bryhn, 2022), which results in limited empirical generalization of

results, there is still a huge research gap concerning the insufficient knowledge on the practical implementation of the CE in EU countries. Understanding the related challenges is essential if the CE concept is to survive and not become just another buzzword on sustainability (Brown *et al.*, 2019).

In order to fill a part of the above-mentioned research gap, the objective of this paper is to identify and analyze the most important problem areas, barriers, and actions conditioning the implementation of the CE in Poland. The considerations undertaken are even more important, since Poland is circular only in 10.2%. Poland's material footprint is 13.8 tons per capita a year and is by nearly 2 percentage points higher than the global average.

What is more, due to the dependence of production of energy in Poland on conventional sources, domestic extraction of raw materials significantly exceeds the EU average (Cullbrand *et al.*, 2022). Although such high consumption and extraction rates are common among EU countries with relatively high income, their consequences require taking multidimensional and comprehensive actions, in which helpful may be an attempt taken in this study and aimed at structuring them conceptually.

The analytical procedure used in the paper starts with carrying out an in-depth analysis of the academic literature regarding barriers to implementing the CE, so as to categorize them. This methodological procedure allowed to define a conceptual framework, based on which it became possible to assess the level of implementing the CE concept in Poland and to formulate the following research questions:

RQ1: What is the actual state of implementing the CE in Poland and what are the most important problem areas of the country in this respect?
RQ2: What are the barriers that currently impede the process of implementing the CE in Poland?
RQ3: What actions should be taken to mitigate the identified barriers to Poland's economic transformation towards CE?

To answer the research questions, the paper has reviewed Polish strategic documents reflecting the path of the country's transition to a circular economic model, and then – using empirical data contained in the EU CE monitoring framework in the Member States – the most important problem areas of the country in this respect have been identified.

Further, by combining two separate types of knowledge (academic literature and gray literature), the most important barriers impeding Poland's economic transformation towards the CE have been identified and described, and measures leading to their reduction have been proposed.

The analysis carried out in the paper may constitute an essential contribution to the still developing stream of scientific literature dedicated to the practical aspects of implementing the CE concept in EU countries. In a utilitarian aspect, the paper contributes to a better understanding of methods and ways of developing circularity in Poland.

On the other hand, an important theoretical contribution of this study is an attempt to structure the considerations being conducted by developing a holistic conceptual approach that integrates barriers, shows their interrelations, refers them to the identified most essential problem areas of the country, and also considers several practical recommendations leading to the removal of barriers to Poland's transition to the CE model.

Although the substantive scope of the paper refers strictly to the Polish economy, it can be a methodological basis for conducting future empirical studies in other national contexts.

2. Literature Review: Barriers to Implementing the CE

In the CE research stream, analyses regarding barriers to undertaking and pursuing circular activities are just beginning (Brown *et al.,* 2019; Tura *et al.*, 2019; Takacs *et al.,* 2022), hence the relatively small number of them and the fact that they are mostly of an exploratory nature. As a result of the fact that researchers use qualitative methods, various proposals for a conceptual structuring of factors and barriers to the transition to the CE model are emerging in the literature.

Guided by a microeconomic perspective, many researchers focus on analyzing barriers to implementing the CE in SMEs, arguing that, firstly, these companies shape the core of highly-developed economies all over the world, and secondly, they are responsible for about 60-70% of all industrial pollution in the EU (Takacs *et al.,* 2022).

Despite the existence of several reliable and multidimensional analyses, attention is drawn to the diversity of typologies of CE factors and barriers applied by researchers. For example, Briguglio *et al.* (2021) mention technological barriers, lack of infrastructure, poor access to finance and competition, while Rizos *et al.* (2016) describe seven key categories of barriers related to company environmental culture, lack of capital, lack of government support/effective legislation, lack of information, administrative burden, lack of technical and technological know-how and, lack of support from the supply and demand network refers.

A different proposal is presented by Takacs *et al.* (2022), who, based on interviews with 59 Swiss SME managers, divide barriers into company-internal barriers (e.g., risk aversion, short-term orientation) and company-external barriers (technology, market, legislation, society, and consumers).

Yet another concept is presented by Ormazabal *et al.* (2018), who, when examining Spanish SMEs, specify hard barriers (e.g., no financial support) and human-based barriers (e.g., no customer interest).

In the literature, research papers are also available, whose authors adopt mezo-economic (studies at the regional or sectoral level) and macroeconomic perspectives. For example, Scarpellini *et al.* (2019), when analyzing the landscape of regional environmental management in the Spanish region of Aragon, point, in particular, to barriers relating to the lack of financing, increasing prices and difficulty in supplying recycled products.

At the sectoral level, Rizos and Bryhn (2022) explore CE barriers in the electrical and electronic equipment sector (EEE) and describe in detail specific constraints concerning five key categories, i.e.: policy, finance/economy, supply chain, technology, consumer-society and company organization.

Other studies, whose authors identify contextual barriers, refer to the building sector (Hart *et al.*, 2019); automotive sector (Baldassarre *et al.*, 2022) and packaging sector (Bening *et al.*, 2021). At the international level, the results of studies by Kirchherr *et al.* (2018) point to lacking consumer interest and awareness, as well as hesitant company culture as key barriers to implementing the CE model in EU countries.

Finally, going beyond European economies and adopting an institutional perspective, Ranta et al. (2017) identify regulative, normative, and cultural-cognitive barriers by examining companies from three different institutional environments (China, the US, and Europe).

Summing up, studies on CE barriers may be classified broadly according to the level of their analysis, which translates into the fact that some barriers are crucial for a specific group of companies, while others are key for pursuing activities in specific sectors or economies.

In addition, most studies, despite their often-comprehensive nature, have been structured differently in conceptual terms, therefore, their thematic generalization is required. In view of the above, the paper adopts a conceptual framework based on the leading literature (de Jesus and Mendonça, 2018; Kirchherr *et al.*, 2018; Brown *et al.*, 2019; Grafström and Aasma, 2021; Takacs *et al.*, 2022) and specifies cultural, technical, market and regulatory barriers.

Cultural (social) barriers refer to the lack of willingness to get involved in CE initiatives on both the demand and supply sides. The results of many studies show, that the lack of interest and awareness of consumers (Kirchherr *et al.*, 2018), their misconception about the potential costs resulting from implementing circular solutions (Rizos and Bryhn, 2022), as well as their lack of actual involvement in

circular practices (Cerulli-Harms *et al.,* 2018) are significant obstacles to the economy's transformation to the CE model.

