THE PACKAGING WASTE MANAGEMENT IN THE EU IN THE CONTEXT OF CIRCULAR ECONOMY REQUIREMENTS

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This analysis examines the provisions set out in the regulatory framework of the European Union relating to packaging waste and its management. An assessment of the level of packaging waste recycling in the EU Member States was carried out and specific examples of best practices for effective management of such waste in accordance with the principles of the circular economy were provided.

Despite the high recycling and recovery rates of packaging waste achieved, the volume of such waste in the EU demonstrates stable annual growth. Given this, the European Union is actively reviewing and improving the current legislation in the field of packaging waste management. The article highlights the key provisions of the new EU Regulation on packaging and packaging waste, in particular issues related to the recycling of packaging waste and the reuse of packaging.

For the purposes of comparative analysis, the state of packaging waste management in Ukraine is considered. Statistical data is presented, which indicates an insufficient level of waste recycling and recovery, and the main barriers that prevent the increase of these indicators are identified. At the same time, possible ways to improve the efficiency of the packaging waste management system in Ukraine were explored.

Particular attention was paid to the need to bring the national legislation of Ukraine into line with the legislative requirements of the European Union on packaging waste management, given Ukraine's strategic aspirations for European integration. The EU's achievements in the field of packaging waste management are extremely relevant and can serve as an important guideline for improving national policy and implementing best practices in this area.

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Introduction

Recently, the problem of environmental degradation and depletion of natural resources has reached unprecedented proportions. Around the world, many countries have focused their attention on combating the increasingly acute threat of global warming caused by increasing greenhouse gas emissions into the atmosphere. In particular, the European Union (EU) has become one of the leading advocates in the fight against climate challenges. The EU has set itself the goal of achieving climate neutrality by 2050. This initiative involves a gradual transition of EU Member States from a linear economic model to a circular economy - a paradigm based on the circulation of resources.

On the 11th of March 2020, the European Commission introduced the Circular Economy Action Plan (European Commission, Directorate-General for Communication, 2020a), a pivotal component of the European Green Deal (European Commission, 2019) strategy.

This plan is designed to curtail resources consumption rates within the EU, increase the reutilization of resources in the forthcoming decades, and concurrently stimulate economic growth.

The measures envisaged under this action plan aim to:

• make sustainable products the norm in the EU;

• empower consumers and public purchasers;

• focus on sectors that consume the most resources and have high circularity potential, such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients;

• reduce waste;

• make the circular economy work for people, regions and cities;

• lead global efforts on the circular economy.

The plan covers the full life cycle of products - from design and production to consumption, repair, reuse, recycling and re-introduction of resources into the economy. Therefore, a key element in building a circular economy is optimizing the use of resources and implementing innovative approaches to waste management, in particular packaging waste.

Within the EU, special attention is paid to the effective management of packaging waste. A number of organizational and legislative measures have been introduced to reduce the volume of packaging waste generation (separate waste collection, introduction of deposit return schemes, multiple use of packaging, etc.) and increase the efficiency of its processing systems. Thanks to these measures, EU Member States have managed to achieve certain successes in the field of packaging waste management, as well as in creating effective systems for packaging waste recycling and disposal.

As for Ukraine, it should be noted that the volume of waste generation continues to grow, while the level of its processing — for example, through recycling or utilization with energy recovery — remains low. Ukraine is only just starting to implement a modern packaging waste management system that meets the requirements of a circular economy. In this context, studying and applying the EU experience is extremely relevant for Ukraine.

The purpose of the study is to analyze the EU organizational and legal systems in the field of packaging waste management and consider possible ways to improve the packaging waste management system in Ukraine based on European experience.

Materials and methods

The analysis was based on the EU and Ukrainian regulatory framework in the field of waste management. In addition, analytical reports, scientific publications and statistical data were analyzed, highlighting the problems and achievements in waste management, in particular in the field of packaging waste.

