

TOWARDS A CIRCULAR ECONOMY IN SMES IN POLAND – PRACTICES, BARRIERS AND SUPPORT

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Purpose: The primary aim of this paper is to identify the specificity and level of implementation of circular economy (CE) practices in small and medium-sized enterprises (SMEs) in Poland.

Design/methodology/approach: To address the research questions, a comparative analysis was conducted using statistical data from the Flash Eurobarometer surveys titled 'SMEs, Green Markets, and Resource Efficiency'. These surveys capture the opinions of SMEs on practices for enhancing resource efficiency and transitioning to CE.

Findings: The research results indicate that the level of implementation of CE practices by SMEs in Poland is low. This conclusion is supported by the number of CE practices reported by SMEs and the level of CE investment funds incurred in previous years. The most frequently implemented CE practices aim at achieving energy savings, material savings, and waste reduction. The major barrier for SMEs in Poland implementing CE practices is the complexity of administrative and legal procedures. It was also revealed that increased access to external funding sources, as well as advice on financing options and financial planning for CE transition investments, could significantly enhance the interest of SMEs in Poland in adopting CE practices.

Originality/value: This paper contributes to the existing literature by presenting the results of an analysis on the implementation level and economic effects of CE practices, barriers to adoption, and resources intended to support CE implementation in SMEs in Poland. The findings are directed towards policymakers, authorities, managers, and practitioners involved in the implementation of CE practices.

Keywords: Circular economy, small and medium-sized enterprises, practices, barriers, support, resources.

Category of the paper: Research paper.

1. Introduction

The concept of the circular economy (CE) has gained popularity in recent years as a way to increase societal prosperity, reduce dependence on natural resources and energy, and minimize waste throughout the product life cycle. The aim of CE is to maintain the highest value and usability of products, materials, and resources as long as possible based on transition from a linear economic model (“take-make-dispose”) to a circular model (“take-make-re-use”) (Janik et al., 2020). There are various strategies for circularity, which are described as the model of 3Rs, 4Rs or even 9Rs frameworks (i.e., Refuse, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover) (Potting et al., 2017).

Due to significant contribution to the European gross domestic product, small and medium-sized enterprises (SMEs) play a pivotal role in transitioning from a linear to a circular economy (Gennari, 2023); thus, they are seeking ways to reorganize offerings and operations to align with this approach (Demirel, Danisman, 2019). The literature on CE has expanded considerably in recent years; however, while the primary focus has been on large companies and multinational corporations, there is a significant gap in understanding the transformation of SMEs towards circularity (Ferasso et al., 2023). Furthermore, despite the increasing number of CE strategies, reports, methods, and tools, researchers have provided little empirical evidence on the corporate practices in SMEs that are vital for transitioning from a linear to a circular economy (Holzer et al., 2021). Therefore, it appears crucial to analyze the key pillars of CE that SMEs should integrate to accelerate the transition towards circularity (Gennari, 2023). This is of utmost importance since the CE approach can help SMEs achieve several goals, including improving resource sustainability and security, enhancing human capital, reducing greenhouse gas emissions, decreasing resource consumption, and improving material efficiency (Malik et al., 2022). Additionally, implementing CE practices may enable SMEs to capture value for societal actors beyond the company itself and benefits the environment. This includes supporting job creation, improving quality of life and consumption choices for users and customers, and reducing social and environmental impacts throughout the production process and the total life cycle of the product or service (D’Amato et al., 2018). Furthermore, implementing CE offers SMEs several opportunities, including increased prestige, cost reduction, recovery of the local environment, and ensuring long-term sustainability (Ormazabal et al., 2018). Nevertheless, SMEs face multilevel critical challenges in transitioning towards CE situated at the intersection of business, societal, and ecosystem value (Howard et al., 2022), and this necessitates collaboration among multiple stakeholders, including SMEs, government, industry associations, large businesses, and consumers, as these groups form the essential ecosystem needed to support CE (Sohal et al., 2022).

Implementing CE practices is a gradual process, beginning with control measures and culminating in the adoption of preventive solutions (Garces-Ayerbe et al., 2019). When SMEs evolve towards CE, they require specific resources and capabilities (Chaudhuri et al., 2022), and experience subsequent development stages, including emerging, filtering, stabilizing, and transforming (Zhu et al., 2022). Based on the CE performance in Austrian SMEs, Holzer et al. (2021) categorized firms into four groups: frontrunners, fast followers, late majority, and laggards. There are also different trajectories towards CE and best practices in one sector cannot be easily transferred to others (Marino, Pariso, 2021). Practices for CE business model encompass value network, customer value proposition and interface, and managerial commitment (Ünal et al., 2019a). In particular, the set of specific CE practices in SMEs may include co-creation, energy recovery, smart waste management, reuse, recycling, repair, resource recovery, resource efficiency, green supply chain management, green purchasing, and waste-to-energy processing (Pereira et al., 2022). However, CE practices can be implemented at various levels of advancement. For example, an analysis of the adoption of CE practices – encompassing design, procurement, production, distribution, consumption, and recovery – in SMEs across France, Greece, Spain, and the United Kingdom revealed that the 'design' function (i.e., designing to extend product life, material selection, designing products for reuse, recycle and remanufacturing, eco-design), contributed the most towards CE adoption, while the 'recovery' function (i.e., remanufacturing and refurbishing, reuse and recycle) contributed the least (Dey et al., 2022). In contrast, research conducted in Italian SMEs showed that although various CE practices are not as widely applied as desired, they are implemented simultaneously, demonstrating a systemic approach to value creation (Mura et al., 2020).

Research reveals various enablers for implementing CE practices in SMEs. Configuring and adapting the firm's circular business model is influenced by internal factors (i.e., strategic orientation, dynamic managerial capabilities, experimentation and R&D process prior to commercialization, company size), and external factors (valorization of local waste, intellectual rights protection, supplier specification) (Ünal et al., 2019b). However, Sharma et al. (2021) identified several critical prerequisites for implementing CE practices, including strong management commitment, the need for innovation and technology upgrades, employee training, customer awareness, and guidelines from competent authorities for a smooth transition from a linear to a circular economy. A study of Mexican SMEs revealed that governmental support and customer pressure have direct effect on the adoption of CE practices (Rodríguez-Espíndola et al., 2022). Another study suggested that the most important enablers for adopting CE practices are the promotion of policies dedicated to sustainability, facilitating access to financial resources, and support in the procurement of raw materials with low environmental impact/identifying suppliers with low environmental impact (Mura et al., 2020). Industrial practitioners from Australian SMEs experienced positive reinforcement towards implementing CE practices, benefiting from enablers such as integrated strategies, continuous improvement, stakeholder involvement, and streamlined processes (Caldera et al., 2019). The convergence of

Industry 4.0 technologies such as blockchain and artificial intelligence (AI) can also serve as enablers for integrating CE practices by SMEs (Pizzi et al., 2021). In addition, Cavicchi et al. (2022) claim that energy management and auditing capabilities constitute the micro-foundations of dynamic capabilities that are needed to sense, seize, and reconfigure the business model around CE. In this line, Garrido-Prada et al. (2021) revealed that knowledge generated by public environmental and energy R&D positively affects the implementation of CE in European SMEs. Furthermore, research by Bodas-Freitas and Corrocher (2019) demonstrated that the benefits of adopting CE practices, such as reduced production costs, are greater among European manufacturing SMEs that receive external financial support and those that adopt a comprehensive set of processes involving re-adaptation and process reengineering for resource efficiency. Additionally, it was indicated that external technical and business support plays a crucial role in the extent of adoption of different CE practices.

SMEs must overcome various barriers to successfully implement CE practices. Research by Ormazabal et al. (2018) identified in this area two categories of barriers: hard barriers (e.g., lack of financial support, insufficient information management systems, inadequate technology, insufficient technical resources, insufficient financial resources, lack of public institution support) and human-based barriers (e.g., lack of customer interest in the environment, lack of qualified personnel in environmental management). Another study identified internal barriers (i.e., risk aversion, short-term orientation, economically dominated thinking, unwillingness to engage in trade-offs, shortage of resources, and lack of knowledge) and external barriers (i.e., technology, market, legislative, and societal/consumer-related) (Takacs et al., 2022). Malik et al. (2022) claim that SMEs must overcome three barriers to change – cognition, volition, and action – and pay special attention to leadership and managerial support. This involves establishing new routines and rituals by leaders and change champions, setting up enabling structures, awareness of the benefits, using a combination of technical and behavioral skills, and finding advocates who can influence others within the SME's ecosystem to embed CE approaches. A study by Rizos et al. (2016) suggested that the lack of support from the supply and demand network is a critical barrier in the transition of SMEs towards CE. Other barriers identified include a lack of capital, insufficient government support, administrative burden, lack of technical know-how, and insufficient information. Studies indicate that barriers to adopting CE practices vary depending on the country of origin of SMEs. For example, the most significant barriers to adopting CE practices among French SMEs include the higher costs associated with sustainable materials and processes, reliance on local suppliers, lack of focus, support, and knowledge of CE principles, time constraints, and limited personal resources (Gentric et al., 2023). Barriers to implementing CE practices in Australian SMEs included a lack of knowledge, skills, and awareness, time constraints, insufficient financial resources, existing organizational culture, the risks associated with implementing sustainable practices, and regulatory and policy challenges (Caldera et al., 2019). Indian SMEs have highlighted several impediments to adopting CE practices, including lack of

awareness, insufficient financial resources and high costs associated with remanufacturing and waste processing, absence of management commitment and clear vision, inadequate technology for material reuse, shortage of skilled manpower and experience in implementing CE initiatives, and challenges related to consumer acceptance (Sharma et al., 2021). In turn, implementing CE practices in Finnish SMEs involved overcoming challenges such as a lack of capital and financial resources, dependence on public support for research and development, and the need to foster cooperation along the value chain (D'Amato et al., 2018). Moreover, Arranz et al. (2024) found that while the feasibility barriers (i.e., lack of customer demand, compatibility with the current business model, and the estimation of profitability) have a decreasing relation with the implementation stages of CE in SMEs, the resource-related barriers (i.e., lack of willingness among management, insufficient awareness regarding the integration of sustainability into the business model, deficits in skills, and a shortage of financial resources) have a U-inverted shape in this relation. Additionally, Garces-Ayerbe et al. (2019) discovered that the most proactive companies in implementing CE practices encounter barriers such as administrative processes, regulations, and a lack of human resources, while firms that have not implemented CE practices perceive financing, investment, and cost-benefit barriers as the most significant. In this line, research conducted in Italian SMEs showed that higher costs were identified as the main barrier for early adopters; however, companies implementing CE practices perceived them as a business opportunity rather than a cost (Mura et al., 2020). In fact, research reveals that SMEs need to make a substantial investment – exceeding 10% of revenues – into circular eco-innovations to gain benefits (Demirel, Danisman, 2019).