On the other hand, the limited knowledge of entrepreneurs about circular solutions, which often overlaps with the instability of the eco-innovation culture in the company (Kirchherr *et al.,* 2018), significantly hinders the inclusion of CE principles in the implemented innovation strategy of the company (Grafström and Aasma, 2021; Rizos and Bryhn, 2022), even after assessing the benefits related to their implementation (Rizos *et al.,* 2016).

Unwillingness of managers to implement circular business models may result from their fear of risk-taking (Ritzén and Sandström, 2017), lack of appropriate resources (Rizos *et al.,* 2016; Brown *et al.,* 2019), giving priority to other goals (Rizos and Bryhn, 2022), misunderstanding of the environmental context (Takacs *et al.,* 2022), as well as the lack of cultural acceptance of circular business models (de Jesus and Mendonça, 2018), i.e., the difficulty of convincing potential customers of the CE benefits (Tura *et al.,* 2019).

In the context of technical (technological) barriers, attention is drawn by the lack of available technical solutions necessary for implementing the CE (technological gaps) and the lack of sufficiently educated/specialized staff (competence gaps). Implementing the CE may be inhibited by the lack of technical solutions (Rizos and Bryhn, 2022), their immaturity (not yet practical enough for operational use) (Takacs *et al.,* 2022), as well as the lack of CE development and measurement criteria (de Pascale *et al.,* 2023).

However, the substantive scope of technical barriers goes beyond the availability of new technical solutions and also refers to their insufficient compatibility with the knowledge base held by companies (Grafström and Aasma, 2021). This may lead to the occurrence of competence gaps, i.e. the lack of skills or knowledge required to use the new technology, which constitutes an important barrier to the transition to the CE model, as emphasized in the literature (de Jesus and Mendonça, 2018; Tura *et al.,* 2019), in particular with respect to SMEs (Rizos *et al.,* 2016).

Market (economic, financial) barriers underline mainly the lack of economic profitability of circular business models (Kirchherr *et al.,* 2018) as a result of, among others, the weakness of economic instruments (taxes, incentives, subsidies), the use of which should lead to the internalization of external costs (Grafström and Aasma, 2021) and the creation of an effective market for secondary products/materials (de Pascale *et al.,* 2023).

The most important market barriers include high initial costs and market uncertainty (long-term return horizon), limiting new investment in the CE (de Jesus and Mendonça, 2018; Kirchherr *et al.,* 2018), deficiency of resources (assets or infrastructure) (Rizos *et al.,* 2016; Tura *et al.,* 2019) and disproportionate prices of

primary and secondary raw materials (Kirchherr *et al.*, 2018), which are a flagship example of poorly internalized externalities (Grafström and Aasma, 2021).

In addition to negative market factors, regulatory (institutional) barriers are a significant obstacle to the economic transition to the CE model. They are reflected in the lack of a clear and consistent legal framework (e.g., regarding the reuse of waste in production processes) (Rizos *et al.*, 2016; de Jesus and Mendonça, 2018), excessive complexity of environmental laws and regulations (Tura *et al.*, 2019), their excessive restrictiveness (Takacs *et al.*, 2022) and limited possibility of their enforcement (Rizos and Bryhn, 2022).

3. Research Methodology

To develop a comprehensive conceptual framework for the implementation of the CE in Poland, capturing the three essential perspectives (problem areas, barriers, and actions leading to their reduction), as well as the mutual and direct relations linking them, the paper conducted research based on desk research methodology.

The first step of the analytical procedure used was a review of Polish strategic documents reflecting the country's transition path to the circular economy, followed by an analysis of empirical data contained in the EU CE monitoring framework in the Member States.

This procedure allowed to define a conceptual framework, based on which it became possible to assess the level of implementing the CE concept in Poland and to answer the first research question (RQ1). The next stage of the research was a review of gray literature, the results of which allowed conceptual structuring of the barriers to Poland's transition to the CE and, as a result, enabled the development of an answer to the second research question (RQ2).

Finally, based on the in-depth review of the academic literature, the paper proposes a series of measures to support overcoming the identified barriers, thus answering the third research question (RQ3), and develops a comprehensive conceptual framework combining all of the above-mentioned analytical perspectives.

4. Research Results and Discussion

4.1 Poland's Potential to Implement the CE

Of key importance to developing strategic assumptions supporting the practical implementation of the CE model at the national level is their convergence with the most important strategic documents developed at the UN and EU forum. The resolution, adopted unanimously by UN Member States in 2015, specifies the 17 Sustainable Development Goals (SDGs) agreed at the global level.

For each goal, specific tasks (taking into account local conditions) to be achieved have been published, which have been translated into national strategic documents. Among the activities undertaken in the EU forum, the most important strategic document, setting out the European model of sustainable development and, at the same time, being an integral part of the strategy for implementing the 2030 Agenda, is the European Green Deal (EGD), initiated by the EC in December 2019.

This document is a set of policy initiatives supporting the ecological transformation in Europe, and one of its most important pillars (and, at the same time, an important area of EU actions in accordance with 'A New Circular Economy Action Plan', adopted by the EC in 2020) is to transform the EU economy into a modern and competitive circular economy and ultimately achieve climate neutrality by 2050.

The EGD idea in Poland is being fulfilled based on national and regional strategic programs, including, among others, 'National Environmental Policy 2030' (national development strategy in the area of environment and water management) and 'National Plan for Energy and Climate for 2021-2030' (which specifies Polish climate and energy goals in the 2030 perspective).

In order to accelerate the economic transformation, in 2019 the Polish government adopted a draft CE road map entitled: 'Transformation towards the circular economy', which is one of the priorities of the Responsible Development Strategy.

The objective of the Polish road map is to identify the major areas of intervention (sustainable industrial production, sustainable consumption, bioeconomy and new business models) and to identify specific actions aimed at maximizing the added value of raw materials/resources, materials and products, and reducing waste generation, while maintaining the condition of efficiency of production and consumption processes (Roadmap Transformation towards…, 2019).

According to the Sustainable Development Report (OECD, 2023), whose objective is to monitor the progress of implementing the Sustainable Development Goals, Poland's current result is 81.8, whereby 100 means that all 17 SDGs have been fully achieved by a given country.

