

Ecocycles, Vol. 10, No. 2, pp. 97-113 (2024)
DOI: [10.19040/ecocycles.v10i2.492](https://doi.org/10.19040/ecocycles.v10i2.492)

RESEARCH ARTICLE

Preliminary Opinion of Consumers on the New Deposit-Refund System in Hungary

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Abstract – In Hungary, from January 1, 2024, the Government Decree of the 450/2023 (X. 4.) regulates the conditions for establishing and applying the deposit fee for pet bottles, metal cans, and glass bottles. The new Deposit-Refund System has been of serious interest among Hungarian consumers, since its rules interfere in the everyday lives of ordinary people, sometimes imposing a greater or lesser financial burden on them. The aim of our research was to find out the preliminary perceptions of Hungarian consumers about this system even before its introduction, since these perceptions can significantly influence its consumer acceptance in the future and provide an opportunity to examine and deal with critical factors in advance, and to reduce preliminary consumer concerns. To reach our research aim we conducted an online consumer survey with 8,225 people. According to our results, about half of the respondents consider the introduction of the new rules to be a promising idea, but at the same time, two-thirds of the respondents feel more or less discomfort about the new system. The preliminary expectations are therefore mostly negative, especially in the ‘Those worried’ and ‘Those refusing’ consumer segments. In addition to discomfort, environmental doubts and economic concerns also appear in consumer opinions, which can hinder the adoption of the new system.

Keywords – Deposit-Refund System, consumer behavior, Hungary, recycling, packaging

Received: October 20, 2024

Accepted: December 15, 2024

1. INTRODUCTION

The EU and the UN have developed a joint sustainable development agenda for the period up to 2030. To fulfil the plans, 17 sustainable development goals were set, of which the 12th goal, i.e., responsible consumption, and production, is of particular importance. The EU and the UN set a sub-goal no. 12.5, that it is necessary to reduce waste production significantly by 2030. This can be achieved through prevention, reduction of use, recycling, and reuse (European Commission, 2024; United Nations, 2024). As a consequence, there have been significant changes in the packaging industry and are expected in the future. Nevertheless, based on the Packaging market (2023) survey, the packaging industry could reach a global value of 1.38 trillion dollars by 2029, which is expected to represent an average annual growth rate of 3.89%.

In packaging technology, the concepts of packaging materials and packaging tools are separated. Packaging material refers

to all the wood, metal, glass, plastics, and paper used for actual packaging. Packaging tools means cups, resealable bags, hollow bodies, glasses, boxes made from materials above, which generate waste after their use. In literature, terms single-use and multi-use packaging also exist. With single-use, i.e., disposable packaging, materials are thrown into the trash immediately after use. These packaging materials are not refilled, but recycled, at least ideally. Multi-use packaging can be reused, e.g. beer, wine, spirit, jam, syrup bottles. These are the so-called deposit fee products. Multi-use packaging can be refilled many times and then recycled after the packaging has aged (Farkas, 2000; Horváth and Stipta, 2007). A reusable beer bottle has 60 times less environmental impact than its disposable counterpart and can be refilled approx. 40 times. Three basic directions for the collection and recycling of packaging materials can be identified. The primary direction, especially in the case of multi-use packaging, is repeated processing. Recycling for energy purposes also appears, where we generate heat by burning waste. A third direction is partial decomposition,

after which the packaging material can be recycled as a chemical raw material (Vermes, 2005; Horváth and Stipta, 2007).

In 2023, the turnover of all beverage products by single-use packaging system in Hungary (this means approx. 3.3 billion pieces and 158 thousand tons of beverage packaging) accounted approx. for 90% (Tamásné Szabó, 2023), but their return rate is low, it was approx. 42% (Eunomia, 2020). On the other hand, Directive 2019/904/EU of the European Parliament and of the Council of 5 June 2019 on the reduction of the environmental impact of certain plastic products ('SUP Directive') requires Member States to collect waste separately and recycle 77% of plastic beverage bottles put on the market in the country by 2025, and 90% by 2026. In addition, 25% of the maximum 3-liter PET bottles marketed in the country must be made of recycled material from 2025, and 30% from 2030 (Boros et al., 2021). The SUP Directive recommends the introduction of a deposit fee as one of the means of implementation, which, after several EU Member States, the packaging tool introduced a new, single Deposit-Refund System (DRS) in Hungary from January 1, 2024, as well. The aim of our primary research was to find out the preliminary perceptions of Hungarian consumers about this system even before its introduction, where interviewees could not yet gain genuine experience of it in Hungary when the research was conducted. These perceptions can significantly influence the acceptance of the system by consumers in the future and provide an opportunity to examine and deal with critical factors in advance, and to reduce preliminary consumer concerns.

1.1 Waste Production, with a Particular Attention to Plastic

Municipal waste accounts only for 10% of the total amount of waste, but its treatment involves a significant use of resources; it accounts for more than a third of the public sector's financial efforts. Municipal waste includes waste from households, but it also includes waste from trade, small industry, institutions, and market waste (OECD, 2024).

In 2021, approximately 188.7 kg of packaging waste was generated per capita in the EU. Regarding the material of packaging waste, 40.3% is paper and cardboard waste, while plastic waste is 19%, glass is 18.5%, wood is 17.1%, metal represents 4.9%. Between 2010 and 2021, the quantity of all the packaging waste materials increased. Regarding relative growth, only wood waste surpassed plastic in the period under review. The recycling rate of packaging waste rose significantly between 2010 and 2016, then fell back to the level in 2010 in the early 2020s (Eurostat, 2024). In 2021, 64% of packaging waste was recycled and 80% was managed in such a way that the waste would serve a useful purpose in the future (European Parliament, 2024).

Plastic waste can be identified as a globally significant environmental problem, this is especially true for the pollution of the marine ecosystem (Statista, 2019). In 2022, the amount of plastic production in the world reached the critical 400.3 million tons, which represents an increase of 1.6% compared to the previous year (Statista, 2022). While

globally only 8% of plastic waste was recycled and almost 50% was landfilled (OECD, 2022), in December 2023, 38% of plastic was recycled in the European Union (ACR+, 2023).

1.2 The Deposit-Refund System Globally

More than 40 countries around the world have already introduced some kind of Deposit-Refund System for the packaging of soft drinks (Zhou et al., 2020). Canada (British Columbia), the United States (Oregon), Australia (South Australia), and Israel has had a refund system since 1970, 1972, 1974, and 2001, respectively. The first recycling process for PET bottles used in the food industry was first authorized in the United States in 1991, and between 1991 and 2011 the recycling of PET bottles globally increased dramatically (Welle, 2011), which is also due to the Recycling Regulation of the European Commission (EU, 2008). In Europe, Sweden was the first country to introduce DRS in 1984 (Reloop, 2022). In November 2023, about 14 EU and EFTA countries (Table 1) were involved and the number of the affected population reached 164 million (ACR+, 2023). The DRS system was launched in Hungary on 1 January 2024, and in the near future it is planned to be launched in Luxembourg and Ireland and is in the development phase in Portugal and Austria (ACR+, 2023). Overall, it can be concluded that the goal and tool system of the DRS operating in different countries are similar, the population must be made financially interested in refunding various beverage packaging. The amount of the deposit fee depends on the country, but it typically varies between 0.1 and 0.4 Euros. Every country tries to make refund more convenient, where automatic refund systems and their widest availability play the key role. The systems operating in different countries have effectively shaped consumer behavior and attitudes, and within a brief period of time they were able to raise the refund rate to around 90% or above this value.

