

CONSUMER PERCEPTIONS IN THE IMPLEMENTATION OF DEPOSIT RETURN SYSTEM

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Abstract

The population plays a crucial role in the successful implementation and operation of the Deposit Return System (DRS). In this context, the research analyzes consumer perceptions and behaviors, focusing on their level of knowledge, attitudes, and intentions to use the system. To gain a detailed perspective, a survey was developed and conducted, targeting consumers to assess their awareness, expectations, and concerns regarding the DRS. The research methodology combines qualitative and quantitative methods, including an in-depth literature review, comparative analysis of international systems, examination of the existing legislative and institutional framework, and a survey of key stakeholders in the waste management sector. The survey aimed to identify consumers' level of awareness, expectations, and concerns about the system, as well as their understanding of the positive impact of DRS on the environment and economy. The results highlight the fundamental role of the population in optimizing the DRS and emphasize the need for information and education campaigns to encourage active participation and raise awareness of the benefits of the circular economy.

Key words: Deposit Return System (DRS), consumer perception, circular economy, waste management, public awareness, sustainability strategies

INTRODUCTION

In the context of global concerns regarding environmental protection, the transition to a circular economy in order to collect and recycle wastes of all kinds is compulsory (Croitoru et al, 2024 [7]; Gknountani and Tsoulfas, 2021 [12]; Tarhini et al., 2022 [25]) The efficient management of packaging waste represents a major challenge and problem for the Republic of Moldova. Of the total waste generated in the country, only a small part is recycled. The latest Report of the Environmental Agency indicates that in 2023, enterprises in the Republic of Moldova generated a total of 372.4 thousand tons of waste from various economic sectors, which represents a significant increase of approximately 41% compared to 2022. Municipal waste constituted approximately 16% of the total waste generated by enterprises, equivalent to 56.2 thousand tons. This waste comes exclusively from the technological processes and commercial activities of enterprises, without including household waste from households.

(Environmental Agency (2025) [10]. At the same time, in 2023, 191.9 thousand tons of waste were recovered, compared to 172.2 thousand tons in 2022. Of this, glass waste was recovered in an amount of 45.1 thousand tons, compared to 31.1 thousand tons in the previous year, and the amount of plastic waste recovered reached 4.4 thousand tons, an increase from 3.9 thousand tons in 2022. The results of a study show that in 2021, a quantity of 1.3 thousand tons of plastic packaging was placed on the Moldovan market, which corresponds to about 19.5 kg/capita (Perciun, 2022) [20]. Deposit return schemes (DRS) have demonstrated remarkable effectiveness in increasing the collection and recycling rates of packaging in many European countries. DRS is a system that combines a tax on the consumption of products with a refund when the product or its packaging is returned for recycling. These schemes are used for a variety of products, including beverage containers, batteries, motor oil, tires and various hazardous materials. Walls (2011) [27]. DRS can ensure high collection rates for beverage packaging,

reaching up to 98% in Germany (Görgün et al., 2021) [13].

One of the keys to the success of a modern DRS is setting ambitious collection targets, ensuring a minimum deposit of \$0.10, including all relevant stakeholders in the system, and financing the system by manufacturers. (Reloop North America, 2023) [22]. A study on consumer perceptions of the effectiveness of the Packaging Deposit Return System was conducted in Greece. The study aims to measure both the impact of consumer motivations on the use of the DRS and how their perception influences recycling participation. Among the main conclusions is that environmental motivations have a positive and significant effect on both consumer perception of the system and its adoption. At the same time, the study highlights technical and logistical problems (such as equipment failures and insufficient collection points) that hinder the efficiency of the system (2023).

DRS has advantages over other waste management policies, such as taxes on virgin materials or subsidies for recycling. DRS avoids the problem of illegal dumping and provides a direct incentive for consumers to return packaging (Walls, 2011) [27].

Implementing a DRS involves a number of costs, such as purchasing and installing the collection infrastructure, operating the system and transporting the packaging. These costs can be covered by contributions from producers, by the value of the uncollected guarantee from consumers or by government subsidies. It is important that the system is designed in a financially sustainable way, ensuring a balance between costs and benefits. In the specific context of the Republic of Moldova, where the separate waste collection rate is low and the waste management infrastructure is still under development, understanding public perception and expectations is crucial for the success of the DRS implementation. (Timofei et al., 2024) [26].

