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FACTORS INFLUENCING THE ENVIRONMENTAL EFFECTIVENESS OF THE DAIRY INDUSTRY IN POLAND

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Purpose: This study aims to identify the environmental impact of dairy plants in Poland, considering their social, economic, legal and managerial aspects.
Design/methodology/approach: The data was collected using CAWI and IDI.
Findings: Factors influencing the studied organisations' environmental performance were defined.
Research limitations/implications: It can be extended to the food industry or manufacturing companies.
Practical implications: As a result of the research, the article contains recommendations for further actions to improve the EPE of organizations, not only in the dairy industry.
Social implications: Research results and recommendations may impact CSR because the information in the article can be used to improve activities in the field of the organization's environmental impact.
Originality/value: The article contains original research results, their interpretation and recommendations for enterprises.

Keywords: environmental effectiveness, dairy industry, environmental factors, environmental impact, environmental management.

Category of the paper: Research paper.

1. Introduction

The dairy industry in Poland has experienced significant growth since joining the EU, with dairy exports growing by 400% (Ministerie van Landbouw, Natuur ev Voedselkwaliteit, 2021). The dairy sector is a vital component of the country's agricultural economy, with a significant economic impact and a competitive presence in the global market, particularly

in cheese production. The industrialization of milk and the production of its derivatives, at a global level, contributes to social and economic benefits for society and generates significant environmental impacts (Üçtuğ, 2019). The industries of the dairy sector, considering these environmental impacts, must be concerned and contribute sustainably and efficiently to the industrialization of products (milk and its derivatives) in a sustainable, nutritious, and safe way (Augustin et al., 2013).

The EU Green Deal and the "Farm to Fork" Strategy have set demanding environmental objectives and ambitions, posing new challenges for European dairy producers and farmers (Ministerie van Landbouw, Natuur ev Voedselkwaliteit, 2021). Considering this context, to be sustainable, the dairy industry must also present an efficient environmental performance and generate economic and social benefits (Feil et al., 2023).

There is apprehension that introducing more stringent environmental standards could lead to a reduction in milk production. However, despite these concerns, there exists an opportunity for enhanced sustainability within the dairy sector (Ministerie van Landbouw, Natuur ev Voedselkwaliteit, 2022). A study on Norwegian dairy farms that incorporated an environmental output measure and drew on 30 years of panel data from 692 specialists (1991-2020) found that dairy farms are inefficient but have room for improvement in the dairy production system and the environment (Alem, 2023). This potential can be driven by policymakers encouraging the best-performing dairy farms to share information on increasing productivity while considering environmental concerns (Alem, 2023). Nevertheless, it is expected to observe that organizations, including those within the dairy sector, often neglect the importance of regularly updating and preserving sustainability performance (Li, Mathiyazhagan, 2018). Production and management processes typically fall short of meeting sustainability standards (Blok et al., 2015), and in fact, many industries are reluctant to integrate sustainable practices into business operations (Luthra et al., 2017; Feil et al., 2023), finding it challenging to balance productivity and environmental efficiency. Research findings also suggest a weak correlation between establishing environmental objectives by organizations and changes in their environmental performance indicators (Matuszak-Flejszman et al., 2019).

Environmental effectiveness can be achieved more with less - more agricultural outputs in quantity and quality for less input of land, water, nutrients, energy, labour, or capital (Keating et al., 2010; Czyżewski et al., 2021). This encompasses maximizing agricultural production or minimizing input usage while minimizing negative environmental impacts (Alem, 2023). Environmental effectiveness is an antecedent of environmental performance and a mediator of the relationship between organizational factors and environmental performance (Tung et al., 2014). Managers must focus on organisational factors to enhance environmental management's effectiveness: employee participation, teamwork, top management support, and training (Tung et al., 2014). Evidence suggests that employees' environmental awareness and management commitment are essential factors affecting environmental effectiveness (Matuszak-Flejszman, Paliwoda, 2022) and also impact the environmental awareness of subcontractors and suppliers.

2. Characterization of the dairy industry in Poland and its impact on the environment

The characterization of the dairy industry in Poland aims to demonstrate and strengthen its importance to humanity and, in addition, its positive and negative social, economic and environmental impacts.

On the world market in 2022, despite the reduction in production in many regions, the upward trend in milk production continued. In the November 2022 forecast, FAO of the United Nations predicts that 2022 global milk production will reach 930 million tons, 0.6% higher than in 2021. This means that the international market for dairy products will be one of the most dynamically developing food markets (OECD/FAO, 2022).

European Union countries are significant producers of milk and milk products. The leading EU milk producers in 2022 are five countries (Germany, France, Poland, the Netherlands, Italy and Ireland) responsible for approximately 70% of EU production (European Commission, 2022). Despite the EU's measures to reduce the concentration of dairy herds, which were aimed at reducing the impact of milk production on the environment (Bienkowski et al., 2021), at the end of 2020, there was a substantial increase in their productivity (by 6% than 12 years earlier; the average milk yield of 1 cow increased by 21%), which consequently allowed for positive dynamics in the production of raw material for processing (Eurostat, 2020).

According to the European Commission's forecast for 2023, with a further reduction in the number of kept animals and a relatively small increase in milk productivity, EU milk production will amount to 152.6 million tonnes, i.e. 0.2% less than in 2022. Market analysts also predict production declines in the longer term. The EU's climate policy will mainly influence it. In the European Union (EU) alone, the increase in milk production is expected to slow down to almost 0.5% per year, and by 2031 it will reach 162 million tonnes. Furthermore, organic milk production in the EU is expected to grow (earning 8% in 2031), leading to economic benefits, environmental benefits and overall animal welfare (The EU Agricultural…, 2021).