1.3 The Deposit-Refund System in Hungary

In Hungary, from January 1, 2024, the Government Decree of the 450/2023 (X. 4.) regulates the conditions for establishing and applying the deposit fee, as well as the distribution of deposit fee products. Since the decree came into force, there have been products with a mandatory deposit fee and products with a voluntary deposit fee. Compulsory refundable products can be reusable (multi-use) or non-reusable (single-use) packaging. The consumer must be informed about the products with a voluntary deposit fee, these are the products marked 'refundable.' From January 2, 2024, all the beverage products in glass, metal, and plastic bottles and cans with a capacity between 1 deciliter and 3 liters (except milk and milk-based beverage products) are marketed with a deposit fee and a refund label. The deposit fee is HUF 50 (approx. 0.13 Euros) in the case of non-recyclable packaging with a mandatory deposit fee. During the return process, the user can choose how the deposit fee is requested to be reimbursed (voucher, transfer to a bank account or charitable donation). In the case of mandatory deposit fee, recyclable (these are the so-called multi-pass, i.e. refillable) and voluntary deposit fee bottles, the amount of the deposit fee is determined by the bottler and its value is indicated in the logo (e.g. HUF 70, i.e. approx. 0.18 Euro).

Table 1 Recycling rates in 2022 by country and type of packaging

No.	Country	Introduced in	Recycling rates (%)		
			Aluminum can	PET bottle	Total
1.	Sweden	1984	87.8	86.7	87.5
2.	Iceland	1989	88.0	85.0	88.0
3.	Finland	1996	99.0	97.0 (2023)	98.0
4.	Norway	1999	93.0	91.0	92.0 (2021)
5.	Denmark	2002	91.0	93.0	92.0
6.	Germany	2003	62.4 (2021)	98.0 (2023)	98.0 (2019)
7.	Estonia	2005	97.2 (2021)	88.0 (2021)	84.0 (2021)
8.	the Netherlands	2005	95.3	70.8	75.3
9.	Croatia	2006	81.0	83.0	76.0
10.	Lithuania	2016	94.0	93.0	91.0
11.	Slovakia	2022	49.7 (2021)	60.0	71.0
12.	Latvia	2022	66.6 (2021)	16.37 (2021)	85.0 (2023)
13.	Malta	2022	80.0 (2023)	81.0 (2023)	75.0 (2023)
14.	Romania	2023	20.5 (2021)	52.0 (2020)	38.3 (2021)
15.	Hungary	2024	38.0 (2017)	42.0 (2020)	52.4 (2020)

Note: The years of the source of data from a year other than 2022 are indicated in separate brackets.

Source: Authors' own editing based on ACR+ (2023), DRS Association (2024), Bottle Bill (2024), Reloop (2024), Statista (2024), Eurostat (2024b), European Parliament (2024) and Eunomia (2020)

Food stores with a sales area of more than 400 m² must be provided with automatic exchange machines. Around 4,000–5,000 vending machines are planned to be installed in Hungarian stores, and based on data on July 2024, around 3,000 vending machine points (REpoints) await customers (Gyöngyösi, 2024). The machine only accepts the packaging if it is undamaged. The new decree allowed a temporary grace period, until June 30, 2024, previously produced, unmarked beverage products could be put on the market. The regulation does not apply to glasses of custom sizes and shapes that cannot be returned with a vending machine, nor to those that are produced in small batches (max. 5,000 pieces). The obligations do not have to be fulfilled in the case of a product whose cost value reaches HUF 25,000 (approx. 63 Euro) and the market player did not manage to purchase an empty or emptied bottle for registration purposes (Government Regulation of 450/2023 (X. 4.)).

The new Deposit-Refund System has been of high interest among Hungarian consumers, since its rules interfere in their everyday lives, sometimes imposing a greater or lesser financial burden on them. Our research questions were the following: What are the preliminary perceptions of Hungarian consumers about the new system before its introduction? What factors may support or hinder its acceptance in advance? The rationale behind these questions is that these perceptions can significantly influence consumer acceptance of the system after its full launch and provide an opportunity to examine and deal with critical factors in advance, and therefore to reduce preliminary consumer concerns, resulting in higher acceptance levels.

1.4 Consumer Behavior Related to the Deposit-Refund System

Consumer perception of the Deposit-Refund System is positive in countries where it has been introduced. For example, according to the results by Dempster et al. (2021), the majority of Northern Irish respondents (86.3%) agreed or strongly agreed that DRS is a good idea, and according to the majority it should be extended to other packaging materials as well (69.4% said definitely, according to 17.7% maybe). Similarly, a large majority of Slovak respondents (80.2%) prefer the new DRS to the old selective collection, and 93.5% consider the new system an innovative idea. Martinho et al. (2024) found that both Portuguese consumers who used the pilot DRS and non-users rated it positively, but the latter rated it significantly lower (respectively 8.3 vs. 7.9 on average, on a 10-point scale).

According to the literature, the role of financial incentives and economic considerations in recycling behavior is indisputable (Czajkowski et al., 2017; Li et al., 2019; Roca i Puigvert et al., 2020; Roca et al., 2022). In addition, studies have pointed out the importance of various psychological factors in this behavior (Czajkowski et al., 2017; Li et al., 2019). The inconvenience associated with recycling (waste handling and storage, the proximity and number of recycling bins, and the time and effort devoted to recycling) also affect recycling activity (Roca i Puigvert et al., 2020; Roca et al., 2022), as well as demographic and socioeconomic characteristics of individuals (Li et al., 2019).

1.4.1 Financial incentives

Based on the majority of literature results, financial incentives are the most effective (Lu and Wang, 2022), they have a very important role in influencing recycling behavior (Östlin et al., 2008; Gneezy et al., 2011; Miliute-Plepiene et al., 2016; Knickmeyer, 2020; Jarossová et al., 2023; Martinho

et al., 2024), especially in poorer segments of the population (Drašković et al., 2011). However, these must be large enough to provide sufficient extrinsic justification to follow the behavior (Thøgersen, 2003; Arriagada et al., 2022), this is confirmed by Dempster et al. (2021) as well. It should be noted that these incentives affect non-recyclers significantly (Vining and Ebreo, 1990). In contrast, according to Konstantoglou et al. (2023), although financial incentives have a role, this factor is not among the most important in the use of DRS. These incentives are more effective in the short, maximum medium term, in the long term the positive effect may disappear (Gneezy et al., 2011), a kind of reward-dependency may develop instead of the strengthening of social norms (Martinho et al., 2024), and even pro-environmental attitudes can weaken (Roca et al., 2022). In contrast to external (extrinsic) collectors, the system that rewards internal (intrinsic) collectors is the one that is sustainable in the long term (Šmaguc et al., 2023).