However, in order to more precisely assess the actual state of implementing the CE in Poland, including the speed and directions of circular changes, it is necessary to identify a list of key monitoring indicators. As concluded by Kulczycka (2020), there are more than 100 indicators, grouped in various thematic areas, which results in their excess, particularly in the context of assessing efficient resource management and achieving sustainable performance.

In order to rectify this, comparative studies are conducted in the literature (Momete, 2020; Mazur-Wierzbicka, 2021), based on the taxonomic method of linear ordering, which is a multi-criteria decision-making procedure. The results of such studies may

provide a good basis for inference, despite the fact they do not provide detailed data on specific problem areas in individual countries.

Therefore, this paper conducts an analysis based on the EU CE monitoring framework in the Member States, covering five extensive thematic areas encompassing production and consumption, waste management, secondary raw materials, competitiveness and innovation as well as global sustainability and resilience and measured by 11 statistical indicators.

According to the Eurostat (2023) methodology, the first area was measured using three indicators concerning material consumption (material footprint and resource productivity) and waste generation. Taking into account Poland's results with regard to material footprint (the amount of raw material extracted to manufacture the goods and services consumed), they are not optimistic.

In 2022, the total extraction of raw materials in Poland amounted to almost 20 tons per capita, which significantly exceeds the EU average (14.9 tons). Better results of the country were recorded in relation to resource productivity (the relation between GDP and domestic material consumption). In the years 2000-2022, the resource productivity of the Polish economy increased by about 64%, while the average resource productivity of the EU increased by only about 37%. Finally, according to Eurostat data, in 2022, there were 4.49 tons of waste per capita in Poland (the EU average is 4.8 tons).

The second thematic area focuses on waste recycling, which is one of the core strategies of the country as regards the transition to the CE model. The waste municipal recycling rate in Poland (the proportion of waste generated that is recycled) has been growing in recent years (from 26.5% in 2014 to 40.9% in 2022).

This indicates progress towards using more waste as resources and the country's growing potential to implement the CE model. However, when compared to the EU average (48.6% in 2022), this result is still not satisfactory. In Poland, most waste is still disposed of by incineration (in the years 2016-2020, the share of waste incineration in the country increased from 19.4% to 21.5%) and landfilling (in 2020, the share of waste landfilling was 39.8%) (EEA, 2022).

The third thematic area includes the monitoring of progress in closing the loop of material flows in EU countries based on two statistical indicators regarding contribution of recycled materials to raw materials demand and trade of recyclable raw materials between EU countries and with the rest of the world.

In 2022, recycled materials accounted for 8.4% of all materials used in Poland, which means a decrease by 2.4 percentage points in relation to 2010 and is well below the EU average (11.5%) (Circular material use…, 2022). Such results are a

consequence not only of the relatively small amount of materials subjected to recycling, but also of structural factors in the national economy.

The fourth thematic area focuses on competitiveness and innovation and concerns eco-design, promoting eco-innovative industrial processes and supporting ecological forms of consumption. It is worth noting that Polish results in this area are close to the EU average.

In 2021, private investment in the recycling sector, repair and reuse sector, as well as rental and leasing sector accounted for 0.7% of GDP in Poland (EU average: 0.8%); the number of people employed in the three circular sectors mentioned above was 2.7% of total employment (EU average: 2.1%) and their gross value added (i.e., gross operating income after adjusting for operating subsidies and indirect taxes) was 1.8% of GDP (EU average: 2.1%).

On the other hand, the number of patents related to recycling and secondary raw materials, being an indicator of innovative technologies, in 2020 amounted to 17.25 in Poland, which indicates a significant decrease in this indicator over the last few years.

Finally, the fifth area takes into account, among others, the aspiration of EU countries for achieving the global sustainable development goals. Poland's results in this area indicate greenhouse gas emissions in 2022 significantly exceeding the EU average (6,481.2 kilograms of CO2 equivalent per capita), the value of which was 9,587.3 kilograms of CO2 equivalent per capita.

However, it should be noted, that this indicator represents greenhouse gas emissions from all productive activities and does not include emissions generated by private households.

Summing up the synthetic analysis of the actual state of implementing the CE model in Poland, the most important problem areas of the country in this area can be mentioned, i.e.: (1) high national material footprint; (2) low rate of waste municipal recycling in Poland; (3) low contribution of recycled materials to raw materials demand; (4) moderate level of eco-innovation, including a declining number of patents related to recyclable materials and (5) high greenhouse gas emissions from production activities.

The above-mentioned problem areas of Poland indicate not only the gap separating the country from European leaders, but first of all the existence of limitations as regards the possibility of growth of circularity indicators in Poland. These limitations result from the occurrence of many barriers, whose specificity is consistent with the conceptual framework adopted in this paper and regards cultural, technical, market and regulatory issues.

4.2 Barriers to Implementing the CE in Poland

The following section is based mainly on a review of gray literature. In this study, an attempt has been made to collect various reports and expert opinions, while taking into account their subjective scope and referring it to the adopted conceptual framework (Figure 1).

The analysis indicated that the most significant barrier to Poland's transition to the CE model is insufficient knowledge about the idea of circular solutions among Polish market participants; whereby this barrier applies to both entrepreneurs and (to a lesser extent) consumers. Although Polish entrepreneurs are usually aware of the environmental impact of their activities, they do not take sufficient actions towards designing and implementing circular business models (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

This is extremely important since it requires changes in the manner of generating, delivering and capturing the value (Bocken *et al.,* 2016), and thus in the manner of understanding and pursuing activities by companies (Pieroni *et al.,* 2019). The ability to transform a business model, so as to ultimately separate the creation of value and the use of resources (Bocken *et al.,* 2016), not only provides a company with a potentially 'renewable' competitive advantage (Prieto-Sandoval *et al.,* 2019), but also strengthens its economic efficiency (Geissdoerfer *et al.,* 2020) and allows it to gain environmental reputation (Brown *et al.,* 2019).

Meanwhile, in Poland, the environmental factor is not a key motivation for entrepreneurs to undertake eco-innovative activities, remaining only an additional aspect of undertakings aimed at minimizing costs or increasing revenues. In other words, the absence of sufficient knowledge of entrepreneurs about the potential benefits of generating circular innovations and a resistant organizational culture mean that new solutions implemented by Polish companies are usually not 'environmentally motivated innovations', but rather 'environmentally beneficial normal innovations' (Carrillo-Hermosilla *et al.,* 2010).

The barrier described above is the direct reason for the problem area of the country identified in the previous section, i.e. the moderate level of eco-innovation of the Polish economy.

