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MUNICIPAL SOLID WASTE MANAGEMENT IN UKRAINE AS A PART OF SUSTAINABLE DEVELOPMENT STRATEGY

Veronika Prykhodko¹, PhD., Vladyslav Mykhailenko², PhD., Tamerlan Safranov³, PhD.

^{1,2,3} Odesa State Environmental University, Lvivska str, 15, Odesa, Ukraine

Abstract. This paper considers the system of solid waste management in Ukraine through the prism of the Agenda 2030 Goals. The study is highly relevant because the main part of the generated waste is disposed of in landfills and dumps, thus causing the waste to permanently lose its resource value and become a source of environmental pollution. The aim of the study is to describe the municipal solid waste management system in Ukraine. Modern reforms in the sphere of municipal solid waste management are designed to solve a number of environmental and resource-saving tasks and must be the basis for sustainable development. The study demonstrates an imbalance between the reforms in the legislative and administrative sphere and the response of the municipal solid waste management system. Military operations on the territory of Ukraine only intensify this crisis. Due to the lack of effective separate collection systems in Ukraine, there is a certain deficit of potentially recyclable material resources (about 30% for plastic, for example). Based on the waste composition, the target groups of recyclable material resources have been identified. These groups are packaging waste, food and garden waste, and recyclable materials with the existing logistic chain "source of generation - recycling production". The experience from individual waste management projects is seen as a basis for implementing the principles of circular economy and extended manufacturer responsibility. Zero-waste initiatives are an important link in ensuring the functioning of the waste management system. In conclusion, current trends in waste management must be in line with sustainable development goals.

Keywords: *circular economy, landfills and dumps, potentially recyclable material resources, zero-waste*

JEL code: *Q5*

Introduction. In 2015, the member countries of the United Nations adopted a global program (resolution) aimed at ensuring sustainable development titled "Transforming Our World: The 2030 Agenda for Sustainable Development" (Agenda 2030). Among the goals of Agenda 2030 are those related to minimizing waste generation and utilizing the resource potential of waste. Ukraine's modern European course and the necessity of achieving sustainable development goals as a UN member country dictate the relevance of research in this direction. The aim of this research is to analyze the current state and prospects in the field of municipal solid waste management (MSW) in Ukraine within the context of the overall strategy for sustainable development.

1. Reforms in the regulatory and legislative domain of municipal solid waste (MSW) management. The reform of the regulatory and legislative framework in the field of municipal solid waste (MSW) management can be considered to have commenced with the National Strategy for Waste Management in Ukraine until 2030 [2]. This document is based on the Waste Hierarchy, transition to a circular economy, risk management, extended manufacturer responsibility, and the implementation of the "polluter pays" principle. This means that the National Strategy (2017) was developed with European experience in this field taken into account and in accordance with Directive 2008/98/EC. The next step was the development of the framework bill "On Waste Management," which underwent public discussion at the end of 2018 and was adopted by the Verkhovna Rada of Ukraine on June 20, 2022 [3]. This Law introduces a system of new terms and definitions in the field of waste management, for example, "waste management service" and also sets target indicators for the reuse and recycling of municipal solid waste (Figure 1, a). The target indicators of the National Strategy (2017) are presented in Figure 1, b.