There is limited research on implementing CE in companies in Poland, particularly among SMEs. One of the few examples is a study conducted on a sample of 400 Polish enterprises, which revealed that, despite recognizing benefits such as lower costs and higher competitiveness, two-thirds of the enterprises do not invest in CE solutions, primarily due to investment obstacles. The study also highlighted a general lack of strategic goals and recognition of CE models, suggesting a discrepancy between acknowledging the benefits of CE and its actual implementation (Szczech-Pietkiewicz, Czerniak, 2024). Another study based on a survey of small and medium-sized hotel enterprises in Poland revealed that the areas least prepared for implementing CE are design, consumption and use, particularly reuse and repair. Raw material collection and distribution were slightly better assessed. However, knowledge about CE issues among investors and designers, consumer attitudes and awareness, the status of legal regulations, and the availability of public support were all rated low (Kachniewska, 2018). A study of ninety-nine SMEs located in the northern sub-region of the Silesian Voivodeship in Poland demonstrated that the most frequently implemented CE models include circular raw materials, recovery of raw materials, and modification and repair. However, it was revealed that the implementation of circular business models is not widely practiced, primarily due to the competence gap in circular business models, and a lack of knowledge and qualified staff (Brendzel-Skowera, 2021). Additionally, the results of a Delphi study involving a panel

of experts from Poland, Japan, Montenegro, Portugal, and Spain revealed that the main obstacles for SMEs to achieve CE goals include constraints on the use of primary raw materials, efforts towards achieving climate neutrality and sustainable development, and closing the material loop (Kafel, Nowicki, 2023).

Due to the importance of research on CE and limited number of studies focusing on this approach in SMEs in Poland, we believe that further analysis in this area is necessary. Therefore, the main aim of this paper is to identify the specificity and implementation level of CE practices in SMEs in Poland. Our research aims to address the following research questions:

- What specific CE practices have SMEs in Poland implemented?
- What effect have CE practices had on production costs, and how much have SMEs in Poland invested to improve resource efficiency?
- What are the primary barriers preventing SMEs in Poland from implementing CE practices?
- Which types of support have SMEs in Poland relied on and expect to implement CE practices?

The remainder of the paper is organized as follows. Section 2 describes the research methodology. The research results and discussion are presented in Section 3. Finally, concluding remarks with identified limitations of the study are presented in Section 4.

2. Materials and Methods

2.1. Data source

To answer the research questions, it was decided to use statistical data from the Eurobarometer. The Eurobarometer is a polling instrument used by the European Commission, the European Parliament and other EU institutions to monitor regularly the state of public opinion in Europe on issues related to the European Union, as well as the attitudes of citizens, households, and companies towards issues of a political or social nature.

Since 2012, the Directorate-General for Internal Market, Industry, Entrepreneurship, and SMEs has regularly commissioned Flash Eurobarometer surveys titled ‘SMEs, Green Markets, and Resource Efficiency’ among SMEs from European Union Member States, neighboring countries (i.e., Albania, North Macedonia, Montenegro, Serbia, Turkey, Iceland, Moldova, Norway), and the United States. The survey aims to collect the opinions of companies (both SMEs and large enterprises) on, among others, the actions they have already taken or plan to take to use resources more efficiently and move towards a CE business model. It also examines the barriers that companies face when implementing CE practices and the types of support that encourage efficient resource use and the transition to CE. The opinions of the

surveyed companies have been collected during interviews conducted with decision-makers (i.e., managing director, CEO, CFO), commercial managers (i.e., commercial manager, sales manager, marketing manager) or legal officers using computer-assisted telephone interviewing (CATI).

To date, the following Flash Eurobarometer surveys have been conducted as part of this series: FL342 in 2012, FL381 in 2013, FL426 in 2015, FL456 in 2017, and FL498 in 2021. To ensure representativeness, the sample size in each EU Member State for these surveys was adjusted to country's specifics (considering both SMEs size and sectors) and was sufficiently large to allow for comparative analysis of the obtained results. Additionally, in the 2021 FL498 survey, data were weighted according to the size of the SME population in each country. Brief overview of the relevant Flash Eurobarometer surveys from the series 'SMEs, Green Markets, and Resource Efficiency' is presented in Table 1.

Table 1.

Characteristics of the Flash Eurobarometer surveys from the series 'SMEs, Green Markets and Resource Efficiency'

	Flash Eurobarometer number				
	FL342	FL381	FL426	FL456	FL498
Date of the survey	24.01-10.02. 2012	09-27.09. 2013	01-18.09. 2015	11-26.09. 2017	08.11-10.12. 2021
Date of report publication	March 2012	December 2013	December 2015	January 2018	March 2022
Total number of surveyed companies	13,167	13,509	15,020	15,019	17,500
Entity conducting the survey	TNS Political & Social network	TNS Political & Social network	TNS Political & Social network	TNS Political & Social network	Ipsos European Public Affairs

Source: FL342 in 2012, FL381 in 2013, FL426 in 2015, FL456 in 2017 and FL498 in 2021.

Taking into account the aim of this article, a comparative analysis was carried out using data collected within the following Flash Eurobarometer surveys: FL381 in 2013, FL426 in 2015, FL456 in 2017, and FL498 in 2021. The data from FL342 in 2012 were excluded because this survey includes a slightly different set of questions regarding increasing resource efficiency and transitioning towards CE compared to the other Flash Eurobarometer surveys presented in Table 1, making comparative analysis impractical.

2.2. Sample characterization

The analyses presented in this article are based on data collected during interviews with SMEs in Poland as part of the Flash Eurobarometer survey. According to commonly accepted methodology, SMEs were divided into three groups based on their size: micro enterprises (1-9 employees), small enterprises (10-49 employees), and medium-sized enterprises (50-249 employees). To ensure representativeness, the number of companies in each group was selected according to the characteristics of the SME population in Poland, taking into account both

company size and industry sectors. The distribution of the survey sample size in Poland for each Flash Eurobarometer survey is shown in Table 2.

Table 2.

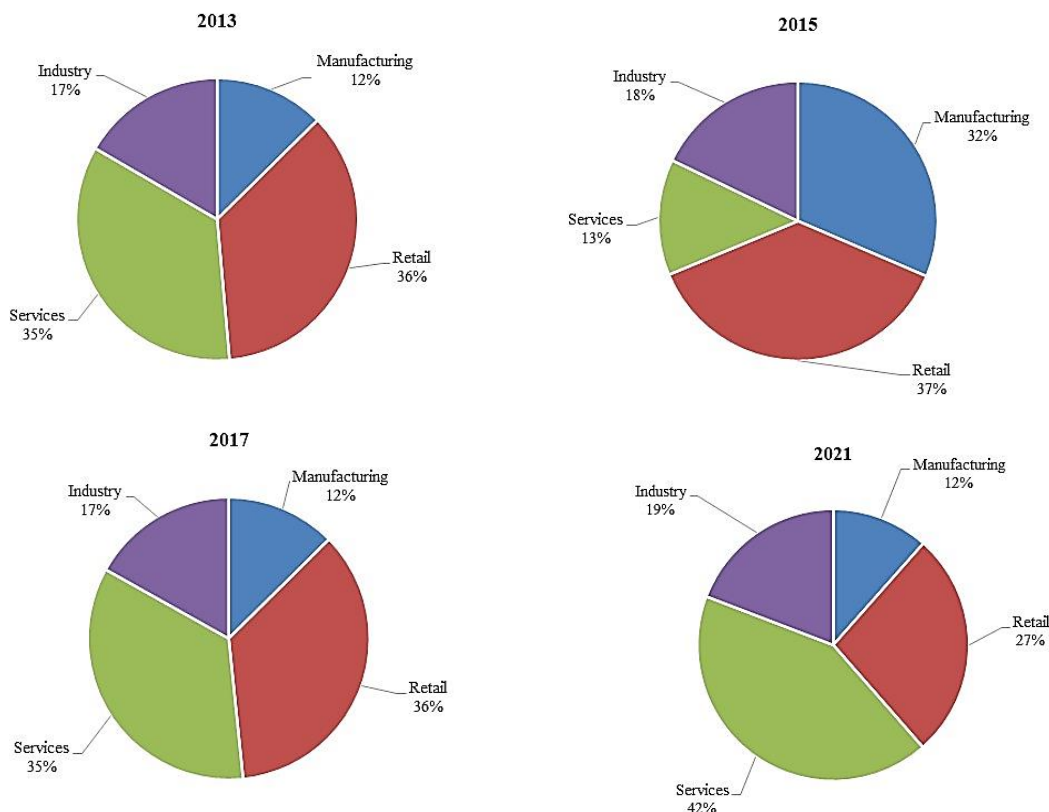
Number of interviews conducted in SMEs in Poland as part of the Flash Eurobarometer series ‘SMEs, Green Markets and Resource Efficiency’

	Micro enterprises (1-9 employees)	Small enterprises (10-49 employees)	Medium-sized enterprises (50-249 employees)	SMEs in total
FL381 (2013)	401	69	29	500
FL426 (2015)	440	51	9	500
FL456 (2017)	393	86	13	492
FL498 (2021)⁽¹⁾	557	25	4	590

(1) In the case of the FL498 study, the data given are weighted according to the size of the SME population in Poland.