When analyzing the other, demand side of the economy, it may be concluded that Poles have a positive attitude towards environmental protection (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023). This conclusion is consistent with the results of studies conducted in various national contexts (Tura *et al.,* 2019; Rizos and Bryhn, 2022).

70% of Polish consumers are willing to fully or partially adapt the consumption of products to a lifestyle reducing adverse environmental impacts (The Circular Voice, 2022). It is worth noting, that a significant part of respondents are ready to pay the

same (63%) or more (24%) for products made from recovered raw materials and suitable for recycling, despite the fact that the prices of these products in Poland are still disproportionately high (Kulczycka, 2021).

The results obtained confirm the conclusions from the academic literature, showing that eco-innovations are dependent on the environmental awareness of consumers (Horbach, 2016) and their willingness to pay relatively lower prices for conventional products decreases when they are informed about the negative environmental impact of such products (Porter and Van der Linde, 1995).

However, the environmentally-friendly attitude of consumers is only one of the factors affecting the market. Still, an unfavorable trend is the fact that Polish consumers transfer the sole responsibility for the practical implementation of the CE to manufacturers, which significantly impedes the elimination of the material footprint. In addition, in the short term, consumer choices are dependent on the range of products and services available in the market.

Meanwhile, the offer of circular products available in Poland is still very limited, which is considered by a significant part of respondents (52%) to be a key barrier to making active choices (The Circular Voice, 2022). The positive attitude to environmental protection declared by Polish consumers does not significantly translate into the consumer behavior observed in practice. This problem does not apply to Polish consumers only and has been confirmed by the results of comprehensive studies on the Europeans' involvement in circular practices (Cerulli-Harms *et al.,* 2018).

Still too few Poles contribute to closing the cycle of materials through proper waste sorting (Kowalczyk *et al.,* 2020), which hinders the implementation of sustainable municipal waste management at home and, as a result, leads to the small share of recycled waste identified in Poland.

In addition, the high prices of recycled products and the small number of eco-labeled products significantly hinder the CE implementation in Poland (Kulczycka, 2021; Akbar *et al.,* 2023). Finally, the analysis carried out shows that educational actions to make consumers aware of the fact, that the change in awareness should be related to a change in their current life habits, are not undertaken sufficiently (Kowalczyk *et al.,* 2020).

Another key barrier to Poland's economic transformation towards the CE results from the fact that the design and implementation of circular business models in companies usually requires access to the state-of-the-art technologies and the development of specific competences. In the absence of such technologies and specific skills, technological and competence gaps arise, which are often experienced by Polish market participants, and which directly undermine the

propensity of Polish companies to undertake innovative activities (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

In the context of the development of circular technologies, researchers point to the potential of digitization (Geissdoerfer *et al.,* 2020) and, in particular, the importance of information and communication technologies (ICT) in the processes of dematerialization of the economy (de Jesus and Mendonça, 2018). The implementation of circular solutions also involves the need to hire highly-qualified personnel having, first of all, eco-design capabilities (Dangelico *et al.*, 2017), as well as the capabilities to plan and predict how circular products will evolve in many life cycles (Sumter *et al.,* 2018).

Researchers further point to the need to gather skills/expertise in other fields, including project management and organizational change management (Pieroni *et al.,* 2019), develop the ability to experiment (Bocken *et al.,* 2016) and build an innovation-oriented learning culture within the company (de Mederios *et al.,* 2014). Deficiencies in this area may effectively block the implementation of the CE idea, both at the stage of initiating and implementing circular business models.

The analysis carried out also points to another barrier to Poland's transition towards the CE model, which is the insufficient scope of cooperation in the whole value creation chain (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023). The literature stressed that the implementation of circular solutions requires new knowledge and resources that are not always developed in companies (Prieto-Sandoval *et al.,* 2019).

Therefore, the key to the implementation of circular business models is to initiate inter-organizational ties (Blomsma *et al.,* 2019). A similar relationship has been identified for the processes of generating and implementing eco-innovations (Triguero *et al.,* 2013; Doran and Ryan, 2016), whereby relations with customers, suppliers and business partners are the most important for the development of eco-innovations. Naturally, the importance of these external sources of knowledge and information may vary depending on the local context (Prieto-Sandoval *et al.,* 2019).

Undertaking inter-organizational cooperation may be a method of mitigating another key barrier in Poland, which is the deficiency of resources (including financial resources) necessary, among others, for making technological investments by companies, concerning, for example, the processing and recovery of certain types of waste (Smol *et al.,* 2021).

This is confirmed by the results of studies conducted among 1200 Polish entrepreneurs, almost half of whom notice a barrier in the economic aspects of undertaking circular activities, which generally involves the lack of own, sufficiently large capital (Iwaszczuk *et al.,* 2022). This problem applies particularly to SMEs, as larger companies being in a better economic situation, due to the larger scale of their activities, generally have a larger resource and skill base, allowing them to conduct

research and development projects and make environmentally-friendly investments (Akbar *et al.,* 2023).

In addition, with regard to the implementation of circular solutions, there is a significant risk related to the long-term return on investment horizon, and thus the possibility of failure of projects with high capital expenditure and a large discrepancy between CE investments and business benefits. This is a factor that determines decisions to implement circular eco-innovative activities in Poland to a larger extent than the availability of financial resources (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

The analysis carried out also indicates that the barrier to Poland's transition to the CE are imperfections in the field of scientific and business cooperation, or the low willingness of companies to establish cooperation with research and development units, institutes and universities (as a result of the existence of, among others, formal barriers with regard to intellectual property rights), and thus the insufficient transfer of knowledge between scientists and business representatives, as well as a limited number of projects, which may be subject to commercialization (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

A significant barrier is also the underfinanced research infrastructure of national research and development units (Smol *et al.,* 2021). All the barriers mentioned above translate into relatively low eco-innovation indicators of the Polish economy and, in particular, the decreasing number of patents related to circular initiatives, as confirmed by Eurostat data.

Other barriers undermining the possibility of Poland's economic transformation towards the CE include disproportionate prices of primary and secondary raw materials (Akbar *et al.,* 2023) and dependence of the production of energy on conventional sources (Kulczycka, 2021). This is evidenced by the conclusions of the document published by the Chancellery of the Senate of the Republic of Poland (2020), which indicates the key barriers of the policy geared towards implementing EGD in Poland, including, first of all, the dominance of coal in the national energy balance.