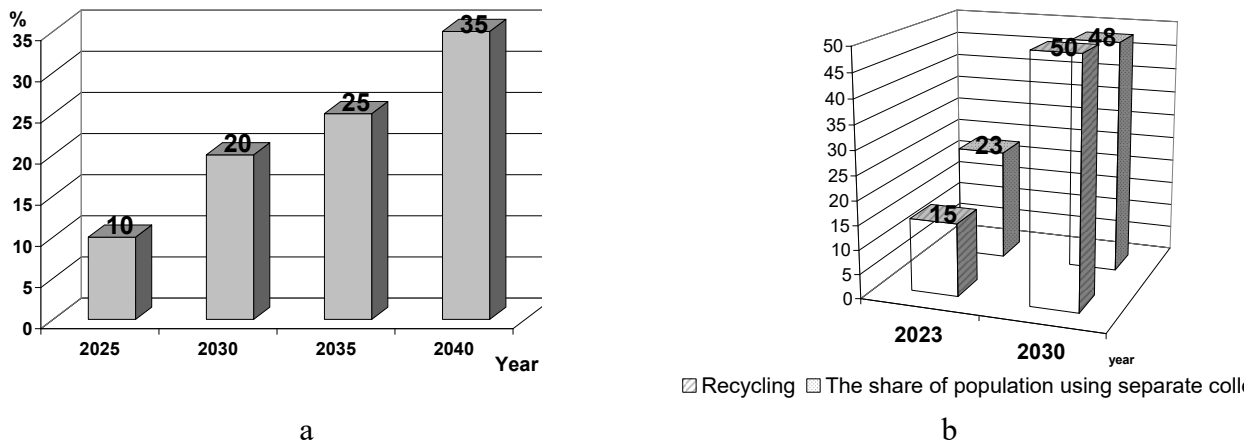


Figure 1. The goals of MSW recycling by Waste Management Law (2022) (a) and indicators of recycling by National Strategy (2017) (b)

In 2021, Ukraine adopted the Law "On Restricting the Circulation of Plastic Bags on the Territory of Ukraine" aiming to prevent environmental pollution caused by plastic bags. With some exceptions, the use of ultra-lightweight, lightweight, and oxo-degradable plastic bags is prohibited in the retail sector. Also, in 2023, a draft law "On Packaging and Packaging Waste" was developed, which establishes the principle of Extended Producer Responsibility (EPR), aimed at solving the problem of packaging waste.

The complex situation with hazardous waste as part of municipal solid waste, particularly batteries, has led to the development of a legislative initiative that would allow the implementation of the Extended Producer Responsibility (EPR) principle, exemplified by the disposal of used batteries.

As of today, there are drafted bills "On Batteries, Cells, and Accumulators" and "On Electronic and Electrical Waste" in the queue.

In addition, new legislative initiatives and projects are put forward for public discussion, and also undergo the procedure of strategic environmental assessment (Law of Ukraine "On Strategic Environmental Assessment").

In summary, significant reforms can be noted in the regulatory and legislative field of municipal solid waste management in Ukraine. This lays the foundation for the implementation of European legislation as a mandatory condition for fulfilling the agreement between Ukraine and the EU.

2. Characterization of the situation in municipal solid waste management.

The issue of MSW is one of the pressing environmental problems of Ukraine, to which a lot of attention is being paid from the administrative-management, scientific and public sectors. The current situation in Ukraine directly determines the state of the waste management sector.

The main approach to municipal solid waste management today remains landfilling in dumps and landfills, of which there are about 5.7 thousand with a total area of almost 8 thousand hectares. This is without accounting for the 14.7 thousand unauthorized dumps with a total area of approximately 600 hectares.

In 2022, about 9.9% of municipal waste was disposed of and recycled, out of which: 1.66% was incinerated, and 8.24% of municipal waste was sent to collection points for recyclable materials and waste processing lines [4].

Figure 2 shows the change in the number of landfills and dumps, their area, and also the volume of generated MSW. It should be noted that for 2022, there is partial absence of data from temporarily occupied territories and from territories of active military operations.