Based on these considerations, we decided to conduct a survey that would outline a picture of the level of information and openness of the population of the Republic of Moldova towards the introduction of the DRS. A survey

on the implementation of the DRS can provide valuable information for authorities and decision-makers: such as: public perception of the DRS, the degree of willingness of citizens to participate in the DRS, factors that could influence the success of the DRS implementation. This comprehensive methodological approach not only allows for a nuanced understanding of consumer attitudes, but also facilitates the identification of trends and potential barriers in the adoption of sustainable practices (Iordachi et al., 2024) [14]. Leveraging quantitative data obtained from the survey, the study provides a comprehensive perspective on consumer behavior, allowing for more targeted strategies to promote sustainability. Thus, the main purpose of this research was to analyze consumer perceptions regarding the implementation of the Deposit Return System (DRS), focusing on assessing the level of knowledge, attitudes and intentions to participate in the system.

In order to investigate this, we proposed the following hypotheses for testing:

H1: The current level of consumer awareness about DRS has a positive and significant effect on the intention to participate in the system. This hypothesis is based on the findings of Konstantoglou et al. (2023) [16] and Rietz (2022) [23], which demonstrate the direct correlation between the level of information and active participation in the system.

H2: Economic motivation has a stronger influence on the intention to participate in DRS compared to ecological motivation. According to some studies, perceived economic benefits have a positive and significant effect on the intention to participate in DRS (Dăce et al., 2013) [8], (Broniewicz et al., 2023) [6].

H3: The perception of logistical barriers has a significant and negative effect on the intention to participate in DRS. The hypothesis is based on the research of Rietz (2022) [23] and Kremel (2023) [17], which emphasize the importance of accessibility and simplicity of the return process, as well as on the studies of Laasasenaho et al. (2022) [18] on the specific challenges of rural areas.

These hypotheses will be empirically tested to assess the determinants of the success of DRS

implementation in the specific context of the Republic of Moldova, thus contributing to the development of effective implementation strategies and improving participation rates in the system. This analytical study will serve as a scientific basis for identifying the critical factors influencing the success of the DRS, thus contributing to the optimization of waste management strategies and the promotion of the circular economy in the Republic of Moldova.

Literature review

The Deposit Return System (DRS) is an essential component in modern waste management and the circular economy, its effectiveness being determined by the interaction between multiple socio-economic and logistical dimensions. Research in the field highlights that the success of DRS implementation depends on several interconnected factors. The complex interaction between these factors determines both consumer behavior in relation to the system and the ability of the DRS to achieve its sustainability and economic circularity objectives.

Research shows that consumer awareness is the foundation of DRS success. Thus, consumer participation and satisfaction are directly proportional to their understanding of the system (Konstantoglou et al., 2023 [16]; Rietz, 2022 [23]). Accordingly, when consumers are well informed about DRS mechanisms and associated incentives, their probability of participation increases significantly, while lack of information represents one of the main barriers to adopting the system (Li & Zhang, 2019 [19]; Jarossová & Gubíniová, 2022 [15]).

Closely related to the level of information, a determining role in the success of DRS is played by economic aspects and financial incentives. Deposit-refund systems can generate significant savings in waste management, benefits that extend beyond the individual consumer to the whole of society (Dăce et al., 2013) [8]. This perspective is reinforced by research from Poland (Broniewicz et al., 2023) [6], confirming the substantial economic benefits of introducing DRS for plastic packaging. A particular aspect

highlighted by Biala & Aregbeyen (2018) [5] is that the amount of the deposit directly influences consumer behavior - higher deposit amounts significantly increasing the likelihood of product returns.

Beyond economic aspects, the literature highlights the critical importance of logistics in the successful implementation of DRS. Rietz (2022) [23] and Kremel (2023) [17] highlight that ease of return is essential for consumer participation, and the accessibility of return points and the simplicity of the process are decisive factors, especially in rural areas (Laasasenaho et al., 2022) [18].

Other aspects that significantly influence the success of DRS highlighted by researchers include environmental protection, cultural-social values and trust in the system. Thus, understanding the role of the system in environmental sustainability and the circular economy improves consumer attitudes (Pinter et al., 2021 [21]; Zorpas, 2024 [28]), aligning DRS with waste management strategies generates superior results in recycling and pollution reduction (Addy et al., 2014 [2]; Faria & Vale, 2019 [11]), perceptions of DRS effectiveness are shaped by pre-existing cultural attitudes towards recycling and environmental responsibility (Konstantoglou et al., 2023) [16], and the sense of fairness and trust in the transparency of the system determines the long-term commitment of participants (Rietz, 2022 [23]; Kremel, 2023 [17]). Within the cultural-social dimension, social norms also have a particular impact, as consumers are much more likely to participate when they observe similar behaviors in their peers, with collective behavior acting as a powerful catalyst for system adoption (Sari et al., 2021 [24]; Adanu et al., 2023 [1]). Perceived environmental benefits are the starting point for motivation, while cultural context and social norms shape how it's applied locally. Ultimately, transparency facilitates the shift from externally motivated behavior to an internalized social norm.