The existence of the above-mentioned barriers results in the small share of recycled materials in the demand for raw materials, as identified in the previous section, and excessively high greenhouse gas emissions, stemming from the country's retardation in the field of decarbonization. Despite the sharp decline in the coal consumption in the EU in recent decades, Poland still remains the largest user of hard coal in the EU and is second only to the German economy in terms of lignite consumption (Cullbrand *et al.,* 2022).

Finally, a significant barrier to Poland's transition towards the CE model is the lack of adaptation of the current legal system to economic realities (outdated legislation

that does not keep up with technological development and innovations), which translates into limited effectiveness.

For example, some products and materials, that are sent to municipal waste collection points, cannot be recycled as, according to the provisions of Polish law, they have the 'status of waste' (Akbar *et al.*, 2023). Other barriers include: the dispersion of regulations into many normative acts, the slow process of introducing legal amendments and delays in the implementation of changing EU regulations.

The results of surveys conducted by Kulczycka (2021) indicate that, according to respondents, legislative amendments should precede the country's transformation to the CE model, since otherwise many circular ideas and projects have no chance of being implemented.

We should also stress the fact, that the legal regulations applicable in Poland are focused mainly on waste management, and to a lesser extent on waste prevention, which translates into the relatively low efficiency of using resources in the value creation chain. Problematic are also excessively strict legal requirements, particularly for recycling companies (Akbar *et al.*, 2023).

The barriers described above are of a multidimensional nature and are the direct reason for the problem areas identified in the previous section as regards the implementation of the CE model in Poland. They relate to cultural, technical, market and regulatory aspects, apply to many areas of the economy and society, and are interrelated, as shown in Figure 1. This means not only the validity of their conceptual structuring, but also the need to identify interconnections between the barriers, so as to achieve higher effectiveness of taking actions to eliminate them.

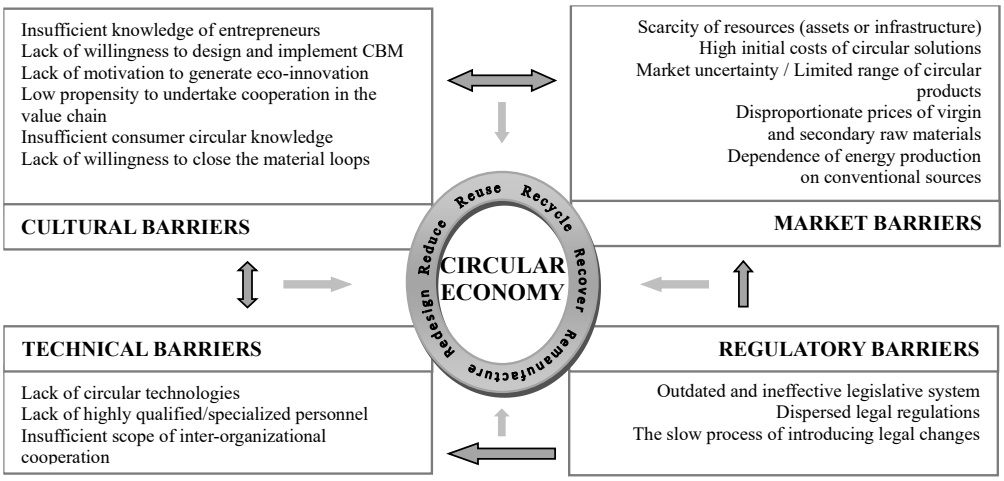
Understanding the interaction of the identified barriers is also essential to understanding the dynamics of the process of the country's economic transformation towards the CE. The passivity of Polish companies in the area of designing and implementing circular business models and generating eco-innovations stems directly from the lack of sufficient knowledge of entrepreneurs and indirectly from the limited awareness of CE benefits among consumers (cultural barriers).

In addition, the conservative circular activities of entrepreneurs are strengthened by the high level of costs of generating and implementing solutions consistent with the CE paradigm, the existence of investment risk (market barriers) and the deficiency of innovative technologies and highly qualified personnel (technical barriers).

In other words, even if advanced circular solutions are technically feasible in Polish companies, their practical implementation is often impeded by the existence of technical and market barriers. The insufficient scope of inter-organizational cooperation and, in particular, the establishment of ties between entrepreneurs and the R+D sphere (technical barrier) is, in turn, due to e.g., inconsistencies in the field

of intellectual property rights (regulatory barrier). Finally, ineffective, outdated and frequently changing legal regulations (regulatory barriers) are basically the biggest constraint concerning taking into account the environmental imperative as a key guiding light for actions taken in the economy.

Figure 1. *Barriers to implementing the CE in Poland and their interactions*



}*Source:* *Own elaboration.*

4.3 Actions Supporting the Overcoming of Barriers Implementing the CE in Poland

Although in the last few years many instruments supporting the economy's transformation towards the CE have been introduced in Poland, these actions are still not sufficient, due to their often-fragmentary nature (Kowalczyk *et al.*, 2020; Akbar *et al.*, 2023). In order to overcome the identified barriers, it is necessary to take consistent, multidimensional and comprehensive actions, in which helpful may be an attempt taken in this study and aimed at structuring them conceptually (Figure 2).

Guided by an in-depth review of the literature, the paper proposes a division of such actions referring to hard/soft heuristic developed by de Jesus and Mendonça (2018). In this way, hard actions have been separated from soft actions and it was assumed, that the former refer to forcing changes through the elimination of technical and market barriers (hard power), while the latter refer to shaping the attitudes of market participants through the elimination of cultural and regulatory barriers (soft power) (de Jesus and Mendonça, 2018).

Among the actions leading to the overcoming of cultural barriers in the academic literature, the role of information instruments is stressed, i.e., conducting

information and promotional campaigns, creating platforms presenting examples of good practices and using certification and eco-labeling, i.e. tools informing potential consumers about the environmental impact of purchased products (de Jesus and Mendonça, 2018; Kirchherr *et al.,* 2018; Rizos and Bryhn, 2022).

It is obvious, that social awareness plays a key role in the successful transformation of the linear economy, since it is people, who are an integral part of the CE system (Lieder and Rashid, 2016). What is more, many innovative circular solutions are relatively new for entrepreneurs (particularly from the SME sector) and they often lack reference points (Tura *et al.,* 2019), i.e., specific role models showing how to effectively implement CE strategies (Rizos *et al.,* 2016; Takacs *et al.,* 2022).

