

Understanding Deposit Refund Systems (DRS) and Reducing Waste for Sustainability

Beytullah Eren ^{*1}

¹Department of Environmental Engineering/Faculty of Engineering, Sakarya University, Türkiye

^{*}(beren@sakarya.edu.tr)

Abstract – This article explores the potential of Deposit Refund Systems (DRS) in mitigating the global environmental crisis arising from rising waste and pollution. DRS motivates recycling by offering financial incentives for returning items like bottles and cans, effectively decreasing plastic waste and litter in diverse locations. The article explores the mechanics of DRS, outlining its benefits and challenges. It also traces the historical evolution of DRS, covering early initiatives to recent implementations across different countries. DRS serves as a compelling motivator for recycling, encouraging individuals to return used containers and contribute to waste reduction. Despite its effectiveness, challenges such as initial setup costs and concerns about fraud are acknowledged. The article details the steps in establishing a DRS, including rule formulation, awareness campaigns, and business collaboration. The positive environmental impact of DRS is highlighted, contributing to increased recycling rates, cleaner public spaces, and job creation. However, limitations are acknowledged, such as setup costs and inconvenience for consumers. In conclusion, DRS emerges as a promising solution to address the environmental crisis, emphasizing the need for careful planning and global cooperation. Ongoing research and innovation are essential to enhance DRS's effectiveness in sustainable waste management. The collaborative efforts of governments, businesses, and individuals are pivotal in shaping deposit refund systems' future toward a more environmentally sustainable world.

Keywords – Deposit Refund Systems (DRS), Waste Reduction, Sustainability, Environmental Impact, Consumer Behavior

I. INTRODUCTION

The world is facing a growing environmental crisis as waste and pollution impact the planet in devastating ways. Governments, businesses, and consumers are increasingly looking for ways to reduce waste and promote sustainability. In recent years, there has been growing concern over the environmental impact of waste and pollution [1], [2]. The deposit refund system (DRS) has become a popular method for dealing with this problem. This system encourages consumers to recycle, reuse, or appropriately dispose of items they no longer require by offering a financial incentive through a deposit refund. From bottles and cans to appliances and furniture, deposit refund systems have been introduced in diverse ways globally, showing promising outcomes in waste reduction and fostering sustainability [3], [4].

The system has been implemented in various forms worldwide and has shown promising results in reducing waste and promoting sustainability. The most well-known example of the deposit refund system is the system used for bottles and cans [5]. In many countries, consumers pay a small deposit when purchasing a beverage in a bottle or can and can then receive a refund when they return the empty container to a designated collection point. This system has been credited with significantly reducing the amount of plastic waste and litter in many cities and countries [6]–[9].

This article will explore the deposit refund system in more detail. We will examine how the system works, its benefits, and its limitations. We will also consider the potential for the deposit refund system to help address the global environmental crisis and

the challenges that must be overcome to make it an effective tool for promoting sustainability.

II. MATERIALS AND METHOD

A. DEPOSIT REFUND SYSTEM

The term “Deposit Refund System” is a general concept that typically refers to a broad scope used within a country or region. This system commonly involves the application of a deposit, especially for specific product types like consumer-packaged beverage containers. Consumers pay an additional fee when purchasing the product, which is refunded when they return it after consumption [10], [11]. A typical example of a deposit refund system is the one employed for bottles and cans in many countries. Consumers pay a small deposit when purchasing a bottle or can and can subsequently receive a refund upon returning the empty container to a designated collection point. This encourages consumers to recycle the containers instead of disposing of them [12]. Deposit refund systems are commonly applied to various items, including beverage containers, lead-acid batteries, motor oil, tires, hazardous materials, electronics, and more [3], [13]. Fig. 1 illustrates an example of a Vending Machine with a Deposit Refund System for plastic bottles.



Fig 1. Example of a Vending Machine with a Deposit Refund System for plastic bottles [14]

The idea of a deposit refund system has existed for over a century. In the early 1900s, many beverage companies in the United States and Canada offered refunds for glass bottles to encourage consumers to return the bottles for reuse. However, as disposable bottles and cans became more widespread, the system fell out of favor. It wasn't until the 1970s and 80s that the deposit refund system was reintroduced to address the growing problem of litter and waste. In 1971,