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The surveyed SMEs belonged to 12 business sectors, corresponding to the Manufacturing sector (NACE category C), Industry sector (NACE categories B/D/E/F), Retail sector (NACE category G) and Services sector (NACE categories H/I/J/K/L/M). The structure of the research sample by sector in the individual Flash Eurobarometer surveys is presented in Figure 1.

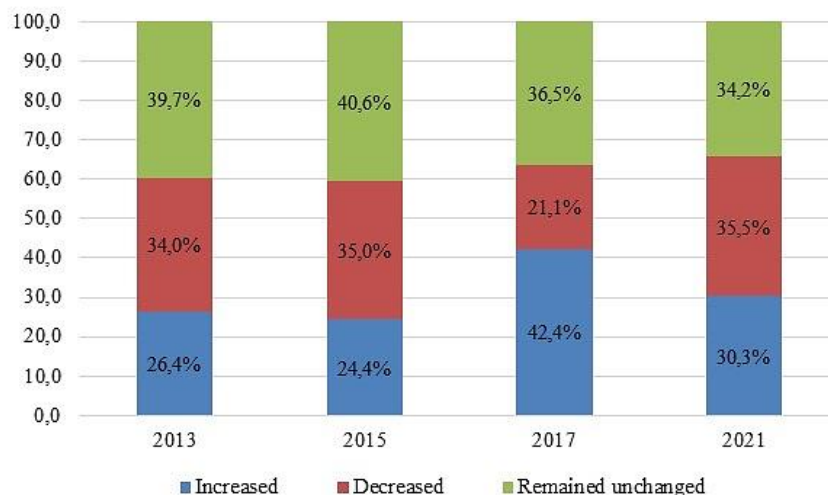


Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 1. Structure of the surveyed sample by sectors in analyzed Flash Eurobarometer.

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

Analyzing the data on the survey sample in relation to changes in the company's turnover over two years from the date of the survey (Figure 2), it can be seen that in the case of the 2013 and 2015 surveys, the largest number of SMEs declared that its annual turnover had not changed over the analyzed period. In the 2017 survey, the largest number of SMEs (43% of respondents) declared an increase in annual turnover, while in 2021 the largest group of SMEs (36% of respondents) reported a decrease in annual turnover over the last two years, which may undoubtedly be related to the situation in which SMEs functioned during the COVID-2019 pandemic.



Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 2. Changes in the company's turnover over the last two years from the date of the survey.

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

2.3. Scope of analyzed issues

A set of eight identical questions on resource efficiency and CE practices that were asked to SMEs during interviews conducted as part of the individual Flash Eurobarometer was selected for the analysis. Given that the questionnaires used in the individual Flash Eurobarometer surveys differed, Table 3 shows the questions utilized in each of the Flash Eurobarometer surveys analyzed.

Table 3.

Compilation of questions from each of the Flash Eurobarometer selected for analysis

Question	FL381 2013	FL426 2015	FL456 2017	FL498 2021
What actions is your company undertaking to be more resource efficient?	Q2T	Q1	Q1	Q1
Over the next two years, what are the additional resource efficiency actions that your company is planning to implement?	Q3T	Q2	Q2	Q2
What impact have the undertaken resource efficiency actions had on the production costs over the past two years?	Q5	Q4	Q3	Q3
Over the past two years, how much have you invested on average per year to be more resource efficient?	Q6	Q5	Q4	Q4

Cont. table 3.

Which type of support does your company rely on in its efforts to be more resource efficient?	Q12	Q10	Q5	Q5
More precisely, which type of external support is it?	Q13	Q11	Q6	Q6
Did your company encounter any of the following difficulties when trying to set up resource efficiency actions?	Q15	Q12	Q7	Q7
Which of the following would help your company the most to be more resource efficient?	Q16	Q13	Q8	Q8

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

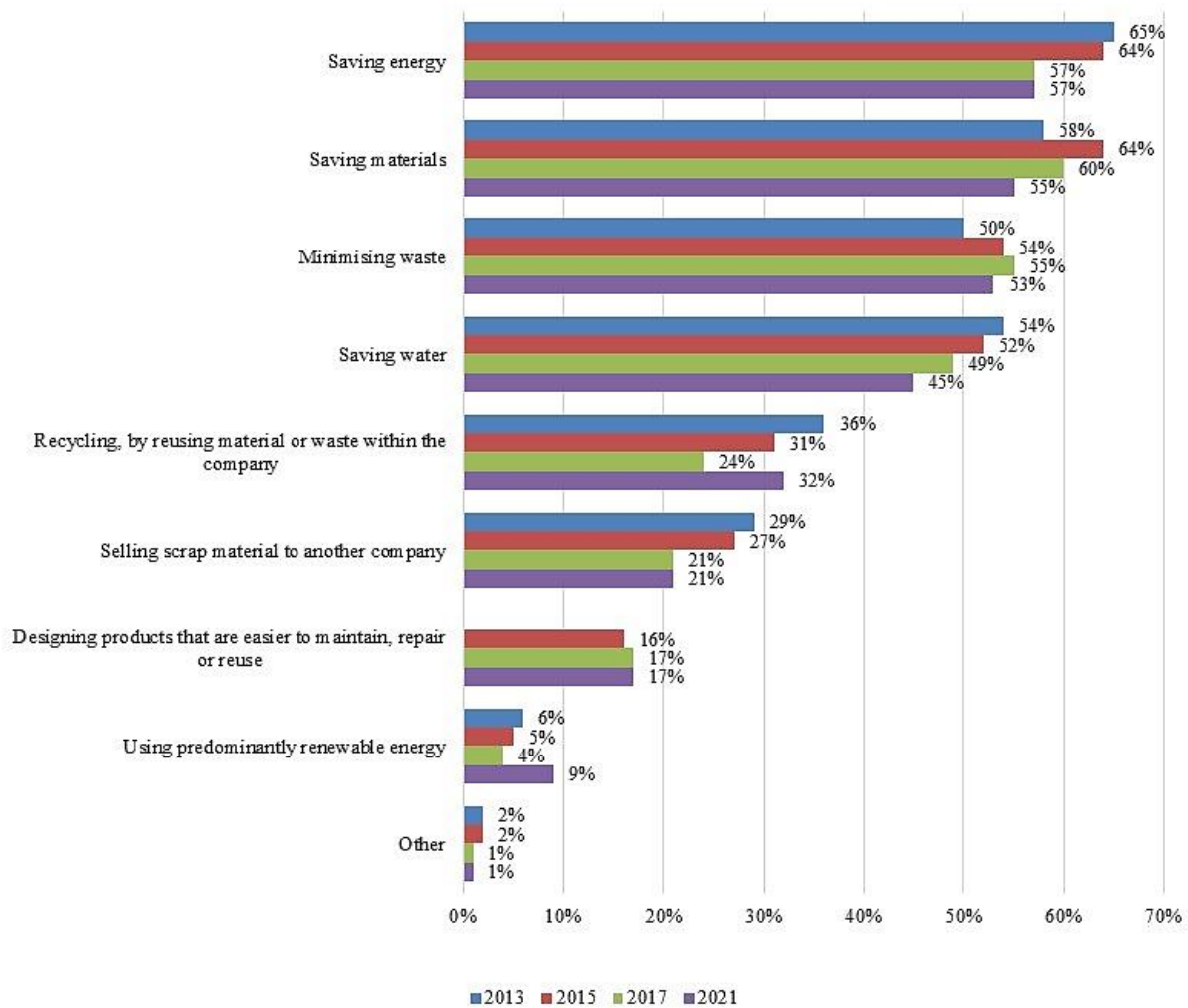
3. Results and Discussion

3.1. CE practices adopted by SMEs in Poland and economic effects

To shift from a linear to a circular economy, companies can engage in diverse activities. Consequently, the first area analyzed in this study was the identification of CE practices implemented by SMEs in Poland. From the list of actions presented in the questionnaire, the surveyed SMEs were asked to select those they had already implemented. Companies could select more than one action. The results show that over 82% of SMEs surveyed in 2021 and 92% of SMEs surveyed in 2013 had introduced at least one action in line with the CE concept. The lack of implementation of such actions was declared by 7% of SMEs in 2013, 17% of SMEs in 2015, 16% of SMEs in 2017, and 11% of SMEs in 2021, respectively.