The results of Du Rietz (2022) point out that deposit and refund are separated amongst consumers, and they lack a holistic view of the deposit-refund nature of the system (Oke et al., 2020). Du Rietz (2022) concluded that most of the young adults in the research considered deposit as part of the price of the product, while the refund was seen as a reward for the effort to return the packaging, or as a kind of bonus received for a good deed, while others thought of it as a discount given by the retail unit, or perhaps as new, extra money, which is either spent immediately (in many cases on indulgent products) or, if it is a sufficiently large amount, used for future purchases of greater value.

Regarding the amount of the refund, the majority of Portuguese respondents considered the value of 0.05 EUR to be adequate, non-users considered a higher value ideal than users of the system (Martinho et al., 2024). On the other hand, 77.5% of Slovak consumers are satisfied with the amount of EUR 0.015 (Jarossová et al., 2023).

1.4.2 Psychological factors

Šmaguc et al. (2023) found that recycling intention is a powerful predictor of recycling behavior; and the intention is strongly influenced by the awareness of recycling by the individual and the perceived behavioral control. This is in line with the results of Gamba and Oskamp (1994), according to which relevant knowledge about recycling is the most critical determinant of recycling behavior, and Vining and Ebreo (1990), Andersson and Von Borgstede (2010), Sidique et al. (2010), and Keramitsoglou and Tsagarikis (2013) also showed a significant positive influence of recycling-related knowledge on recycling intention or behavior. Šmaguc et al. (2023) found that knowledge of recycling has a positive effect on participation in an extended DRS. Martinho et al.'s (2024) results also confirm the role of knowledge, according to which DRS knowledge also showed a correlation with the use of the system; significantly more people who had prior knowledge used the system. Accordingly, Dempster et al. (2021) found that the factor most encouraging the use of DRS is system-related information to consumers, while Oke et al. (2020) show that knowledge of DRS has an impact on the use of DRS. Similarly to Roca and Puigvert et al. (2020), Roca et al. (2022) found that information about the system is critical; however, after the initial positive perception, detailed

information about the DRS can reduce the willingness to accept (Roca et al., 2022).

The importance of perceived behavioral control has also been proven by studies (e.g. Park and Ha, 2014; Botetzagias et al., 2015; Heidari et al., 2018). In addition, according to Šmaguc et al.'s (2023) results, the effect of the subjective norm on recycling intention is significant, although weaker than that of the first two factors. Perceived behavioral control and subjective norm have an impact on recycling behavior not only through intention, but also directly. On the other hand, subjective norm and perceived behavioral control do not have a significant effect on the use of a specific DRS system (Šmaguc et al., 2023).

The results of Sidique et al. (2010) suggest that the knowledge of the recycling process and the availability of recycling infrastructure predicts attitudes towards recycling. According to some research studies, attitudes towards recycling are of fundamental importance in the intention to recycle (Ramayah et al., 2012; Li et al., 2019), while according to others, they have no significant effect (Šmaguc et al., 2023), i.e., even if consumers have a positive attitude towards recycling, they do not necessarily participate in it, which may be due to a lack of opportunities, skills or resources (Diyana and Osman, 2010). In addition, the lack of social pressure (Arli et al., 2020) and the perceived discomfort of recycling can also induce it (Šmaguc et al., 2023). Šmaguc et al. (2023), on the other hand, found that the strongest influencing factor for participation in an extended DRS is the attitude towards DRS, but the attitude towards recycling is also important.

The importance of personal moral emotions is underlined by Martinho et al.'s (2024) results, according to which the most important reason for using DRS is concern for the environment (42.9% of respondents), which precedes even the importance of economic incentives (34.7%). Similarly, Jarossová et al. (2023) concluded that protecting the environment is the most important incentive, followed by financial motivation. Boros et al.'s (2021) research conducted among Hungarian consumers, as well as Oke et al.'s (2020) research in Scotland, concluded that environmental concerns influence the adoption of DRS, Videras et al. (2012) also emphasizes the role of environmental standards in recycling behavior. Consumers are more likely to engage in a specific behavior if they believe that it is important and contributes to environmental sustainability (Antonetti and Maklan, 2014; Leary et al., 2014), but some of them are skeptical about the contribution of DRS to sustainability (Oke et al., 2020).

Additionally, Oke et al. (2020) emphasizes that political views also influence support for the system; there is a kind of political resistance to DRS, stemming from the fact that consumers feel that the system has been imposed on them without any demonstration of its effect. Many people perceive the deposit as another kind of tax, and people also feel that those who have already participated in recycling are being taxed, and those who have not are rewarded.

1.4.3 Convenience factor

The importance of the convenience factor in participation in recycling activities has been demonstrated by several

research studies, for example the problems arising from accessibility and distance by Hage et al. (2018) and Oliveira et al. (2018) and Aprile and Fiorillo (2019); the problem of cleaning the packaging was addressed by Klaiman et al. (2017), and finally, the discrepancy between home garbage disposal and the comfort of the waste island is found by Hage et al. (2018), Hahladakis et al. (2018), and Velzen et al. (2019).

The discomfort of the DRS system as a limitation of acceptance has been discussed in several studies (Miafodzyeva and Brandt, 2013; Oke and Kruijssen, 2016; Amantayeva et al., 2021); the importance of the convenience of system use is supported by the research of Martinho et al. (2024) among the Portuguese consumers, supported by the fact that the less practical nature of the DRS was the most frequently mentioned disadvantage; significantly higher in non-users compared to users. The latter result is consistent with the results of Best and Kneip (2019), according to which comfort as an aspect is more important for consumers with lower pro-environmental attitudes. Among the problems related to practicality, users mentioned the loss and damage of labels, as well as storing the packaging without compression, which is especially problematic for those who live in a small apartment. The latter proved to be a significant deterrent to the use of DRS among Slovak consumers as well (Jarossová et al., 2023). The storage problem can even be counterproductive in that if the consumer does not have space for storage at home, it means multiple trips to the store (including the time and money involved), by car, polluting the environment more (Oke et al., 2020).

Regarding the location of Reverse Vending Machines (RVMs), most people prefer large shopping centers, then supermarkets close to their homes (especially users), and non-users also prefer other alternatives, such as railway stations and gas stations. The placement of RVMs is critical for accessibility, as it may be limited for some consumers, such as those living in rural areas (Martinho et al., 2024). One obstacle to the use of RVMs identified by Konstantoglou et al. (2023) is that they are far from the consumer's home.

The importance of comfort is also indicated by Dempster et al.'s (2021) results, according to which consumers think that digital DRS (scanning the packaging with a phone and throwing it into the existing selective bin at home or on the street; the deposit can then be returned via the app) requires less effort, but more information is needed to understand it (although 89% would not find it difficult to download and use the app); however, they would be more likely to use it compared to the traditional one. Accordingly, 70.5% of respondents would rather collect plastic packaging at home than take it to a central location, or at least scan it at home.

Most of the most common reasons for avoiding DRS are related to inconvenience in some way and these are remarkably similar internationally. Most often, RVM breakdown/maintenance (Jarossová et al., 2023; Konstantoglou et al., 2023; Martinho et al., 2024), long lines in front of the RVM (Jarossová et al., 2023; Šmaguc et al., 2023; Martinho et al., 2024), the inadequate capacity, saturation of the machine (Jarossová et al., 2023; Konstantoglou et al., 2023), and the extra time and energy

investment (Šmaguc et al., 2023) are mentioned. It is worth noting, however, that those who recycle less consider it to be more time-consuming and complicated (Roca i Puigvert et al., 2020).