Poland is currently a significant EU and world milk producer. Among EU countries in terms of the amount of milk produced, it ranks third, while on a global scale, it ranks 12th (Europa Commision, 2023). According to data from the Ministry of Finance, in 2022, the export value of Polish dairy products amounted to a record EUR 3.6 billion and increased by as much as 37% compared to 2021. Therefore, it is considered an essential segment of the food products market with high development potential and participation in creating Polish GDP from agriculture. The largest share in processing is the production of whey, skimmed milk powder and butter. In 2022, raw cow milk production was higher (approximately 2.2% than in 2021) than the internal demand, which created the possibility of exporting the surplus to foreign markets - about 70% were EU-27 countries (KOWR, 2023).

Moreover, the Polish dairy sector is among the few in the domestic food industry where most market leaders are Polish entities. Farmers who are co-owners, together with the processing plant itself, create highly vertically integrated enterprises that, in principle, operate stably in this volatile market. It should be emphasized that the Polish dairy market is currently ruled by the following companies: Mlekovita, Mlekpol and Polmlek (Portal Spożywczy, 2023).

As a result of the consolidation of smaller companies, they are becoming more vital and valued brands in the domestic and foreign markets. The observed structural changes in the Polish dairy industry result, to a large extent, from the processes of adapting companies to uniform EU market conditions. The thorough modernization of milk production and processing technology has enabled producers to significantly improve the quality of dairy products, which, in addition to the cost and price advantage of Polish milk producers, significantly affects competitiveness in the EU market. This, in turn, increases the negative impact on the environment resulting from the activities of enterprises in this industry. The food industry in Poland consumed approximately 793 hm^3 of water annually in 2014, with dairy accounting for as much as 35% of this consumption (Boguniewicz-Zabłocka et al., 2019). The negative impact of dairy farming on the environment is also reflected in the generation of large amounts of sewage. It is estimated that processing one liter of milk produces 0.2-10 liters of wastewater (Gramegna et al., 2020). Dairy sewage, compared to municipal or domestic sewage, is characterized by a higher content of organic substances, mainly nitrogen and phosphorus compounds, which - if discharged into the environment without appropriate treatment - increases the risk of eutrophication of reservoirs and watercourses (Kolev Slavov, 2017). Disposing dairy wastewater without or partial treatment remains problematic and requires a cost-effective and straightforward solution (Kasmi, 2018). The dairy industry also generates vast amounts of production and packaging waste. Kasmi (2018) points out that the wide variety of dairy products produced by the dairy industry generates a variety of wastes in terms of quality and quantity that can cause serious contamination problems. Diversification and quantification of waste from dairy organizations can be generated regardless of the industry's size and the industrial plant's size.

Company coal-fired boiler rooms cause air pollution (emissions of SO_2, NO_2, CO, CO_2, soot and ash). Dust from the spray drying process of milk or whey and freons and ammonia compounds escaping from refrigeration installations are also a significant problem (Kasztelan, 2012).

Legal regulations related to the sustainable development of the food industry - the "Green Deal", the "farm to fork" strategy and the "circular economy" - the so-called zero waste, are a challenge for food producers and processors (European Commission, 2020). The tool for implementing these activities is the development by dairy industry organizations of an environmental policy allowing for a structured approach to environmental protection, which will be consistent with the assumptions and goals of the ecological policy of the state and the EU (EEA, 2019).

As part of pro-environmental activities, the dairy industry uses various solutions to reduce the negative impact on the environment. These activities are mainly aimed at reducing the amount of waste and reusing it. The literature indicates numerous ways of using dairy waste and sewage sludge to produce value-added products. If no other way of management is possible, waste and sludge may be subjected to energy recovery processes, both thermal and electrical. It is expected to modernize installations and implement water and heat recovery systems, which reduce the amount of raw materials used. Optimizing energy consumption in enterprises using renewable energy sources, in turn, allows for reducing emissions of harmful substances and enables effective energy management (Gralak et al., 2022). In addition, innovative and eco-friendly product packaging is used.

However, the transformation of the Green Deal in the Polish dairy industry requires enormous effort in the: 1. Transport; 2. Fuels and energy sources used; 3. Monitoring greenhouse gas emissions and water pollution (ensuring a decrease in emissions by approximately 1% per year); 4. Reducing greenhouse gas emissions (about 30%, by 2030-2035); 5. Phasing out or significantly reducing the use of hard coal (by 2050); 6. Waste reduction and reuse; 7. Use of advanced techniques/technologies supporting the circular economy; 8. Production of products with a low carbon footprint and 9. Systemic solutions in managing work organization in the company. The consequence of these requirements for the sustainable development of enterprises was the increase in capital expenditures in the investment structure observed in 2019 - most often the purchase of machines and equipment. Buildings and structures also had a large share. Significant investments (development of the technical, technological and product base) included mainly storage and logistics bases and energy, water and sewage management installations (EDA, 2019; European Commission, 2020).