In each of the analyzed surveys, SMEs in Poland implemented most frequently actions aimed at achieving energy savings (between 57% and 65% of surveyed SMEs declared that they had implemented such actions), material savings (between 55% and 64% of surveyed SMEs reported that they had implemented these actions), and waste reduction (between 50% and 55% of surveyed SMEs declared that they had implemented such actions). This aligns with the findings of Pereira et al. (2022), who emphasized the importance of revamped energy processes, reduced resource usage, and waste minimization in SMEs' involvement in CE.

SMEs in Poland were least likely to introduce solutions utilizing predominantly renewable energy (e.g., including own production through solar panels). Only 6% of SMEs declared the implementation of such actions in 2013, 5% in 2015, 4% in 2017, and 9% in 2021. CE practices indicated by SMEs in Poland in individual Flash Eurobarometer surveys, along with the share of SMEs in which a given activity was implemented, are presented in Figure 3.



Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 3. CE practices adopted by SMEs in Poland (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

Taking into account the size of SME, it can be stated that in 2013 and 2021, the most frequently implemented practice in each SME group was energy saving, while in 2015 it was material saving. In 2017, micro enterprises (1-9 employees) and small enterprises (10-49 employees) most frequently implemented actions for saving materials, while medium-sized enterprises (50-249 employees) most frequently chose actions that resulted in energy savings.

The collected data were also analyzed in terms of the business sector in which the surveyed SMEs operate. The results of these analyses are presented in Table 4.

Table 4.*CE practices adopted by SMEs in Poland by sector of activity (%)*

		Saving water	Saving energy	Using predominantly renewable energy	Saving materials	Minimising waste	Selling residues and waste to another company	Recycling, by reusing material or waste within the company	Designing products that are easier to maintain, repair or reuse
Manufacturing (C)	2013	57%	73%	3%	69%	52%	36%	34%	n/a
	2015	55%	73%	3%	75%	70%	28%	38%	24%
	2017	63%	63%	5%	76%	76%	32%	26%	24%
	2021	50%	74%	11%	80%	74%	41%	46%	37%
Retail (G)	2013	57%	65%	6%	51%	51%	33%	35%	n/a
	2015	59%	72%	4%	61%	57%	33%	30%	11%
	2017	52%	69%	2%	55%	52%	25%	27%	21%
	2021	58%	71%	8%	53%	62%	19%	43%	13%
Services (H/I/J/K/L/M)	2013	45%	66%	17%	61%	47%	26%	19%	n/a.
	2015	40%	54%	7%	54%	33%	9%	19%	7%
	2017	44%	50%	3%	58%	48%	12%	18%	11%
	2021	40%	49%	11%	47%	41%	16%	21%	11%
Industry (B/D/E/F)	2013	43%	47%	14%	44%	36%	29%	29%	n/a
	2015	41%	36%	10%	57%	36%	29%	29%	19%
	2017	44%	45%	11%	62%	60%	20%	27%	16%
	2021	35%	47%	5%	60%	56%	23%	32%	21%

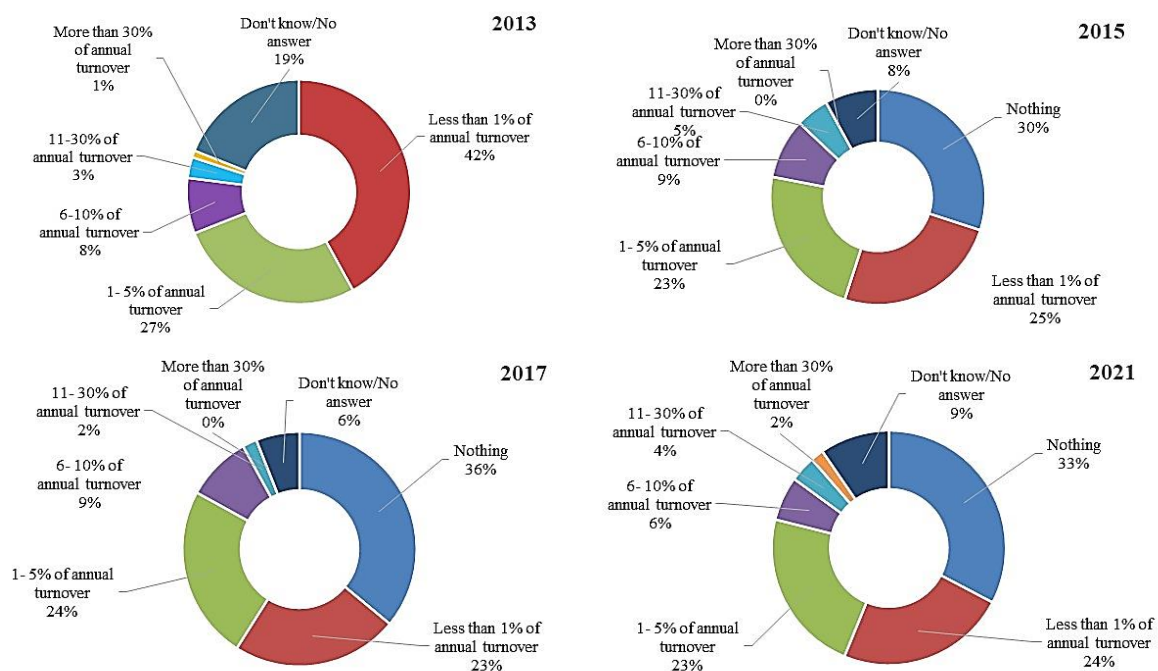
Note: Red color indicates the action selected by the largest percentage of SMEs in Poland in a given Flash Eurobarometer survey, blue indicates the action with the second-highest percentage, and green indicates the action with the third-highest percentage.

Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

Based on the data presented in Table 4, it can be stated that in 2015, 2017, and 2021, the largest percentage of SMEs operating in the Manufacturing and Industry sectors implemented actions aimed at saving materials (75-80% of SMEs in the Manufacturing sector and 57-60% in the Industry sector). In 2013, the largest percentage of SMEs in Poland in these sectors declared the adoption of practices focused on energy-saving (73% of SMEs in the Manufacturing sector and 47% in the Industry sector). For SMEs in Poland in the Service sector, the largest group implemented energy-saving actions in 2013 and 2021, while in 2017, the largest group of Service sector SMEs declared the implementation of material-saving actions. In 2015, 54% of SMEs in the Service sector indicated that energy and material-saving actions were the most frequently implemented CE practices. SMEs in the Retail sector were the most consistent group, reporting energy-saving actions as the most frequently implemented CE practices in each survey.

An alternative way to examine the level of transition of SMEs in Poland to CE is to analyze the average annual amounts they invested in implementing CE practices in the two years following the survey. This question was asked to SMEs that had previously declared the implementation of at least one CE practice. It was assumed that SMEs not implementing CE practices would be included in the analyses alongside those that reported no allocation of funds to CE practices. A comparison of the results obtained in each of the analyzed Flash Eurobarometer surveys is shown in Figure 4.



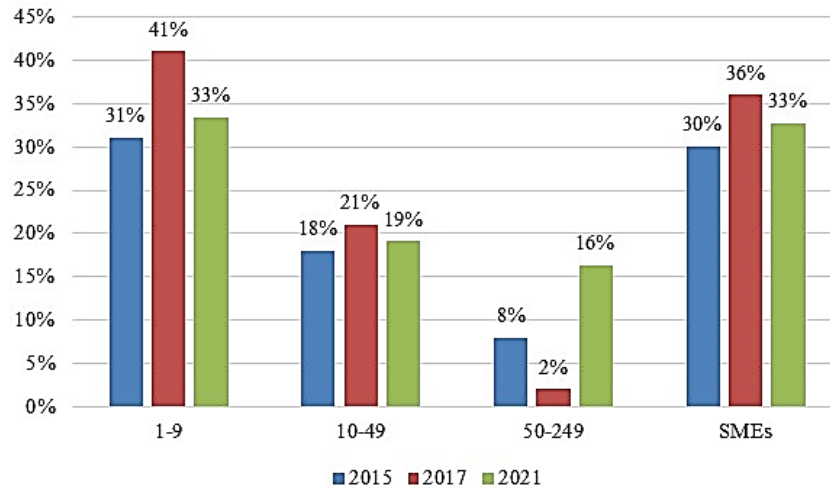
Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 4. Allocation of financial resources for implementing CE practices among SMEs in Poland (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498

The data presented in Figure 4 demonstrate that in 2015, 2017, and 2021, slightly more than half of SMEs in Poland did not allocate any funds or allocated less than 1% of annual turnover for actions enabling the transition to CE. Allocation of funds for CE investments exceeding 5% of annual turnover were declared by 11% of SMEs in 2017, 12% of SMEs in 2013 and 2021 and 14% of SMEs in 2015. This aligns with the findings of Szczech-Pietkiewicz and Czerniak (2024), which indicate that despite acknowledging benefits like lower costs and increased competitiveness, two-thirds of enterprises in Poland refrain from investing in CE solutions primarily due to investment obstacles.

Analyzing the responses of SMEs that reported no investment in CE practices and examining this in relation to SME size, it can be concluded that micro enterprises (1-9 employees) most frequently declare no investment in CE practices. Such a response was given by 31% in 2015, 41% in 2017, and 33% in 2021 of the surveyed SMEs in Poland in this group (Figure 5). According to sector-specific analysis, in 2017 and 2021, the largest group of SMEs from the Retail sector reported no investment in CE actions (41% in 2017 and 38% in 2021), while in 2015, SMEs from the Industrial sector most frequently indicated this response (35%).

