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IMPLAMENTATION OF THE DEPOSIT SYSTEM AS A CIRCULAR ECONOMY TOOL IN SELECTED EUROPEAN UNION COUNTRIES

Mokrišová Vera, PhD. (economics), assistant professor, head of the department of economics, marketing and managament, College of International Business ISM Slovakia in Prešov, Slovakia
e-mail: mokrisova@ismpo.sk
ORCID: 0009-00078817-2614

Abstract. *The article deals with one of the instruments of the circular economy policy, which is the deposit of returnable packaging. The author of the article describes the reasons and historical foundations as well as the reasons for the creation of this system. At the same time, she IMPLAMANTATIONexplains that the introduction of this system is not only a regulation of the European Union, but is a beneficial activity for individual member states, primarily in terms of reducing environmental burdens. The circular economy policy is a fundamental tool that the European Union uses to achieve a wide range of synergistic goals related not only to sustainability and environmental protection, but also to economic growth. The article points out that it is a key part of an ambitious program that emphasizes the support of environmentally sustainable economic models. At the same time, the article declares that demands are placed on packaging manufacturers and operators of the deposit system to streamline processes. We point out the system of re-purchase of packaging returns, which is related to the motivation of consumers to return packaging. Packaging back-up is an important issue that needs to be addressed not only for Europe, but also for the entire globalized world. Waste material negatively affects the ecosystem, the aesthetic side of countries, which also disrupts the overall human perception and quality of life. Significant pioneers within the framework of back-up systems in Europe are primarily the back-up systems in Scandinavian countries. In this context, we have developed an overview of European back-up systems and the implementation of a back-up system in the Slovak Republic.*
Keywords: *circular economy, environmental impacts, waste management, backup systems.*

ВПРОВАДЖЕННЯ РЕЗЕРВНОЇ СИСТЕМИ ЯК ІНСТРУМЕНТУ ЦИРКУЛЯРНОЇ ЕКОНОМІКИ В ОКРЕМИХ КРАЇНАХ ЄВРОПЕЙСЬКОГО СОЮЗУ

Мокришова В.Ю., кандидат економічних наук, доцент, завідувач кафедри економіки, маркетингу та менеджменту Коледжу міжнародного бізнесу, м. Пряшов, Словаччина
e-mail: mokrisova@ismpo.sk
ORCID: 0009-00078817-2614

Анотація. *У статті розглядається один із інструментів політики циркулярної економіки – депозит поворотної тари. Автор статті описує причини та історичні основи, а також мотиви створення цієї системи. Водночас вона пояснює, що запровадження цієї системи є не лише регламентом Європейського Союзу, а й корисною діяльністю для окремих держав-членів, насамперед з точки зору зменшення навантаження на довкілля. Політика циркулярної економіки є основним інструментом, який Європейський Союз використовує для досягнення широкого спектру синергетичних цілей, пов'язаних не лише зі стійкістю та захистом навколишнього середовища, а й з економічним зростанням. У статті вказується, що це ключова частина амбітної програми, яка наголошує на підтримку екологічно стійких економічних моделей. Водночас у статті зазначається, що до виробників тари та операторів депозитної системи висуваються вимоги щодо оптимізації процесів. Розглянуто систему зворотного викупу тари, яка пов'язана з мотивацією споживачів повертати тару. Резервне копіювання упаковки є важливою проблемою, яка потребує вирішення не лише для Європи, а й для всього глобалізованого світу. Відходи негативно впливають на екосистему, естетичну сторону країни, що також порушує загальне людське сприйняття та якість життя. Значними піонерами в рамках систем резервного копіювання в Європі є передусім системи резервного копіювання в скандинавських країнах. У цьому контексті ми розробили огляд європейських систем резервного копіювання та впровадження системи резервного копіювання в Словацькій Республіці.*
Ключові слова: *циркулярна економіка, вплив на навколишнє середовище, управління відходами, резервні системи.*

JEL Classification: Q530; Q560

Problem formulation. The circular economy policy is based on the basic principles of waste minimization and an emphasis on renewable resources. According to Leipold (2021), compared to the traditional linear economic model, which leads to products and materials ending up in landfills or being incinerated at the end of their useful life, this policy seeks to extend the life cycle of products, repair them and recycle them. In this way, the negative environmental consequences associated with the production and disposal of products are minimized. In addition, there is an emphasis on the design of products that are easily repairable, modifiable and recyclable. Sustainability is one of the central elements of this policy.