Demographic factors such as age, education, and socio-economic status also have an impact on perceptions and behaviors related to DRS. Rietz (2022) [23] and Kremel (2023) [17] show that younger generations tend to have more

positive attitudes towards sustainability initiatives, including DRS. Accordingly, there is a need for a personalized approach in the communication and implementation of the system.

The success of DRS implementation depends both on the technology that facilitates access and use of the system, and on effective marketing and communication strategies, through which this technological infrastructure can radically transform consumer perceptions. Messages that combine individual benefits with positive impacts on the community and the environment are powerful tools for stimulating active involvement in the system. The analysis of the international literature on the success factors of DRS systems suggests how essential it is to assess the applicability of these findings in the specific context of the Republic of Moldova, taking into account local socio-economic and cultural peculiarities.

Adapting the conclusions from the literature to local realities, we highlight that the level of information is the foundation of any functional DRS system in the Republic of Moldova, with research demonstrating that implementation failure often stems from a lack of environmental education, not from insufficient infrastructure. Environmental concern must be strategically cultivated in the local context, with environmental behavior being learned, not innate. Specific economic conditions require careful calibration of financial incentives to truly motivate participation without overloading the system. The success of DRS in the Republic of Moldova will depend less on technological sophistication and more on building public trust and adapting to existing social norms.

MATERIALS AND METHODS

To investigate perceptions and attitudes towards the Deposit-Return System (DRS) in the Republic of Moldova, we used a quantitative survey-based approach. Data collection was carried out through a structured questionnaire, administered to a sample of 608 respondents during the period December 2024–February 2025. Data were collected through the Google Forms Platform, as well as

through telephone interviews. Given that the preface to the questionnaire mentioned that the responses would be aggregated and analyzed at a general level, used for research purposes, and published, individual consent from respondents was not required. Also, respondents who were contacted by telephone were informed about this aspect, and those who did not wish to participate in the survey had the opportunity to refuse. The questionnaire was approved by the Ethics Committee of NIER AESM.

The questionnaire was designed to measure multiple dimensions relevant to the implementation and functioning of the DRS, including the level of knowledge, attitudes, behavioral intentions and perceptions of barriers. The instrument contains 25 questions covering demographic, cognitive, attitudinal and behavioral aspects, using predominantly 5-point Likert-type scales to capture the nuances of the responses.

The choice of the questionnaire survey method was determined by several factors. First, this method allows for the efficient collection of a large volume of standardized data from a diverse population, essential to obtain a representative picture of public perceptions of the DRS. Compared to qualitative methods (in-depth interviews or focus groups), the questionnaire facilitates the generalization of results and allows the identification of statistical patterns relevant to public policies. For data analysis, we opted for statistical methods implemented in the GRETl software, the choice being justified by the accessibility of the program and its robust analytical capabilities.

Thus, the analytical strategy included:

1. Descriptive analysis - to characterize the central tendencies and dispersion of the measured variables. This provides an overview of the level of knowledge, attitudes and behavioral intentions of the population.
2. Correlational analysis - to evaluate bivariate relationships between the variables of interest. Correlation coefficients allow the identification of significant associations that can guide subsequent more complex analyses.
3. Multiple linear regression (OLS) modeling - to test the hypothesized causal relationships

and quantify the effects of independent variables on behavioral intentions.

The choice of OLS regression as the primary method of analysis is justified by its ability to simultaneously assess the effects of multiple explanatory variables, controlling for the influences of other factors. Although variables measured on Likert scales are technically ordinal in nature, recent methodological literature supports the treatment of scales with 5 or more points as approximately continuous, justifying the use of parametric methods such as OLS.

Methodological alternatives, such as ordinal logit models or quantile regression, could have provided valuable complementary analyses. However, OLS regression was preferred due to the direct interpretability of the coefficients and its robustness to moderate deviations from the assumptions, as well as its availability in the GRETTL software package.

The sample size ($n=608$) provides adequate statistical power to detect even small or medium magnitude effects. Using the formula for calculating sampling errors, with a 95% confidence level, the maximum error is approximately $\pm 4\%$, acceptable for research purposes.

To validate the statistical models, we implemented standard diagnostics available in GRETTL, including tests for multicollinearity, heteroscedasticity and normality of residuals. These ensure compliance with the fundamental assumptions of regression analysis and the validity of statistical inferences.

Therefore, the adopted methodology represents a balanced compromise between scientific rigor, practical considerations and research objectives. The combination of a comprehensive questionnaire and robust statistical methods implemented in GRETTL provides the necessary foundation for assessing the factors influencing perceptions and behavioral intentions related to the Guarantee-Return System, thus providing valuable empirical evidence for optimizing its implementation in the Republic of Moldova.