1.4.4 Demographic and socio-economic factors

Regarding demographic factors, Johnson et al. (2004) found that women, the elderly, the highly educated, those living in larger families, city dwellers, and liberals are more likely to recycle; similar results were obtained by Saphores et al. (2012) for age and family size, and Gamba and Oskamp (1994) and Sidique et al. (2010) in the case of family size, which was explained by the larger amount of waste generated in larger households. Bell et al. (2017) found that consumers with higher education and higher social status are more likely to participate in recycling, Amantayeva et al. (2021) reached the same conclusion regarding education. Do Valle et al. (2004), on the other hand, concluded that gender, age and education did not predict recycling behavior significantly. Gamba and Oskamp (1994) and Sidique et al. (2010) found that a higher income affects participation positively in recycling activities, but Klaiman et al. (2017). Best and Kneip (2019) and Šmaguc et al. (2023), on the other hand, did not find a significant effect of demographic variables (gender, age, education, place of residence, household income and size) on the intention or behavior to participate in recycling.

A Hungarian study (Boros et al., 2021) found that demographic characteristics influence DRS acceptance; on the other hand, education has no effect on the perception of DRS. Martinho et al. (2024) found a significant difference in the use of DRS according to labor market status, the system is used more by full-time employees compared to retirees and students. Šmaguc et al. (2023) found that education and household income are related to the adoption of extended DRS negatively, suggesting that users of the system would be those of lower socioeconomic status who would be motivated by financial compensation. Their further result is that the attitude towards recycling affects the acceptance of the extended DRS only among men, while the knowledge of recycling only among women.

2. MATERIAL AND METHODS

We conducted our research in Hungary with an online questionnaire. We informed the interviewees that we are interested in their preliminary expectations and perceptions regarding the Government Decree of 450/2023. (X. 4.); on how the new system will affect them. We also informed the interviewees that the research does not cover those packaging tools that were refundable in the previous system. Consequently, the research investigated the preconceptions and stereotypes of consumers in connection with the new Deposit-Refund System to be introduced.

Potential respondents could find the questionnaire on the Pénzcentrum's online interface (www.penzcentrum.hu; a popular website in Hungarian dealing with economic topics, particularly). The questionnaire was open to everyone; identification and registration were not required for completion; it was anonymous and voluntary. The questionnaire was filled in by 8,225 people between January

18, 2024, and February 23, 2024. The strength of our research is that the large number of respondents and the diversity of the sample definitely provide significant indicative value

about consumer opinions. Table 2 illustrates the distribution of respondents according to socio-demographic variables.

Table 2 Socio-demographic composition of the sample (N=8,225)

Socio-demographic variables	Number of respondents	%
Distribution by gender		
Male	4998	62.1
Female	3048	37.9
Distribution by education		
8 th grade or below	93	1.1
Vocational training	890	11.1
Secondary-school leaving certificate	2930	36.4
College, university	4137	51.4
Distribution by age		
< 18 years	8	0.1
18–29 years	201	2.5
30–39 years	681	8.4
40–49 years	1361	16.8
50–59 years	1868	23.1
60–69 years	2198	27.2
70–79 years	1574	19.5
>80 years	198	2.4
Distribution by status		
Student	57	0.7
Performs physical work	1166	14.5
Performs intellectual work	2928	36.3
Pensioner with disability, pensioner	3144	39.0
None of the categories above	761	9.5
Distribution by income status of the household		
Significantly below the average	622	7.8
Slightly below the average	1363	17.0
Average	3647	45.6
Slightly above the average	1893	23.6
Significantly above the average	481	6.0
Distribution by the place of living		
Village/settlement	1486	18.4
City	3030	37.6
County seat	1452	18.0
Capital city	2096	26.0

Source: Authors’ own research, 2024

The questionnaire contained 7 questions in addition to socio-demographic questions. We had one question where the answers were determined using a five-point Likert scale, which measured the strength of agreement. Respondents were also asked an open-ended question. The questionnaires were processed using SPSS 28.0, Microsoft Excel and OpenAI ChatGPT 4.o. It is important to note that ChatGPT 4.o was not used to write text passages, create figures or generate tables, but rather to assist in text analysis of answers to open-ended questions. Specifically, ChatGPT was tasked with clustering consumer opinions into coherent groups based on content similarity, which facilitated a more structured and nuanced analysis of qualitative data. This approach allowed for the extraction of thematic patterns and sentiments that might otherwise be overlooked in manual coding processes due to human error or bias. However, the incorporation of AI into our methodology could also be introduce potential biases, primarily related to the model’s training data. ChatGPT’s responses are influenced by the data it was trained on, which may not fully represent the diverse opinions or lexical nuances of our specific respondent group. Furthermore, while AI can efficiently process and categorize data, it lacks the human ability to understand context deeply, which can lead to oversimplifications or misinterpretations of

complex human sentiments. Regarding statistical reliability, while ChatGPT provides a robust tool for preliminary data analysis, its outputs require careful scrutiny and validation against established qualitative research methods to ensure accuracy. The potential for AI to misinterpret nuanced language or fail to capture subtle contextual clues necessitates a hybrid approach, combining AI efficiency with human oversight. Therefore, in our research, ChatGPT did not independently process the responses to open-ended questions, but assisted with human processing and categorization. During the quantitative processing, we used mean and some measures of variability (standard deviation, coefficient of variation), and the existence and closeness of the association between the variables was analyzed based on the Chi-square test and Cramer’s association test. In addition, we used K-means cluster analysis to create homogeneous consumer groups and analyzed the differences between the groups with Kruskal–Wallis one-way analysis of variance. The SPSS calculations were based on Field’s (2009) guidelines. We did not use ChatGPT for statistical calculations.

3. RESULTS

First, we examined how often the respondents consume soft drinks or drinks that have been affected by the new refund system in Hungary. In our research, we examined plastic bottles, metal cans and bottles separately. 67.8% of the respondents buy drinks in non-reusable plastic bottles (e.g. mineral water, soft drinks) at least weekly (41.3% of them on a daily basis). The option only a few times a year was chosen by 14.5%, while the option never bought appeared in 3.5%. 45.9% of respondents buy drinks in non-reusable metal cans (e.g. beer, energy, or vitamin-containing drinks) at least weekly (15.5% of them daily), 21.8% only a few times a year, while never 12.5%. 30.4% of the respondents use products in non-reusable glass packaging (e.g. alcoholic or non-alcoholic drinks in unusual packaging) at least weekly (5.9% of them daily), 32.9% only a few times a year, while 12.7% never buy. We conducted a Chi-square test and then Cramer’s association test to reveal whether there is an association between socio-demographic characteristics (gender, age, education, etc.) and how often the respondents consume soft drinks or drinks that have become affected by the system. Based on the results of the Chi-square test, there is an association between the variables ($p < 0.05$). The results typically showed a weak relationship, i.e., the socio-

demographic characteristics had only a small influence. In two cases, the Cramer’s association coefficient was higher than average. Drinks in non-reusable metal cans (e.g. beer, energy, or vitamin-enhanced drinks) and products in non-reusable glass packaging (e.g. alcoholic or non-alcoholic drinks in unconventional packaging) are more commonly purchased by men than by women. Regarding drinks in metal cans, the rate of at least weekly consumption in men is 55.2%, while in women it is 30.3% (Cramer’s $V = 0.299$), and in the case of drinks in glass packaging, 36.4% and 20.5%, respectively (Cramer’s $V = 0.236$).