Polish companies managed to achieve improvement in the context of the impact of dairy organizations on the natural environment in the following areas (Parashar et al., 2016; Boguniewicz-Zablocka et al., 2019; Bataille, 2020; Fiore et al., 2020; Muradin et al., 2023; Szymańska, Mroczek, 2023):

- emission standards (carbon footprint of the product/organization, low-emission fuels, monitoring the amount of substances emitted into the air);
- energy efficiency (production of energy from renewable sources, limiting the share of hard coal, heat and energy recovery system - cogeneration system, application of BAT, reducing the energy consumption of processes, reducing the emission of gas fuels, modernization of installations);
- waste management (use of the electronic Waste Database, waste recycling, innovative packaging and eco-labelling, ecological education);
- water and sewage management (subjecting waste and sludge to energy recovery processes - thermal and electrical, reduction of pollutants in water and its recovery, monitoring and control of consumption rates, use of dairy waste - e.g. whey and sewage sludge to produce various types of added-value products.

In addition to implementing activities under the sustainable development strategy (environmental and financial aspects), the organization's management is obliged to conduct constant information activities, consisting of communicating to consumers, stakeholders or state organizations (Hadryjańska, 2015) about the credibility of its "green" projects (Pink et al., 2022). The tools used for this purpose are voluntary environmental management systems (eco-labelling and reporting in ISO 14001, EMAS, CSR, ESG), characterized by clear rules for informing interested parties and used only where feasible and appropriate.

3. Environmental impact of the dairy industry

The dairy industry has a significant impact on the environment. Data focus mainly on greenhouse gas emissions, water pollution, habitat losses, air pollution and animal suffering. The dairy sector produces greenhouse gas emissions, including methane, nitrous oxide, and carbon dioxide, contributing to climate change (WWF, 2023; 2019). According to the average eco-efficiency score, conventional dairy farms could cut input use and CH4 emissions by 5% while maintaining output (Alem, 2023). Also, dairy production significantly affects water quality through eutrophication, acidification, and biological and chemical pollution (Pope et al., 2021) due to the high concentrations of harmful contaminants in dairy wastewater (Al-Tayawi et al., 2023). Dairy operations can consume large volumes of water to grow feed, water cows, manage manure, and process products.

Additionally, manure and fertilizer runoff from dairy farms can pollute water resources, contributing to the growth of algae, which reduces oxygen for aquatic plant and animal life. Unsustainable dairy farming and feed production can lead to the loss of ecologically important areas, such as prairies, wetlands, and forests (WWF, 2023). Airborne ammonia emissions can damage downstream habitats, resulting in the loss of species diversity. The particulate matter and odour output from on-farm activities can negatively impact air quality (Hussain, 2022). Regarding the manufacturing of dairy products, the primary environmental impacts are (Szymańska, Mroczek, 2023; Antonopoulos et al., 2018; Rad, Lewis, 2014; Place, Mitloehner, 2010):

- by-product generation (resulting from processes such as coagulation, curd treatment, drainage, and pressing);
- wastewater generation (producing whey from coagulation, curd treatment, drainage, and pressing) and creating brine during the salting stage. Additionally, it plays a significant role in cleaning and disinfection operations);
- energy consumption (including thermal energy usage, such as for pasteurization, cleaning, and disinfection operations, as well as electricity consumption, particularly for refrigeration);
- water consumption (primarily in cleaning and disinfection operations).

However, the industry can significantly reduce environmental impacts through better management practices and technologies. The Sectoral Reference Documents (SRDs) on Best Environmental Management Practices (BEMPs) prepared by the European Commission provide guidance and inspiration to organizations in specific sectors to further improve environmental performance. Research findings indicate that the requirements related to the application of BEMPs contained in the SRDs may significantly contribute to an increase in effectiveness (Matuszak-Flejszman, Paliwoda, 2022). The Food and Beverage Manufacturing industry guide encompasses a series of practices to reduce its adverse environmental footprint. These practices include conducting environmental sustainability assessments for both products and operations, implementing sustainable supply chain management, enhancing or choosing packaging with minimal environmental impact, adopting eco-friendly cleaning procedures, refining transportation and distribution methods, optimizing freezing and refrigeration processes, implementing energy management and enhancing energy efficiency across all operations, and incorporating renewable energy sources into the manufacturing process. Furthermore, it promotes the prevention of food wastage within manufacturing operations (Antonopoulos et al., 2018).

4. Research Methodology

The empirical research was conducted in 2023 among dairy industry enterprises. The geographical scope of this study was Poland, which is located in the middle of Europe. The primary methods used in this study were Computer Assisted Web Interviews (CAWI) and Individual In-depth Interviews (IDI). These research tools were strategically selected to ensure a holistic understanding of the subject matter and provide a good perspective on the issues under investigation. CAWI served as one of the principal data collection techniques in the research. It involved administering structured questionnaires through an online platform called Webankieta. Respondents from various dairy industry enterprises in Poland were invited to participate in this survey via the internet. The use of CAWI offered several advantages, such as the ability to reach a large and diverse sample of participants efficiently. It allowed for standardized data collection, reducing the risk of interviewer bias and ensuring consistency in the responses. The online format also enabled real-time data entry and management, facilitating data analysis. In addition to CAWI, the research included IDIs to go deeper into the subject matter. IDIs are a qualitative research method that involves in-depth discussions with selected participants. These interviews were conducted with key stakeholders and experts. The purpose of IDIs was to gather detailed insights. This approach allowed the research team to capture qualitative data that complemented the quantitative data obtained through CAWI.