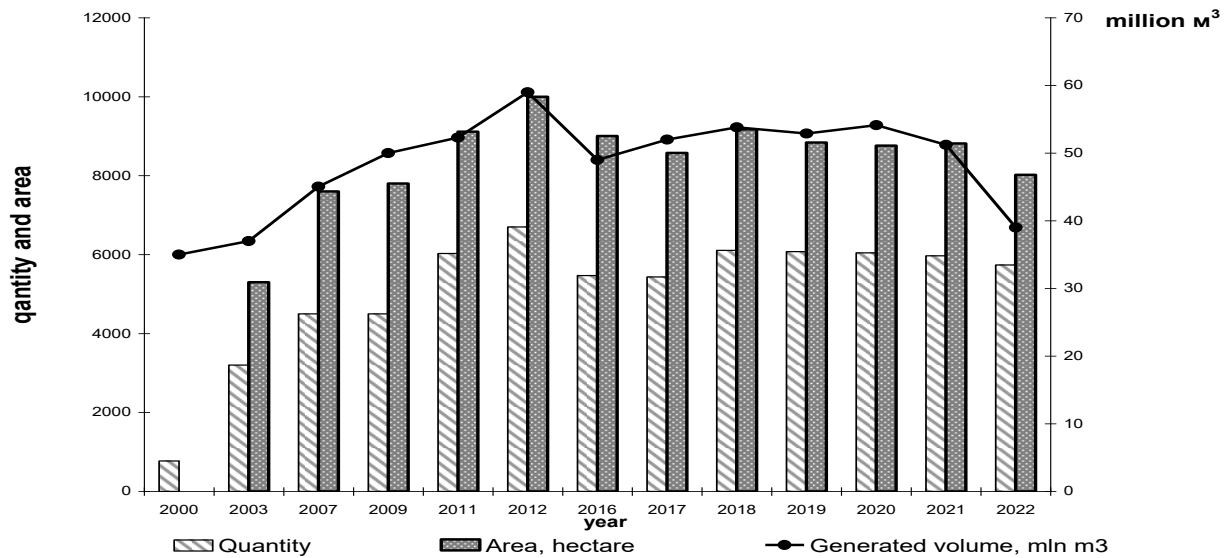


Figure 2. The quantity and area of waste disposal sites, and waste generation volume of Ukraine (2000-2022)

As shown on Figure 2, the volume of MSW generated in Ukraine is at the level of around 50-55 million m³, and the changes in the data are associated with the lack of information from occupied territories. It should also be noted that the specific generation of MSW increased by 3.5 times in volume and 1.4 times in mass over the period 1926-2018 [5]. Obviously, the increase in volumes of MSW generation and the dominance of landfilling lead to an increase in the area and number of waste disposal sites. Thus, over the period 1998-2022, the number of burial sites in Ukraine increased by 8.2 times, and over the period 2003-2022, the area increased by 1.5 times. The existing burial sites have long exhausted their resource designed for 15-20 years of operation, and for the most part do not meet national requirements for environmental safety, let alone European ones.

According to the goals of the National Strategy (2017) and the Law of Ukraine "On Waste Management" it is planned to inventory existing burial sites and make decisions on modernization or closure in the near future. Solid waste flows are planned to be redirected to regional landfills with a minimum capacity of 50 thousand tons per year, which will serve an area with a population of at least 400 thousand people. From 2030, it will be prohibited to bury waste that can be recycled in landfills. As of 2019, 19 solid waste landfills are equipped with a biogas collection system. According to Ukraine’s Greenhouse Gas Inventory (2021), 25.30 kt of landfill methane were recovered and 0.01 kt were flared in 2019.

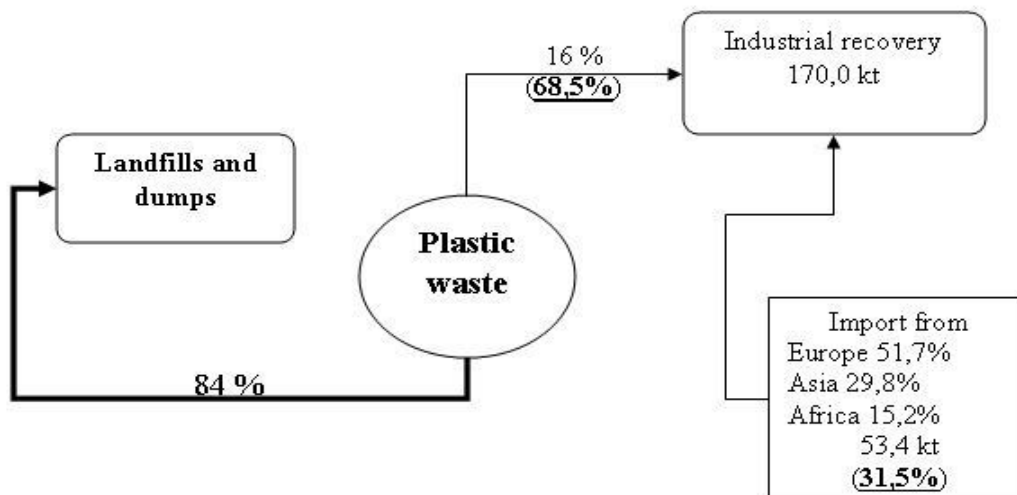


Figure 3. Some facts about plastic waste management (based on UkrVtorma data [6])

While solid waste continues to replenish existing landfills and landfills that have long exhausted their resources, there is a shortage of secondary raw materials, such as plastic (Figure 3).

A similar situation is typical for the waste paper and glass market. For example, in 2018, recycling enterprises imported 392 thousand tons of waste paper and 32.5 thousand tons of glass [6].