In the questionnaire, we asked the respondents to indicate what they had previously done with the packaging of non-returnable products. The answers could be given using a 5-point scale depending on the proportion in which these packaging materials were selectively collected. A value of 1 meant that ‘I did not collect selectively at all, I threw all such packaging into the communal household waste’, while a value of 5 meant that ‘I paid maximum attention to this, all such products were always collected selectively’. The distribution of the answers according to the individual socio-demographic characteristics can be seen in Table 3.

Table 3 The attitude of the respondents to selective collection (N=8,225)

Socio-demographic variables	Mean	Standard deviation	Coefficient of variance (%)
Gender			
Male	4.08	1.25	30.59
Female	4.29	1.12	25.98
Education			
8 th grade or below*	3.74	1.57	41.97
Vocational training	3.90	1.32	33.90
Secondary-school leaving certificate	4.12	1.23	29.89
College, university	4.26	1.13	26.64
Age			
<18 years*	4.00	1.41	35.36
18–29 years	3.87	1.26	32.47
30–39 years	4.04	1.27	31.38
40–49 years	4.19	1.16	27.76
50–59 years	4.17	1.19	28.67
60–69 years	4.19	1.17	27.94
70–79 years	4.17	1.25	30.05
>80 years	4.26	1.16	27.22
Status			
Student*	3.82	1.24	32.45
Performs physical work at workplace	3.95	1.29	32.77
Performs intellectual work at workplace	4.26	1.11	26.10
Pensioner with disability or pensioner	4.20	1.20	28.54
None of the categories	3.97	1.32	33.34
Income status of the household			
Significantly below the average	3.92	1.39	35.53
Slightly below the average	4.01	1.26	31.47
Average	4.21	1.15	27.22
Slightly over the average	4.24	1.15	27.17
Significantly over the average	4.20	1.30	30.92
Place of living			
Village/settlement	4.16	1.17	28.21
City	4.09	1.27	30.99
County seat	4.13	1.24	30.02
Capital city	4.29	1.08	25.15

*The size of the group is too small to take the value into thoughtful consideration during the evaluation.

Source: Authors’ own research, 2024

In the light of the means, we can conclude that, on the basis of no single socio-demographic variable, the selective collection of waste was not an important and central issue. Among the groups with a sufficient number of respondents, the lowest average value (3.83) was given by those with maximum 8th grade education, but the average value of 3.87 for the age group between 18 and 29 years is no less beneficial for the future. It can be seen from the gender distribution of the respondents that for women it was a key question whether they collect waste selectively or not. It is also clear that with the increase in education level, age, income, and the size of the place of residence, the mean values rise. Based on their status, those who perform intellectual work, as well as retirees

and disabled pensioners, most often mentioned that the selective collection of waste was important to them. Based on the values of the Kruskal–Wallis test, the means of groups proved to be different ($p < 0.05$). The values of the coefficient of variance, on the other hand, usually exceed 10%, therefore the elements of each group do not cluster well around the averages.

The questionnaire research included the expected future effects of the Government Decree of 450/2023. (X. 4.) We asked the respondents to indicate how they expected the new return system to affect their own lives. The answers are illustrated in Figure 1.

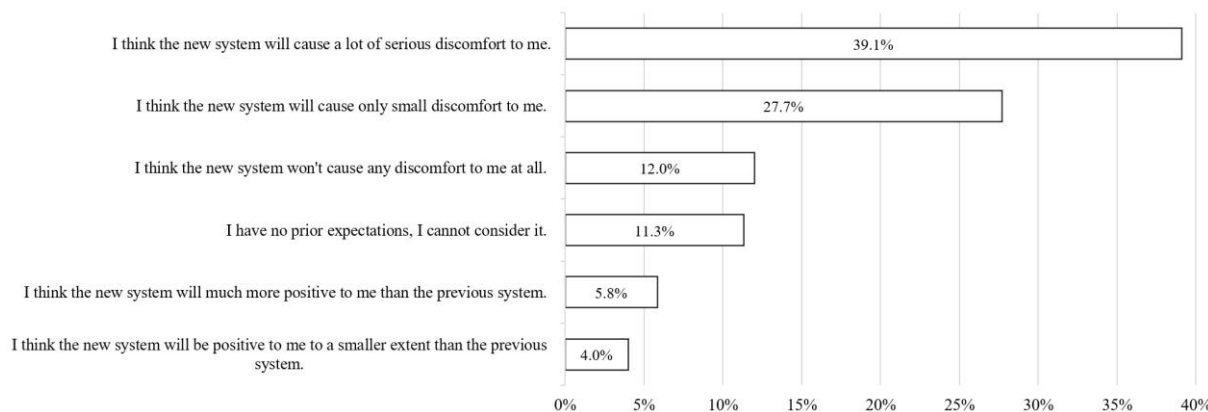


Figure 1 Preliminary expected effect of the new Deposit-Refund System on the respondents (N=8,225)

Source: Authors’ own research, 2024

The majority of the respondents had negative expectations of the new Deposit-Refund System that has come into force. 66.8% of the respondents reported more or less discomfort, 9.8% mentioned more or less positive effects, while 12% of the respondents were neutral on the question. Only 11.3% of the respondents stated that they had no prior expectations or could not decide on the question yet.

It is also interesting to study what preliminary plans respondents had regarding their consumption of mineral water/soft drinks in connection with the new refund system, since this range of products constitutes the largest consumption volume. 35.9% of the respondents did not plan to change their current habits; they have consumed the range of products so far, and will continue to do so, they bring back the bottles/cans, line up and refund them. 24.2% of them said that they planned to reduce their consumption of mineral water/soft drinks that can be bought in the store by switching to tap water, while 11.4% would reduce their consumption of mineral water/soft drinks that can be bought in the store by buying a water filter/water purifier equipment. Finally, 4.4% stated that they would reduce their consumption of mineral water/soft drinks that can be bought in the store and would instead switch to the consumption of larger ballooned water of 10 or 20 liters. 16.1% of the respondents stated that they had never consumed mineral water/soft drinks, so the changes would not affect them. 8% (636 people) indicated some other solution. We analyzed these ‘other’ answers with artificial intelligence (ChatGPT 4.0) in addition to human processing,

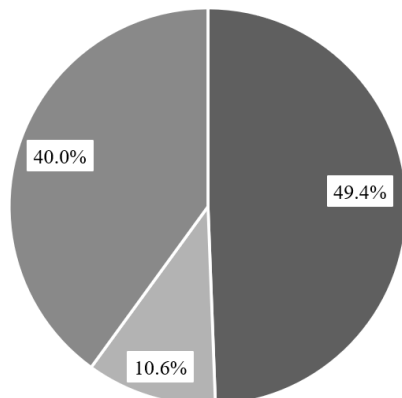
so subjectivity could be reduced. We asked ChatGPT 4.0 to cluster consumer views with similar content into groups. As a result, it was established that the answers given within the framework of the other alternative show diversity in consumer plans related to the new Deposit-Refund System. The answers have been grouped according to three main criteria, although it should be noted that the exact classification of the answers is a difficult task (because the respondent tells a personal story, several criteria are mixed, etc.), so we cannot provide exact values of proportions, but we can provide values of order of magnitude for the proportion of freely formulated answers. Several people (about 40%) planned to maintain their consumption, while others (about 35%) turn to alternative solutions, such as buying a soda machine, using a water filter, or switching to tap water, while some planned to buy drinks without a deposit fee from abroad. In addition, a considerable number of respondents (approx. 25%) indicated that they do not plan to change their consumption habits, continue to choose selective waste collection, or simply throw away the packaging. By paying the deposit, they pay the price of their passivity or pollution.