Results and Discussion

The general principles of waste management in the EU are set out in Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive) (European Union, 2008). The Directive sets out principles relating to a hierarchy of measures in the field of waste management. According to this hierarchy, the highest priority is given to measures aimed at preventing waste generation (e.g. implementing eco-design principles for products, banning or restricting the use of single-use products, informing the

public about the consequences of excessive consumption, etc.). The next levels of waste treatment in this hierarchy are product reuse, waste recycling and other recovery methods, such as energy recovery. The lowest level in the waste management hierarchy is landfilling or incineration without energy recovery. In 2018, this Directive was amended, which is reflected in Directive (EU) 2018/851 (European Union, 2018a).

It should be noted that the Waste Framework Directive is the most general, which applies to different types of waste. As of today, matters related to packaging waste management are governed by the recently adopted Regulation (EU) 2025/40 on Packaging and Packaging Waste (PPWR), which entered into force on February 11, 2025 (European Union, 2025). The general application of the provisions of this regulation will begin on 12 August 2026, after an 18-month transition period.

The PPWR sets as a preliminary requirement that all packaging placed on the EU market must be recyclable. The PPWR also sets minimum percentages of recycled content that plastic packaging must contain by 1 January 2030 and 1 January 2040 respectively. In the case of single-use plastic bottles, these figures are set at: 30% by 2030 and 65% by 2040. The Regulation introduces obligations on packaging design, stipulating that by 1 January 2030, packaging must be designed in such a way that its weight and volume are reduced to the minimum necessary to ensure its functionality.

Also, according to this Regulation, a ban on the placing on the market of a number of packaging formats will apply from 1 January 2030, including, for example, single-use plastic group packaging, single-use plastic packaging for unprocessed fresh fruit and vegetables, and single-use plastic packaging for condiments, preserves, sauces, coffee creamers, sugar and spices in the HORECA sector, among others.

This PPWR also regulates issues related to the use of reusable packaging. The PPWR establishes a harmonized labeling system based on the material composition of packaging for waste sorting, accompanied by appropriate markings on waste containers. This will facilitate the sorting of waste by consumers of products. In order to ensure a very high collection rate and high-quality recycling, in particular for beverage bottles and cans, targets have been set for their separate collection.

The main innovation introduced by the Regulation related to the Extended Producer Responsibility (EPR) system is the extension of its scope. In addition to producers, importers and distributors who first place packaged products on the territory of a Member State, EPR will now also apply to those who first place transport packaging, service packaging or primary packaging on the market, as well as to those who unpack packaged products without being the final consumer.

Various measures implemented at EU level have made significant progress in developing an effective packaging waste management system. Key instruments include the introduction of Extended Producer Responsibility (EPR) principles, which obliges producers not only to collect and recycle their product waste but also to finance the relevant systems. Legislative restrictions on the use of single-use plastics, the development of infrastructure for separate waste collection, the creation of incentives for the recycling industry, and an active information campaign among the population also played a significant role. Taken together, these measures contributed to increasing the level of packaging recycling, reducing landfill volumes, and strengthening the culture of responsible consumption.

Let's consider the current state of packaging waste management in the EU.

In 2022, 186.66 kg of packaging waste per inhabitant was generated in the EU. Of this amount of waste, 121.89 kg was recycled (Eurostat, 2025). If we consider the generation of packaging waste

and the recycling of packaging waste taking into account the packaging material, the following can be noted. 76.03 kg of packaging waste from cardboard and paper was generated per inhabitant in 2022, of which 63.21 kg, or 83.1%, was recycled. As for packaging made of plastic, Eurostat figures show that 36.13 kg of waste was generated per inhabitant in 2022, and 14.71 kg, or 40.7%, was recycled.

Information in graphical form on the generation of packaging waste from different materials and the level of recycling of this waste is presented in Figure 1 and Figure 2, respectively.

