

Evaluation of the Deposit System as a Mechanism to Promote Recycling and Reuse of Packaging in Poland

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ABSTRACT:

According to a European Commission regulation, at least 65% of all packaging waste should be recycled by the end of 2025 and 70% by the end of 2030. Poland is highly likely to fall short of meeting the targets. This is an alarming forecast, as recycling rates play a key role in assessing the efficiency of waste management systems, as well as in monitoring progress towards a circular economy. One of the solutions currently being implemented by the Polish government is the packaging deposit system, which is to become operational in October 2025. The aim of this article is to evaluate the deposit system as a mechanism to promote recycling and reuse of packaging in Poland. The literature review, the analysis of statistical data and conduction of a survey made it possible to formulate conclusions for the science and practice of waste management in the context of the transformation towards a circular economy. The results of the survey indicate that the Polish public positively evaluated the assumptions of the deposit system and its positive impact on reducing environmental pollution. On the other hand, a significant barrier of the deposit system is an insufficient information campaign and a deficient educational activity about its implementation.

Keywords: deposit system, recycling rates, waste management, European Union, circular economy

1. Introduction

Almost every day, when following the news reported by the media, one can come across information about serious threats to the natural environment. The exploitation of natural resources has been taking place on a large scale for years, often without adequate concern for future generations. Raw material deposits are exhaustible, which means that their resources are not infinite. Such irresponsible behaviour leads to environmental degradation – air, water and soil pollution, and loss of biodiversity. All this, in turn, contributes to the threat to human life, as human health and safety are closely linked to the condition of the environment.

At the same time, one of the unresolved problems is the excess waste that people generate every day. Rubbish accumulates in forests and landfills, poisoning the environment and threatening ecosystems. This problem requires effective solutions, one of which is recycling. Recycling allows raw materials to be reused, reducing the need to extract new resources and limiting the amount of waste going to landfills. Recycling rates have a crucial role in assessing the effectiveness of waste management systems and monitoring progress towards a circular economy. The higher the recycling rate, the better for the environment, as it means less waste ends up in landfills and more raw materials are recovered and reused. This, in turn, contributes to the conservation of natural resources, reduces harmful emissions and supports sustainable development.

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According to a report by the European Commission, it is highly likely that Poland will not achieve its 2025 goals for preparing packaging waste for reuse and recycling (Zajemska et al., 2024). The recycling targets are set out in Directive (EU) 2018/851 and require each Member State to recycle at least 65% by weight of all packaging waste by 31 December 2025. These targets are significantly higher than those previously achieved by many countries. By 2030, the overall packaging recycling target will increase to 70%, forcing EU countries to further improve their collection and recycling systems.

In practice, the only possible instrument for achieving these high recycling rates for single-use beverage containers is the implementation of a deposit system (Malindzakova et al., 2022). A deposit-refund system is a mechanism whereby consumers pay an additional fee (deposit) when purchasing goods in packaging covered by the system, which is refunded to them when they return the packaging to a collection point. Many studies have shown the positive impact of deposit systems on reducing the inappropriate dumping of waste (Zhou et al., 2020; Linderhof et al., 2019; Walls, 2013). The introduction of deposit systems should contribute to reducing environmental pollution caused by packaging waste, increasing recycling rates and reducing the consumption of primary raw materials. In addition, it should have an educational impact on society, shape positive habits regarding waste sorting, and constitute another step towards the transition to a circular economy.

The success of the deposit system largely depends on how willingly and regularly consumers return packaging. Research results, such as those conducted by Görgün et al. (2021), show that the key indicator in the proper functioning of the system is the percentage of packaging that consumers return for recycling. The amount of packaging returned depends on the willingness and commitment of consumers. This means that the more people are aware of the benefits of recycling, feel responsible for the environment and have easy access to return points, the more willing they will be to return packaging. On the other hand, lack of motivation, inconvenience or lack of awareness can reduce return rates. Therefore, it is important that the system should be simple, accessible and motivating, and that public education should promote positive attitudes towards the deposit system. The aim of this article is to evaluate the deposit system as a mechanism to promote recycling and reuse of packaging in Poland. In order to achieve this goal, the following research questions were posed:

- What is the public awareness of the deposit system currently being implemented in Poland?
- Does the Polish public support the launch of the deposit system and does it recognize the benefits?
- Does the new deposit system have a chance to become a mechanism promoting recycling and reuse of packaging in Poland?