This approach also supports the protection of biodiversity, climate change mitigation and the preservation of natural ecosystems (Dantas et al., 2021). Stanek (2021) states that the government of the Slovak Republic has adopted measures to support recycling and reduce waste landfilling. There is also a growing number of initiatives and projects that seek to make resource use more efficient and reduce the negative impact of industry on the environment. Circular economy – the circular economy has therefore found its place in the modern economic dictionary and it is not just a dictionary where it gains a firm position. It is receiving more and more attention and is given many different meanings. As we have already mentioned, it is about replacing the outdated linear business model of the make – use – throw away type with a new one, which has several steps and does not end with a simple throwing of the product into the garbage container. It includes continuous steps such as design – production, remanufacturing – consumption, use, reuse, repair – collection – recycling – raw materials. Let us focus on the goals of the circular economy, which is to keep products in circulation for as long as possible through the above steps, to produce secondary raw materials instead of waste and thus reduce the pressure on the extraction and use of primary non-renewable resources. Another advantage of the circular economy is the reduction of greenhouse gas emissions. According to the European Environment Agency, industrial processes and product use are responsible for almost 10% of greenhouse gas emissions in the EU. Other processes related to waste management account for over 3% of emissions. The EU also aims to reduce its dependence on raw materials.

The world's population is growing, and with it the demand for raw materials. However, supplies of crucial natural resources are limited. The total value of trade in raw materials between the EU and the rest of the world has almost tripled since 2002. Although exports have grown faster than imports, Europe is still importing more. In 2021 alone, this led to a trade deficit of EUR 35.5 billion. All of these are strong motivators for the development of the circular economy and for the continuous adoption of new strategies, such as the European Green Deal or the new Circular Economy Action Plan. This issue not only presents crisis scenarios, challenges and threats, but also opportunities. It is assumed that the transition to a circular economy could increase competitiveness, stimulate innovation, support economic growth and create new jobs. In the EU alone, up to 700 thousand new jobs could be created in this sector by 2030, with innovative and flexible SMEs playing a decisive role. A number of activities and opportunities will need to be seized and implemented in consumer education. Where there is no demand, there is usually no supply and the opposite is also true. If sufficiently well-communicated means and activities are used to spread awareness about the circular economy, then consumers will significantly contribute to the implementation of the principles of sustainable growth through their behavior. Consuming less, for example textiles, using any products for longer, buying local products, at least to reduce the carbon footprint from transport, and consistently sorting waste from products and packaging can help Slovakia's economic growth, separate from increasing consumption of non-renewable raw materials. Business opportunities in this sector will be created and supported in several ways. In this article, we focus on supporting the circular economy in the form of implementing deposit systems for recyclable packaging, especially bottles and cans, in selected EU countries and compare it with the system in Slovakia.

Analysis of the latest research and publications. In this paper, we have worked with sources dealing with the researched issue. These are scientific contributions (Walls 2011); (Dantas et al., 2021); (Stanek 2021); (Leipold 2021); (Tomra 2022), and scientific reports with secondary analyses of renowned professional societies (Circularity Gap Report, 2023); (European Commission 2023). We have based ourselves on the basic definition of the researched issue and available published secondary data.

Methodology of work and research methods. The methodology of research and processing was subject to the established research issue and research objectives. The basis was synthesis, induction, comparison, analysis and deduction.

Base material. A deposit-refund system is a fee for the consumption of disposable products and also as compensation that the consumer receives when returning the used product packaging for recycling or proper ecological disposal. In most countries, this system is focused on beverage packaging, such as PET plastic bottles and cans, glass bottles. In the United States, this system is better known as “bottle bills”, and was originally adopted to solve the problem of litter. Later, this approach was extended to other types of packaging and hazardous materials. Another English name used universally in Europe is "Deposit-refund system" or "Deposit-refund scheme" in abbreviation DRS (Walls 2011). Today, deposit systems are used not only for beverages, but also for other types of products, such as lead-acid car batteries, motor oils, tires, electronics and

various substances hazardous to humans and the environment. This system can also be an effective tool for solving broader environmental problems, such as air, water and soil pollution. For these secondary products, the deposit is applied at the beginning of consumption or production, and the proceeds from these fees are then used to support environmental measures that allow controlling environmental burdens in a similar way. We are talking about the so-called Pigouvian tax, which serves to regulate negative externalities. This tax is not reflected in the final price of the product directly.