RESULTS AND DISCUSSIONS

General characteristic of the sample

A total of 608 respondents participated in the survey. Of these, 48.7% were female, 42.4% were male, and 8.9% declined to state their gender. This distribution suggests a reasonably balanced representation of genders. Furthermore, the age demographics of the respondents were also relatively representative (as shown in Table 1).

Table 1. Cross-tabulation of Age (rows) against Location (columns)

Age	Rural	Urban	Total
18-25	38.8%	61.2%	116
26-35	73.5%	26.5%	117
36-50	64.2%	35.8%	148
51-65	40.9%	59.1%	132
over 65	37.9%	62.1%	95
TOTAL	52.0%	48.0%	608

Source: Author's calculations based on survey data.

Findings revealed that 52% of respondents resided in rural areas, while 48% were from urban areas, demonstrating a relatively balanced representation. This demographic diversity facilitates a comparative analysis of consumer perceptions and behaviors regarding the packaging return guarantee system, allowing for the identification of potential variations between rural and urban consumer expectations and needs.

The distribution of respondents' education levels, as depicted in the diagram, is as follows: 19.2% primary/secondary education, 44.2% secondary education (high school/vocational), and 36.5% higher education (university/postgraduate). When these figures are compared to national statistical data, which generally indicate a lower proportion of individuals with higher education, it can be inferred that the participant group possesses a marginally higher level of educational attainment than the average population. Consequently, the sample reflects a distribution by education levels in which:

- The percentage of those with primary/secondary education is slightly lower than the national average.
- The share of people with secondary education (high school/vocational school) is consistent with the general structure, but can be easily influenced by factors such as age or residential area.

▪ The segment of those with higher education slightly exceeds the national average, suggesting a higher participation of respondents with university/postgraduate education.

Therefore, the sample appears to be relatively well-represented in terms of education categories, but with a slight over-representation of those with higher education. This may influence the survey results, as respondents with higher education may generally show a higher degree of interest and involvement in environmental or innovation issues.

H1: The current level of consumer awareness about the DRS has a positive and significant effect on the intention to participate in the system

To find out the level of awareness regarding the DRS, respondents answered the following questions:

1. *Do you know the Guarantee-Return System (DRS) for plastic packaging?*
2. *Do you know how the guarantee return system works (1 = Not at all, 2 = A little, 3 = Moderate, 4 = Good, 5 = Very good)*
3. *Do you know the types of packaging accepted for this system (1 = Not at all, 2 = A little, 3 = Moderate, 4 = Good, 5 = Very good)*

Figure 3 shows the distribution of responses to the question *Do you know the Deposit-Return System (DRS) for plastic packaging*. This distribution of the level of information reveals several essential aspects:

1. Most respondents (59%) have partial knowledge of the DRS, which indicates that, although they have been exposed to the concept, they do not have complete and detailed information about the functioning and benefits of the system.
2. A percentage of 20% of respondents consider themselves very well informed about the DRS. This segment represents a potential pillar of support for promoting the system, since well-informed people can positively influence and educate the community through example and dissemination of correct information.
3. Approximately 21% of respondents do not know at all what the DRS means, highlighting a critical area that requires immediate

intervention. These responses indicate that a significant part of the population needs more complete and detailed information.

In response to inquiries regarding their level of knowledge concerning the DRS mechanism, approximately 42% of respondents reported an average understanding, 18% indicated no knowledge, 23% reported limited knowledge, 12% reported good knowledge, and 5.4% reported very good knowledge. This indicates a general awareness of the DRS, but a lack of in-depth understanding among most respondents.

It is undeniable that the DRS represents an important tool in waste management and in promoting the circular economy, providing an organized framework for the collection and recycling of packaging. Thus, people need to know the types of packaging that are returned, whether it is plastic, glass or metal, because correct information facilitates active and efficient participation in the system, thus contributing to the optimization of collection and recovery processes and the omission of barriers that would affect this mechanism from the start. Confusion and lack of information regarding the types of packaging collected through the DRS can reduce the participation rate, because users, not understanding exactly what is collected, may become reluctant to actively engage in the system or may lead to additional sorting and processing costs.

Thus, when asked about the level of knowledge of the types of packaging accepted by the DRS, it was highlighted that approximately 58% of respondents have an average level of information, 18% do not know these types at all, and 7% have only minimal knowledge. Only 12.5% said they knew them well, and a small segment of 5.4% said they knew them very well.

To test the hypothesis that the level of awareness influences the intention to participate, we applied a regression analysis using data obtained from 608 respondents. The study focused on examining the link between the level of knowledge of the system and the willingness to participate in it.

The results of the descriptive analysis present the values for the main indicators studied (Table 2).