2. Theoretical background

The earliest economic analyses of the deposit system date back to 44 years ago and was published in the book by P. Bohm (Linderhof et al., 2019). Picuno et al. (2025) cite the Glossary of Environment Statistics definition of a packaging return system as “a

surcharge on the price of potentially polluting products, with a refund of the surcharge granted when pollution is avoided by returning the products or their residuals”. The deposit system is one of the methods to perform Extended Producer Responsibility (Görgün et al., 2021). Deposit systems force producers to adopt clean production methods and guide consumers to hand over waste products to specific institutions for recycling, which is the requirement of circular economy and the purpose of deposit-refund system (Zhou et al., 2020). The deposit system is not only a beneficial model for achieving the high recycling targets, but also, it has various economic and environmental benefits (Table 1).

Table 1: Benefits of a deposit system

Environmental benefits	Author(s)
Achieving the high recycling targets Decrease in sea, land and air pollution Emission savings by recycled materials that are not stored in landfills Increase the amount of packaging recycled Reduce household waste Reduce litter Reducing mining activities to obtain virgin materials Reduction of carbon emissions Saving and effective use of raw materials and resources	Abejón et al. (2020) Fitzsimons et al. (2010) Görgün et al. (2021) Krzywda (2022) Linderhof et al. (2019) Malindzakova et al. (2022) Picuno et al. (2025) Zarebski et al. (2024) Zhou et al. (2020) Zhou et al. (2023)
Economic benefits	
Decrease in fossil fuel-based energy consumption in packaging production Decreasing the waste management cost of local authorities Development of technology and capacities of recycling facilities Engage the socially excluded in collecting litter to redeem deposits Have costs from the system met largely by those who litter or discard waste Increase demand for refillable bottles Recyclable materials do not lose their material value in the containers where they are mixed with municipal organic waste in the landfill facilities (such materials can be recycled into high-quality materials with a source separation model). Reduce the costs of municipal waste management	

Source: own study

In addition to environmental and economic benefits, the implementation of a deposit system also has other positive effects, such as educational benefits, for example increasing the engagement of end users in the process, increasing their environmental awareness (Malindzakova et al., 2022). In addition to increasing recycling rates, the main benefit of a deposit system should be waste reduction. This should happen because producers should not place new glass or plastic packaging on the market. Linking a monetary value to a beverage container, in the form of a refundable deposit, in fact, should decrease the likelihood that the containers are dispersed in the environment, as consumers

are motivated to return them for recycling so that they can claim the refund (Agnusdei et al., 2022).

Koch et al. (2024) define circular consumption behaviour as the individual acts performed by people to satisfy their needs in various areas of life, in which they acquire, use and dispose of goods and services that contribute to the principles of a circular economy (based on Geiger et al., 2018). Consumption, as a key aspect of the circular economy, should focus on extending the life of products and materials through strategies such as sharing, renting, reusing, repairing and recycling. This approach aims to minimise waste and resource depletion, contributing to a more sustainable and resilient economic system. Circular consumers thus not only use products or services but are also active participants in supply and demand chains, contributing to the provision of raw materials through recycling, engaging in repair, maintenance or upcycling activities, and appropriating refurbished, repaired or second-hand products (Rabiu & Jaeger-Erben, 2022). In the case of the deposit system, two key aspects of circular consumption are implemented: extending product lifecycles and reducing waste.

Different countries have implemented different deposit-refund systems, making it difficult to identify similarities and differences in their functioning that could help in implementing such systems in other regions. This variability is influenced by the network of stakeholders involved and the interaction of social, cultural, economic and legislative factors that are crucial to the success of such systems (Picuno et al., 2025; Krzywda, 2022). Nevertheless, the success of a deposit system depends on the balance of several factors, with the key relationship being between the number of return points (or the ratio of return points to population), the deposit value per bottle, and public awareness and motivation to achieve high return rates (Picuno et al., 2025).