If we go back to the late 18th century, plastic bottles did not yet exist as they do in modern times. Drinks such as beer or sweetened beverages were typically only available in glass or even ceramic containers. Unlike today's plastic bottles and aluminum cans, these more expensive containers were not considered disposable. They were considered the property of the supplier and of course the property of the business, and it was an unwritten rule between the seller and the consumer that the container should be returned. This was of course done as a gesture of goodwill, without any financial deposit. In the United Kingdom, there was a system: "Rinse and return", which served as a system of bringing milk to the doorstep of households, where glass milk containers were reused up to 40 times. In the decades that followed and as markets developed and expanded, producers faced the challenge of financial losses due to the diminishing returns of returnable containers. Something had to be done to increase the chances of getting their property back. This was a key turning point in the DRS system, the introduction of a deposit on packaging, which was one of the logical solutions for its introduction into society. These were so-called voluntary schemes because producers themselves took the initiative and introduced it without the scheme being approved and introduced into legislation. In the United Kingdom, in the early 19th century, manufacturers offered money back on drinks containers, from the early 20th century, the first manufacturers charged deposits up front. Records from the US indicate that manufacturers began implementing these deposits as early as the 1870s and 1880s, but the implementation process took until the mid-20s for these container deposits to become a common part of sales and people's lives (Tomra, 2022). The first "Deport-return" system was introduced in the Canadian province of British Columbia in 1970. In Europe, this system was first introduced in 1984 in Sweden.

The Circularity Gap Report (2023) states that only 7.2% of the global economy is circular. The rest is linear. As the report further states, this percentage has decreased compared to 2018, when the circular economy accounted for 9.1% of the global economy, and in 2020 it was at 8.6%. Given the aforementioned decrease, this situation is not only sad, it is downright astonishing and threatening our planet. The transformation of the linear economy to a circular one is therefore inevitable. The report also states that the circular economy could reduce the extraction and consumption of primary raw materials by about one third.

In the circular economy system, recycling is a very common tool and process. It is the process of recovering, re-processing waste and materials for use in new products. Typical materials that are recycled include: iron, steel scrap, aluminum cans, glass bottles, paper, wood and plastics. The materials reused in production serve as a substitute for primary materials, obtained from increasingly scarce natural resources, such as oil, natural gas, coal, minerals and wood. Recycling can help reduce the amount of solid waste deposited in landfills, which are increasingly overcrowded. Recycling also reduces air, water and soil pollution that occurs during waste disposal. The recycling of raw materials is referred to as chemical recycling, which consists in obtaining raw materials using chemical reactions and processes. An example is the processing of plastic packaging into new plastic products.

Thermal recycling is also called energy recycling, where the main product is energy obtained by burning waste. Material recycling involves the mechanical processing of waste to create products with functional value, e.g. converting used tires into granulate or tartan. Organic recycling is used for biodegradable waste. This waste is broken down by microorganisms and the organic processes lead to the production of methane, organic substances or compost. The possibility of earning money for recycling provides direct financial resources and encourages this activity. Users participate in the return system and meet high returns in countries where the amount of return for packaging is motivating. Entrepreneurs can have access to high-quality recycled products, which can reduce production costs and improve sustainability. This creates space for new business opportunities in collection, recycling and processing. Brands can benefit from the current trend to use recyclable products that are harmless to the environment. Countries that have introduced Deposit-Return-schemes have achieved a reduction in illegal landfills formed from beverage packaging. Such a result has an impact on cleaner public places, beaches and water bodies. Also, a reduction in pollution of water bodies, seas, ecosystems and the protection of animals in the wild. It also reduces

costs for local authorities, improves the image and tourist potential and increases the quality and standard of living of local residents. The European Union bodies approve a resolution on the DRS, by 2029 the total return should reach a target of at least 90% and also gives the member states the obligation to launch this system in their country. It also set a target that by 2030 all materials used for the production of packaging should be recyclable and reusable.