We asked the respondents to indicate their expectations for the new refund equipment/system and what impact they think it will have on their own lives. 58.3% of the respondents did not expect anything positive, according to them, the new system will be characterized by long lines and waiting times, faltering refund, and confused people. 41.7% of the

respondents believed that after minor interruptions at the beginning, people will quickly learn to use it, and the system will function smoothly.

The interviewees were then asked about the new Deposit-Refund System in general. We looked for the answer to how

they consider the new system in advance. Respondents could only choose from 3 answer options within the framework of a closed question. The choice ratio of the 3 options is illustrated in Figure 2.



- I think reducing the quantity of waste is a good idea, we need to strive to achieve sustainability and environmental protection.
- This topic is neutral to me. It is a law, we must accept it.
- It gives me goosebumps. Cans/bottles have to be returned undamaged. Queuing, inconvenience, discomfort. Do I have to carry empty cans and bottles with me all day?!

Figure 2 Preliminary opinion on the principles of the new Deposit-Refund System (N=8,225)

Source: Authors' own research, 2024

Since the socio-demographic characteristics did not fully explain the responses of the interviewees (see Cramer's association tests), it is also important to examine what segments (clusters) the respondents can be classified into

based on other characteristics on their preliminary opinion about the new DRS. Therefore, with K-means cluster analysis, we created four segments based on four variables, which is illustrated in detail in Table 4.

Table 4 Mean values or percentage shares of the segmentation variables per cluster (N=8,225)

	Segments				F value
	Segment1	Segment2	Segment3	Segment4	
Share of segment within the population (%)	50.6	12.7	15.0	17.2	-
What did you do before with the packaging of non-refundable products?*(average)	4.69	3.97	2.02	4.63	4488.999
According to your preliminary expectations, how will the new Deposit-Refund System affect you? (%)					
I think the new system will cause a lot of serious discomfort to me.	55.9	0.0	60.9	0.0	18372.511
I think the new system will cause only small discomfort to me.	43.4	0.0	30.5	0.0	
I think the new system won't cause any discomfort for me at all.	0.7	0.0	7.2	58.2	
I think the new system will be slightly more favorable for me.	0.0	0.2	1.4	21.1	
I think the new system will be much more favorable for me.	0.0	15.7	0.0	20.7	
I have no prior expectations, I cannot consider.	0.0	84.1	0.0	0.0	
What are your expectations for the new Deposit-Refund Equipment/System? (%)					
I don't expect anything positive, long lines and waiting time, faltering refund, confused people.	70.2	44.3	78.5	16.4	647.803
After minor interruptions at the beginning, people will quickly learn to use it, and the system will function smoothly.	29.8	55.7	21.5	83.6	
If you can only choose from the 3 options below, how do you view the new Deposit-Refund System in advance? (%)					
I think reducing the quantity of waste is a good idea, we need to strive to achieve sustainability and environmental protection.	37.2	63.4	27.5	93.3	742.237
This topic is neutral to me. It is a law, we must accept it.	10.7	14.5	12.3	5.5	
It gives me goosebumps. Cans/bottles have to be returned undamaged. Queuing, inconvenience, discomfort. Do I have to carry empty cans and bottles with me all day?!	52.1	22.1	60.2	1.2	

* The respondents could give their answers using a 5-point scale depending on the proportion of selective collection of these packaging materials. 1 – 'I did not collect selectively at all, I threw all such packaging into the communal household waste', 5 – 'I paid maximum attention to this, all such products were always collected selectively.' Source: Authors' own research, 2024.

The accuracy and correctness of the analysis is proven by the fact that we obtained reliable values for all variables ($p < 0.001$). The F values show the weight of the segmentation criteria, so where the value is the highest, it is the most important segmentation criterion. Accordingly, preliminary expectations regarding the new system are by far the most important group-forming criterion. During the study, we could not classify only 4.5% of the respondents into any cluster. During the cluster analysis, 4 segments represented an exact solution, the opinions of which can be clearly separated. The socio-demographic characteristics of the clusters are presented in Table 5 in the Appendix. The main characteristics of the formed clusters are as follows:

Segment 1: Those worried

Even before the introduction of the regulation, the members of the segment collected the packaging materials of the beverage products selectively affected by the regulation. In their case, the mean value of selective collection was the highest (4.69). Considering their personal comfort, the members of the segment are concerned. 55.9% of the members believe that the new regulation will cause them a lot of serious discomfort, while 43.4% expect minor discomfort. 70.2% of them do not expect anything positive from the new system, they expect long lines and waiting times, faltering refund, and confused people. In advance, 52.1% of the segment had a particularly negative opinion about the effects of the new regulation. 28.7% stated that they would reduce their consumption of mineral water/soft drinks and switch to tap water. The proportion of men in the segment is 65.1%, the most typical age groups are 50–59 years and 60–69 years. The proportion of people with higher education is the highest in this segment (54.9%). The proportion of residents of the capital and above-average incomes in the segment is higher than the average. The proportion of the segment within the sample is 50.6%.

Segment 2: Those waiting

Its members can best be characterized by the phrase ‘we’ll see what happens.’ They were waiting to form their opinion, they were unsure, but – if only to a small extent – they showed a rather positive attitude towards the new regulation. 84.1% of the group’s members had no prior expectations, they could not consider how the new regulation will affect them. According to the opinion of 55.7%, after minor interruptions at the beginning, people will quickly learn to use it, and the system will function smoothly. According to 63.4%, the introduction of the regulation is a promising idea (this is the second most favorable value among the segments), the amount of discarded waste should be reduced, sustainability and environmental protection should be strived for. The proportion of women in this segment is the highest, 48.6%. 46.8% of the members of the segment have an average income. The proportion of villagers and city dwellers is the highest in this segment. The proportion of the segment within the sample is 12.7%.

Segment 3: Those refusing

Members of the segment did not really collect packaging materials for beverage products selectively. In their case, the mean value of selective collection is by far the lowest (2.02). Considering their personal comfort, the members of this

segment were similarly worried about the new DRS to Segment 1. 60.9% of the group’s members believed that the new regulation would cause them a lot of serious discomfort, while 30.5% expected minor discomfort. 78.5% of them did not expect anything positive in connection with the new system, they expected long lines and waiting times, faltering refund, confused people. 60.2% of the group had a particularly negative opinion about the effects of the new regulation. The proportion of men in the segment is 70.2%. In this segment, the proportion of people with vocational qualifications and physical work is the highest. The cumulative proportion of those with significantly below-average and below-average incomes is the highest in this segment. The proportion of the segment within the sample is 15.0%.