3. Recycling rates and deposit systems in the European Union

EU Member States are required to achieve specific levels of selective collection of packaging waste (77% from 2025 and 90% from 2029). In addition, for single-use plastic bottles, they will be required to ensure that these packages, including their caps and lids, contain a minimum weight percentage of: from 2025 – 25% recycled plastic and from 2030 – 30% recycled plastic (Regulation EU 2025/40). According to a report published by the Institute of Environmental Protection – National Research Institute, the recycling rate for packaging waste in Poland in 2022 was 60.4%. More than half of the recycled packaging waste (56%) was paper and cardboard waste. This fraction also recorded the highest recycling rates, amounting to 89.1% or 83.9%, depending on the methodology used (Raport IOS-PIB, 2022).

According to Statistics Poland (2025), in 2024 the average Pole produced 376.9 kg of municipal waste. This is the largest increase in 10 years. In 2022-2023, the difference in the amount of waste generated per capita was 2 kg – in 2022 it was 355 kg, and in 2023 it was 357 kg. As previous data show, the amount of municipal waste per capita has been slowly but steadily increasing since the beginning of the 21st century. These data refer only to municipal waste, which accounts for only 11% of all waste generated in our country. The remaining 89% are waste from economic activity and is classified as industrial waste.

12.2 million tons of waste were collected from households in Poland in 2024, which accounted for 86.2% of all municipal waste generated. The collected municipal waste in 2024 was directed to the following processes: (Statistics Poland, 2025):

- 1) recovery – 7511.0 thousand tonnes (53.0%), including:
 - recycling – 2596.5 thousand tonnes (18.3%),
 - biological processing (composting or fermentation) – 1813.7 thousand tonnes (12.8%),
 - thermal transformation with energy recovery – 3100.8 thousand tonnes (21.9%),
- 2) neutralization – 4260.3 thousand tons (30.1%), including:
 - through thermal conversion without energy recovery – 3200 tonnes (0%),
 - by landfilling – 4257.1 thousand tonnes (30.1%).

At the end of 2024, there were 247 landfills for municipal waste, occupying a total area of 1627.4 ha. In 2024, 7 landfills with a total area of 13.9 ha were closed (Statistics Poland, 2025).

The above data may seem alarming, but on the other hand, Poles are better off than the inhabitants of many European countries – they generate much less municipal waste than the average European (the EU average in 2023 was 511 kg per capita, in Germany 601 kg per capita, in Norway 724 kg per capita and in Belgium 689 kg per capita). According to available data, only the average resident of Albania generated less waste than the average Pole, with only 306 kg of waste generated in the entire year of 2023. Unfortunately, Eurostat has not yet published detailed data for 2024, so when comparing Poland with other EU countries, information for 2023 was used (Eurostat). Such large disproportions between EU countries may be due to differences in consumption patterns, the wealth of societies, but also different calculation methodologies.

In 2023, the level of municipal waste recycling in Poland was 15.8%, a decrease from 2022 (Statistics Poland, 2025). Meanwhile, 48% of municipal waste in the EU was recycled (material recycling and composting) in 2023 (Eurostat). In a broader time perspective, the amount of municipal waste recycled in the EU increased from 19% (in 1995) to 48% (in 2023), and the amount of landfilled waste decreased to 51 million tons in 2023 from 70 million tons in 1995. At the same time, the amount of municipal waste destined for incineration increased from 28 million tonnes (70 kg per capita) in 1995 to 58 million tonnes, or 129 kg per capita, in 2023 (Eurostat).

Currently, 180 million people in Europe, i.e. more than a quarter of the population, use the deposit system. It operates in sixteen European countries (Figure 1). Due to the strict legal requirements regarding packaging waste, more and more countries, including Austria, Belgium, Spain, Portugal, and the United Kingdom, are considering its introduction (Zero Waste, 2025). Somewhere between Italy and France, which remain at the stage of unfulfilled promises, and Belgium, which is already ready to introduce a deposit system, is Poland (the deposit system is to start functioning from 1 October 2025).

