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Management of Municipal Waste in Romania and Hungary in the EU Context

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Abstract

At the EU level, practices aimed at changing municipal waste management methods toward sustainable management systems are regulated. In the waste hierarchy, the first option is prevention of waste generation, but the emphasis is also on recycling and energy recovery. The present study analyses the dynamics of municipal waste management, in the period 2018-2021, in Romania and Hungary in the European Union context. The general results regarding municipal waste management at the level of the two countries, highlighted increases in the values of some indicators in terms of the quantities generated, but these values are below the average recorded in the EU. With regard to the indicators of efficient management of municipal waste, the two states have made efforts, but they are far below the European average, especially with regard to the quantities recycled, composted and utilised for energy. In this sense, the low recycling rates in Romania of 11.3 %, and in Hungary of 34.9 %, in 2021, compared to the European average, which is around 49 %, are noted, being far below the target proposed for 2020 by 55 %. For this reason, the storage rate is high in both countries, 80% in Romania and 50 % in Hungary. Both states must make efforts to increase municipal waste recycling rates and reduce the amounts stored, especially Romania, so as to better put into practice the principles of integrated waste management and meet the objectives assumed upon accession in this regard.

Keywords: municipal waste, generation, landfill, recycling rate.

JEL Classification: Q50, Q53, Q59.

1. Introduction

In the context of population growth and changes in consumption patterns, waste management is a priority for every country. An effective waste management is

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based on the principles of the "waste hierarchy", to reduce the pressure on the environment and to capitalise on the waste resources. In this sense, the focus is on methods of preventing waste generation and reusing resources. If these methods cannot be applied, it is recommended to recycle the materials, and another possibility would be the energy recovery of municipal waste. The disposal of waste in landfills is the last possible option and the least recommended.

The very different origin of municipal waste, mainly from households, but also from shops, offices, and public institutions, makes them present major differences in terms of their composition and therefore their value as resources. Their inadequate management leads to the endangerment of human health, environmental pollution, and also to the increase of production costs and the depletion of resources. In 1994, the European Union issued a directive on packaging waste, aimed at reducing the quantities that go to landfills or incinerators. The directive encourages the minimisation of the amount of material used in packaging, the reuse of components, and the recycling of packaging materials.

At the EU level, policies and objectives regarding municipal waste management are established. Thus, the objectives for this category of waste refer to reaching the percentage of 60 % recycling and preparation for reuse by 2025 and 65 % by 2035, plus the reduction of municipal waste thrown into landfills below 10 % by 2035, as well as revised objectives for packaging waste (Directive 2018/850).

2. Problem Statement

Waste management has an impact on the environment and on society, but also from an economic point of view.

In recent decades, the problem of rational and efficient use of the total amount of material goods produced in the economy to reduce waste generation has become more and more acute for humanity (Vitenko et al., 2021). Economic growth and technological development have increased the consumption of goods and services, as well as the amount of waste (Petrescu et al., 2022).

Managing the selective collection of waste and its various treatments, especially recycling, contributes to the realisation of a circular economy (López-Portillo et al., 2021). The European Union has outlined its plan for a circular economy with the aim of maintaining growth and competitiveness while halving resource extraction by implementing innovative ways of production and consumption (https://www.sustainability-seeds.org/). Proper management of solid waste is a central pillar of sustainable and long-term environmental policies.

In the EU, waste management (according to the hierarchy of their management methods) is based on the principles of sustainable development. Member States must take measures to treat the waste produced, according to a clear hierarchy: prevention, preparing for re- use, recycling, recovery, e.g. energy recovery and disposal. EU-wide targets include achieving a recycling rate of 65 % by 2030 and capping landfill waste at no more than 10 % (as a percentage by weight) (Cecere, Corrocher, 2016).

In the EU, municipal waste represents 7-10 % of all generated waste (Directive EU/2018/851). Differentiated levels regarding values in the field of waste management in the EU member countries come from the adoption of different development strategies for the transition of economies to the circular economy and also from the differences that appear in social and economic development (Mazur-Wierzbicka, 2021).

The analysis of European waste management demonstrates that member states have faced similar problems in municipal waste treatment, these problems originating in the impact of rapid economic development (Buclet, Godard, 2000).

EU policies and strategic focus are moving away from energy recovery and landfill disposal as ways of dealing with waste (Traven et al., 2018). In recent years, the EU has started a comprehensive regulatory action aimed at moving waste management practices towards sustainable waste management systems, the first premise being the prevention of waste generation and, secondly, the promotion of recycling practices (Chioatto et al., 2022).