Some countries have started recycling on their own initiative to improve the environment and reduce pollution as a sign of the country's and economy's maturity. We can take the Nordic countries of Europe, especially Sweden, as an example. Interestingly, large countries with large economies such as France, Spain and Italy, unlike Slovakia and gradually the V4, do not use a deposit system at all and there is no plan to implement one.

After intensive preparation, the Slovak Republic is the twelfth country in Europe to join the deposit system and the first country in our V4 region to join the idea of a circular economy and launch a deposit system. In 2023, a series of meetings took place, where the Administrator shared valuable information about the deposit system as part of the cooperation. He communicated with countries such as Slovenia, Ireland, Hungary, the Czech Republic, Bulgaria, Poland and organized a meeting of the Association of Deposit Systems in Europe. The spread of the idea of a circular economy was also supported by the royal couple from the Netherlands.

Table 1

Year of DRS launch in countries

Country	Year of implementation
Sweden	1984
Iceland	1989
Finland	1996
Norway	1999
Denmark	2002
Germany	2003
Estonia	2005
Netherlands	2005
Croatia	2006
Lithuania	2016
Latvia	2022
Slovakia	2022
Malta	2022
Romania	2023
Ireland	01.02.2024
Hungary	01.01.2024
Poland	===
Portugal	January 2025
United Kingdom of Great Britain (outside EU)	(outside EU)
Scotland(outside EU)	(outside EU)
Cyprus	===
Greece	Legislatively adopted (date unknown)
Turkey	January 2025
Belgium	Legislatively adopted, from 2025 (some regions only)
France	===
Luxemburg	===
Slovenia	===

Czech Republic	Legislatively adopted, from 2025 (some regions only)
Spain	===
Taliansko	===
Bulharsko	===

Source: European Commission 2024

Amount of recycling deposit for PET bottles

Table 2

Comparison of DRS deposit with other EU, EAA and non-EU countries

Country	PET Deposit Amount
Sweden	2 SEK – 0.17€
Iceland	0.10€ (<0.35L), 0.20€ (0.35L-1L), 0.40€ (>1L)
Finland	0.15€ (0.15L-0.5L), 0.25€ (0.5L-3L)
Norway	2 NOK – 0.20€ (<0.5L), 3 NOK – 0.30€ (>0.5L)
Denmark	OW – 1.50 DKK – 0.20€ (<1L), 3.00 DKK – 0.40€ (1-20L) WDM- 1.50 DKK – 0.20€ (<1L), 3.00 DKK – 0.40€ (>1L)
Germany	0.25€
Estonia	0.10€
Netherlands	0.25€ (<1L), 0.15€ (1L-3L)
Croatia	0.10€
Lithuania	0.10€
Latvia	0.10€
Slovakia	0.15€
Malta	0.10€
Romania	0.5LEI – 0.10€
Ireland	0.15€ (0.15L-0.5L), 0.25€ (0.5L-3L)
Hungary	===
Austria	0,25 from Januar 2025
Poland	===
Portugalsko	January 2025
United Kingdom of Great Britain (outside EU)	(outside EU)
Scotland(outside EU)	(outside EU)
Cyprus	===
Greece	Legislatively Accepted
Turkey	Legislatively Accepted
Belgium	Accepted, implementation from 2025 (some regions only)
France	===
Luxemburg	===
Slovenia	===
Czech Republic	Accepted, implementation probably 2026
Spain	===
Italy	===
Bulgaria	===

Source: European Commission 2024

From secondary sources we can see that countries that have a deposit system in place according to the EU directive have a high return rate for PET bottles. Germany is at the forefront with an incredible 98%, as the deposit is up to €0.25 and it is understandable that people in poverty or even homeless people can earn large amounts of money for food, just thanks to a few bottles.

In Slovakia, DRS operates as a non-profit organization "Administrator of the Deposit System, n.o.", which ensures the creation of individual points, administration, financing and coordination. A system of sellers, retailers, distributors has been created that ensures better transparency of the system, mutual control and, above all, a common interest in a direct, economically and environmentally suitable operating system that will provide users with suitable conditions and jointly achieve the set goals.