Table 2. Descriptive statistics for the main indicators regarding the knowledge of the DRS and the intention to participate

Variable	Average	Median	Min	Max	St. Dev.
Knowledge of working processes	2.64	3.00	1.00	5.00	1.07
Knowledge of packaging	2.82	3.00	1.00	5.00	1.04
Probability of participation	3.68	4.00	1.00	5.00	1.04

Source: Author's calculations based on survey data.

The responses indicate a moderate level of understanding of how the system works (mean 2.64) and the types of packaging accepted (mean 2.82), while the intention to participate has a higher mean value (3.68). This suggests that although knowledge of the system is at an average level, there is a relatively high willingness to participate.

To explain the variability of the intention to participate, a multiple linear regression model was constructed:

$$\text{Intention_to_participate} = \beta_0 + \beta_1 \text{Knowledge_DRS} + \beta_2 \text{Knowledge_work} + \beta_3 \text{Knowledge_packaging} \dots (1)$$

The model shows an adjusted R^2 of 0.567, meaning that approximately 56.7% of the variation in participation intention can be explained by the included variables.

The coefficient for packaging knowledge (0.71) is the largest and statistically significant ($p < 0.001$), indicating that this dimension of knowledge has the strongest influence on participation intention.

Table 3. Results of the regression model for determining the factors influencing the intention to participate in the DRS

Variable	Coefficient	Std. error.	t-ratio	p-value
Constant	1.77226	0.0988	17.94	5.52e-058 ***
Knowledge_DRS	-0.289765	0.07923	-3.657	0.0003 ***
Knowledge_function	0.0962666	0.05589	1.722	0.0855 *
Knowled_packaging	0.709622	0.05590	12.69	6.79e-033 ***
Unadjusted R-squared	0.567489			
Adjusted R-squared	0.565340			
F(3, 604)	264.1651			
P-value(F)	1.7e-109			

Source: Author's calculations based on survey data.

Note: *** indicates statistical significance at 0.1% level ($p < 0.001$)

It is interesting that the variable related to the general knowledge of DRS has a negative coefficient (-0.29), statistically significant ($p < 0.001$). This apparently paradoxical relationship could suggest that simply knowing about the existence of the system, without a detailed understanding of its functioning, may generate a certain reluctance to participate. In contrast, detailed knowledge of the types of packaging accepted has a strong positive effect on the intention to participate.

The research results emphasize the importance of educational strategies that focus on the practical aspects of the DRS, especially on familiarizing the population with the types of packaging accepted in the system. These efforts could significantly contribute to increasing the participation rate and, implicitly, to the success of the DRS implementation in the Republic of Moldova.

H2: Economic motivation has a stronger influence on the intention to participate in DRS compared to ecological motivation

Economic motivation provides direct, measurable benefits. Consumers perceive a clear financial gain—such as cashback or discounts—when they return packaging. This immediate reward can offset any inconveniences linked to the process, making participation a more attractive and pragmatic choice (Becker and Schmitt, 2020) [4]. Many consumers weigh the immediate costs (time, effort, and potential price increases) against the benefits. Economic incentives directly counterbalance these costs, whereas the benefits of ecological motivation, such as reduced environmental impact, are more diffuse and long-term. When financial rewards are evident, they can effectively lower the psychological barrier to participation (Li and Zhang, 2019) [19]. Recent studies have shown that when consumers are presented with clear

economic benefits, their intention to participate in recycling programs, including DRS, increases significantly. Becker and Schmitt (2020) [4] found that the promise of economic gain is a strong predictor of recycling behavior, while Li and Zhang (2019) [19]. demonstrated that economic incentives can trigger more robust engagement in circular economy practices compared to purely ecological appeals.

What is the perception in the case of the Republic of Moldova? According to our survey, about 59% of respondents indicated that the main reason for which they would participate in the DRS is also the financial benefit (recovery of the guarantee). At the same time, there is a percentage of 15.5 percent who will participate because of concern for the environment, 12.7% consider the main reason – social responsibility, 9% of respondents

stated that they will not participate in this system.

To test the hypothesis that economic motivation has a stronger influence on the intention to participate in DRS compared to other types of motivations, we applied regression analysis. This statistical method allows the assessment of the relative impact of different types of motivation (independent variables) on the intention to participate (dependent variable), thus providing a clear picture of the factors that most strongly influence consumer behavior towards DRS.