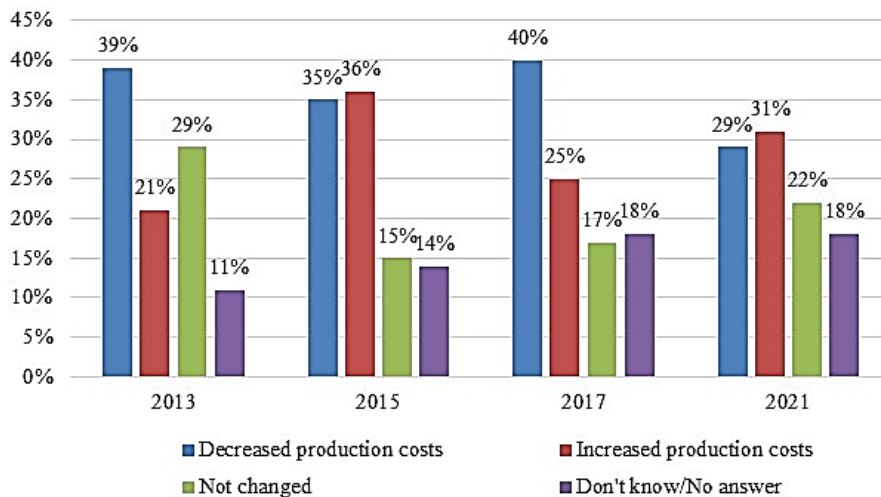


Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 5. Share of SMEs in Poland not allocating financial funds for CE activities by SME size (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

Surveyed SMEs that had adopted CE practices were also asked to indicate whether taking these actions had affected production costs. The relevant results are presented in Figure 6.



Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Figure 6. Effects of CE practices adopted by SMEs in Poland on production costs over the past two years (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The data in Figure 6 show that in 2013 and 2017, the largest group of SMEs in Poland adopting CE practices declared that these actions decreased production costs. The percentages were: 39% of SMEs in 2013 and 40% in 2017. In 2021, the group of SMEs declaring a decrease in production costs due to adoption of CE practices was 11 percentage points lower compared to 2017, while the number of SMEs declaring an increase in production costs due to CE increased (from 25% in 2017 to 31% in 2021). The percentage of SMEs reporting in 2021 no change in production costs due to the introduction of CE practices also increased (by 5% compared to 2017 and by 7% compared to 2015).

According to sector-specific analysis, it can be seen that in the Manufacturing sector, the percentage of SMEs declaring a decrease in production costs due to implementing CE actions decreased with each survey (from 52% in 2013 to 34% in 2021). In the Services sector, the percentage of SMEs declaring that the introduction of CE practices increased its production costs rose by 10 percentage points in 2021 compared to 2017 (from 25% in 2017 to 35% in 2021). In the Industrial sector, the percentage of SMEs claiming a decrease in production costs due to implementing CE practices dropped significantly in 2021 compared to 2017 (from 44% to 24%). A similar decline (by 20 percentage points) occurred in the Retail sector. Impact of CE practices adopted by SMEs on production costs over the past two years by business sector was presented in Table 5.

Table 5.

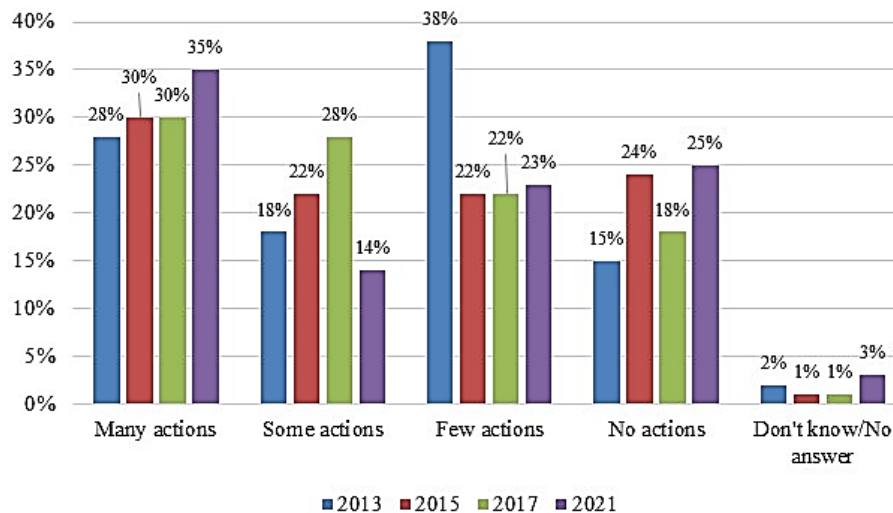
Effects of CE practices adopted by SMEs in Poland on production costs over the past two years by sector of activity (%)

Sectors grouped (NACE)	Year of survey	Decreased production costs	Increased production costs	Not changed	Don't know/ No answer
Manufacturing (C)	2013	52%	19%	27%	2%
	2015	40%	42%	9%	9%
	2017	39%	42%	14%	5%
	2021	34%	39%	21%	6%
Retail (G)	2013	36%	23%	29%	12%
	2015	27%	33%	21%	19%
	2017	40%	19%	22%	19%
	2021	20%	23%	18%	30%
Services (H/I/J/K/L/M)	2013	37%	17%	32%	14%
	2015	31%	28%	20%	21%
	2017	38%	25%	13%	24%
	2021	29%	35%	19%	17%
Industry (B/D/E/F)	2013	38%	31%	23%	8%
	2015	45%	35%	10%	10%
	2017	44%	27%	12%	17%
	2021	24%	32%	33%	11%

Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

SMEs in Poland were also asked whether they plan to implement further activities in line with the CE concept in the next two years. The results are presented in Figure 7. It was revealed that 30% of SMEs in Poland surveyed in 2015 and 2017 and 35% of SMEs surveyed in 2021 reported that they planned to implement many such actions in the future. In 2013, the largest group of SMEs in Poland responding to this question (38%) indicated that they planned to implement only a few CE practices. It should also be noted that in 2021, nearly one-quarter of SMEs stated they would not further implement CE practices in the next two years. This may have been influenced by the COVID-19 pandemic and its subsequent impact on SMEs.

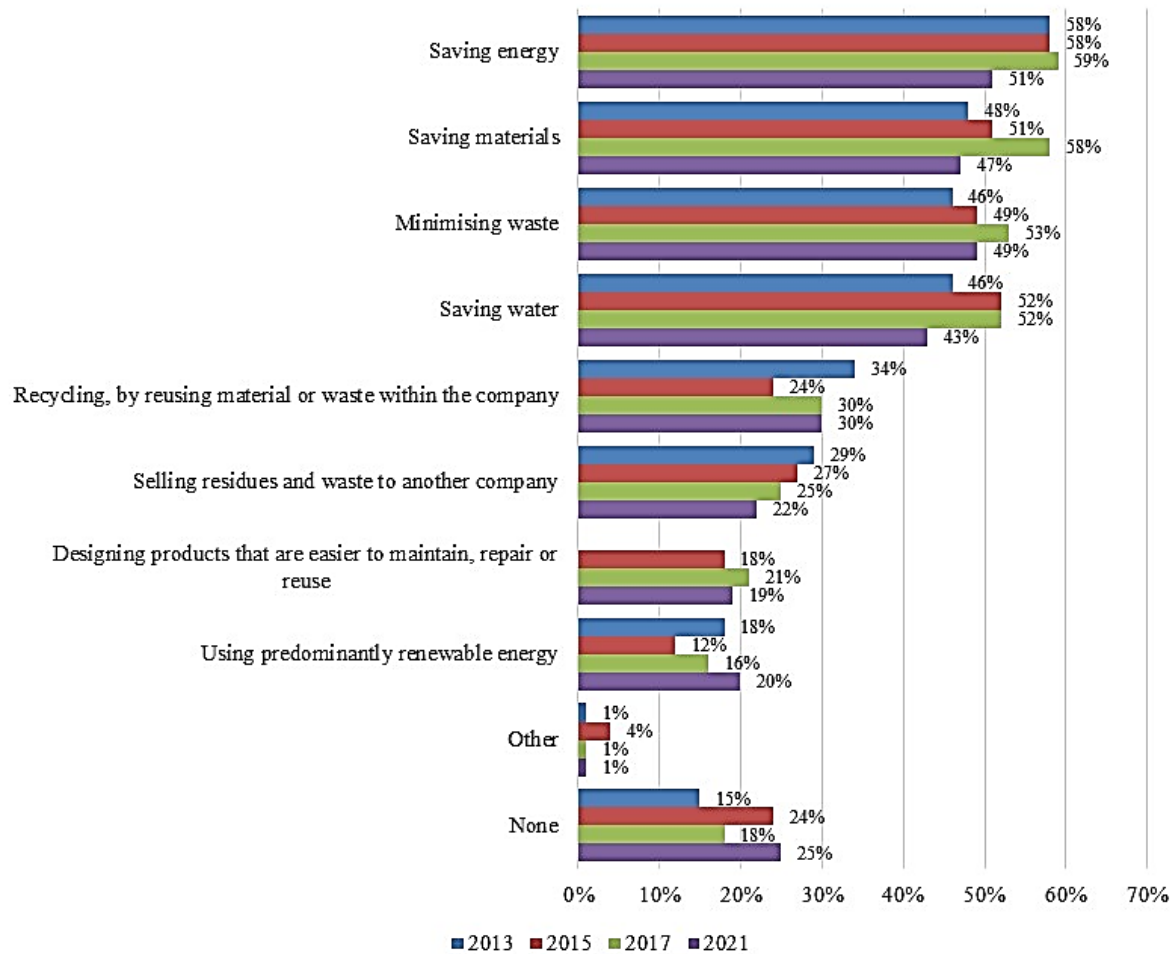


Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 7. Number of CE-related actions planned by SMEs in Poland within two years of the survey date (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

Similarly to the practices already implemented by SMEs, the largest group of SMEs plans to save energy, save materials, and minimize waste in the next two years. The smallest percentage of SMEs intend to implement actions enabling the use of renewable energy. However, it should be noted that the group of SMEs planning to implement these actions in 2021 (20% of SMEs in Poland) was notably higher compared to the share of SMEs that declared in 2021 that they had already implemented such actions (9% of SMEs). The list of practices planned by SMEs for implementation in the next two years from the date of the survey is presented in Figure 8.