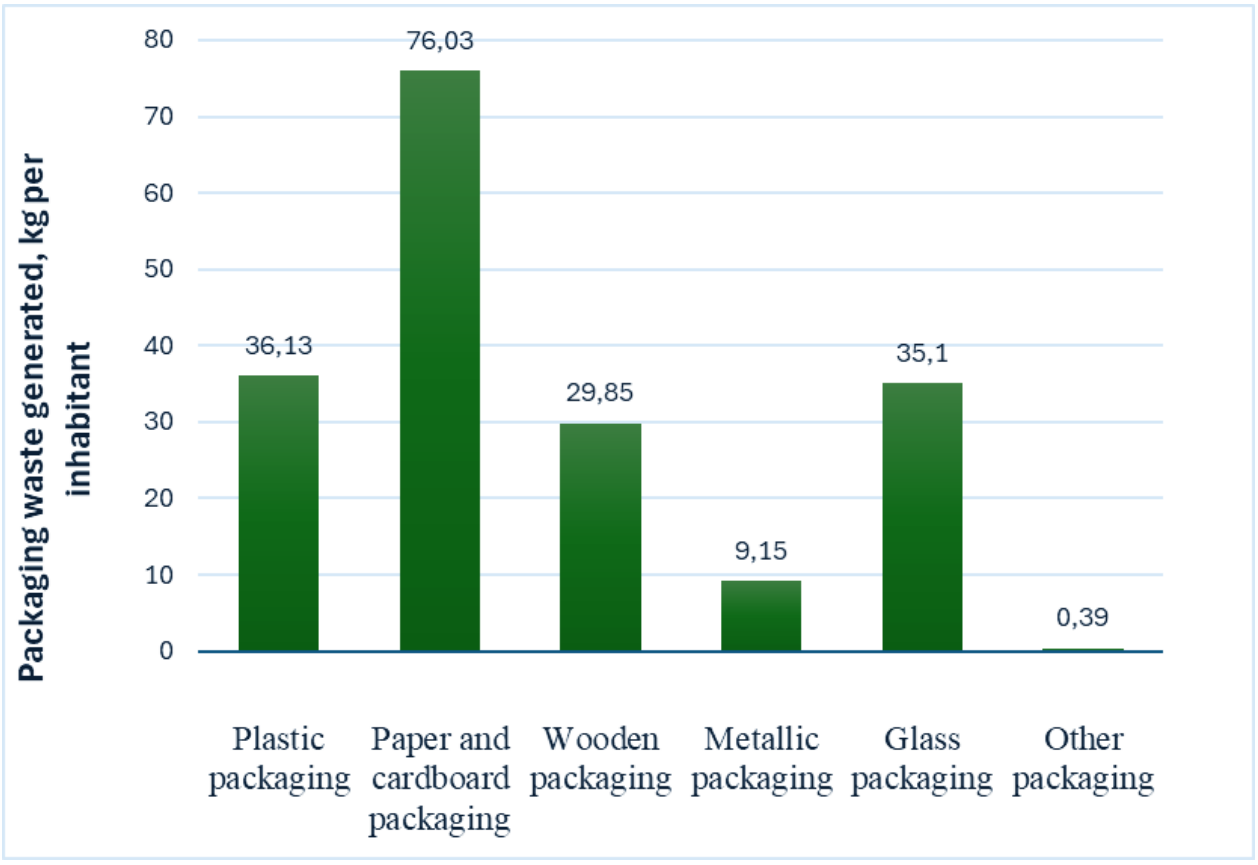

Figure 1. Amount of packaging waste generated per inhabitant in the EU in 2022 (developed by the authors based on Eurostat data, 2025)

As can be seen from the above data (Figure 2), the greatest progress in 2022 in recycling packaging waste in the EU was achieved for cardboard and paper packaging (83.1%), metal packaging (76.9%) and glass packaging (75.6%). The lowest recycling rate is observed for plastic packaging waste – only 40.7%. There are several reasons why plastic packaging is still not sufficiently recycled. They cover technical, economic, infrastructural and behavioral aspects.