Finally, the use of eco-certification is a solution, that reduces the asymmetry of information between buyers and sellers (Takacs *et al.,* 2022) and consequently encourages companies to generate eco-innovations, as well as makes it easier for consumers to make sustainable purchasing decisions (de Pascale *et al.,* 2023).

An incentive for Polish companies in the field of design and implementation of circular business models may be the carrying out of educational actions, promoting the sustainable production (including making entrepreneurs aware of its potential environmental, economic and social benefits) (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

The objective of such interventions may be to strengthen environmentally-friendly attitudes among entrepreneurs, disseminate the principles of eco-design and develop their knowledge about the scope (and assessment) of adverse environmental impacts of their economic activities (Kulczycka, 2021). Meanwhile, Polish entrepreneurs still lack the basic knowledge in the field of the LCA methodology or the use of indicators such as Product Environmental Footprint Category Rules (PEFCRs) and Organization Environmental Footprint Sector Rules (OEFSRs) (Akbar *et al.,* 2023).

Building awareness of Polish consumers may take place through proper education on changing consumption patterns and undertaking information and promotional actions aimed at identifying benefits of the sharing economy (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

An action to support the overcoming of the existing demand-side barriers to implementing the CE in Poland may also be the introduction of properly designed systems for the separate collection of municipal waste (‘pay-as-you-throw’ systems according to the ‘polluter pays’ principle), which are a key factor allowing to improve the – still too low – recycling rates in the country, as identified in the previous section.

It is also necessary to increase the offer of circular products available in the Polish market, and to create and promote a clear system of certificates and product labeling

confirming the minimization of their negative environmental impact (Kulczycka, 2021; Akbar *et al.*, 2023).

Poland's transition from a linear economy to a circular economy requires overcoming technical barriers, whose adverse effects are signaled by both academic and non-academic literature. De Jesus and Mendonça (2018) stress that the availability of technical solutions is a necessary condition for balancing the sustainability, efficiency and quality of innovative products offered in the market.

Other researchers (Chaudhuri *et al.*, 2022; Rizos and Bryhn, 2022) point to specific examples of digital technologies that use the advantages of ICT systems in industry (e.g., the Internet of Things) as the basis for innovative approaches to circularity. The absence of such technologies (Tura *et al.*, 2019) and, in particular, the technological path dependencies of companies (Takacs *et al.*, 2022) may prevent the replacement of old, inefficient technologies with innovative solutions.

The adverse impact of path dependency in implementing the CE concept is analogous to the constraints they cause in building capabilities (Teece, 2007) necessary for developing ecological innovations (Aragón-Correa and Sharma, 2003). What is also necessary to overcome technical barriers, are actions integrating sustainable consumption with sustainable production, i.e., the introduction of product-service systems (PSS), offering a combination of a product and related services (Loiseau *et al.*, 2016) and supporting the dematerialization of the economy.

Finally, the literature stresses the need to build appropriate skills, competences and capabilities in companies (Dangelico *et al.*, 2017; Sumter *et al.*, 2018; Pieroni *et al.*, 2019), as well as to develop technological, chemical, material, production and reverse logistics knowledge (Eisenreich *et al.*, 2021), the deficiencies of which create challenges in the field of identification, evaluation and implementation of more advanced technical options (Rizos *et al.*, 2016; Tura *et al.*, 2019).

Similarly, in the gray literature, it is highlighted that, for the CE development in Poland, it is required to invest in creating new environmental technologies and eco-products, as well as to adapt existing solutions to new applications in line with the CE concept (Kowalczyk *et al.*, 2020).

An important role in this regard is played, in particular, by digital innovation hubs, i.e. centers supporting the dematerialization of the economy by gathering knowledge and competences in the field of digital transformation of enterprises' activities (The Polish Agency for Enterprise Development, 2023). It is also needed to harmonize and develop procedures for conducting comprehensive audits of circular activities pursued by companies (Kowalczyk *et al.*, 2020; Akbar *et al.*, 2023). A barrier to Poland's economic transformation is also the absence of specific competences and capabilities supporting the practical implementation of the CE (competence gap).

Therefore, there is an urgent need to create regional advisory centers (hubs) organizing workshops and seminars for entrepreneurs on possible directions and methods of pursuing more sustainable activities (Akbar *et al.,* 2023). The offer of such actions should be addressed mainly to SMEs, since it is the functioning of these entities, that is to the greatest extent determined by the existence of technical barriers.

Another action stressed in the literature and supporting the overcoming of technical and market barriers to implementing the CE is the undertaking of close cooperation with customers and suppliers. The implementation of such cooperation may help companies implement circular solutions that optimize resource management throughout the value creation chain (Rizos *et al.,* 2016; Kirchherr *et al.,* 2018), as well as better predict technological trends (Rizos and Bryhn, 2022).

However, this requires rethinking of partnerships, so as to create common business models (Lieder and Rashid, 2016; Blomsma *et al.,* 2019). Taking such actions is vital to expanding the resource base available in companies and overcoming financial barriers resulting from high initial costs of circular investments (de Jesus and Mendonça, 2018).

Researchers also point out, that technical and market barriers, i.e. deficiencies of resources or knowledge, may be addressed by creating business ecosystems (Takacs *et al.,* 2022), that promote the reuse of by-products in various industrial processes (de Jesus and Mendonça, 2018) through the exchange of recyclable waste/materials.

This opinion is also confirmed by the review of non-academic literature carried out in the paper, according to which of key importance to accelerating the Polish economy's transformation towards the CE is the development of a business support ecosystem, including, among others: creating a system of institutions providing professional services supporting the optimization of the whole life cycle management process of new products, building links in the value creation (and recovery) chain, and promoting industrial symbiosis (Kowalczyk *et al.,* 2020; Akbar *et al.,* 2023).

Important in this context is also the role of technology, science, as well as science and technology parks (offering assistance in transforming the results of scientific research and development work into technological innovations) and technology incubators (providing newly established innovative companies from the SME sector with assistance in achieving maturity and ability to function independently in the market).

The idea of CE should also be more broadly considered in academic fields of study, particularly at technical universities, so as to strengthen students' knowledge in the field of eco-design, eco-innovation and corporate social responsibility (Akbar *et al.,* 2023). Such actions may be conducive to developing the country's future potential to

create and implement circular solutions (Smol *et al.*, 2021; Oluleye *et al.*, 2022), also to create the scope and intensity of developing patents related to recycling and secondary raw materials and to implement innovative research and development projects.