In the first stage, 22 properly completed surveys were collected, representing 32.5% of dairy industry enterprises operating in the Polish market. Among the surveyed entities, medium-sized companies dominated (63.6%). Large enterprises accounted for 27.3%, while small ones constituted 9.1%. Small and medium enterprises (SMEs) are essential for global green growth and eco-innovation. The study's second phase comprised Individual In-depth Interviews (IDI) with organizational representatives. These IDIs were carried out via online platforms, offering convenience and flexibility to the participants. The IDI questionnaire was standardized and segmented into sections, facilitating a comprehensive exploration of the organizational viewpoint. The data collected through IDIs was qualitative. The information presented in the results and discussion in this paper is based on research derived from the CAWI survey conducted in the first stage. The data collected in this study is non-sensitive and does not encompass health, genetic information, intimate details, political views, ethnicity, beliefs, or religious convictions. The study did not involve continuous tracking or observation of the participants. Participants were engaged in completing survey questionnaires, and their responses were handled anonymously, with collective analysis conducted without identifying individual respondents. No psychological or physical harm risks to respondents or researchers were identified.

5. Research Results and Discussion

Out of the surveyed companies, 31.8% have implemented an environmental management system based on the international standard ISO 14001 requirements.

The primary motivation for implementing the Environmental Management System (EMS) according to ISO 14001 was the desire to improve environmental impact management (85.71%). This demonstrates a high level of awareness and commitment from the leadership in the dairy industry. Other significant motivators include ensuring compliance with environmental legal requirements and enhancing the organization's reputation (71.43%). Notably, respondents also highlighted the potential for cost savings (57.14% - definitely yes, and 28.57% - rather yes), reducing waste associated with material consumption (28.57% - definitely yes, and 57.14% - rather yes), and reducing waste generated (28.57% - definitely yes, and 42.86% - rather yes). These factors can significantly contribute to reducing an organization's environmental footprint. Therefore, implementing the ISO 14001 standard as an effective environmental management tool can offer numerous benefits to the organization's leadership and result in positive environmental outcomes stemming from the organization's activities.

Notably, 77.27% of the surveyed organizations set environmental goals for themselves, and the majority successfully achieved them. These organizations primarily assess the effectiveness of their environmental efforts by evaluating the extent to which environmental goals are met (68.18%). Some organizations also practice environmental cost accounting (59.09%) and follow the guidelines provided in ISO 14031 (27.27%). While various tools, such as EMAS, KPIs, ISO/TC 14033, LCA, and ISO 14051, are available for evaluating an organization's environmental performance, their utilization still needs to be improved. None of the surveyed organizations have yet implemented indicators derived from the CSRD directive for ESG reporting.

Among the key environmental objectives set by the surveyed organizations, ensuring compliance with legal requirements and other environmental protection obligations (76.47% - definitely important, 17.65% - important, 5.88% - rather important) and reducing their negative environmental impact (47.06% - definitely important, 47.06% - important, 5.88% - rather important) are of paramount significance. Specific areas such as reducing energy consumption, water usage, and waste generation received equally high ratings regarding importance (35.29%) and importance (64.71%). Other areas of great importance in the surveyed organizations' environmental objectives include reducing environmentally hazardous situations (29.41% - definitely important, 58.82% - important, 17.65% - rather important), improving wastewater quality (35.29% - definitely important, 58.82% - important), enhancing air quality (23.53% - definitely important, 76.47% - important), and reducing emissions of pollutants into the air (23.53% - definitely important, 64.71% - important, 5.88% - rather important, and 5.88% - less important). Environmental objectives were also related to management areas, such as increasing employee environmental awareness (29.41% - definitely important, 58.82% - important, 11.76% - rather important), streamlining communication processes (17.65% - definitely important, 58.82% - important, 17.65% - rather important), and improving the management of environmental aspects (17.65% - definitely important, 58.82% - important, 17.65% - rather important).

Factors influencing the environmental effectiveness of organizations in the dairy industry are categorized into four areas:

- economic factors,
- social factors,
- legal factors,
- organizational factors.

Among the economic factors that significantly stimulate the environmental effectiveness of the surveyed organizations, we can include the opportunity to acquire funds, grants, and loans (77.27%) and the awareness of monetary benefits associated with the environmental efficiency of these organizations (72.73%). The funds are directed towards various eco-friendly investments such as upgrading wastewater treatment plants, new equipment to improve air quality, incorporating renewable energy sources, and new technological solutions to reduce the

organization's environmental impact, enhancing its effectiveness. Particularly in the case of environmental investments, a barrier to absorption in the dairy industry is the limited access to knowledge, advisory support, government backing, and specific incentives such as financial support, suitable training programs, or a tax-friendly policy (Gralak et al., 2022). Among the economic factors that significantly stimulate environmental effectiveness, 59.09% of the representatives from the surveyed organizations included tax incentives, eco-friendly investments, and high fees for environmental usage. These factors encourage organizational leaders to initiate actions to minimise the negative environmental impact, as their absence could lead to substantial financial losses. The environmental effectiveness of the surveyed organizations is also significantly influenced by the high costs associated with material consumption and the use of resources such as water, energy, and gas. This has become particularly important in the recent period due to the conflict in Eastern Europe, which has led to a dramatic increase in resource costs, compelling management to introduce cost-saving solutions. It is important to note that these actions should not compromise the quality of dairy industry products.

Moreover, market requirements (86.36% strongly and somewhat stimulate) also boost organizational environmental effectiveness. This is directly linked to the entire organizational environment and stakeholders influencing the organization's activities. Factors related to the lack of government incentives, insufficient support and funding (72.73%), and the absence of the influence of environmental activities on tax relief (54.54%) can also impact not achieving environmental outcomes. If increased government incentives translated into tax relief, many managers of the surveyed organizations would allocate more resources to activities to minimise the environmental impact, expecting financial benefits. The suspension of EU funding does not promote organizational development and, consequently, the achievement of environmental effectiveness by these organizations. The research results are presented in Figure 1.