Oregon became the first US state to implement a bottle bill, which required consumers to pay a 5-cent deposit on beverage containers and provided a refund when the containers were returned [15], [16]. In 1984, Sweden introduced Europe's first deposit refund system. Lithuania, launching its scheme in 2016, achieved outstanding results, recovering 70% of drink containers in the first year and 90% in the second year. Several countries, including Germany, Denmark, Estonia, Finland, Croatia, Norway, Sweden, Switzerland, Hungary, and the Czech Republic, have successfully implemented DRS [17]. There wasn't a nationwide deposit refund system implemented in Turkey. In 2017, a waste reduction initiative known as the “Zero Waste” Project was introduced in Turkey. The project aimed to enhance national recycling rates. Subsequently, in 2019, the Ministry of Environment and Urbanization announced plans to implement a deposit scheme for all beverage containers by 2023 as part of the “Zero Waste” initiative. Initially slated for 2021, the scheme's official implementation was later confirmed to commence in January 2022, overseen by the Turkish Environment Agency. The setup includes deposit points strategically located in high-traffic areas like shopping centers and malls [18], [19]. Despite not yet being fully implemented in Turkey, localized initiatives have been introduced to promote recycling through a deposit refund system. For example, a pilot project in Istanbul was initiated in 2019, encouraging consumers to return plastic bottles by offering credits on their Istanbulkart, a smart card used for public transportation [20].

B. ADVANTAGES AND DISADVANTAGES OF THE DEPOSIT REFUND SYSTEM

The deposit refund system presents several advantages. Firstly, it is a powerful motivator for recycling, offering consumers a financial incentive to return used containers, thereby contributing to higher recycling rates and a reduction of waste. Additionally, the system helps reduce littering, as individuals are less likely to discard containers irresponsibly when there is a financial reason for their return. Furthermore, by encouraging the return and reuse of containers, the deposit refund system promotes the principles of a circular economy, fostering resource conservation and waste minimization. Job creation is another positive outcome, with opportunities arising in the

collection, sorting, and recycling processes. The revenue generated from unclaimed deposits can be allocated to support recycling programs and other environmental initiatives [21], [22].

However, the deposit refund system is not without its challenges. The initial setup costs can be substantial, potentially increasing consumer beverage prices. Concerns arise from fraud and abuse, encompassing issues such as the return of containers not bought within the country or the utilization of counterfeit or stolen containers. Inconvenience may be a drawback, as consumers might find it difficult to return containers to designated collection points, especially if these locations are not conveniently situated [23]. The system's scope is limited, addressing only specific types of beverage containers and not extending to other forms of waste. Lastly, there's the potential for reduced charitable donations, as organizations relying on aluminum can collection for fundraising may be adversely affected, given that consumers may opt to return cans for a deposit rather than donate them. It's essential to note that the effectiveness of the deposit refund system, along with its advantages and disadvantages, can vary depending on the specific context and implementation [24].

C. APPLICATION STEPS OF THE DEPOSIT REFUND SYSTEM

The specific steps of the deposit refund system may vary based on each system's context, regulations, and goals. Figure 2 illustrates the general application steps of the deposit refund system, outlining key stages from policy formulation to expansion and adaptation.

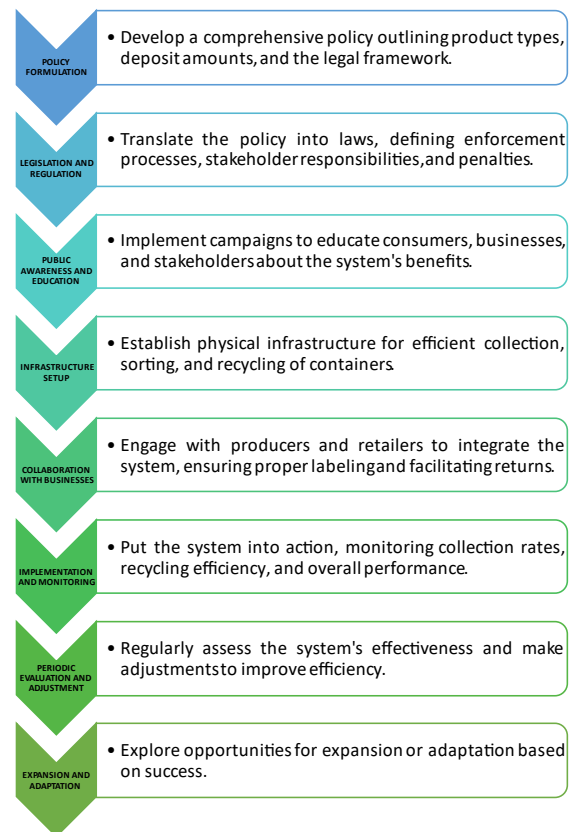


Fig. 2. General Application Steps of the Deposit Refund System (DRS)

The application steps of the general deposit refund system involve a systematic process to establish and implement an effective recycling policy. It begins with formulating a comprehensive approach that outlines the types of products, deposit amounts, and the legal framework. This policy is then translated into legislation and regulations, defining enforcement processes, stakeholder responsibilities, and penalties for non-compliance. Public awareness and education campaigns are crucial to inform consumers, businesses, and stakeholders about the system's benefits and functionality. Establishing physical infrastructure, including collection points, sorting facilities, and recycling centers, is crucial in efficiently handling returned containers. Collaboration with businesses, such as producers and retailers, is essential to integrate the deposit refund system into their operations, including proper labeling and facilitating the return process. The implementation phase involves implementing the plan and monitoring key metrics like collection rates and recycling efficiency. Regular evaluations are conducted to assess system effectiveness, with adjustments made based on findings to improve efficiency and address challenges. Finally, the

system may explore opportunities for expansion or adaptation based on its success, potentially including additional products or regions.