The implementation of the deposit system in Slovakia had the following steps:

Implementation process	✓ Producers registered their product in the DRS administration system, paid a fee foreach package delivered to the market. ✓ The manufacturer sells the product to a retailer, who pays a deposit in addition to theprice. ✓ The retailer sells the product to a customer, who pays him for the price of the drinkand the deposit. ✓ The customer returns the package to a designated packaging collection point, where amachine or staff performs the transaction. ✓ The retailer returns the collected packages to the administrator, who pays him adeposit and a handling fee as a reward. ✓ The administrator ensures the inspection, counting, transportation, and processing ofthe package. ✓ From the administrator, the material travels to the recycler. ✓ The recycler processes the material, which can then be used to produce new bottlesand cans.

Important aspects of the deposit system are the manufacturer, distributor and system administrator. The manufacturer places beverages in these packaging on the market. The distributor distributes the given beverage packaging. The system administrator keeps records of deposited single-use packaging in order to fulfill the reporting obligation. The administrator of the deposit system in the Slovak Republic is a non-profit organization consisting of four entities: the Association of Non-Alcoholic Beverages and Mineral Water Producers in Slovakia, the Slovak Association of Beer and Malt Producers, the Slovak Alliance of Modern Trade and the Slovak Trade Union. The Slovak DRS system (Deposit-return scheme) was introduced by a mandatory regulation by an EU directive from 2022, unlike some countries such as Germany, Finland and Sweden, which launched the program on their own initiative.

The amount for the returned packaging is set uniformly by the system administrator, at €0.15. This amount should be motivating enough for consumers to return single-use deposit-based packaging. The above-mentioned symbol "Z" as deposit-based is also important. Within the single-use deposit-based packaging system, targets were set as part of the implementation of European legislation, which are anchored in the Act on Deposit-Based Packaging, and are divided into two categories, namely:

1. Targets for the return of deposited single-use plastic beverage packaging,
2. Targets for the return of deposited single-use metal beverage packaging.

Table 3

Return targets for deposited packaging in the Slovak Republic

Year of implementation	% return
2022	60
2023	80
2024	85
2025	90

Figures 1 and 2 show the marking of the back-up packaging in Slovakia and Germany.

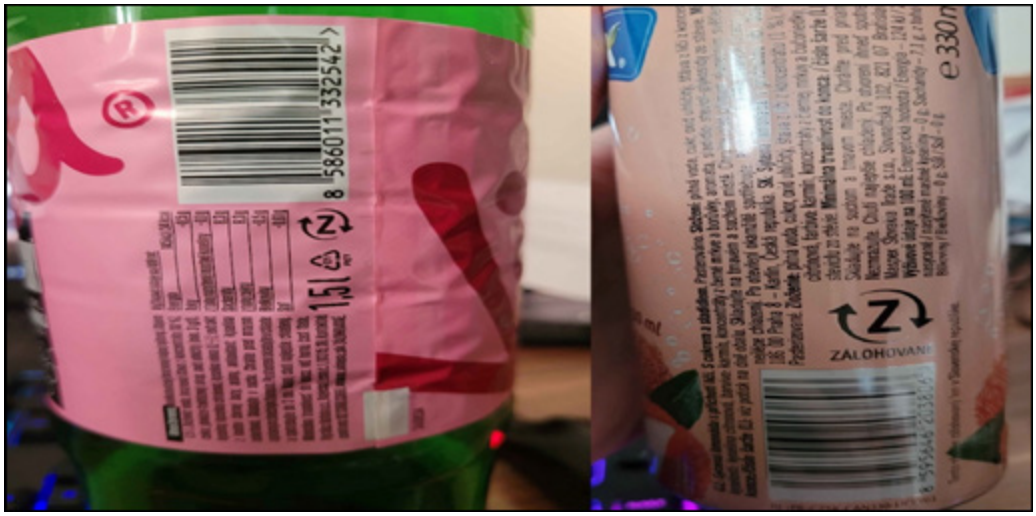

Figure 1: Marking of a reserve container in Slovakia with the symbol Z with arrows.