A significant social factor that strongly stimulates the environmental effectiveness of the surveyed organizations is the desire to enhance the organization's reputation (63.64%). Organizational leadership with a substantial environmental impact often makes decisions to improve its reputation, often tied to corporate social responsibility (CSR) activities. In addition, representatives from the surveyed organizations identified several other drivers of environmental effectiveness. These include employee awareness and engagement (22.73% strongly stimulates, 63.64% rather stimulates), societal pressure (22.73% strongly stimulates, 40.91% rather stimulates), customer pressure (18.18% strongly stimulates, 59.09% rather stimulates), and pressure from other stakeholders (13.64% strongly stimulates, 63.64% rather stimulates). These factors are closely related to stakeholders' environmental awareness and environmental activities. However, the need for more environmental awareness among the general public and employees can hinder an organization's environmental effectiveness. The research findings are presented in Figure 2.

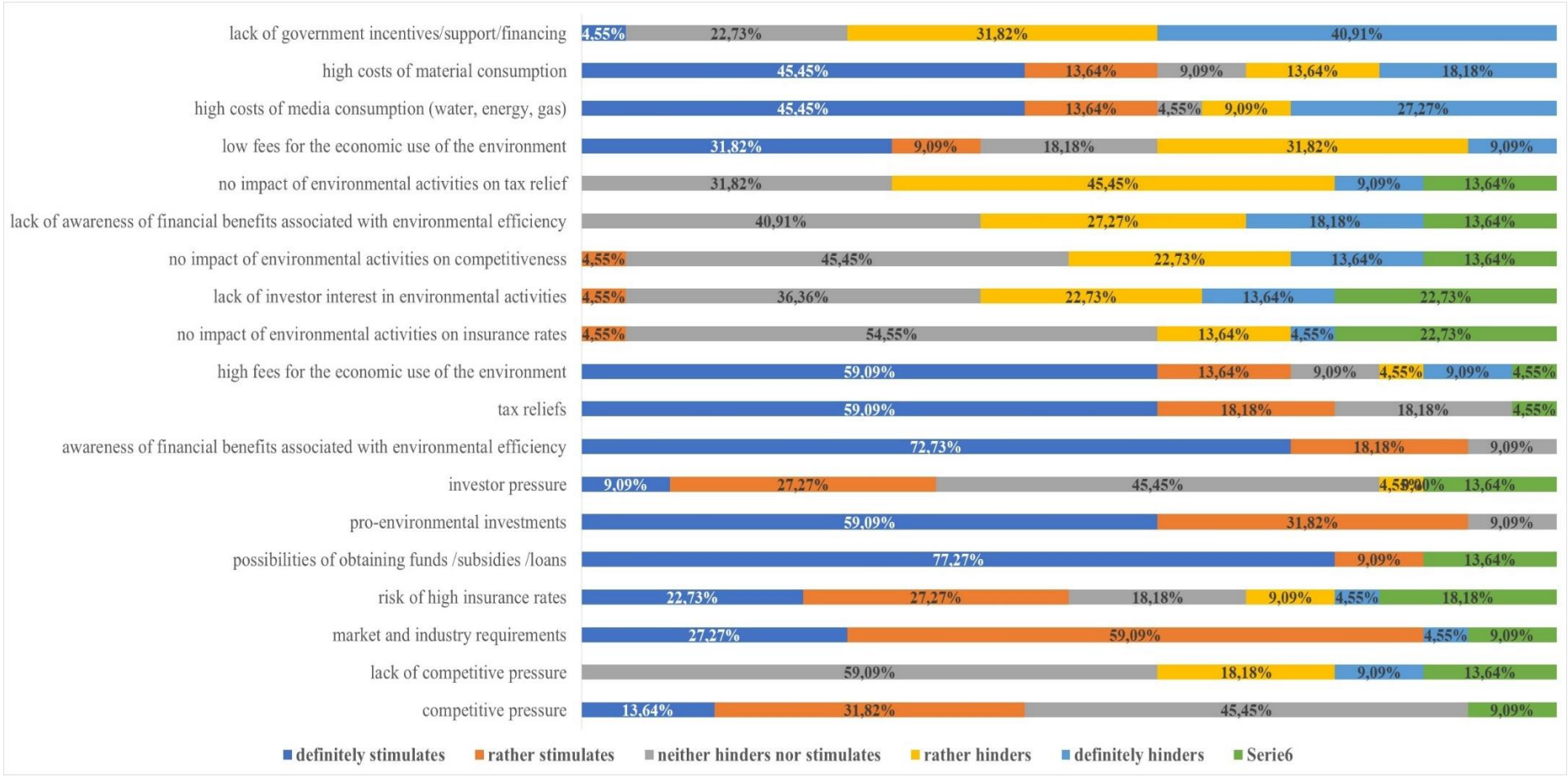

Figure 1. Economic factors affecting the environmental efficiency of your organization.

Source: own elaboration.