Briefly, Although the steps provided offer a broad framework for setting up a deposit refund system, the details of its implementation may vary depending on the specific context. The system's success is intricately tied to factors like the collaboration of beverage producers and the level of public engagement and willingness to participate in the program actively.

III. ASSESSING THE ENVIRONMENTAL IMPACT OF THE DEPOSIT REFUND SYSTEM

The environmental impact of the deposit refund system is diverse, addressing various critical dimensions. Figure 3 illustrates the benefits of the deposit refund system.

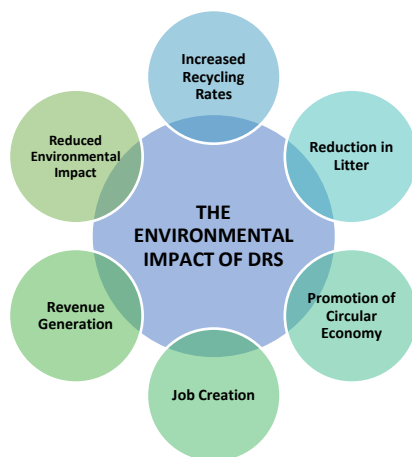


Fig. 3. The benefits of the deposit refund system

The Deposit Refund System (DRS) has many benefits. It encourages recycling by giving consumers a financial reward for returning used items, thereby increasing recycling rates. Additionally, the system helps reduce litter by discouraging irresponsible disposal, leading to cleaner public spaces with fewer discarded items. The DRS also supports a circular economy by promoting the return and reuse of items, conserving resources, and minimizing waste. This system creates jobs in collection, sorting, and recycling, benefiting local economies. Unclaimed deposits add to revenue, supporting recycling programs. Furthermore, the DRS reduces the overall environmental impact by lowering the demand for new materials and using less energy in manufacturing.

The Deposit Refund System (DRS) comes with several limitations. Firstly, the initial setup costs are substantial, potentially resulting in higher consumer prices. There are concerns about fraud, like people returning items not bought locally or using fake or stolen containers. Additionally, returning things to designated collection points may inconvenience consumers, mainly if these locations are inaccessible. The system has a limited scope, focusing primarily on specific items like beverage containers and excluding other forms of waste. Lastly, the system's effectiveness varies depending on the particular context and implementation, making it context dependent.

IV. CONCLUSION

In conclusion, the deposit refund system presents a promising approach to addressing the environmental crisis by reducing waste and promoting sustainability. Its effectiveness in motivating recycling, reducing litter, and fostering a circular economy is evident from successful global implementations. However, the system is not without challenges, including economic considerations, potential consumer inconveniences, and the need to address unintended consequences and fraud concerns.

The effectiveness of DRS relies on finding the right balance between economic advantages and societal approval, requiring adjustments fitted to specific contexts. DRS should be integrated into a broader waste management strategy that considers diverse waste streams and encourages global collaboration to maximize its impact. As nations strive to overcome implementation challenges, ongoing research, and innovation will play a crucial role in refining DRS and ensuring its effectiveness as a tool for sustainable waste management. The continued dialogue between governments, businesses, and consumers will be instrumental in shaping the future of deposit refund systems and their role in building a more sustainable world.

Although quantifying the exact contribution of the deposit refund system to the environment may be challenging, it is evident that it has played a crucial role in promoting sustainable waste management and resource conservation.