The multiple linear regression model was constructed as follows:

$$\text{Intention_to_participate} = \beta_0 + \beta_1 \text{financial_motiv} + \beta_2 \text{environ_motiv} + \beta_3 \text{social_motiv} + \beta_4 \text{standards_motiv} + \beta_5 \text{nonparticip_motiv} \dots (2)$$

Table 4. Results of the regression analysis on the impact of different types of motivation on the intention to participate in the DRS

Variable	Coefficient	Std. error.	t-ratio	p-value
Constant	1.00000	0.718755	1.391	0.1646
Financial_motiv	2.78273	0.719755	3.866	0.0001 ***
Environ_motiv	3.20213	0.722568	4.432	1.11e-05 ***
Social_motiv	3.14286	0.723407	4.345	1.64e-05 ***
Standards_motiv	3.00000	0.735669	4.078	5.15e-05 ***
Nonpartic_motiv	0.392857	0.725144	0.542	0.5882
Unadjusted R-squared	0.528197			
Adjusted R-squared	0.524278			
F(5, 602)	134.7912			
P-value(F)	9.66e-96			

Source: Author's calculations based on survey data.

Note: *** indicates statistical significance at 0.1% level ($p < 0.001$)

The results of the regression analysis contradict the initial hypothesis, indicating that ecological motivation ($\beta = 3.20$, $p < 0.001$) exerts a stronger influence on the intention to participate in the return management system (DRS) compared to economic motivation ($\beta = 2.78$, $p < 0.001$). The model presents a robust explanatory power ($R^2 = 0.53$), demonstrating that motivational factors explain over half of the variation in the intention to participate. It is notable that social motivation ($\beta = 3.14$, $p < 0.001$) and personal standards ($\beta = 3.00$, $p < 0.001$) also have substantial effects, suggesting that the effective implementation of DRS should emphasize not only economic benefits, but especially aspects of ecological sustainability and social responsibility. So, the

results of the regression analysis indicate that ecological and social motivation have a stronger influence on the intention to participate in DRS than economic motivation. This moment can also be explained by the fact that a majority of respondents with higher education participated in our survey. Therefore, it was expected that they would be more informed and aware of the environmental impact and the importance of social responsibility. Therefore, messages promoting DRS can benefit from this predisposition, emphasizing ecological advantages (e.g., pollution reduction and resource conservation) and social values (such as community involvement and long-term sustainability).

It is worth noting the difference between the primary motivation stated by respondents in Figure 6 (where 59% indicate financial benefit) and the stronger influence of environmental motivation demonstrated by the statistical model. This apparent discrepancy is not a contradiction, but rather illustrates the difference between explicitly stated preferences and the factors that actually influence behavior. According to studies by Konstantoglou et al. (2023) [16], consumer perceptions are often shaped by multiple motivations operating at different levels. When respondents are asked directly about their primary motivation, they tend to identify immediate and tangible financial benefit. However, advanced statistical analysis reveals that environmental values exert a deeper influence on their actual willingness to participate. These results are consistent with research by Pinter et al. (2021) [21] and Zorpas (2024) [28], which show that understanding the benefits for sustainability significantly improves consumers' attitudes towards return schemes, even if they do not explicitly identify this factor as primary.

Contradicting our initial hypothesis represents a valuable discovery that nuances the understanding of consumer motivations in the Republic of Moldova. Although international literature (Dăce et al., 2013 [8], Broniewicz et al., 2023) [6] emphasizes the predominance of economic motivations in other geographical contexts, our results indicate a stronger affinity for ecological values among respondents. This difference can be explained by three factors:

1. The demographic structure of the sample, with a higher representation of respondents with higher education (36.5%), a segment that tends to value environmental considerations more strongly;
2. The evolution of ecological awareness in recent years at a global level, which has led to changes in consumer priorities compared to previous studies;
3. The particularities of the local context, including visible environmental problems in the Republic of Moldova that may sensitize the population to sustainability aspects.

This result suggests that communication strategies for DRS implementation should

emphasize ecological benefits, without neglecting the economic aspects that remain important for certain segments of the population.

H3: Perception of barriers has a negative and significant effect on the intention to participate in DRS

To test this hypothesis, respondents were asked to answer the following 2 questions: What is the main difficulty you anticipate in actively participating in the DRS? Also - How much time would you be willing to allocate to returning packaging?

The analysis of response distribution regarding difficulties identified the top three perceived barriers as:

- Increased product prices (additional expenses): approximately 71%
- Lack of information: approximately 49%
- Lack of adequate infrastructure: approximately 48%

These results lead us to the idea that the vast majority of respondents fear that with the implementation of the DRS, the increased costs will have a direct financial impact on their personal budget, so people may be reluctant to support the initiative, regardless of its environmental or social benefits. Without a clear understanding, consumers may be reluctant to participate and may distrust the efficiency and ultimate purpose of the system, and limited access to collection points or/and the absence of well-established facilities, even informed and motivated people may give up, due to the major additional effort that the return process may involve. Thus, addressing these barriers in a coherent and integrated way can improve public trust and significantly increase the participation rate in the DRS.

Notably, the data concerning the time respondents are willing to dedicate to packaging returns demonstrates a clear preference for efficient and easily manageable procedures.