An important action leading to the removal of market barriers, including, first and foremost, the cost intensity and long-term nature of circular investments, is the creation of a system for financing green innovations (Brown *et al.*, 2019), whose effects have been confirmed, for example, in the Chinese economy (Wang *et al.*, 2021).

Many researchers (Tura *et al.*, 2019; Grafström and Aasma, 2021; Rizos and Bryhn, 2022) also emphasize the need to increase the effectiveness of tax policy, which has a direct impact on competitive advantages of companies and is also a basic tool for eliminating the barrier resulting from disproportionate prices of primary and secondary raw materials (Lieder and Rashid, 2016; Kirchherr *et al.*, 2018).

Among the practical recommendations leading to the removal of barriers to Poland's economic transformation towards the CE, particularly essential is the development of a financing offer for R+D activities undertaken by Polish companies, aimed at developing breakthrough eco-innovations, as well as financial assistance for SMEs at the initial stage of transformation (including, for example, for the purchase of infrastructure related to implementing environmental technologies) (Akbar *et al.*, 2023).

The importance of such actions results from the fact that the launch of preferential loans and credits, as well as guarantees for the development of sustainable activities, may encourage also those entrepreneurs with much lower initial capital to invest in new technologies.

In addition, the effective generation of eco-innovations and, above all, the implementation of environmental technologies in Poland, that lead to closing the loop of material flows (at least at the initial stage of their development), should be supported by specialized entities, such as CE accelerators, with the co-financing from private funds (VC/PE) (Kowalczyk *et al.*, 2020).

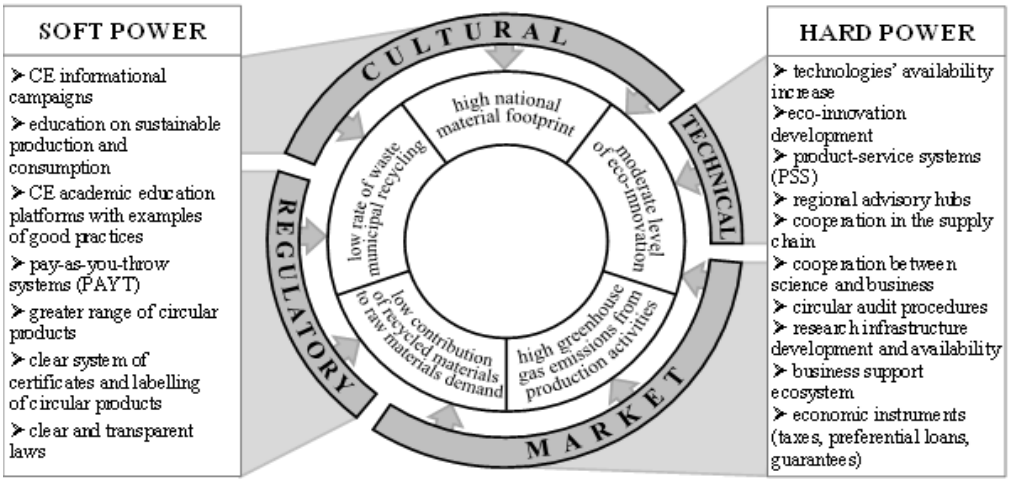
The acceleration of Poland's transition to the CE may also be achieved through introducing other economic instruments. Useful tools supporting sustainable municipal waste management include, for example, landfill taxes, often used alternatively or in combination with landfill bans on certain types of waste, as well as municipal waste incineration taxes, which, so far, have been introduced in nine other EU countries only (EEA, 2023).

The objective of such instruments is to increase the costs of waste landfilling/disposal, and thus to enhance the competitiveness of recycling. Other

types of economic instruments related to municipal waste are extended producer responsibility schemes, usually geared towards specific products, including those that end up in municipal waste (EEA, 2023).

In addition, the elimination of other market barriers, including the dependence of the production of energy in Poland on conventional sources, requires a systemic transformation of the whole economy, leading to improving its energy efficiency and, in particular, the transition from fossil fuels to renewable energy and a long-term shift of the country towards a service economy.

Figure 2. *Conceptual framework for implementing the CE model in Poland*



Source: *Own elaboration.*

Finally, the academic literature highlights the leading role of laws, regulations and standards (de Jesus and Mendonça, 2018; Kirchherr *et al.*, 2018; Brown *et al.*, 2019; Tura *et al.*, 2019; Grafström and Aasma, 2021; Rizos and Bryhn, 2022) facilitating the economic transformation towards the CE, since a stable regulatory framework supports long-term circular (Scarpellini *et al.*, 2019; de Pascale *et al.*, 2023) and eco-innovation (del Río *et al.*, 2016; Horbach, 2016) investments.

Therefore, among the actions supporting the overcoming of regulatory barriers to implementing the CE model in Poland, we can indicate, first of all, the need to create a transparent law compliant with the general principles of environmental protection

and based on measurable criteria (Kowalczyk *et al.*, 2020; Kulczycka, 2021; Akbar *et al.*, 2023).

In fact, the effectiveness of the economic instruments described above depends not only on their amount, but also on the manner of their design, implementation and enforcement. Primarily, it is essential to modify the definition of recyclable materials and to develop transparent and consistent criteria relating to the status of end-of-life waste.

According to Akbar *et al.* (2023), the inadequacy and fragmentation of the current legal framework in Poland means that Polish entrepreneurs often delay risk-taking and allocate much less resources than necessary to pursue (and develop) eco-efficient innovation activities.

Figure 2 illustrates a comprehensive conceptual framework for implementing the CE model in Poland, based on three basic perspectives (problem areas, barriers and actions leading to their mitigation) and their mutual and direct relations.

Among the most important problem areas in the field of Poland's economic transformation towards the CE, noteworthy is the moderate level of eco-innovation, including a declining number of patents related to recyclable materials, which is primarily affected by supply-oriented cultural barriers, technical barriers (technological and competence gaps) and market barriers (i.e., among others, scarcity of resources, high initial costs of circular solutions, and market uncertainty).

The identified low rate of waste municipal recycling in Poland is, in turn, due to the existence of, first and foremost, cultural barriers (e.g., lack of willingness to close the material loops) and regulatory barriers.

Low contribution of recycled materials to raw materials demand results predominantly from the existence of market barriers (i.e. disproportionate prices of virgin and secondary raw materials) and outdated and ineffective legislative system (regulatory barriers).