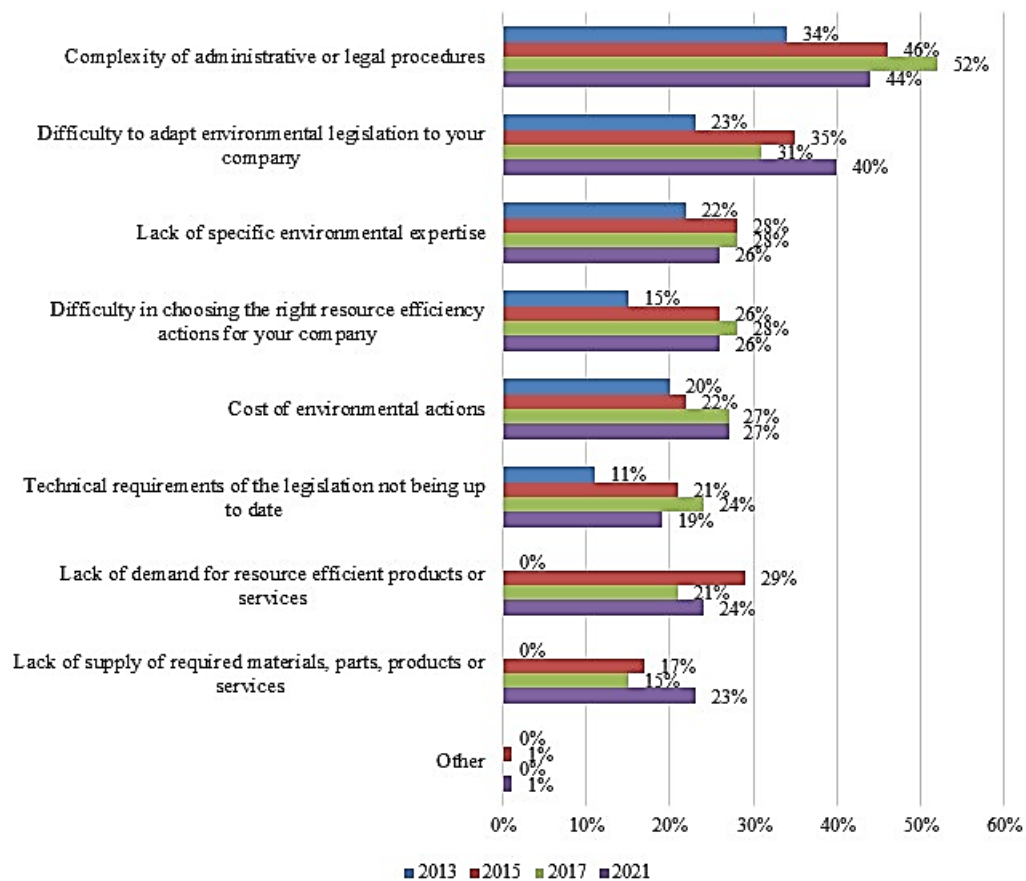
Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 8. CE practices planned by SMEs in Poland within two years of the survey date (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

3.2. Barriers to CE practices implementation in SMEs in Poland

In assessing the level of introduction of the CE business model in SMEs in Poland it is important to know the barriers encountered by SMEs in adopting CE practices. These obstacles can hinder SMEs' decisions to implement such practices in the future. Therefore, surveyed SMEs that reported implementing CE practices were presented with a list of potential barriers they may have faced. Companies were allowed to indicate more than one issue. The results obtained in each Flash Eurobarometer survey are shown in Figure 9.



Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Figure 9. Barriers to CE practices implementation in SMEs in Poland (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The data presented in Figure 9 demonstrate that in each Flash Eurobarometer survey, the largest group of SMEs declared that they faced the complexity of administrative or legal procedures when undertaking CE actions. In 2013, such a barrier was indicated by 34% of SMEs in Poland, while in 2017, this percentage increased to 52%. The second most frequently mentioned barrier SMEs encountered in implementing CE practices was difficulties in adapting environmental legislation to the company. This difficulty was indicated by 23% of SMEs in 2013, more than one-third of SMEs in 2015 and 2017, and 40% SMEs in 2021. Additionally, a lack of environmental expertise and difficulties in choosing appropriate resource efficiency actions for the company proved to be significant barriers. More than one-quarter of SMEs in Poland in 2015, 2017, and 2021 reported encountering these obstacles during the implementation of CE practices. Another significant difficulty that SMEs had to face was the cost of environmental actions, which was reported by more than one-fifth of SMEs in 2013 and 2015 and more than one-quarter of SMEs in 2017 and 2021. These results are consistent with the observations made by Rizos et al. (2016) and Garces-Ayerbe et al. (2019). It should also be noted that one-fifth of the surveyed SMEs declared that the implementation of CE practices did not involve any of the barriers presented in the survey questionnaire. This response was indicated by 20% of SMEs in 2013 and 2021, 21% in 2015, and 23% in 2017.

Analyzing the data by SME size, it is evident that across all surveys, SMEs, regardless of their size, reported struggling with the complexity of administrative or legal procedures and the difficulty of adapting environmental regulations to company when implementing CE. For nearly one-third of medium-sized companies (50-249 employees), the cost of environmental actions was also an obstacle in implementing CE. For small businesses (10-49 employees), significant barriers included the difficulty of adapting environmental regulations to the company (20% in 2013 and 47% in 2017), the lack of demand for resource-efficient products or services (37% in 2015), and the cost of environmental actions (34% in 2021). Micro enterprises (1-9 employees) reported a lack of specific environmental expertise (21% in 2013 and 27% in 2017), a lack of demand for resource-efficient products or services (28% in 2015), and the cost of environmental actions (27% in 2021) as main barriers they faced in implementing CE practices. The barriers faced by SMEs in Poland in implementing CE practices, categorized by SME size, are presented in Table 6.

Table 6.

Barriers faced by SMEs in Poland in implementing CE practices by size of SME (%)

		Complexity of administrative or legal procedures	Difficulty to adapt environmental legislation to company	Technical requirements of the legislation not being up to date	Difficulty in choosing the right resource efficiency actions	Cost of environmental actions	Lack of specific environmental expertise	Lack of supply of required materials, parts, products or services	Lack of demand for resource efficient products or services
2013	1-9	34%	23%	11%	15%	20%	21%	bd	bd
	10-49	33%	20%	7%	13%	18%	22%	bd	bd
	50-249	43%	24%	12%	21%	26%	34%	bd	bd
2015	1-9	46%	34%	21%	26%	22%	27%	16%	28%
	10-49	48%	45%	15%	25%	20%	31%	18%	37%
	50-249	57%	40%	14%	27%	37%	28%	9%	21%
2017	1-9	48%	27%	21%	23%	24%	26%	15%	23%
	10-49	72%	47%	35%	49%	38%	39%	18%	13%
	50-249	45%	35%	29%	12%	29%	15%	2%	11%
2021	1-9	43%	39%	18%	26%	27%	26%	24%	25%
	10-49	55%	48%	24%	29%	34%	27%	23%	11%
	50-249	51%	50%	21%	26%	36%	25%	19%	15%

Note: Red color indicates the barrier choosing by the largest percentage of SMEs in Poland in a given Flash Eurobarometer survey, blue indicates the barriers with the second-highest percentage, and green indicates the barriers with the third-highest percentage. Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

According to sector-specific analysis it was revealed that the difficulties most frequently indicated by SMEs operating in Poland, regardless of industry, were the complexity of administrative or legal procedures and difficulties in adapting environmental protection regulations. Only in 2015 did the largest percentage of SMEs in the Services sector, and in 2021 the largest share of SMEs in the Industry sector indicate difficulty in adapting environmental legislation to the company as the most significant factor inhibiting the implementation of

CE activities. SMEs in the Services sector also reported difficulty in choosing the right CE actions for the company as an important challenge they faced in implementing CE practices, while companies in the Retail sector indicated a lack of specific environmental expertise. For SMEs from Manufacturing sector the cost of environmental actions and the lack of specific environmental expertise also proved to be an obstacle in implementing CE practices, whereas for SMEs from Industry sector the lack of supply of required materials, parts, products, or services was a significant barrier. Barriers faced by SMEs in Poland in implementing CE practices by sector of activity are presented in Table 7.

Table 7.