References

- [1] “How Our Trash Impacts the Environment - Earth Day”. Erişim: 10 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.earthday.org/how-our-trash-impacts-the-environment/>
- [2] S. Bećirović, S. Ibro, ve B. Kalač, “Environmental pollution and waste management”, *Balkan Journal of Health Science*, c. 03, ss. 2-10, Oca. 2015.
- [3] M. Walls, “Deposit-Refund Systems in Practice and Theory”. Rochester, NY, 23 Kasım 2011. doi: 10.2139/ssrn.1980142.
- [4] G. Zhou *vd.*, “A systematic review of the deposit-refund system for beverage packaging: Operating mode, key parameter and development trend”, *Journal of Cleaner Production*, c. 251, s. 119660, Nis. 2020, doi: 10.1016/j.jclepro.2019.119660.
- [5] D. R. Schneider, T. Tomić, ve R. Raal, “Economic Viability of the Deposit Refund System for Beverage Packaging Waste – Identification of Economic Drivers and System Modelling”, *Journal of Sustainable Development of Energy, Water and Environment Systems*, c. 9, sy 3, ss. 1-33, Eyl. 2021, doi: 10.13044/j.sdewes.d8.0386.
- [6] Z. S. Mazhandu, E. Muzenda, T. A. Mamvura, M. Belaid, ve T. Nhubu, “Integrated and Consolidated Review of Plastic Waste Management and Bio-Based Biodegradable Plastics: Challenges and Opportunities”, *Sustainability*, c. 12, sy 20, s. 8360, Eki. 2020, doi: 10.3390/su12208360.
- [7] O. Balcers, J. Brizga, ve H. Moora, *Deposit Return Systems for Beverage Containers in the Baltic States. Riga: Green Liberty*. 2019. doi: 10.13140/RG.2.2.16772.58244.
- [8] F. Alpizar *vd.*, “A framework for selecting and designing policies to reduce marine plastic pollution in developing countries,” *Environmental Science & Policy*, c. 109, ss. 25-35, Tem. 2020, doi: 10.1016/j.envsci.2020.04.007.
- [9] O. Horodytska, A. Cabanes, ve A. Fullana, “Plastic Waste Management: Current Status and Weaknesses”, içinde *Plastics in the Aquatic Environment - Part I: Current Status and Challenges*, F. Stock, G. Reifferscheid, N. Brennholt, ve E. Kostianaia, Ed., içinde *The Handbook of Environmental Chemistry*, Cham: Springer International Publishing, 2022, ss. 289-306. doi: 10.1007/978-3-030-74080-1_408.
- [10] E. Görgün *vd.*, “Deposit refund system for beverage containers as a best practice example for recycling maximization”, *ERT*, c. 4, sy 3, Art. sy 3, Eyl. 2021, doi: 10.35208/ert.862611.
- [11] G. P. Agnusdei, M. G. Gnoni, ve F. Sgarbossa, “Are deposit-refund systems effective in managing glass packaging? State of the art and future directions in Europe”, *Science of The Total Environment*, c. 851, s. 158256, Ara. 2022, doi: 10.1016/j.scitotenv.2022.158256.
- [12] “Introducing a Deposit Return Scheme for drinks containers in England, Wales and Northern Ireland - government response”.
- [13] P. Rossetti, “Deposit Refund Systems Are More Effective Than Mandates”.
- [14] S. S. W. Management, “Various models of Deposit Refund Scheme and its pros and cons”, *Sensoneo*. Erişim: 12 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://sensoneo.com/various-models-deposit-refund-scheme/>
- [15] “Department of Environmental Quality : Oregon’s Evolving Bottle Bill : Recycling : State of Oregon”. Erişim: 12 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.oregon.gov/deq/recycling/pages/bottle-bill.aspx>
- [16] “History of Oregon’s Bottle Bill”, *OBRC*. Erişim: 24 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://obrc.com/oregons-bottle-bill/history-of-oregons-bottle-bill/>
- [17] Recykal, “Why are countries all around the world implementing Deposit Refund Schemes?”, *Recykal*. Erişim: 20 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://recykal.com/blog/why-are-countries-all-around-the-world-implementing-deposit-refund-scheme/>
- [18] “Global Deposit Book 2020”, *ReLoop Platform*. Erişim: 20 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.reloopplatform.org/resources/global-deposit-book-2020/>
- [19] B. Şimşek, “Deposit return scheme set to join Turkey’s zero waste project”, *Daily Sabah*. Erişim: 20 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.dailysabah.com/turkey/deposit-return-scheme-set-to-join-turkeys-zero-waste-project/news>
- [20] “Istanbul Launches Recycling Vending Machine as Pilot Project”, *Globe Post Turkey*. Erişim: 20 Aralık 2023. [Çevrimiçi]. Erişim adresi: <http://turkey.theglobepost.com/turkey-recycling/>
- [21] recykal_wpapp, “4 benefits of implementing Deposit Return Scheme”, *Recykal*. Erişim: 24 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://recykal.com/blog/deposit-return-scheme/>
- [22] “Deposit Return Scheme Environmental Benefits”. Erişim: 24 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.zerowastescotland.org.uk/resources/deposit-return-scheme-environmental-benefits>
- [23] “Deposit return schemes: resolving plastic waste”, *Innovation News Network*. Erişim: 24 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.innovationnewsnetwork.com/deposit-return-schemes-plastic/532/>
- [24] G. Consumer, “Deposit return schemes: The pros and cons”, *Verdict*. Erişim: 24 Aralık 2023. [Çevrimiçi]. Erişim adresi: <https://www.verdict.co.uk/deposit-return-schemes-pros-cons/>