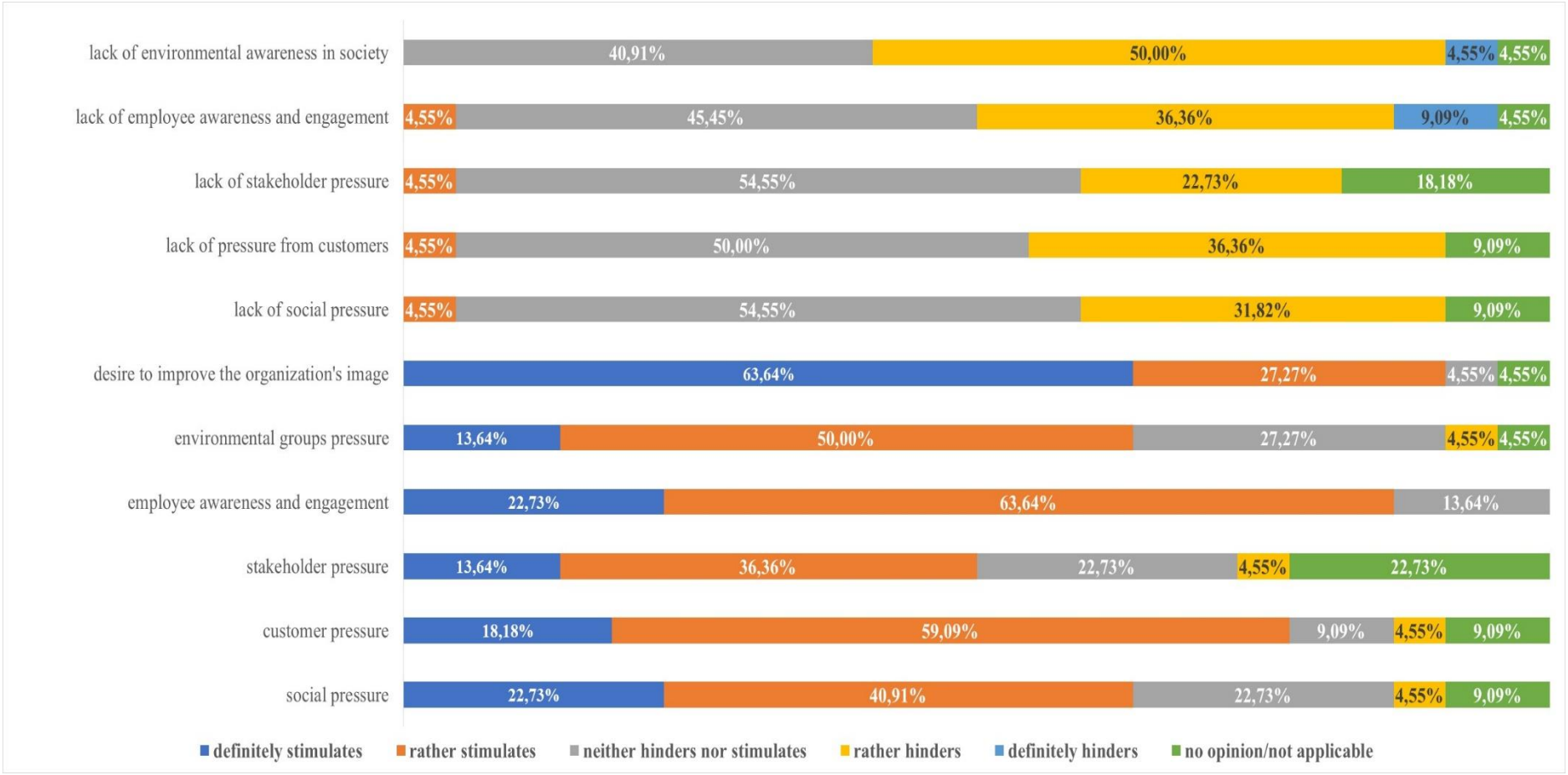

Figure 2. Social factors affecting the environmental efficiency of your organization.

Source: own elaboration.

Among the most significant legal factors that stimulate the environmental effectiveness of the surveyed organizations, representatives identified changes in legal requirements regarding environmental protection (22.27% strongly stimulate, 31.82% rather stimulate). Additionally, sector-specific reference documents and best environmental management practices were highlighted (18.18% strongly stimulate, 22.73% rather stimulate). Changes in legal requirements related to environmental protection are oriented towards minimizing the negative impact of organizations on the environment and preventing pollution resulting from their activities. Implementing eco-friendly solutions and investments resulting from legal requirements often translate into economic benefits. Information contained in sector-specific reference documents is precious for organizations. These documents, a result of information exchange organized by the European Commission in compliance with industrial emissions regulations, are tailored for specific activities. They describe techniques, current emission and consumption figures, and methods considered when determining the best available techniques. They also provide details about the Best Available Techniques (BAT) conclusions and any new technologies. These reference documents may greatly assist organizations and contribute to achieving environmental effectiveness. Sector-specific reference documents, developed by the Commission by Regulation (EC) No 1221/2009, are essential for helping sector-specific organizations better address key environmental management aspects. They enable assessment, reporting, and improvement of environmental performance. These documents encompass best environmental management practices, environmental performance indicators, and, where applicable, excellence criteria and assessment systems to classify the level of environmental performance in these sectors. Within sector-specific reference documents related to best environmental management practices, sector-specific environmental performance indicators, and excellence criteria, surveyed organizations can refer to the reference document for the food and beverage production sector (Commission Decision (EU) 2017/1508). This document contains best practices and guidelines for the dairy industry, cheese production, and whey recovery. Unfortunately, the surveyed organizations also identified legal factors that significantly or rather hinder their environmental effectiveness. These factors include a complex legal framework related to environmental protection and a need for familiarity with legal requirements for environmental protection. Respondents also highlighted inconsistencies in complying with environmental legal requirements and ineffective oversight by legislative authorities. The research findings are presented in Figure 3.