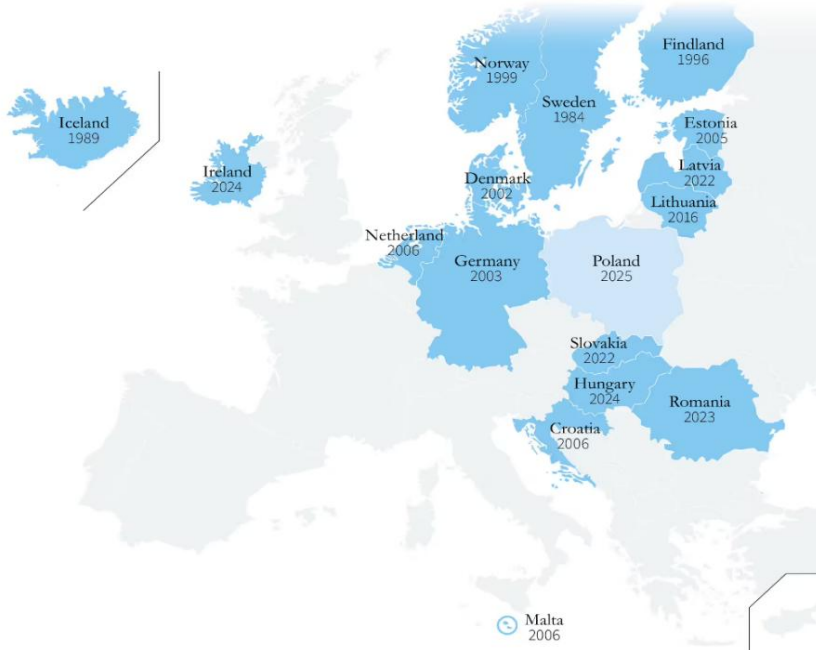


Figure 1: The deposit system in Europe and the year of introduction
 Source: own study based on Krymski (2024) and Zero Waste (2025)

The deposit system in Poland is the result of EU regulations aimed at increasing the level of plastic packaging recycling and reducing the amount of single-use waste. The key role here is played by Directive (EU) 2019/904, which aims to reduce plastic waste in the environment.

Deposit system is a mechanism that supports recycling and reuse of packaging. In Poland the system will be implemented by entrepreneurs who put beverages in packaging (producers, importers, brand owners) and stores that offer products in packaging for beverages covered by the deposit system. Companies producing beverages in packaging included in the system will be required to place a label on the packaging indicating the system to which it belongs and the amount of the deposit. In Polish regulations, it was decided that the deposit system would cover not only plastic packaging required by Directive (EU) 2019/904, but also glass bottles and metal cans. For sanitary reasons, the deposit system does not apply to milk beverage containers.

4. Survey research methodology

A survey was conducted from April to June 2025. The survey involved 100 respondents over the age of 18. A convenient sampling was used. The survey questionnaire was prepared in an online form on the free Google Forms platform. The questionnaire contained five simple questions, which made it easier for respondents to participate and increased the number of responses. This type of survey is conducive to obtaining

information in a short time, especially when the researcher is interested in the high availability and convenience of respondents.

The convenience sampling, as one of the non-probability methods of selecting a research sample, is mainly used in situations where the priority is to collect data quickly and relatively cheaply, and the aim of the study is not to generalise the results to the whole population, but rather to make a preliminary diagnosis of the phenomenon or to assess the directions for further analysis. This type of selection is dictated by the researcher's capabilities (often financial) rather than theoretical premises (Świdarska et al., 2023; Brzeziński, 2019). In this study, due to its exploratory nature, it was decided to select respondents who were easily accessible to the researcher, which allowed for efficient data collection in a short time and with limited resources. The respondents were people from the researcher's close community, i.e. family members, friends and their acquaintances, which made it possible to obtain answers to the research questions and identify potential relationships that could be explored in further research. Although this type of sample does not meet the criteria for representativeness, it is a valuable source of information in a pilot context, where it is crucial to identify the main trends and collect material for preliminary analyses.