The disposal of municipal waste by storing it in landfills is a traditional way of disposal, which has been addressed in the past in many EU countries, but this can have harmful effects on the environment and people, leading to pollution (Khaertdinova et al., 2021). There are countries that almost no longer practice waste storage (Belgium, Holland, Denmark, Sweden, Germany, Austria), where incineration plays an important role alongside recycling. Eastern and Southern European countries still opt for storage, with more than 50 % of municipal waste being stored in landfills (https://www.europarl.europa.eu/).

In recent years, Europe has made substantial progress towards more sustainable management of municipal waste (https://www.interregeurope.eu/). In the short and medium term, the EU will become a leader in the practical implementation of the circular economy concept through reuse and recycling, which will lead to savings on both electricity bills and raw material imports and increase the environmental culture of the population (Vitenko et al., 2021).

3. Aim of the Research and Research Methods

The article addresses waste management issues in the context of promoting a transition to a circular economy. Both countries have a well-developed policy and legal framework for waste management, driven mainly by EU requirements and supported by quantitative targets and economic instruments. The Eastern region of Europe, including Romania and Hungary, is lagging behind in terms of municipal waste management, but the Romanian-Hungarian border area benefits from attracting foreign investments, including in the field of waste management.

The purpose of this research was to perform a comparative analysis of municipal waste management in Romania and Hungary, two neighbouring states, taking into account both the geographical proximity, but also the differences due to the time of the start of negotiations for EU accession, as well as the time of effective accession. The research hypothesis is whether there is a gap regarding the implementation of European norms regarding the management of municipal waste

between the two analysed countries and whether Romania and Hungary have improved their waste management by increasing recycling and recovery rates and decreasing the use of landfills of waste, hypotheses verified by analysing the main waste management indicators.

For this study, specific indicators were selected for municipal waste management in the period 2018-2021. The indicators analysed are: the amount of municipal waste generated, the amount of municipal waste treated, the recycling rate of municipal waste, the amount of municipal waste disposed - landfilled and other, the amount of incinerated waste, the amount of recycled waste, and the amount of waste prepared for reuse. These values were taken both in absolute terms and in terms of the quantity per inhabitant. The study focused on the qualitative analysis of data in Romania and Hungary, compared to the EU average. The data were taken from the Eurostat database.

4. Findings

Municipal solid waste is a mixture of biomass and fossil fuel-based materials. Biomass or the degradable portion includes materials such as food and animal waste, yard waste, paper/cardboard, leather and wood, while non-degradable materials are stable and can take years to decompose in landfill (Ayodele et al., 2018).

Regarding the municipal generated waste, based on the data analysis, it can be appreciated that the general trend is increasing, both at the level of the EU and at the level of the two countries, but the values recorded by Romania and Hungary are lower than the EU average.

In 2018, municipal waste in Romania recorded a value of 272 kg/capita, reaching a total of 302 kg/capita in 2021, representing a percentage increase of 11 %. The values are significantly below the EU average regarding the generation of municipal waste, but the percentage increase is higher in the analysed interval, compared to the European average and the one registered in Hungary (Figure 1).

In Hungary, in 2018, the value of the amount of municipal waste generated was 381 kg/capita and increased to 416 kg/capita in 2021, representing a percentage increase of 9 %. In the EU, the values registered an upward trend, from 500 kg/capita in 2018, to 530 kg/capita in 2021, and the percentage increase in 2021 compared to 2018 was 6 %.

Figure 1. Municipal waste generated (kg per capita)

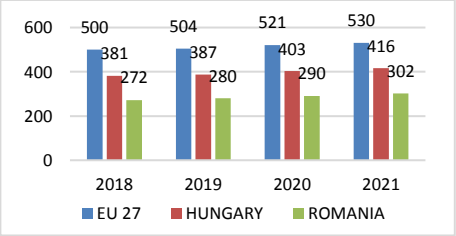
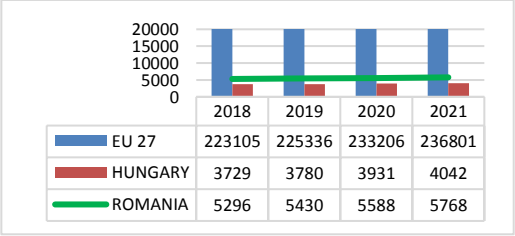


Figure 2. Municipal waste generated (thousand tonnes)



	2018	2019	2020	2021
EU 27	223105	225336	233206	236801
HUNGARY	3729	3780	3931	4042
ROMANIA	5296	5430	5588	5768

Source: https://ec.europa.eu/eurostat.