Another group of factors influencing environmental effectiveness is related to management, known as organizational factors. One factor that strongly and somewhat stimulates the environmental effectiveness of the surveyed organizations is a supportive and engaged management team (59.09% strongly stimulate, 31.82% rather stimulate).

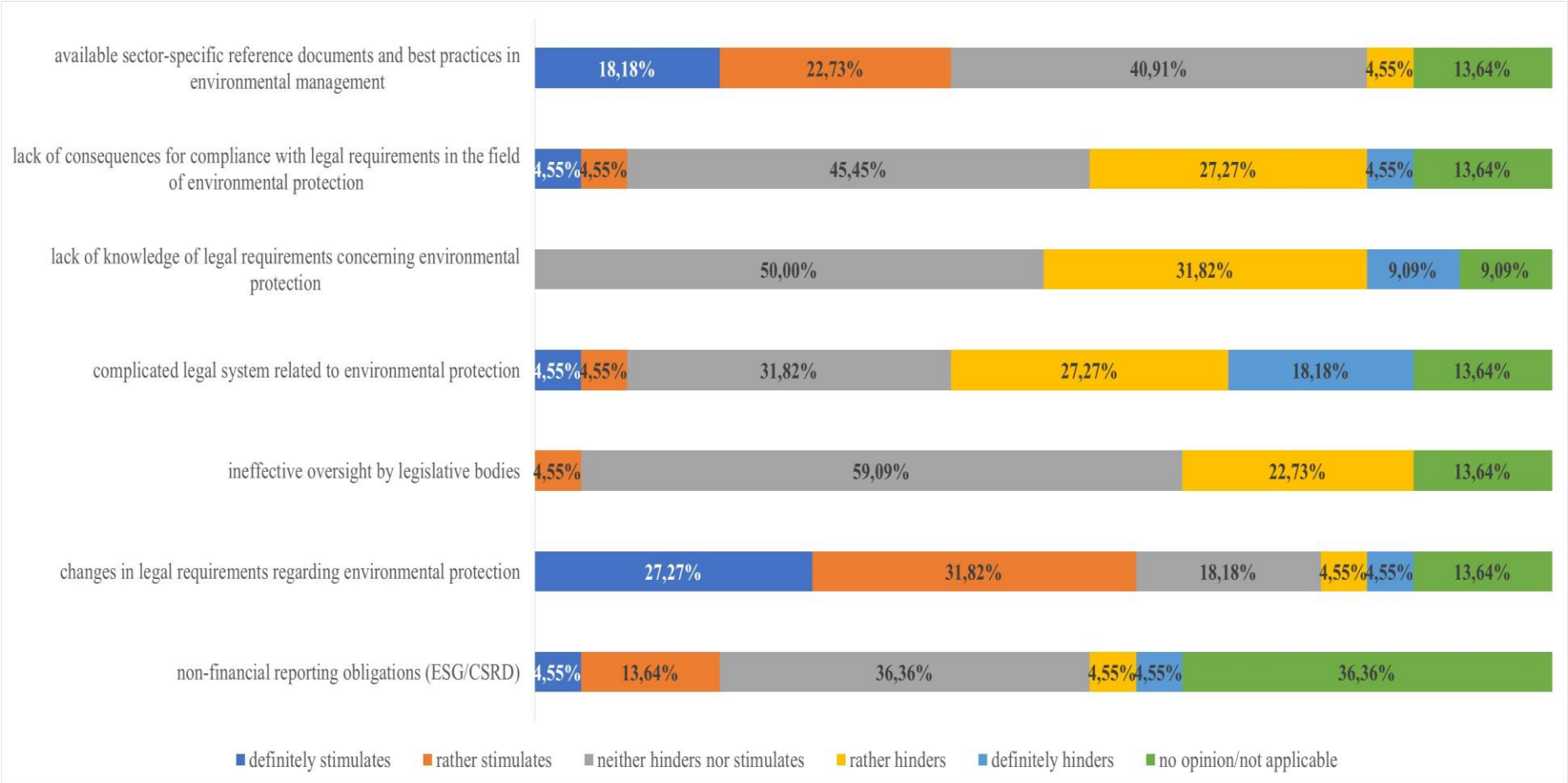

Figure 3. Legal factors affecting the environmental efficiency of your organization.

Source: own elaboration.