Figure 2: Labeling of the backup packaging in Germany.

The Slovak DRS (Deposit-return scheme) system was introduced by mandatory regulation by an EU directive from 2022, unlike some countries such as Germany, Finland and Sweden, which launched the program on their own initiative.

Amount of recycling deposit for aluminum cans

Table 4

Comparison of DRS deposit for aluminum cans with other EU, EAA and non-EU countries

Country	The amount of the deposit of an aluminum can (an aluminum can)
Sweden	1 SEK – 0.09€ (<1L)
Iceland	18 ISK – 0.12€
Finland	0.15€
Norway	2 NOK – 0.20€
Denmark	1 DKK – 0.13€ (>0.5L), 3DKK – 0.40€ (>0.5L)
Germany	0.25€
Estonia	0.10€

Netherlands	0.25€ (<1L), 0.15€ (1L-3L)
Croatia	0.10€
Lithuania	0.10€
Latvia	0.10€
Slovakia	0.15€
Malta	0.10€
Romania	0.5LEI – 0.10€
Ireland	0.15€ (0.15L-0.5L), 0.25€ (0.5L-3L)
Hungary	50 HUF = 0,15 €
Austria	0,25 Eur
Poland	===
Portugal	January 2025
United Kingdom of Great Britain (outside EU)	Ouside EU ===
Scotland(outside EU)	Ouside EU ===
Cyprus	===
Greece	Adopted (date unknown)
Turkey	===
Belgium	Adopted, from 2025 (some regions only)
France	===
Luxemburg	===
Slovenia	===
Czech Republic	Accepted, probably 2026
Spain	===
Italy	===
Bulgaria	===

Source: European Commission 2024

The European countries described above have long-term high rates of return of deposit-based single-use beverage containers made of glass, PET and aluminium, ranging from 90 to 100%. Such a high recycling rate is difficult to achieve by any other means than a deposit system. Despite minor differences, the systems for operation, collection, deposits, financing and recycling are similar in individual countries. They are usually created by beverage producers and importers or beverage traders and are accountable to the Ministry of the Environment or the Environmental Agency or another responsible state authority, which controls their operation or participates in the system itself. A uniform system for the entire country seems to be cheaper and more practical. Consumers return beverage containers personally to the retailer or through return machines. Beverage producers pay a cash deposit into the system when their product is placed on the market.

The price of the beverage includes a deposit for each container, and the retailer does not bear any costs when paying deposits to the consumer for returned packaging, because the initial deposit for payment to consumers was provided to the system by the manufacturer. In addition to the deposit, the manufacturer also pays a fee for each container into the system. This fee serves as a reimbursement for the costs of collecting, sorting and subsequent processing of the containers. These costs can be borne by the manufacturer of the beverage or beverage container, the distributor or, in some cases, the state.

Conclusion. The paper highlights the use of one of the circular economy tools, namely packaging recycling. The possibility of receiving a reward for recycling provides direct financial resources and encourages this activity. Users participate in the return system and meet high returns in countries where at least €0.15 per package is returned. Entrepreneurs can have access to high-

quality recycled products that can reduce production costs and improve sustainability. This creates space for new business opportunities in collection, recycling and processing. Brands can benefit from the current trend to use recyclable products that are harmless to the environment.

Countries that have introduced Deposit-Return-schemes have achieved a reduction in illegal landfills formed from beverage packaging. Such a result has an impact on cleaner public places, beaches and water bodies. It also reduces costs for local authorities, improves the image and tourist potential and increases the quality and standard of living of local residents. An indisputably important challenge for the next period in terms of maintaining the sustainability of the project is the quality of the collection network and its scope. It is also crucial for the backup partners to be able to operate effectively and comfortably in the system. This includes the need to improve and digitize processes. In order to achieve the goals of the backup system and positive environmental impacts, it is important to constantly maintain public awareness of the backup itself. The practice of countries where the backup system for beverage containers has been in place for a longer time also shows that people need to be constantly motivated. The goal in the future is to maintain awareness of the Slovakia Backups brand and associate it with the backup itself. At the same time, it is important to remind people of the benefits of the backup system, explain the process as such and the impact of the system on our lives and the environment.

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