In absolute terms, EU citizens generated 236,801 thousand tons of municipal waste in 2021, an increase of 6% compared to 2018. In the case of Romania, the trend was also strictly upward, the total amount of municipal waste varied between 5296 thousand tons in 2018 and 5768 thousand tons in 2021, representing an increase of 8%. In Hungary, the trend was also strictly upward during the analysed period, increasing from 3729 thousand tons in 2018 to 4042 thousand tons in 2021, representing an increase of 8% (Figure 2).

An important aspect of municipal waste management is represented by its treatment method, in order to avoid storage in landfills. Regarding the treatment of municipal waste, the situation of the values recorded in the period 2018-2021 is presented in figure 3. In Romania in 2018, the amount treated was 255 kg/capita, reaching up to 280 kg/capita, representing an increase of 9%. In Hungary, the treated quantities started at 383 kg/capita, gradually increasing up to 416 kg/capita, the percentage increase during this period being 8%. Thus, it is found that the values in Romania are much lower than the European average and compared to those in Hungary, which leads to the idea that sustained efforts must be made in this direction.

Figure 3. Municipal waste treatment (kg per capita)

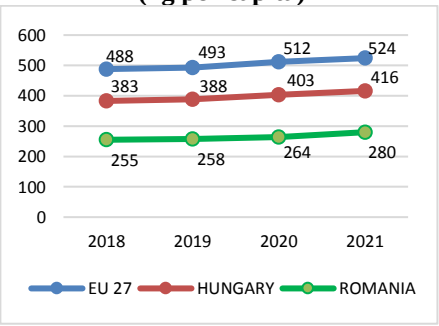
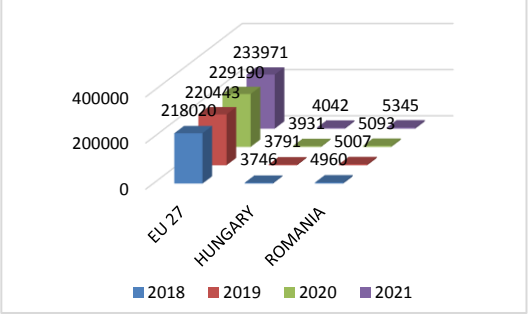


Figure 4. Municipal waste treatment (thousand tonnes)



Source: https://ec.europa.eu/eurostat.

In absolute terms, the amounts of municipal waste treated increased throughout the analysed period. In the EU, the values ranged between 218020 thousand tons in 2018 and 233971 thousand tons in 2021, an increase of 7 % in 2021 compared to 2018. In the case of Hungary, the increase was 7%, a value based on gradual increases from 3746 thousand tons in 2018 to 4042 thousand tons in 2021. In Romania, the increase was also 7 %, from 4960 thousand tons in 2018 to 5345 thousand tons in 2021 (Figure 4).

The recycling rate of municipal waste in the European Union in the period 2018-2021 had an upward growth trend from 46.4 % to 49.6 % (Figure 5). These values are determined based on data from member countries.

Figure 5. Recycling rate of municipal waste (%)

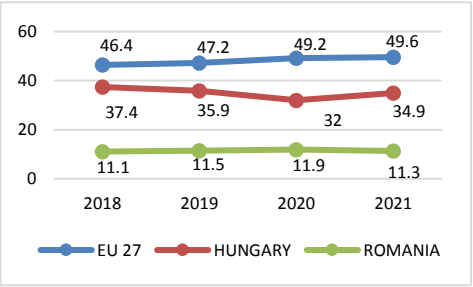
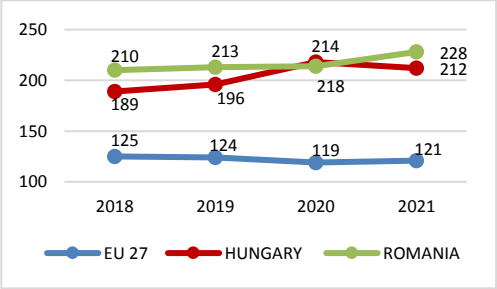


Figura 6. Municipal waste - disposal landfill and other (kg/capita)



Source: https://ec.europa.eu/eurostat.