3. Determination of target groups of secondary material resources (SMR) as part of solid waste.

Among the factors that determine the effectiveness of the waste management system is the analysis of conditions - the morphological composition of solid waste and the possibility of collecting and processing recyclable materials. Based on this approach, we have identified the main groups of waste materials - packaging waste, food and garden waste, recyclable materials with the existing supply chain “source of formation - processing production” (Table 1).

Table 1. Potentially recyclable material resources and recycling opportunities in Ukraine

Food waste	Paper and cardboard	Polymers (plastics)	Glass	Garden waste	Textile	Metal	Total
Average content in total MSW mass, %							
36,1	14,3	5,8	6,2	9,8	3,4	2,3	77,9
Separation option from general MSW flow							
TC WMA	RC TC CP	RC TC P&R CP	RC TC P&R CP	TC WMA	TC	RC TC CP	
Recycling infrastructure (approximate number of enterprises) [6]							
–	20	39 + 15 (PETF)	17	–	–	> 1700	

Note: RC - retail chains

TC - targeted collection

P&R - procurers and recyclers

CP - Collection points for recyclable materials ("grey" sector)

WMA (collection and disposal) - administrator of waste management service.

As we can see, in Ukraine there is a basis and opportunities for the selection and disposal of separated components of solid waste. In our opinion, the main problems of the low efficiency of separate collection are the disruption of the relationship in the “population (educator) – enterprise (processor)” system, the lack of a clear system for distributing recyclables flows, the work of the “gray sector”, etc.

In our opinion, it is most advisable to introduce a separate waste collection system with extraction of easily biodegradable organic waste from the general solid waste flow [5]. This principle forms the basis of the Concept of municipal solid waste management developed at OSENU [7], the Modular approach to the formation of an individual waste management system (Veolia), and the Zero Waste City program etc.

According to the Ministry for Restoration [4], in 2018, separate collection of MSW has been implemented in 1181 populated areas, which is a 22-fold increase compared to the initial data of 2009. Ukraine also operates 26 waste sorting lines. As a result, in 2021 8.24% of MSW is directed to recycling collection points and waste recycling plants.

4. The successful experience of waste management projects in Ukraine.

In Ukraine, several local waste management projects have been implemented, and the experience gained from these initiatives can be valuable in the implementation of waste management systems at the regional level. For instance, there is a project for the separate collection of household waste in Vyshhorod, Kyiv Oblast. Under the auspices of UkrPEC (Ukrainian Packaging and Environmental Coalition), a five-year project on separate waste collection was executed in 2017,

aimed at developing a model for implementing Extended Producer Responsibility (EPR) at the level of an individual municipality. The project's success is measured by achieving a 50% waste packaging recycling rate. The transparent packaging waste management model can be replicated in any populated area in Ukraine. Funding for the project was provided by major packaging producers, including PEPSICO, Coca-Cola HBC Ukraine and Moldova, Elopak, and Tetrapak. The project emphasizes community engagement and has been well-received.

Lviv has been notably successful in implementing an effective MSW management system. In 2021, Lviv joined the Zero Waste Cities program and attained the status of a candidate city (another candidate city being Lubotin). Thanks to the efforts of the NGO "Zero Waste Lviv," unique projects have been developed to bring the "zero waste" lifestyle to the city level, such as "Organic Waste in Times of War," aimed at establishing separate waste collection in institutions responsible for accommodating and feeding the Armed Forces. It's worth noting that Lviv is the only city in Ukraine where a centralized collection system for organic waste and subsequent composting is in operation. Since 2020, a composting facility in the city has been processing approximately 500 tons of food and garden waste each month, producing a marketable product – compost [8].

Conclusions

It is evident that the strategy for MSW management is closely intertwined with the strategy for sustainable development. The successful implementation of MSW management goals can lead to significant achievements in the realm of sustainable development, particularly in the Sustainable Development Goals (SDGs) 11 - "Sustainable Cities and Communities," 12 - "Responsible Consumption and Production," and 13 - "Climate Action." An effective MSW management model, whether at the local or national level, is designed to rationalize the use of natural resources and minimize the environmental impact of waste generated by consumption. Ukraine is actively creating conditions for transitioning to a sustainable consumption model, adapting its regulatory framework to progressive European standards, successfully implementing practical cases, and, importantly, advancing environmental education and awareness among all stakeholders.

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