The sample included people aged 18-79 living in Poland. The structure of the sample differs from the general population, including in terms of gender and age, which limits the possibility of generalising the results. The general characteristics of the respondents are presented in Table 2.

Table 2: Characteristics of respondents

Gender/Year of birth	1946-1964	1965-1980	1981-1994	1995-2007	In total
Female	7	23	23	17	70
Male	1	8	5	14	28
Refusal to answer	0	1	0	1	2
In total	8	32	28	32	100

Source: own study

Despite its practicality, the convenient sampling method has significant limitations. One of the main risks is the possibility of bias in the sample, resulting from the fact that participants are not selected at random. This can lead to distorted results and limit their representativeness of the entire population. Therefore, although convenience sampling facilitates efficient data collection, researchers should carefully assess its impact on the reliability and usefulness of the results obtained (Świdarska et al., 2023).

5. Survey results

The first question was designed to check whether respondents were aware that a new deposit system for packaging was being introduced in Poland (Figure 2). This is

important because knowledge of such a system can influence their attitudes and behaviours related to recycling. If people have heard about this solution, they may be more inclined to use the return points, follow the rules, and actively participate in the system. On the other hand, people who haven't heard about it may not know how the system works, which can limit their involvement and affect the effectiveness of the entire initiative.

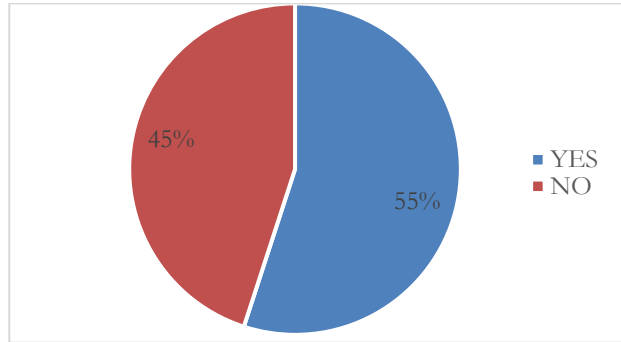


Figure 2: Respondents' awareness of the new packaging deposit system in Poland

Source: own study

The proportions of responses, i.e., 55% of respondents have heard about the introduction of a new deposit system for packaging in Poland, and 45% have not, show that the majority of society is already aware of this solution. This is good news, as it means that more than half of the people are familiar with the new regulations and may be more willing to actively participate in the recycling system. However, on the other hand, 45% of respondents had not heard about it, which indicates the need for intensified education and information activities. Lack of knowledge in this group may limit the effectiveness of the system, as unaware individuals may not use the return points or understand the benefits of this solution.

The next question concerned the types of packaging that people would like to return as part of the deposit system in Poland (respondents could select more than one answer).

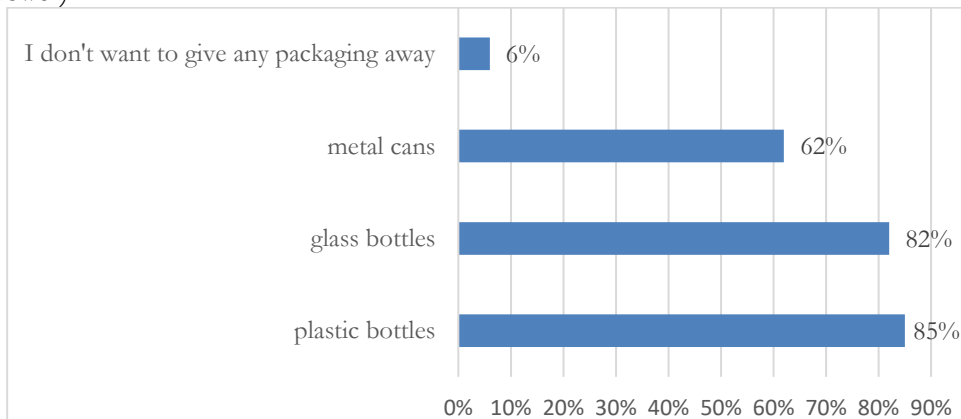


Figure 3: Preferred types of packaging for return within the new deposit system in Poland