Barriers faced by SMEs in Poland in implementing CE practices by sector of activity (%)

		Comple- xity of adminis- trative or legal procedu- res	Difficul- ty to adapt environ- mental legisla- tion to company	Technical require- ments of the legisla- tion not being up to date	Difficul- ty in choosing the right resource efficien- cy actions	Cost of environ- mental actions	Lack of specific environ- mental expertise	Lack of supply of required materials parts, products or services	Lack of demand for reso- urce efficient product or services
Manufacturing (C)	2013	47%	26%	14%	16%	21%	21%	n/a	n/a
	2015	46%	33%	25%	27%	25%	28%	16%	24%
	2017	56%	28%	19%	36%	42%	20%	17%	17%
	2021	55%	53%	14%	41%	37%	44%	39%	23%
Retail (G)	2013	33%	23%	12%	14%	27%	27%	n/a	n/a
	2015	49%	37%	19%	27%	21%	29%	19%	29%
	2017	45%	35%	19%	24%	26%	31%	14%	22%
	2021	39%	29%	17%	25%	21%	19%	13%	23%
Services (H/I/J/K/L/M)	2013	26%	20%	8%	16%	12%	15%	n/a	n/a
	2015	31%	34%	7%	24%	24%	31%	14%	13%
	2017	51%	28%	30%	33%	19%	27%	15%	27%
	2021	44%	41%	22%	23%	27%	23%	21%	25%
Industry (B/D/E/F)	2013	46%	27%	13%	17%	20%	25%	n/a	n/a
	2015	48%	39%	26%	19%	16%	23%	38%	32%
	2017	66%	32%	27%	20%	29%	29%	17%	12%
	2021	41%	45%	22%	23%	29%	29%	30%	24%

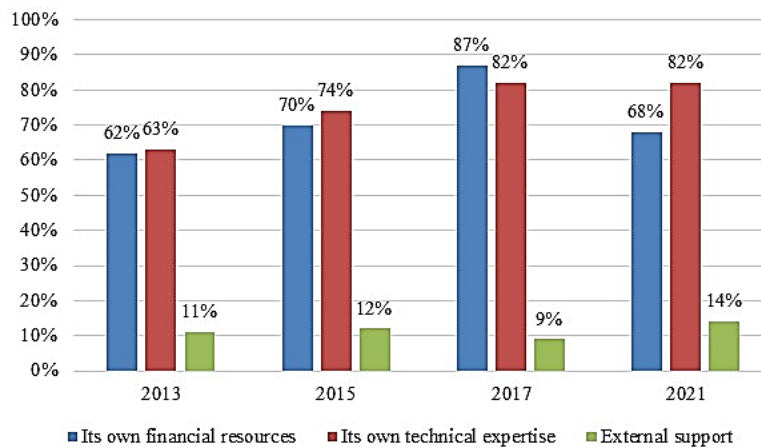
Note: Red color indicates the barrier choosing by the largest percentage of SMEs in Poland in a given Flash Eurobarometer survey, blue indicates the barriers with the second-highest percentage, and green indicates the barriers with the third-highest percentage.

Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

3.3. Resources to support SMEs transition to CE

The final important issue analyzed in this research was the identification of the types of support used by SMEs when implementing CE practices. The types of such indicated support are presented in Figure 10.



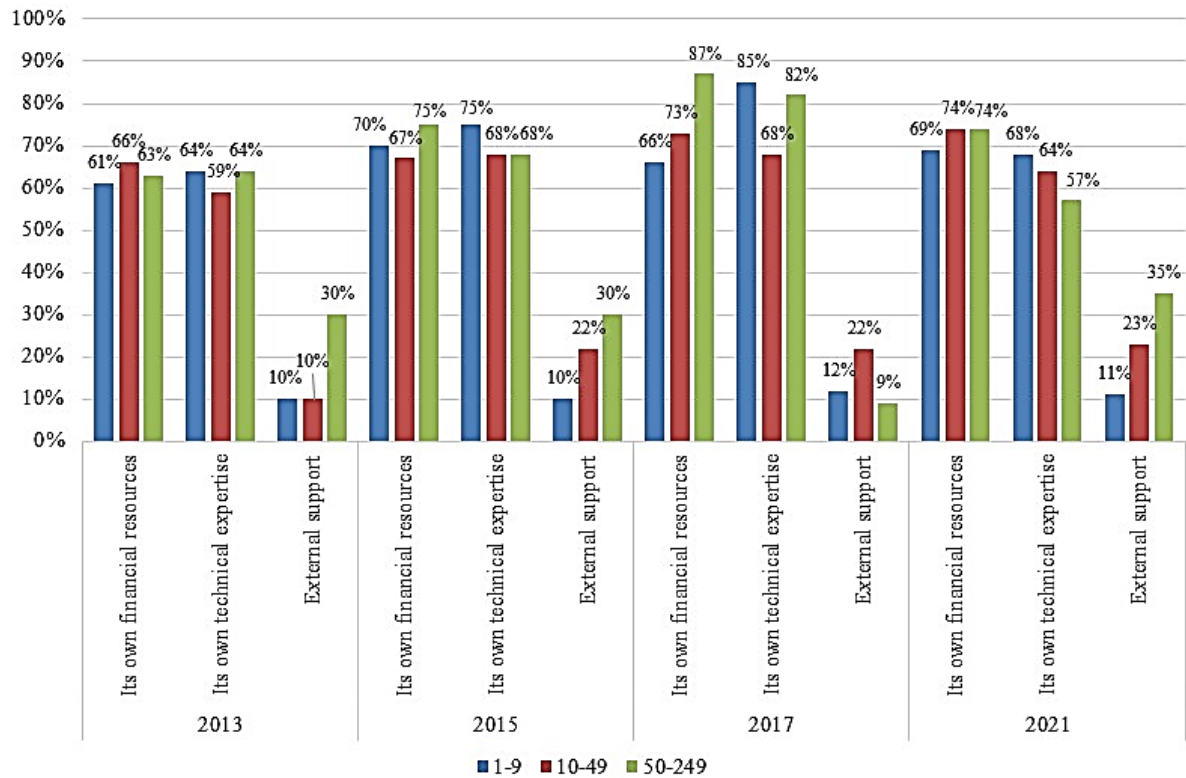
Base: SMEs in Poland adopting CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Figure 10. Types of support utilized by SMEs in Poland to implement CE practices (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The data presented in Figure 10 show that in each of the analyzed Flash Eurobarometer surveys, the vast majority of SMEs reported using their own financial and knowledge resources to implement CE practices. In individual surveys, less than 15% of surveyed SMEs implementing CE practices utilized external support. In 2021, compared to 2017, the share of SMEs relying on their own financial resources has dropped significantly (-19 percentage points), while the percentage of SMEs relying on external support has increased slightly (+5 percentage points), and the share of SMEs relying on their own technical support has remained constant.

Considering the size of SMEs, only the use of external support reveals differences according to SME size. Detailed relevant data are presented in Figure 11. The largest group of medium-sized enterprises (about one-third of SMEs in this group) declared using this form of support when implementing actions to transition to the CE. In the group of small enterprises, just over one-fifth of SMEs utilized external support, while in the group of micro enterprises, about one-tenth of surveyed SMEs indicated using external support in implementing CE practices.

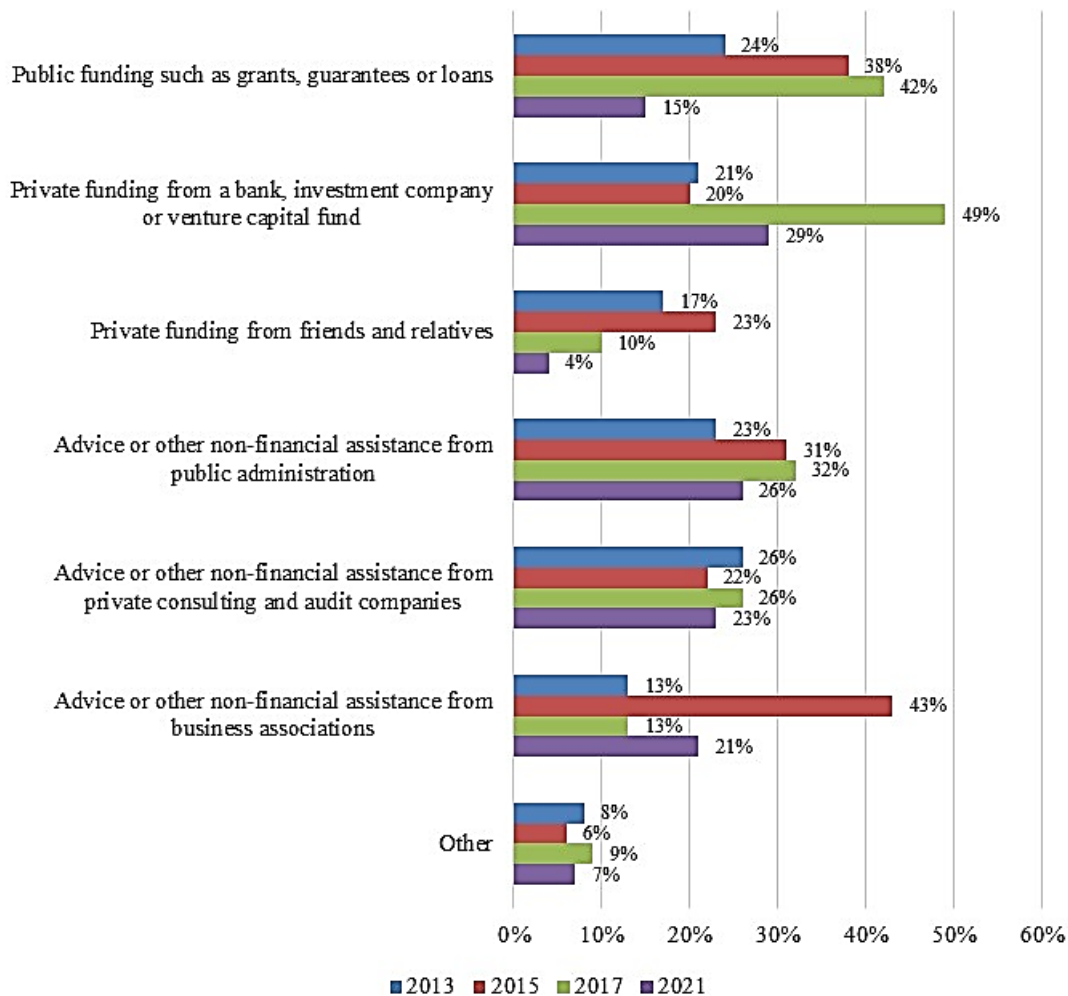


Base: SMEs in Poland undertaking CE practices (n = 461 in 2013; n = 404 in 2015; n = 409 in 2017; n = 470 in 2021).