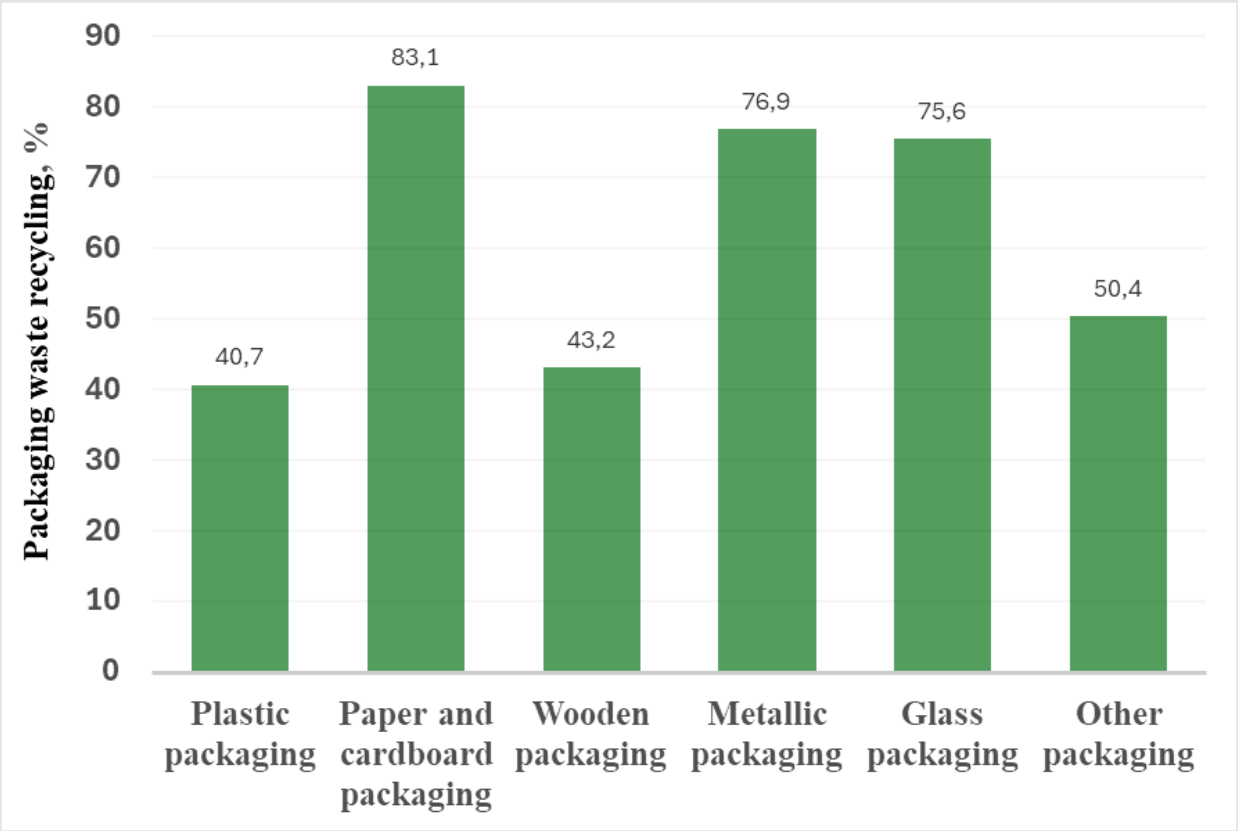

Figure 2. Recycling rates of packaging waste from different materials in the EU in 2022 (developed by the authors based on Eurostat data, 2025)

The statistics on waste recycling in individual EU Member States is presented in Figure 3.

As can be seen from the data in Figure 3, the lowest levels of packaging waste recycling are observed in countries such as Malta, Romania, Hungary and Greece, and the highest levels are observed in countries such as the Czech Republic, Slovakia, Estonia, the Netherlands, Belgium, Cyprus, Italy and Germany.

In this regard, it is interesting to consider the experience and best practices in waste management of those countries that have achieved significant success in developing effective waste management systems, in particular, high levels of packaging waste recycling.

In Germany, the so-called "door-to-door" system is widespread for the separate collection of municipal waste, in particular packaging waste. The "door-to-door" collection system is most often used for paper and cardboard, as well as for plastic, metal and combined packaging waste (mixed collection), which is also complemented by collection points. Glass packaging is mostly collected via collection points and in some regions also via door-to-door collection. In most municipalities, door-to-door or collection points are limited to packaging waste. Waste other than packaging is usually collected by municipal collection points or private companies (scrap metal). In addition, separate collection of packaging waste from non-household sources is mandatory in Germany (ETC/CE, 2022a).