In Romania, the values of the municipal waste recycling rate during the analysed period were very low, of only 11-12 %, which makes it far below the proposed target for 2020 of 55 %, according to the European directives in force. In Hungary, the recycling rate is higher than the values recorded in Romania, but lower than the European average, with an oscillating tendency, the values in the analysed period being between 37.4 % in 2018 and 32 % in 2020 (Figure 5).

Landfill is the least recommended option, but it is the main means of waste disposal in some Member States, which contradicts the "Resource Efficient Europe" initiative. The EU Circular Economy Action Plan envisages changing the current model of the linear economy and 'closing the loop' on product life cycles through greater reuse and recycling. The plan aims to follow the entire cycle of products, from their production and consumption, to waste management and the market for secondary raw materials (https://ec.europa.eu/).

Thus, in the period 2018-2021, it can be seen that in Romania the quantities sent for storage decreased until 2021 to 121 kg/place, from 125 kg/place in 2018 (Figure 6). In Hungary, there was an increase in the first part of the analysed interval, followed by a slight decrease, reaching 212 kg/place in 2021. Regarding the EU average, the values are much lower than in the case of the two countries, the trend being slightly downward, from 125 kg/capita in 2018 to 121 kg/capita in 2021.

Regarding the nominal values related to the quantities of recycled waste (kg/capita), it is found that in the EU, the trend is strictly upward, increasing from 147 kg/capita in 2018 to 157 kg/capita in 2021, an increase of 6 % (Figure 7). In Hungary, the trend is non-linear, the lowest value being recorded in 2020 of 90 kg/capita, increasing to 106 kg/capita in 2021, the percentage difference being 17 %. In Romania, the recycled quantities are far below the values recorded in the EU and in Hungary, the lowest registered value being 16 kg/capita in 2020, and in 2021 it increased to 20 kg/capita, the trend being oscillating. These values show the lack of concern of the Romanian authorities and citizens regarding the application of European directives.

Figure 7. Municipal waste – recycling material (kg/capita)

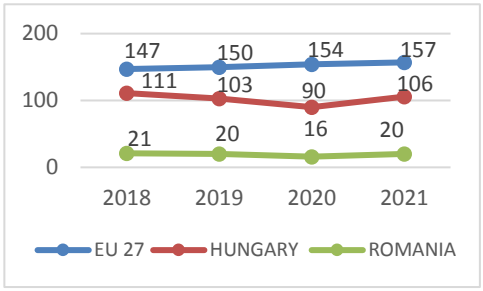
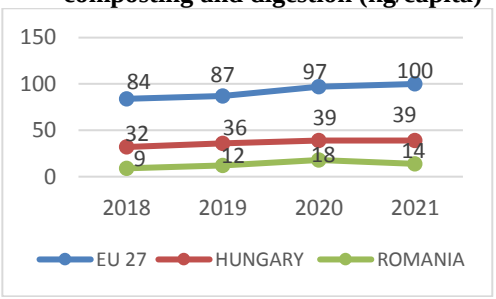


Figure 8. Municipal waste – composting and digestion (kg/capita)



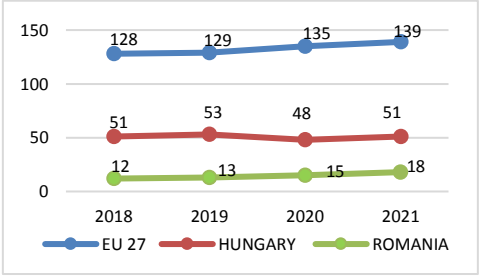
Source: https://ec.europa.eu/Eurostat.

Composting is a method recommended to be used for the valorisation of biodegradable organic waste. The values recorded in the EU are much higher compared to the two analysed countries, due to the fact that in other member states more emphasis is placed on this method, the values being between 84 kg/capita in 2018 and 100 kg/capita in 2021 (Figure 8).

In Hungary, the values gradually increased from 32 kg/capita in 2018, to 39 kg/capita in 2021, and in Romania, the values are lower compared to Hungary, starting from 9 kg/capita in 2018, reaching 14 kg in 2021.

When other waste treatment options, such as reuse or recycling, are not possible, it is recommended to use them through energy recovery. Thus, it is found that this method is practiced at the EU level, the quantities of municipal waste from which energy is recovered, varying between 128 kg/capita in 2018 and 139 kg/capita in 2021 (Figure 9). In Hungary, the values were slightly oscillating during the analysed period; they started from 51 kg/capita and remained at the same value in 2021. In Romania, the values are lower than in Hungary and much lower than those in the EU, but on a slightly upward trend starting from 12 kg/capita in 2018 and reaching 18 kg/capita in 2021.