Figure 11. Types of support utilized by SMEs in Poland to implement CE practices by size of SME.

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

SMEs that reported utilizing external support during the implementation of CE practices were asked to specify the type of support they adopted. The obtained results in this area are presented in Figure 12.



Base: SMEs in Poland that rely on external support in implementing CE practices (n = 51 in 2013; n = 47 in 2015; n = 56 in 2017; n = 58 in 2021).

Figure 12. Types of external support utilized by SMEs in Poland to implement CE practices (%).

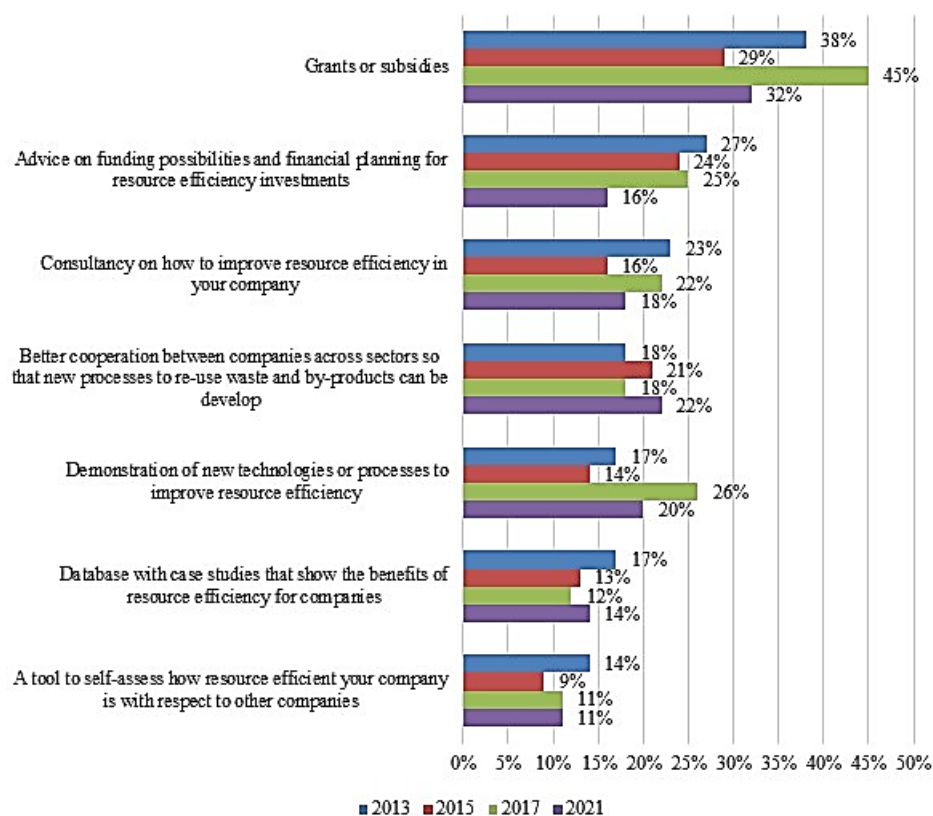
Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The data presented in Figure 12 indicate that the largest group of SMEs relying on external support in 2017 and 2021 used external funding from private banks, investment companies, or venture capital funds (almost half of SMEs in 2017 and one-third in 2021). Public funding, such as grants, guarantees, or loans, was used by 24% of SMEs in 2013, 38% in 2015, 42% in 2017, and only 15% in 2021. The least popular type of external financial support was financial resources from friends and relatives. When implementing CE practices, SMEs also utilized advice and non-financial support from various entities. They chose most frequently non-financial assistance from private consulting and audit companies, as well as from public administration. Non-financial assistance from business associations was less popular in 2013, 2015, and 2021, though it was the most popular type of external support in 2015 (43% of SMEs).

It should be noted that external support is a critical issue, as other studies have suggested that SMEs using external financing and advice are more likely to implement CE practices. Furthermore, external support significantly contributes to production cost reductions, increasing the benefits from adopting CE practices (Aristei, Gallo, 2021).

Analyzing the data by SME size, it can be stated that, regardless of size, SMEs more often chose support offered by private entities in the form of financial support or provided consultations and advice over support offered by public entities. Only in 2017 a larger percentage of medium-sized SMEs declared using support from public entities (73%) than from private entities (67%).

The final issue analyzed was what would most help SMEs become more resource-efficient and achieve a higher level of CE implementation. The obtained results are presented in Figure 13.



Base: SMEs in Poland (n = 500 in 2013; n = 500 in 2015; n = 492 in 2017; n = 590 in 2021).

Figure 13. Actions to assist SMEs in achieving higher levels of CE implementation (%).

Source: Own elaboration based on: FL381, FL426, FL456 and FL498.

The data presented in Figure 13 show that in each Flash Eurobarometer surveys, the availability of grants and subsidies was the most frequently indicated form of support that could encourage SMEs to undertake CE actions in the future. Another form of support expected by SMEs is the availability of advice on financing options and financial planning of investments that enable efficient use of resources, thereby facilitating the transition to a circular economy model. Additionally, technical advice on improving resource efficiency was also highly desired.

One-fifth of the surveyed SMEs indicated that better cooperation between cross-sectoral companies, enabling the development of new processes for the reuse of waste and by-products, could further encourage them to implement more CE activities.

4. Conclusion

The shift towards CE, essential for sustainability, poses a key contemporary challenge, inspiring the search for relevant solutions in which SMEs are crucial players. Therefore, the main aim of this paper was to identify the specificity and implementation level of CE practices in SMEs in Poland.

The conducted research showed that over three-quarters of surveyed SMEs in Poland have implemented at least one practice aligned with the CE concept. However, only slightly more than one-quarter of SMEs declared undertaking numerous practices to transition to CE. SMEs in Poland most frequently implement actions aimed at achieving energy savings, material savings, and waste reduction. These practices were also indicated as actions that SMEs plan to undertake in the coming years.

The study revealed that SMEs in Poland implement CE actions primarily to achieve savings and reduce production costs. However, while in 2013 and 2017 nearly 40% of surveyed SMEs reported a reduction in production costs after implementing CE practices, in 2015 and 2021, one-third of SMEs indicated an increase in production costs following the implementation of these solutions.

An analysis of the level of funds invested by SMEs in Poland in CE practices reveals that nearly one-third of the surveyed SMEs did not allocate any funds for this purpose. Investments exceeding 5% of annual turnover were declared by less than 15% of SMEs in each of the analyzed Flash Eurobarometer surveys. These data indicate a relatively low level of commitment to CE implementation among SMEs in Poland.

SMEs in Poland most often rely on their own sources of financing and knowledge when adopting CE practices. The share of SMEs declaring the use of external assistance (in the form of external financing or non-financial advice and support from private consulting and auditing firms, public administration, or business associations) did not exceed 15% in any of the Flash Eurobarometer surveys analyzed. Therefore, increasing the level of external support, particularly by facilitating access to external finance and providing advice on financing options and financial planning for investments in the transition to CE, is expected to encourage SMEs to enhance the implementation of CE practices.

The surveyed SMEs in Poland encountered various barriers during the implementation of CE practices. Regardless of size or sector, SMEs most often face problems related to the complexity of administrative or legal procedures when undertaking CE actions and difficulties

in adapting environmental legislation to their operations. Therefore, a key challenge seems to be the support and guidelines from competent authorities and experts that assist SMEs in understanding the legal and administrative procedures and environmental legislation they will face when implementing CE practices.

This research, like other studies, has certain limitations that offer provide potential opportunities for future research. Our analysis was based on data from the Eurobarometer surveys, which primarily focused on resource efficiency. Consequently, they do not encompass all areas related to potential CE activities. While additional information could have broadened the research results, data availability was a limiting factor. Moreover, the analyzed Eurobarometer surveys relied on subjective self-reported data from individuals representing SMEs in Poland. This introduces a potential risk of responses being influenced by social desirability; however, given the standardized procedure and format of the Eurobarometer questionnaire used, this risk is likely minimized. Nevertheless, comprehensive research based on real data should provide stronger evidence on the actual practices and nuances of CE in SMEs in Poland. Furthermore, the analysis was based on cross-sectional data obtained in different years from various samples. Collecting panel data from the same individuals in SMEs in Poland would allow for a longitudinal perspective to characterize the evolution of CE patterns, as well as to test and determine causal relationships between the variables characterizing specific CE practices, enablers, barriers, etc.

Nonetheless, our study contributes to the existing literature by presenting the results of an analysis on the implementation level and economic effects of CE practices, barriers to adoption, and resources intended to support CE implementation in SMEs in Poland. Furthermore, our findings can be utilized by policymakers and authorities to improve measures facilitating the transition of SMEs to CE, as well as managers and practitioners involved in implementing CE practices.

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