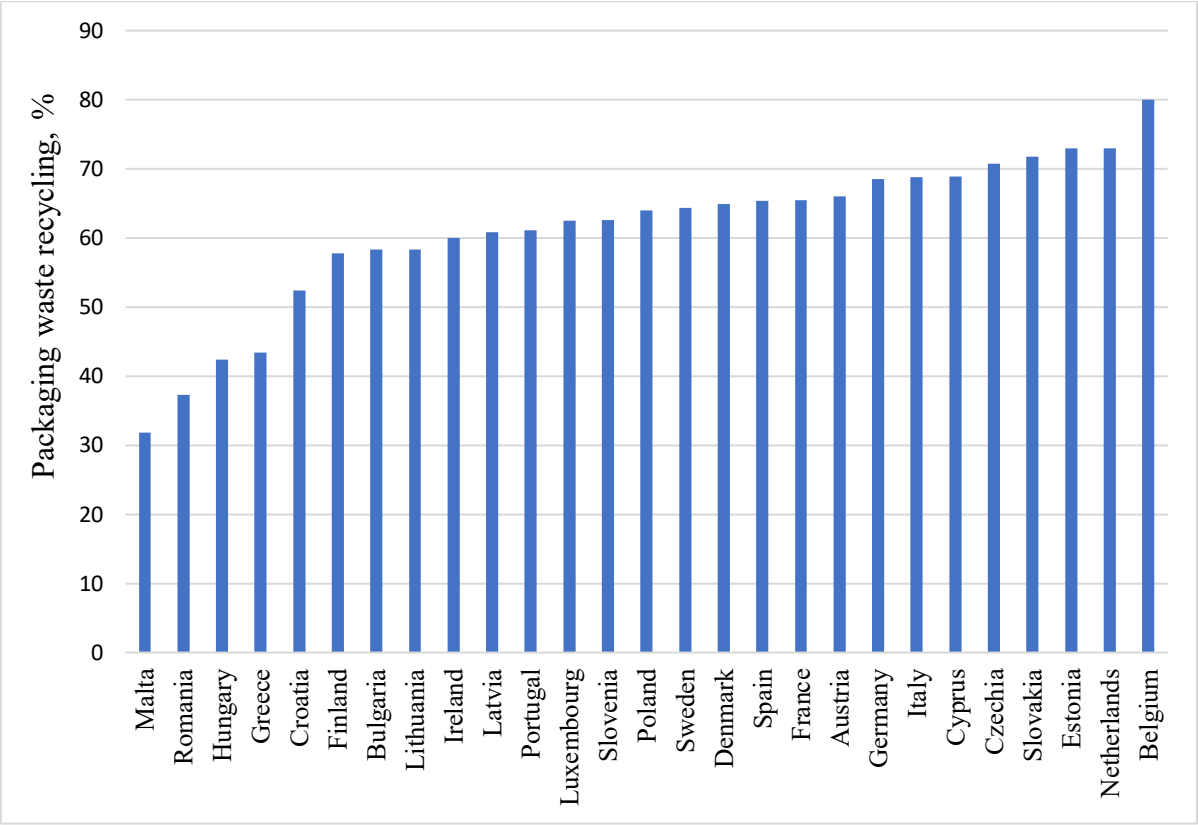

Figure 3. Packaging waste recycling rates in EU Member States in 2022 (developed by the authors based on Eurostat data, 2025)

Although pay-as-you-throw systems are important for improving waste separation at source, German municipalities are not obliged to implement such systems. As a result, the coverage of the population is only around 30%. The European Commission has suggested that the introduction of a mandatory 'pay as you throw' system at national level could improve waste management in Germany (EC, 2023).

The national deposit-return system (DRS) in Germany was one of the first in Europe. Today, the mandatory scheme covers almost all single-use beverages in cans and bottles made of aluminium, glass and plastic (PET). Previous exemptions (e.g. for some alcoholic beverages and dairy products) were repealed in amendments to the Packaging Act (VerpackG) in 2022 and 2024. In addition, there are additional voluntary deposit systems for individual plastic crates and wooden packaging (ETC/CE, 2022a). Figure 4 presents an example of the German deposit return system (DRS).