The survey revealed that approximately 57% of participants are inclined to allocate between 5 and 10 minutes to packaging returns, while 22% prefer to complete the process in under 5 minutes. Conversely, 10% are unwilling to dedicate any time. Furthermore, only 10% of respondents, cumulatively, expressed a

willingness to invest more than 10 minutes. These findings suggest a general tendency to prioritize time-efficient tasks, especially in the absence of perceived significant benefits. To determine the impact of perceived barriers on intention to participate, we applied

regression analysis, using two distinct models. This statistical approach allows us to quantify the effect of each perceived barrier (independent variable) on respondents' willingness to participate in the system (dependent variable).

Table 5. Results of the regression analysis on the impact of various barriers on the intention to participate in the DRS

Variable	Coefficient	Std. error.	t-ratio	p-value
Constant	2.58545	0.06957	37.16	1.18e-157 ***
Price_Barrier	1.37091	0.08999	15.23	1.59e-44 ***
Time_Barrier	-0.3217	0.186716	-1.723	0.0853 *
Info_Barrier	0.8146	0.156818	5.195	2.82e-07 ***
Complex_Barrier	0.0044	0.176337	0.02500	0.9801
Costs_Barrier	-1.094	0.176014	-6.216	9.58e-10 ***
Infrastru_Barrier	1.02845	0.154161	6.671	5.78e-11 ***
Queues_Barrier	-0.372986	0.207606	-1.797	0.0729 *
Schedule_Barrier	-0.014984	0.167231	-0.089	0.9286
Unadjusted R-squared	0.371018			
Adjusted R-squared	0.362618			
F(8, 599)	44.16664			
P-value(F)	1.17e-55			

Source: Author's calculations based on survey data.

Note: *** indicates statistical significance at 0.1% level ($p < 0.001$)

* indicates significance at the 10% level ($p < 0.1$)

The first regression model, which analyses the impact of each barrier individually, presents interesting and partly counterintuitive results. The explanatory power of the model is moderate ($R^2 = 0.37$), indicating that approximately 37% of the variation in participation intention can be explained by perceived barriers.

Contrary to initial expectations, not all barriers have a negative effect on participation intention. PriceBarrier ($\beta = 1.37$, $p < 0.001$), InfoBarrier ($\beta = 0.81$, $p < 0.001$) and InfrastruBarrier ($\beta = 1.03$, $p < 0.001$) have positive and statistically significant coefficients, suggesting that respondents who identified these barriers still tend to have a higher intention to participate. This apparently contradictory finding could indicate that individuals with a higher level of interest and motivation in participation are also those who possess a greater awareness of potential challenges. In contrast, CostBarrier ($\beta = -1.09$, $p < 0.001$) has a strong negative effect on the intention to participate, partially confirming our hypothesis. TimeBarrier ($\beta = -0.32$, $p < 0.1$) and RowBarrier ($\beta = -0.37$, $p < 0.1$) also have

negative effects, although with lower statistical significance. To examine not only the impact of each individual barrier, but also the cumulative effect of perceived difficulties, we built a second model in which we analyzed the relationship between the total number of barriers identified by each respondent and their intention to participate in the DRS.

To examine not only the impact of each individual barrier, but also the cumulative effect of perceived difficulties, we built a second model in which we analyzed the relationship between the total number of barriers identified by each respondent and their intention to participate in the DRS.

The second model provides a surprising result. The positive and significant coefficient ($\beta = 0.097$, $p < 0.001$) indicates that, on average, the more barriers a person identifies, the higher their likelihood of participation. However, the explanatory power of this model is relatively low ($R^2 = 0.098$), suggesting that the total number of barriers, in itself, is not a strong predictor of participation intention.

These seemingly contradictory results can be explained from several perspectives. It is possible that individuals more interested in the DRS have a deeper awareness of potential

challenges, thus identifying more barriers, but still maintaining a high intention to participate. Alternatively, the identification of barriers

could indicate a constructive critical attitude, rather than a total reluctance towards the system.

Table 6. Results of the regression analysis on the impact of the total number of perceived barriers on the intention to participate in the DRS

Variable	Coefficient	Std. error.	t-ratio	p-value
Constant	3.32220	0.0591282	56.19	1.80e-242 ***
NumbBarriers	0.0971567	0.0119193	8.151	2.07e-15 ***
Unadjusted R-squared	0.098807			
Adjusted R-squared	0.097320			
F(1, 606)	66.44186			
P-value(F)	2.07e-15			

Source: Author's calculations based on survey data.