Finally, cultural barriers are primarily responsible for too high national material footprint, and market barriers (dependence of energy production on conventional sources) are responsible for too high greenhouse gas emissions from production activities. Naturally, the conceptual framework presented in Figure 2 does not include all the intermediate relations between the perspective of problems and the perspective of barriers.

Moreover, the objective of the adopted conceptual structuring of actions leading to the removal of barriers to Poland's transition to the CE model was to precisely refer hard actions to supporting technical and economic trajectories, and soft actions to initiating social changes (de Jesus and Mendonça, 2018).

5. Conclusions, Proposals, Recommendations

The circular economy is of interest to both economic practitioners and researchers, as a concept that may support the separation of economic growth from adverse environmental impacts, thanks to promoting sustainable production and consumption.

However, despite the growing popularity of this subject in the academic literature, researchers indicate that not only the concept itself but, in particular, the factors and barriers determining the economic transformation of countries towards the adoption of the CE model, require further in-depth studies (de Jesus and Mendonça, 2018; Tura *et al.,* 2019; Rizos and Bryhn, 2022), and the level of discussion rarely concerns practical issues (Lieder and Rashid, 2016).

The main objective of the paper was to identify and analyze the most important problem areas, barriers and actions conditioning the implementation of the CE in Poland. Capturing the essence of this issue is essential from the point of view of creating plans on promoting organic products, minimizing the amount of emissions and waste generated, as well as responsible management of resources and the use of alternative energy sources, i.e., taking actions leading to meeting the EU's environmental and climate goals.

Therefore, three research questions were developed. The answer to the first research question required a review of Polish strategic documents reflecting the country's path of transition to a circular economic model and empirical data included in the EU framework for CE monitoring in the Member States.

The results of the analysis carried out indicate that Poland has a significant potential to implement the CE concept, however, the main problem areas of the country include: (1) high national material footprint; (2) low rate of waste municipal recycling in Poland; (3) low contribution of recycled materials to raw materials demand; (4) moderate level of eco-innovation, including a declining number of patents related to recyclable materials and (5) high greenhouse gas emissions from production activities.

The above-mentioned problem areas result from the occurrence of various barriers, whose identification was the answer to the second research question. Based on a review of the leading academic literature (de Jesus and Mendonça, 2018; Kirchherr *et al.,* 2018; Brown *et al.,* 2019; Grafström and Aasma, 2021; Takacs *et al.,* 2022), barriers have been structured conceptually, and cultural, technical, market and regulatory barriers have been specified.

Then, relying on academic and non-academic sources, the most important barriers impeding Poland's economic transformation towards the CE have been identified

and described. In addition, the paper proposed measures leading to their reduction, which answered the third research question.

An important implication of the study is the fact that overcoming the barriers to Poland's transition to the CE are long-term processes, and their effects are even more postponed in time. Polish entrepreneurs are currently in the process of 'learning' the CE (Kowalczyk *et al.,* 2020) and show a strong orientation towards maintaining stability (Akbar *et al.,* 2023).

The Polish companies' fear of risk-taking and the lack of openness to new solutions often prevent them from making technological and organizational changes that require the involvement of significant resources, transformation of business models and the development of specific competences and capabilities.

What is more, a short-term planning perspective is in contradiction with the CE implementation's objective, which is to close the loop of material flows and to maintain products in these cycles for the longest possible time (Takacs *et al.,* 2022).

Similarly, changing the awareness of Polish consumers may be time-consuming, since it entails a thorough change in their shopping habits (which are often of a permanent and repeatable nature) (Kirchherr *et al.,* 2018). In addition, consumers wrongly convinced of the superiority of traditional ownership-based models, as well as of the unreliability of used and refurbished products (Rizos and Bryhn, 2022), are very unwilling to shift to more conscious consumption patterns.

The dominant price criterion and the throwaway mentality (Takacs *et al.,* 2022) make changing consumer awareness the most difficult challenge. Finally, the introduction of the 'optimal' combination of environmental laws, taxes and regulations is a complicated action (Rizos *et al.,* 2016; de Jesus and Mendonça, 2018), at least because of their complexity (Tura *et al.,* 2019) and the lack of consistency of Polish law with the policies implemented by other EU Member States.

In their current form, the legal regulations applicable in Poland are perceived as a significant threat, reducing the competitiveness of Polish products in the European and international arena (Akbar *et al.,* 2023).

An important implication of the analysis carried out is the fact, that the barriers impeding Poland's economic transformation towards the CE are closely interrelated and interpenetrate. This means, that the removal of barriers belonging to one category may be a catalyst for the removal of others. The interweaving complexity is best seen in the case of interaction of cultural and regulatory barriers.

By introducing circular solutions to their offer, entrepreneurs have an impact on shaping the consumer attitudes (de Pascale *et al.,* 2023). On the other hand, the

greater consumer interest can make the processes of designing and implementing circular business models in companies more dynamic (Kirchherr *et al.*, 2018).

Finally, legal regulations may be treated as a double-edged sword, they are necessary to remove other barriers, while being an obstacle themselves (Takacs *et al.*, 2022). Therefore, the proposed direction of further studies may be a conceptual approach to the barriers to pursuing circular activities in categories of their broad and mutually conditioned networks.

Another valuable research direction may be to conduct empirical studies, checking the conceptual approach developed in the paper. The implementation of such studies, which is, after all, the author's intention, will allow to lift the most important constraint of the analysis carried out, which is the use of secondary data constituting the exclusive basis for inference.

Although the substantive scope of the paper applies to the Polish economy, it can be, however, a basis for conducting future empirical studies also in other national contexts.

Summing up, despite the existence of barriers described in the paper, Polish efforts towards implementing the CE model should be rated positively. Noteworthy is the growing involvement of consumers in ordinary savings concerning, for example, water or energy consumption, as well as the growing willingness to use organic products and services (Akbar *et al.*, 2023).

In addition, some Polish companies perceive the country's economic transformation towards the CE more as an opportunity rather than a threat. Measurable benefits indicated by entrepreneurs include access to new types of raw materials, as well as the development of new opportunities and management of business niches (Akbar *et al.*, 2023).

Poles also perceive the CE as an opportunity for the development support, resulting from the EU financial perspective for the years 2021-2027. Finally, the transition to the CE seems to be the only way to increase the country's energy efficiency and maintain the competitiveness of the whole economy, as well as to achieve climate neutrality, assumed in the European Green Deal, by 2050.

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