In Estonia separate collection of paper and cardboard, metals, packaging waste, bio-waste, combustible waste (including wood and plastic), bulky and hazardous waste is mandatory for both households and non-household sources (ETC/CE, 2022b).

In Estonia, as in Germany, a separate door-to-door collection system is in place in residential areas of cities for paper and cardboard, as well as for bio-waste (the latter two municipalities introduced bio-waste collection in April 2024). A collection point system has been introduced for glass, plastic, metal, and packaging materials made of paper and cardboard (separately or mixed), which is complemented in some areas by door-to-door collection of packaging waste.

Figure 4. An example of the German deposit-return system (EURACTIV)

The separate collection system is mainly focused on packaging waste, while the collection of non-packaging recyclable material is mostly organized through municipal collection points.

In Estonia, EPR applies to all types of packaging, and some advanced modulation of fees is applied (i.e. differentiation of payments not only by main types of materials, but also by the complexity of recycling individual types of plastic or combinations of materials).

Estonia has a packaging tax (excise duty), which is applied only in case of failure to meet the established recycling standards. The excise duty is 0.60 EUR/kg for glass, 2.50 EUR/kg for metal and plastic, and 1.20 EUR/kg for wood, paper and cardboard. (ETC/CE, 2022b). To encourage source separation, almost all regions and municipalities have introduced various types of pay-as-you-go systems. In addition, Estonia has a mandatory deposit system for most aluminum beverage cans, some glass bottles and most plastic bottles. (ETC/CE, 2022b).

Cardboard and paper packaging, glass packaging, plastic-metal packaging, beverage cartons and other packaging (e.g. wooden packaging) are collected in separate containers at public packaging waste disposal points in Tallinn (Figure 5).

Focusing attention on the situation in Ukraine, the following can be noted. Packaging waste management is an integral part of the overall solid waste management system. Currently, waste management is largely reduced to landfilling of waste in landfills, many of which are overloaded and do not meet established environmental safety standards. At the national level, there is an underdevelopment of the infrastructure for separate collection and recycling of packaging waste. The system of extended producer responsibility has not been implemented at the national level. The deposit-return scheme for beverage bottles has not become widespread in Ukraine. All this leads to the wasteful loss of significant amounts of valuable resources, including paper, cardboard, plastic, glass, metals and wood. These materials have the potential to be re-introduced into economic circulation and can be used as raw materials for the production of new products, or packaging can be

reused many times, which will contribute to reducing waste generation as the highest priority in the waste management hierarchy.

Figure 5. Public packaging waste disposal point in Tallinn (https://www.tallinn.ee/en/keskkond/pakendijaatmed)

If we consider statistical indicators, the following can be noted. In 2022, only 9.9% of household waste, which also includes packaging waste, was incinerated or recirculated, namely, 1.66% was incinerated, and 8.24% of household waste went to collection points for secondary raw materials and waste processing lines. The number of overloaded landfills is 163 units (2.8%), while 693 units (12%) do not meet environmental safety standards [Ministry of Community, Territory and Infrastructure Development of Ukraine, 2023].

On the other hand, as a candidate for EU accession, Ukraine has committed to harmonizing its legislation with the EU legal framework, particularly in the field of waste management.

The provisions of Directive 2008/98/EC have been implemented into Ukrainian legislation by the Law of Ukraine "On Waste Management" [Verkhovna Rada of Ukraine, 2022]. This Law (entered into force on 07/09/2023) provides for the reform of waste management, which will contribute to the transition of Ukraine to models of circular economy and sustainable development, as well as the introduction at the legislative level of the main European approaches and principles, including the five-level hierarchy of waste management and the principle of extended producer responsibility.

The Cabinet of Ministers of Ukraine, by order No. 1353-r dated 27.12.2024, approved the National Waste Management Plan until 2033 (Cabinet of Ministers of Ukraine, 2024). The National Plan is a framework planning document that determines the main directions of implementing state policy in the field of waste management, while regional and local waste management plans determine specific measures, necessary infrastructure facilities, technologies that take into account local conditions, economic calculations and implementation capacity.