Source: own study

Data presented in Figure 3 show which types of packaging are most desirable for return under the deposit system in Poland. The largest group were people who wanted to recycle plastic bottles – as many as 85%. This is not surprising, as plastic bottles are common, easily accessible, and often associated with recycling. A high percentage (82%) of respondents would also like to return glass bottles, and 62% would like to return metal cans. In the "other" category, one person said they would also like to return all glass containers and plastic boxes, such as those used for fruit. In turn, 6% of respondents declared that they do not want to return any packaging, which is a positive sign, as it means that the majority is willing to participate in the system. These data suggest that society is willing to recycle various types of packaging, especially the most popular and commonly used ones. This, in turn, may indicate a high level of environmental awareness and willingness to engage in pro-environmental activities. However, it is important that the system is well organized and accessible to everyone, so that these intentions can be translated into real actions and an increase in the amount of packaging returned.

In the next question, respondents were asked to evaluate the deposit amounts for individual packaging that will be in force in Poland from 1 October 2025 (Figure 4). This question was crucial, because evaluating the deposit amounts for different packaging allows understanding how society perceives the costs associated with recycling and whether they are motivating them to return packaging. Respondents were asked to evaluate whether the proposed amounts are appropriate, too high or too low.

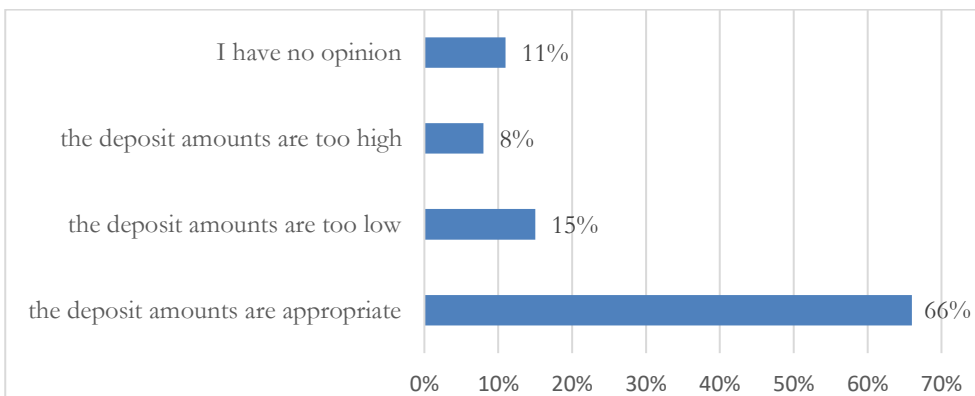


Figure 4: Assessment of planned deposit amounts for packaging

Source: own study

The fact that 66% of respondents considered the deposit amount to be appropriate means that most people accept the proposed amounts and see them as motivating, but not excessively burdensome. In turn, 15% believed that the deposit was too low, which may suggest that for this group, increasing the amount could further encourage the return of packaging and increase the effectiveness of the system. 8% of respondents stated that the deposit was too high, which may indicate concerns about excessive financial burden, especially for people with lower incomes. However, 11% had no opinion, which is natural in surveys – it may be due to a lack of sufficient knowledge or simply a reluctance to express an opinion on the subject. In summary, these results

suggest that the majority of society is satisfied with the proposed amounts, but there is also a group that sees the potential for their possible adjustment. This is important information for decision-makers who can use it to optimize the system to make it as acceptable and effective as possible.

In the next question, respondents were asked if they thought the deposit system for packaging would have a positive impact on the environment.