Segment 4: Those supporting

58.2% of the segment preliminarily believed that the new system would not cause them any discomfort at all, while the remaining 41.8% hoped for more or less positive effects from the regulation. 83.6% of them believed that after minor interruptions at the beginning, people would quickly learn to use it, and the system would function smoothly. 93.3% of the members of the segment thought that the creation of the regulation was a promising idea, that the amount of discarded waste should be reduced, and sustainability and environmental protection should be strived for. The members of this segment mostly live in larger cities and county seats, live in better financial conditions, and do intellectual work. The proportion of the segment within the sample is 17.2%.

In the questionnaire survey, within the framework of an open-ended question, the respondents were given the opportunity to express their own opinions and insights regarding the new system. In our research, 1854 people (22.5%) answered this question. Among the answers, we can find positive and negative opinions, sometimes expressed quite passionately, suggestions for changes, and sharing of life stories. Without claiming to be complete, we quote some typical comments verbatim:

- *‘It would have been better to put a mark on the cap, e.g. a QR code. Then the bottles would have been collapsible, and you wouldn’t have to play with bags. The cap always remains intact. Someone tries to collect beer cans or thin mineral water bottles without crushing them. It won’t work.’*
- *‘The biggest problem is that bottles/cans can only be returned undamaged. It takes up a lot of space that way. You often have to exchange tiny amounts. Storage in an apartment is difficult to solve.’*
- *‘We will spend + HUF 50 per bottle, we will still throw it into the selective. We don’t have the capacity to fool around with the new system.’*
- *‘The idea is good, but the implementation hides many pitfalls.’*
- *‘There will be no automatic reverse vending machines in the villages. Everything will remain as it was.’*
- *‘The deposit fee should have been determined at least HUF 100. Return to reusable bottles. You need a lot more refund points. Even in Germany there is a constant queue.’*

- ‘Bottles of 3.1 liters will appear, and that’s all!’
- ‘In my opinion, the printing ink would not hold.’
- ‘It’s about time to introduce it here as well, because only with this measure can the amount of waste released into the environment be reduced.’

The responses were also evaluated with ChatGPT version 4.0 in addition to manual processing, the aim of which was again to exclude/reduce subjectivity. The insights of the artificial intelligence were consistent with the researchers’ opinion. Free speech opinions about the new refund system were mixed, but they can be grouped into several well-defined main topics:

1. Logistical and comfort uncertainties: Respondents complained that refund would be difficult, especially for those living in smaller settlements where there are few or no refund points. They also mentioned the problem of damaged bottles, as well as the fact that storing empty bottles at home could be a problem. This topic appears in about 33.3% of the answers.

2. Environmental protection uncertainties: Some criticized that the system would not actually reduce pollution or that manufacturers should be held responsible for packaging, not consumers. Some people thought that the refund system was not the real solution to the problem of plastic pollution. This topic appears in about 13.3% of the answers.

3. Financial concerns: Several people mentioned the costs of the system, especially those who believed that the new system would only impose an additional burden on consumers, as well as on those who could not or did not want to return the bottles, thus losing the deposit fee. This topic appears in about 20% of the answers.

4. Resistance and acceptance: While some were completely against the system, others were more pragmatic or even supported it, given the environmental benefits. Some believed that the introduction of the system was premature, while others have been waiting for it for a long time. This topic appears in about 26.7% of the answers.

5. Comparison to other countries: Some comments mention that similar systems work successfully in other countries, or, on the contrary, that they are not popular there either. This topic appears in about 6.7% of the answers.

The dominance of negative opinions was also marked here, their proportion is ranging between 75–90%, depending on the way of grouping.

4. DISCUSSION

According to our results, the respondents most often choose drinks in non-reusable plastic bottles, followed by products in metal cans and finally glass bottles, which reflects the actual sales rates in Hungary (Tamásné Szabó, 2023). This is also in line with the fact that almost a fifth of European packaging waste (second most common packaging material) is plastic (Eurostat, 2024). The purchase of different packaging materials affected by the new Deposit-Refund System shows

only weak variation according to socio-demographic background variables. We found a stronger-than-average difference only in terms of gender: men consume drinks in metal cans and products in non-recyclable glass packaging significantly more often than women. This is partly due to the fact that men in Hungary consume alcoholic beverages at a higher intensity. According to KSH (2021) data, the proportion of heavy drinkers and moderate alcohol consumers is higher for men (9.3% and 30.9%) than for women (1.5% and 10.6%), these products are typically marketed with the above-mentioned packaging material.

For our respondents, even before the introduction of the new Deposit-Refund System, the selective collection of waste was on average particularly important (4.16 on a five-point scale), at least at the level of words. This is also confirmed by our result, according to which almost half of the respondents think that the new system is a promising idea from a sustainability point of view. However, this is contradicted by the fact that the PET bottle collection rate in Hungary was only around 42% before the introduction of the new system (Eunomia, 2020), which is a tailender among European countries. This significant discrepancy between the values held and the behavior followed is not uncommon in issues related to sustainability (Shields et al., 2002). Examining demographic differences, we found that selective collection was more important for women, those performing intellectual work, pensioners and disabled pensioners, and that its importance increases with education, age, income, and the size of the place of residence. These results are consistent with the majority of previous research (Gamba and Oskamp, 1994; Johnson et al., 2004; Sidique et al., 2010; Saphores et al., 2012; Bell et al., 2017; Amantayeva et al., 2021), while some are contradicted (Do Walle et al., 2004; Klaiman et al., 2017; Best and Kneip, 2019; Šmaguc et al., 2023).

As a result of the new system, most people (about 40%) did not plan to change their mineral water and soft drink consumption habits but thought that they would try to adapt to the new system. Approximately the same number of people (about 43%) believed that they would try to reduce their consumption, primarily by replacing bottled drinks with tap water, but the purchase of water filter/water purification equipment, the consumption of larger bottled water, and even the purchase from abroad were also mentioned among the alternatives. The replacement of drinks, which are now available in packaging with a deposit fee, by other alternatives was also observed in Portugal in the case of plastic bags when they could no longer be obtained for free, but for money (Luis et al., 2020). Thus, the introduction of DRS can not only improve the recycling rate, but also reduce the amount of packaging waste generated.

Based on the responses of those interviewed, the majority (about two-thirds) of them had negative expectations regarding the new deposit fee and DRS, while only about 10% expected more or less favorable effects. Contrary to previous research results related to the adoption of DRS (Boros et al., 2021; Šmaguc et al., 2023; Martinho et al., 2024), we did not find any significant differences in this question between socio-demographic groups.