In order to implement the National Plan until 2033, the following priority goals have been identified:

improvement and approximation of national legislation to the requirements of EU legislation to implement the provisions of the Association Agreement in the field of waste management;

introduction of economic instruments to improve the system of waste management;

improvement of the institutional structure and strengthening of human resources in the field of waste management;

reform of the information support system in the field of waste management;

ensuring the development and modernization of waste management infrastructure;

increasing public awareness of waste management.

As a result of the implementation of the National Plan, it is planned to achieve the following quantitative and qualitative indicators: increasing the level of preparation for reuse and recycling of household waste by at least 10 percent of its mass by 2025, 20 percent by 2030; increasing the coverage of household waste management services to 85 percent by 2033; implementing a system of separate collection of household waste in settlements with an annual increase of 10 percent of population coverage starting from the second year of the local waste management plans; organizing composting of green waste from public parks and gardens by 2030 for all settlements with a population of over 100 thousand inhabitants (the goal does not set restrictions on the implementation of composting in other smaller settlements); establishing a nationwide network of regional landfills for the disposal of household waste by 2033 (146 landfills are needed); increasing the level of preparation for reuse, recycling and other recovery of materials, construction and demolition waste that is not hazardous to at least 70 percent by mass by 2033.

As for packaging waste, as of today, the draft law "On packaging and packaging waste" (Verkhovna Rada of Ukraine, 2023) is under discussion. The enactment and execution of the "On Packaging and Packaging Waste" law will serve to align national regulations more closely with EU legislation.

At the same time, it's crucial to recognize that for building the efficient packaging waste management systems in Ukraine, it is prudent to examine and adopt the exemplary practices observed within EU member states. Acknowledging that waste generation prevention holds prime importance in the EU's waste management hierarchy, it becomes pertinent to elaborate packaging waste management approaches in Ukraine that closely align with the EU's commendable accomplishments in this realm.

Given the successful experience of EU countries in the field of packaging waste management, the following steps are proposed to improve the relevant systems at national, regional and local levels. One of the key measures is the introduction of a mandatory deposit-return system for plastic bottles and aluminum cans - a practice that has proven effective in a number of EU countries. In response to the excessive generation of packaging, it is also advisable to introduce bans on certain types of packaging. In particular, this concerns the restriction or complete ban on the use of single-use packaging for food and drinks in catering sector, packaging for fresh vegetables and fruit, as well as small single-use containers such as mini-bottles with hygiene products in hotels. In parallel, it is worth developing initiatives that contribute to increasing the recyclability of packaging, in particular by establishing clear requirements for its design. This will allow determining which types of packaging should be compostable and subject to disposal together with bio-waste. Manufacturers, in turn, should be required to include a certain proportion of recycled materials in new plastic packaging, which will

increase the value of recycled plastic as a resource. Finally, it is important to ensure the effective application of the polluter pays principle, which will incentivize packaging manufacturers to implement environmentally friendly approaches in line with the principles of the circular economy.

Conclusions

This study examines the current state and regulatory framework governing packaging waste management in the European Union. It shows that a number of measures implemented in the EU in this contex have contributed to significant progress. Packaging waste management systems in countries such as Germany and Estonia are examined in more detail and the factors that have enabled high levels of packaging waste recycling and reduced generation are analyzed.

Unlike most EU Member States, Ukraine significantly lags behind in the indicators of recycling and reuse of waste, in particular packaging waste. Landfilling remains the main method of waste management. To overcome this situation, it is necessary to form a modern legislative framework in the field of waste management, in particular, the adoption of a special law "On Packaging and Packaging Waste". This will allow creating a more effective organizational and economic model and will contribute to the involvement of packaging waste in resource recycling.

In the context of Ukraine's course towards European integration, it is extremely important to adopt and implement EU best practices in the field of packaging waste management, with a special emphasis on its recycling, reuse and recovery.

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Conflict of interest

The authors state no conflict of interest.

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