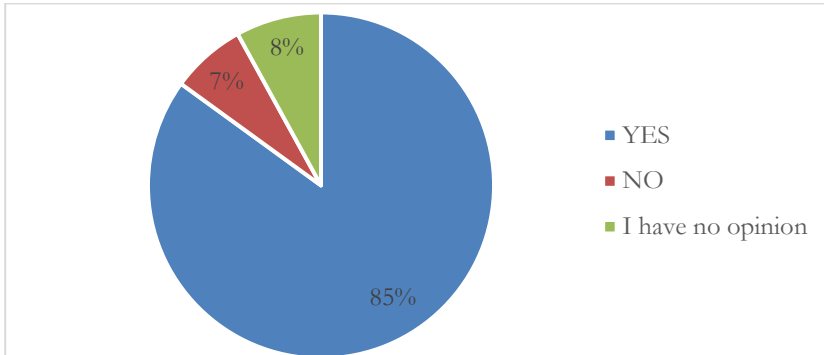


Figure 5: Assessment of the impact of the deposit system for packaging on the environment
Source: own study

The result that 85% of respondents believe that the new deposit system in Poland will have a positive impact on the environment shows that most people are optimistic and believe in its beneficial impact (Figure 5). This is a very important signal, because it means that society recognizes the ecological benefits of such a solution and is willing to support it. In turn, only 7% of the respondents were sceptical, which may indicate the need for further education or explanation of how the system works and what benefits it brings. 8% of the respondents had no opinion, which shows that not everyone has full knowledge on the subject. Generally speaking, these results are very positive and can be a solid basis for further actions promoting and developing the deposit system, because the society already sees its potential for environmental protection.

In the last question, respondents were asked to assess their support for the introduction of a deposit system in Poland (Figure 6).

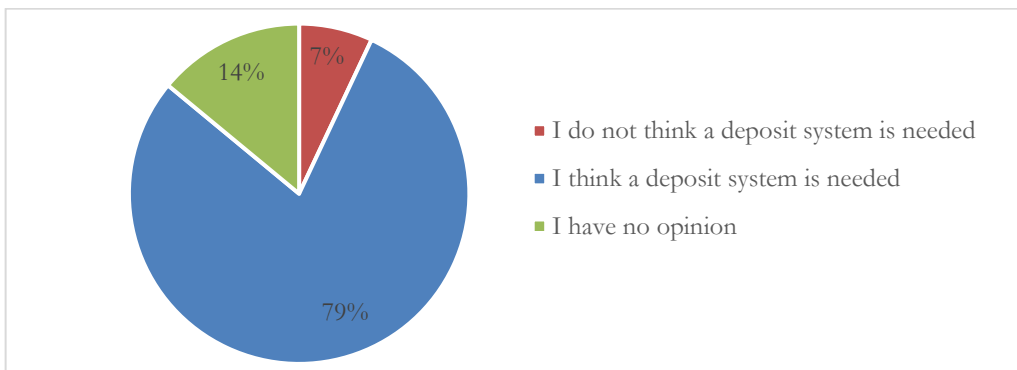


Figure 6: Assessment of support for the introduction of the deposit system in Poland
Source: own study

The fact that 79% of respondents believe that a new deposit system in Poland is needed shows that the majority of society recognizes its value and benefits. This is a strong indication that people are aware of the problems related to waste and are willing to support solutions that can help solve them. In turn, only 7% are opposed to the idea, which suggests that there is little resistance to the system. 14% had no opinion, which may indicate a need for further education or information about the system. Overall, these results show a high level of social acceptance and can provide a solid basis for further actions to introduce a deposit system in Poland.

5. Discussion and conclusion

The aim of this article was to evaluate the deposit system as a mechanism to promote recycling and reuse of packaging in Poland. Survey results indicate that there is a generally low level of public awareness – only 55% of respondents knew that a new deposit system was being implemented in Poland. Understanding the level of public awareness on this topic is crucial for assessing how well the new system functions and what educational measures may be needed to increase its effectiveness. The results indicate the need to intensify information activities to reach as many people as possible and increase general social awareness about the deposit system for packaging. This, in turn, can contribute to even better functioning of this solution and achieving the intended goals. These findings are consistent with the results of Konstantoglou et al. (2023), who confirmed that citizens' opinions about the packaging return and recycling system affect their participation in the process. This influence is positive, which means that authorities should take specific marketing actions to promote the packaging return system, explaining to consumers why they should participate in it and what benefits they can gain from it. It is becoming clear that decision-makers should provide consumers with more incentives and improve their perception of the packaging return system to increase their participation in this process. Additionally, the fee that consumers receive for each recycled product could be increased to make the packaging return system more attractive (Konstantoglou et al., 2023).