Note: *** indicates statistical significance at 0.1% level ($p < 0.001$)

The paradox of the results regarding barriers requires a nuanced interpretation. The positive coefficients for certain barriers (price, lack of information, infrastructure) and the positive correlation between the total number of barriers and the intention to participate can be explained by the phenomenon of "critical awareness" (Diemer et al., 2016) [9]. This phenomenon manifests itself when people who are more involved and interested in the DRS are also more attentive to potential obstacles. At the same time, this dual model of barrier perception is consistent with theories of planned behavior (Ajzen, 1991) [3] and suggests that the identification of structural barriers may actually indicate a high level of information and involvement, rather than a reluctance towards the system. Thus, the identification of barriers does not necessarily represent a negative attitude, but rather an analytical and constructive perspective.

There is, however, an important distinction between the types of barriers. Structural barriers (price, lack of information, infrastructure) are perceived as obstacles that can be overcome through systemic interventions and do not diminish the intention to participate of respondents aware of the benefits of DRS. In contrast, personal barriers (hidden costs, time, queues) represent direct inconveniences for the individual and have a negative impact on the intention to participate. Our research suggests that addressing specific barriers, especially those related to hidden costs, time and queue management, could have a significant impact on increasing the intention to participate. At the same time, transparency

in price communication and the development of an adequate infrastructure could capitalize on the already existing interest among people who are aware of these aspects.

In conclusion, the hypothesis that the perception of barriers has a negative and significant effect on the intention to participate in DRS is partially confirmed, being valid for certain specific types of barriers, but not for all and not for the total number of perceived barriers. This nuance provides a deeper understanding of the complexity of factors that influence citizens' willingness to participate in the guarantee-return system.

Therefore, the return system should be designed to be as convenient and fast as possible (accessible collection points, simplified scanning/recycling processes). In the absence of conditions that facilitate speed, participants are likely to give up or not pay attention to the return system. It follows that infrastructure plays a decisive role in reducing the time spent returning packaging. Thus, an extensive network of collection points, strategically located (e.g. near supermarkets, parking lots, residential areas) and equipped with fast pick-up and reward technologies should be designed. All of this could meet the needs of the majority of respondents who do not want to spend more than 5-10 minutes.

If respondents consider that the benefits (whether financial or environmental) do not justify the time invested, they will be less willing to participate. Therefore, an information campaign is needed that emphasizes the positive impact of recycling and the tangible benefits (price discounts,

shopping vouchers, prizes, etc.), to demonstrate to participants that the time allocated is not wasted.

Therefore, for a DRS to be successful, it is essential to adapt to the time requirements of most consumers, who want a quick experience that is easy to integrate into their daily routine. Thus, an accessible infrastructure, clear communication, and rewards can reinforce the perception that the time invested is worth the effort, contributing to increasing participation rates.

Even in the context of the anticipated cumulative barriers and the time required for return, respondents considered that DRS in the Republic of Moldova will have a moderate efficiency. Respondents were asked to estimate from 1 to 5 the efficiency of DRS in the Republic of Moldova (1 being not at all efficient and 5 – very efficient). Thus, about 52% of respondents believe that DRS once implemented will have a moderate efficiency, about 8 percent are convinced that DRS will be very efficient, and 9% - not at all efficient.

This fact can be interpreted as follows:

Real perception of obstacles

Respondents are aware of the challenges related to costs and the time required for return, but do not consider these barriers severe enough to completely invalidate the potential benefits of the DRS. They acknowledge that although there are difficulties, the system can function to a reasonable extent if solutions are implemented to reduce the impact of these obstacles.

Balance between costs and benefits

The fact that only 8% are convinced of a very high efficiency, and 9% believe that the system will be not efficient at all, suggests that the overall perception is one of balance. Respondents seem to consider that although barriers may affect the degree of participation, these can be compensated by other benefits.

Moderate but realistic expectations

The moderate assessment of efficiency reflects a pragmatic attitude of the respondents. They do not expect spectacular results, but a significant improvement over the current situation, while recognizing that the implementation of the DRS will require an

adaptation effort from both consumers and authorities and other parties involved.

The need for compensatory measures

This moderate perception emphasizes the importance of implementing complementary measures – such as facilitating access to collection points, information campaigns and technological solutions that reduce the time required for returns – to maximize the efficiency of the system.

So, the moderate assessment given by the respondents indicates that the system could function at a satisfactory level in the Republic of Moldova, but with appropriate interventions from decision-makers and the media, the potential of the DRS could be optimized.

CONCLUSIONS

We can mention that the hypothesis testing demonstrated that, for a successful implementation of the DRS in the Republic of Moldova, an integrated approach is essential. While the level of information and knowledge about the system stimulates the intention to participate, ecological and social motivations have a stronger influence than economic ones. In addition, logistical barriers represent a major obstacle, which underlines the need to optimize the infrastructure and reduce the perceived costs. By adopting appropriate information strategies, infrastructural development and incentives, the DRS can be successfully implemented, contributing both to environmental protection and to the development of a sustainable circular economy.

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