The success of an organization depends significantly on the commitment and leadership of its management team, which plays a pivotal role in driving environmental initiatives. The management of the surveyed organizations demonstrates a high level of engagement in environmental activities, guided by a vision focused on environmental actions and the provision of necessary resources. Therefore, an eco-friendly mission, vision, and strategy have been identified as one of the most important factors stimulating the environmental effectiveness of the surveyed organizations (81.82%). Representatives from the surveyed organizations also identified other drivers of environmental effectiveness, including adequate resources (86.36%), technical and technological capabilities of the organization (81.82%), and well-established and executed environmental goals (81.82%). Adequate resources (human, financial, infrastructure, knowledge, and process operation environment) are crucial factors that could be achieved without environmental results. These resources encompass both the technical and technological capabilities of the organization. The more modern the infrastructure and technology, incorporating environmental impact minimization, the easier it is to achieve environmental outcomes resulting from the organization's activities. Moreover, activities related to environmental management systems were also considered as stimulants to environmental effectiveness. It was noted that effective environmental auditing (86.36%), effective corrective and improvement actions (81.82%), systematic compliance assessment with legal requirements for environmental protection (81.82%), the ability to respond to changes in legal requirements (77.27), effective embedding of environmental aspects in business processes (77.27), and a practical risk-based environmental approach (72.73%) are additional determinants of environmental effectiveness in the surveyed organizations. As part of the research, respondents were asked about factors that hinder environmental effectiveness. The most significant barriers to achieving environmental outcomes are more resources for environmental activities (81.81%) and an unsupportive and unengaged management team (77.27%). Additionally, factors negatively affecting the environmental effectiveness of the surveyed organizations include an inappropriate set of environmental indicators and metrics (63.63%) and actions related to the lack of a systematic approach to environmental management, such as ineffective corrective and improvement actions (68.18%), improperly formulated environmental goals (63.64%), the absence of management reviews (59.09%), the lack of environmental elements in the mission, vision, and business strategy (59.09%), and the absence of environmental impact assessments (58.28%). An effective environmental management system allows organizations to achieve significantly greater environmental outcomes. A graphical representation of the organizational factors influencing environmental effectiveness is presented in Figure 4.

Figure 4. Organizational factors affecting the environmental efficiency of your organization.

Source: own elaboration.

Based on the research findings, several recommendations can be made to improve the environmental effectiveness of the dairy products industry. Firstly, government support. The government should provide support, including incentives and knowledge sharing, to facilitate eco-friendly investments within the industry (Alem, 2023) to expedite the adoption of sustainable technologies. For example, the United States dairy industry formed The Dairy Alliance and has set aggressive environmental sustainability goals to achieve greenhouse gas neutrality, optimize water usage, and improve water quality by 2050 (The Diary Alliance).

Secondly, employee engagement. Employee engagement can be an effective way to promote sustainable practices within the dairy industry. For instance, dairy farmers can be encouraged to adopt sustainable practices through training and education programs. Organizations should invest in ongoing environmental awareness programs and motivation initiatives to involve all employees in eco-conscious practices, essential for a holistic approach to environmental responsibility. This shall also include knowledge-sharing and benchmarking opportunities. The industry should focus on continuous compliance with environmental regulations and sector-specific reference documents. Additionally, organizations should share knowledge and collaborate to align with best practices and lessons learned from successful sustainability initiatives (Van Slyke et al., 2021).

Thirdly, the emphasis should be placed on implementing effective environmental management systems based on a risk-based approach. Leadership teams should commit to resource allocation and adopting innovative, eco-friendly technologies to achieve better environmental outcomes. Effective environmental management practices can help reduce the dairy industry's environmental impact. While implementing the environmental management system, organizations shall take a holistic approach considering the entire value chain of the dairy industry, from feed production to milk processing and distribution. The dairy industry can benefit from adopting a circular economy approach, which reduces waste and maximises resource efficiency (Oliveira et al., 2021).

One limitation of the study is its geographical scope, which is limited to Poland. To gain a more comprehensive understanding of the environmental effectiveness of the dairy industry, future research could expand its scope to include multiple countries or regions, allowing for cross-country comparisons and insights into different regulatory environments and cultural influences. The study was focused on the dairy industry's environmental effectiveness and might not cover all sustainability-related aspects. Future research could explore broader aspects of sustainability, such as social and economic sustainability, to provide a more holistic understanding of the industry's impact.

In terms of future research, several ways are worth considering. Firstly, investigating the long-term impact of environmental management systems such as ISO 14001 on the dairy industry's environmental performance could provide valuable insights. Additionally, exploring the potential for circular economy practices in the dairy sector could be an area for further investigation. Understanding how external factors, such as global economic conditions or

international trade agreements, affect the environmental practices of the dairy industry is another promising path for future research. Such studies could provide insights into how external forces influence the industry's environmental effectiveness.

6. Conclusions

Research has shown that various factors influence organisations' environmental effectiveness, stimulating or hindering it. In light of the comprehensive examination of factors influencing environmental effectiveness within the dairy products industry, this study has uncovered essential implications for the industry and individual organizations. To enhance environmental effectiveness, organizational leadership should focus on improving environmental activities in the four mentioned areas because they are closely interconnected. The dairy products industry faces a dynamic landscape with increasing environmental standards and growing societal demands for eco-conscious products.

Our research highlights several key findings. The study identifies economic, social, legal, and organizational factors as key influencers of environmental effectiveness in the dairy industry.

- Economic factors: Access to funding, grants, and loans for eco-friendly investments is essential for modernization and sustainability in the dairy sector. Securing financial support significantly enhances environmental effectiveness. Limited access to knowledge, government support, and incentives remains a barrier.
- Legal factors: Compliance with increasing environmental regulations and sector-specific reference documents is crucial for enhancing environmental effectiveness.
- Social factors: Environmental consciousness, employee engagement, and societal pressure are powerful drivers for improving environmental effectiveness. Promoting awareness and motivation among employees is crucial.
- Organizational factors: Effective environmental management systems, supported by committed leadership, resource allocation, and innovative, eco-friendly technologies, are at the core of environmental effectiveness. A systematic, risk-based approach to environmental management is recommended.

The research is limited to Poland, which affects its geographical scope. Future research could expand to include multiple countries or regions for cross-country comparisons. The study focused on environmental effectiveness and may not cover all sustainability-related aspects. Future research could explore broader aspects of sustainability.

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