The results of the survey indicate that the respondents positively evaluated the assumptions of the deposit system and its positive impact on reducing environmental pollution. If the majority of respondents believe that the packaging system will have a positive impact on the environment, it means that they have a high level of environmental awareness and believe in the effectiveness of such solutions. Such support is very important, because decision-makers often take public opinion into account when making decisions. Generally, the more positive reviews, the greater the chance of successful implementation and social acceptance of this solution. These results are consistent with the views of Picuno et al. (2025), who argue that integrating environmental and social issues is crucial, and that designing deposit systems with social aspects in mind should be a priority. For comparison, a study of Spanish consumers' perceptions of a deposit system for packaging revealed that several factors influence attitudes: availability of information, public engagement, and the clarity of the system's mechanism (Roca i Puigvert et al., 2020).

Many research findings indicate that deposit systems are an effective tool for preventing uncontrolled waste disposal and increasing recycling rates (Zhou et al., 2020). This is confirmed by examples from various EU countries. In Sweden, where the deposit

system has been in operation for the longest time in Europe, the packaging return rate is around 85-90%. In Norway, known for one of the most advanced deposit systems, recycling rates reach around 97-98%. In Germany, which has one of the most developed deposit systems, the packaging recycling rate is around 98% (Eurostat, European Environment Agency). Modern deposit systems in neighbouring countries, such as Slovakia, where it was implemented in January 2022, achieved a collection rate of over 70% in its first year of operation. This means that in this country, 7 out of 10 bottles and cans were returned to the system operator (Toborek, 2023).

On the other hand, the conclusions formulated by Agnusdei et al. (2022) raise serious doubts about the success of the new deposit system in Poland. The authors emphasise that the deposit system for glass packaging has not contributed to a reduction in consumption and waste compared to other systems. In actuality, the consumption rate of glass packaging during the period under study in countries that implemented the deposit system was consistent with the rate in countries that did not adopt it.

When analysing reports (e.g. Deloitte, 2024) and government documents and publications (System Kaucyjny, 2025), attention should be paid to the numerous infrastructural, financial, legal and social barriers to the implementation of the deposit system in Poland. The most important of these are: lack of adequate infrastructure, market fragmentation and lack of a coherent policy, costs of implementing and maintaining the system, low public awareness and consumer habits, lack of an adequate legal framework (implementing acts), logistical problems and the supply chain. Overcoming these barriers requires coordinated action at the government, local government and industry levels.

In the case of Poland, the biggest challenge seems to be information and educational campaigns aimed at the public. In 2024, 42% of municipal waste was collected selectively, and 58% was sent to mixed waste (Statistics Poland, 2025). Despite growing environmental awareness, burning waste in fireplaces or central heating furnaces is a thriving practice in Poland. It is estimated that only 40%-50% of PET bottles introduced to the market are collected by recycling plants. The remaining bottles “disappear” from the statistics, just like other packaging that was introduced to the market but never made it to the garbage truck. Therefore, the actual amount of waste generated may be higher than that indicated in statistical reports (Eko bez kantów, 2025).

Without an educational campaign, the implementation of the new deposit system may not achieve the expected results, and the recycling rates of packaging waste will likely remain low.

The presented research results fill a knowledge gap, as there have been no published data on how society assesses the assumptions of the new deposit system. In this way, these results represent an important step towards a more informed and effective implementation of the deposit system, taking into account the opinions of society. Future research should focus on this challenge and more thoroughly examine the factors affecting the feasibility and effectiveness of the deposit system, which may result from, among other things, the number of available collection points, the amount of the deposit required for glass packaging, and the ease of its recovery. Future research should focus on analysing the rates of returned packaging and regional differences. It would be useful to examine the role of financial incentives and the density of return points, which could provide data.

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