Based on the behavior related to selective collection and the preliminary expectations related to the new system, we grouped the respondents into four clusters, of which 'Those worried' make up half of the sample. In addition, 'Those refusing' (about 15%) are the ones who look at the new system with the most negative expectations. The two clusters – in terms of their socio-demographic characteristics – represent two extremes: while those who are concerned typically come from consumers with a higher socio-economic status (with higher education and higher income), those refusing are clearly consumers with lower education and income. This duality is also reflected in previous research results, while according to the results of Šmaguc et al. (2023), there is a negative relationship of education and household income with the adoption of DRS, which suggests that users of the system are those of lower socioeconomic status who use the system because of financial compensation, Gamba and Oskamp (1994), Sidique et al. (2010), Bell et al. (2017) and Amantayeva et al. (2021), found that consumers with higher education, income, and social status were more likely to participate in recycling, presumably because of their higher level of environmental awareness. In addition, since the 'Those worried' group is mostly represented by older people, the fears of this age group may not be unfounded, as Jarossová et al. (2023) presented, according to whose results, the older generation mostly feels that the new DRS introduced in Slovakia negatively influenced their purchasing process. What is common in the segments of 'Those worried' and 'Those refusing' is the dominance of men (especially in the segment of 'Those refusing'). Only 'Those supporting,' who make up less than one fifth of the sample, have a clear good opinion of the system. They typically live in larger cities, have a higher income, and do intellectual work.

More than a fifth of the respondents answered the open-ended question about the new DRS and expressed their own opinion. In general, the response rate to open-ended questions tends to be low (typically a few percent), as answering those questions may require more time and effort (Connor Desai and Reimers, 2019). The high response rate of the open-ended question indicates how much the topic interests (and divides) Hungarian consumers. Based on their own opinions, the respondents were worried about the discomfort of the system, the difficulties of refund, logistical problems, as well as environmental effects and economic consequences. Most of these concerns are essentially the same as the aspects of discomfort associated with refund appearing in the literature, which hinder the adoption of already introduced DRSs (Miafodzyeva and Brandt, 2013; Oke and Kruijzen, 2016; Best and Kneip, 2019; Amantayeva et al., 2021; Jarossová et al., 2023; Šmaguc et al., 2023; Martinho et al., 2024). In addition, respondents thought that the introduction of the system would not solve the basic problems of waste management, and there would be better solutions, as confirmed by Oke et al. (2020) results. There were also positive opinions, but they were less frequent and mostly referred to the environmental benefits or the necessity of the system due to sustainability. Similarly to literature (Oke et al., 2020; Boros et al., 2021), the protection of the environment as a motivating factor for the use of DRS is important – according to certain research (Jarossová et al., 2023; Martinho et al., 2024) it is the most important factor –, it also appeared among Hungarian consumers.

The results found in the literature show that the acceptance of DRS is favorable and that positive attitudes towards it predominate (Dempster et al., 2021; Martinho et al., 2024); it is true, however, that research was carried out after the introduction of the system. According to Sidique et al. (2010), knowledge of the recycling process and the availability of the infrastructure, and even the use of the system itself (Martinho et al., 2024) helps the development of positive attitudes and acceptance, so it is expected that after the introduction of the DRS (when more information and instructions for use will be available with experience) the proportion of negative opinions will also be lower in Hungary.

5. CONCLUSIONS

In summary, we can state that Government Decree of 450/2023. (X. 4.) – which provides for the detailed rules for the establishment and application of the deposit fee, as well as the distribution of products with a deposit fee – is of serious consumer interest in Hungary. Its rules also interfere in the everyday lives of ordinary people, sometimes imposing a greater or lesser financial burden on them.

We conducted an online consumer survey with 8,225 people to explore preliminary consumer expectations regarding the new Deposit-Refund System. According to our results, about half of the respondents consider the introduction of the new rules to be a promising idea, but at the same time, two-thirds of the respondents feel more or less discomfort about the new system. The preliminary expectations are therefore mostly negative, especially in the 'Those worried' and 'Those refusing' consumer segments. In addition to discomfort, environmental doubts and economic concerns also appear in consumer opinions, which can hinder the adoption of the new system. However, the literature results indicate that after the introduction of the system, after learning about it, acceptance is expected to reach a higher level.

Due to the considerable number of respondents and the diversity of the sample, this research definitely has a serious indication of the opinion and perception of Hungarian consumers in advance of the introduction of DRS; however, it cannot be considered representative. As a limitation, the questionnaire survey examines preliminary opinions, since at the time the research was conducted there was no refundable single-use packaging in Hungary. It may therefore be worthwhile to repeat the research when Hungarian consumers have enough experience with DRS, on a representative sample. Moreover, the opinions are subjective, and consumers may have shaped their answers according to social pressure (knowing what is the socially accepted, correct answer), which may cause a discrepancy between the professed values and the followed behavior.

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Appendix

Table 5 Detailed descriptive statistics of the segments, % (N=8,225)

Question	Those worried	Those waiting	Those refusing	Those supporting
What preliminary plans do you have regarding the new Deposit-Refund System for the consumption of mineral water/soft drinks?				
I have not consumed mineral water/soft drinks so far, so the changes do not affect me.	10.3	25.9	10.9	29.0
I don't plan to make any changes to the current ones, I've consumed them so far and will continue to do so, I'll take the bottles/cans back, wait my turn and exchange them.	34.3	37.2	29.5	47.0
I will reduce my consumption of mineral water/soft drinks, I will switch to drinking tap water.	28.7	16.6	30.5	12.0
I will reduce my consumption of mineral water/soft drinks, I will buy a water filter/water purification equipment.	13.4	8.2	11.9	6.8
I will reduce my consumption of mineral water/soft drinks, I will switch to drinking 'balloon' water in larger packages, 10–20 liters.	5.2	3.6	5.9	1.2
Other	8.2	8.6	11.2	4.1
Gender				
Male	65.1	51.4	72.2	53.9
Female	34.9	48.6	27.8	46.1
Age				
<18 years*	0.1	0.3	0.1	0.1
18–29 years	2.3	1.7	3.3	3.2
30–39 years	8.6	8.1	9.0	8.8
40–49 years	16.7	18.2	14.9	19.6
50–59 years	23.3	23.9	23.2	23.6
60–69 years	27.8	25.4	27.8	26.4
70–79 years	18.7	20.3	19.7	16.6
>80 years	2.5	2.2	2.0	1.7
Education				
8 th grade or below*	0.5	3.1	1.2	1.1
Vocational training	8.8	13.8	16.1	10.6
Secondary-school leaving certificate	35.6	39.3	38.6	33.6
College, university degree	54.9	43.8	44.2	54.7
Status				
Student*	0.5	1.3	0.7	1.1
Performs physical work at workplace	12.5	16.4	19.2	15.8
Performs intellectual work at workplace	39.8	30.2	29.4	40.4
Pensioner with disability, pensioner	38.3	40.0	37.6	36.0
None of the categories	8.9	12.0	13.1	6.7
Income status of the household				
Significantly below average	6.7	9.7	10.4	5.9
Slightly below average	16.2	18.7	21.4	13.7
Average	45.8	46.8	43.0	46.8
Slightly over average	24.9	19.8	19.3	27.5
Significantly over average	6.4	5.0	5.8	6.2
Place of living				
Village/settlement	17.0	21.2	18.8	19.8
City	36.2	41.1	40.2	37.0
County seat	17.7	16.4	18.7	20.1
Capital city	29.0	21.3	22.4	23.2

*The size of the group is too small to take the value into thoughtful consideration during the evaluation.

Source: Authors' own research, 2024



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