Figura 9. Municipal waste - energy recovery (kg/capita)



Source: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en.

In Table 1, the municipal waste treated by management operations is analysed. Thus, at the EU level, 54,147 t are disposed of by storage, and in Romania and Hungary are stored 4,357,000 tons and 2,061,000 tons, respectively.

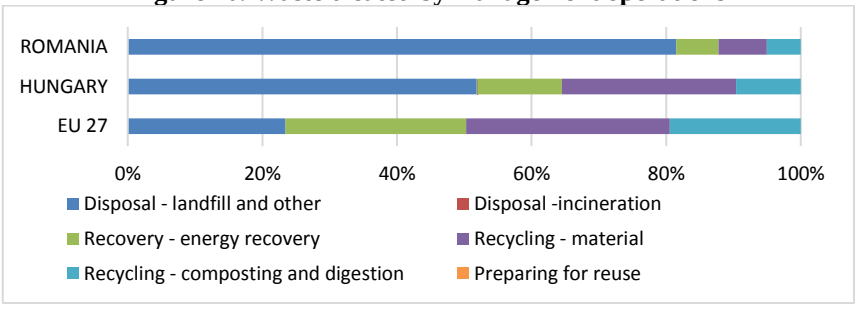
Table 1. Municipal waste treated by management operation (thousand tonnes)

2021	Municipal waste treated (thousand tonnes)					
	Disposal - landfill and other	Disposal - incineration	Recovery - energy recovery	Recycling - material	Recycling - composting and digestion	Preparing for reuse
EU 27	54147	:	61966	69948	44894	:
HUNGARY	2061	3	500	1029	382	0
ROMANIA	4356	0	335	384	270	0

Source: https://ec.europa.eu/eurostat.

Figure 10 shows the treated waste according to their management operations. Thus, it is found that over 80 % of the waste treated in Romania is stored in landfills. It can be appreciated that Romania is one of the countries where most of the collected municipal waste is treated through storage operations at landfills, recycling, and recovery being used to a very low extent. These observations are in accordance with those presented by Ioana et al. (2016). In the case of Hungary, the percentage of waste - landfilled exceeds 50 %. This happens despite the fact that within the waste management hierarchy of the European Union Framework Directive, disposal by storage is the least sustainable option. Both countries must improve their waste management by applying the principles of the waste hierarchy more strictly, especially Romania.

Figure 10. Waste treated by management operations



Source: Own representation based on data available at https://ec.europa.eu/eurostat.

Many EU countries have received loans from the European Investment Bank to finance investments in waste management and treatment. In Poland, the Czech Republic, Hungary and Slovenia, grants from EU funds supported a wide range of waste treatment investments, including integrated waste facilities that combined sorting, recycling and composting for municipal solid waste (https://www.oecd-ilibrary.org/sites/1f4e61ee-en/index.html?itemId=/content/component/1f4e61ee-en).

Efficient waste management involves costs, and these costs are usually too high for local municipalities. Most of the time, the collected sanitation fees do not fully cover the costs necessary to ensure an integrated waste management. The expenses for the protection of the environment represent an economic measure of the response that society gives regarding the state of the environment, and they refer to the expenses incurred for the performance of environmental surveillance and protection activities, those for the prevention of pollution and those incurred for combating effects or damage to the environment (https://www.oecd.org/env/40501169.pdf).

In order to evaluate the situation of the efficient use of environmental and waste management taxes, the identification of a link between the revenues collected from environmental taxes (millions of euros) and the amount of recycled materials (thousands of tons) was also pursued. As other authors have identified, in EU countries, there is a strong correlation between environmental tax revenues and the amount of recycled materials (Năstase et al., 2019).

At the Hungarian level, the value of the correlation coefficient between these indicators (0.200) indicates a weak direct link between the analysed variables (Table 2). The higher the environmental tax, the more materials should be recycled.

Table 2. Correlation

			MATERIAL RECYCLING	
			Hungary	**Romania**
Spearman' rho	ENVIRONMENTAL TAX REVENUES	Correlation Coefficient	,200	-,316
		Sig. (2-tailed)	,800	,684
		N	4	4

Source: Own processing based on data https://ec.europa.eu/eurostat.

In the case of Romania, the value of the correlation coefficient is -0.316, which indicates an indirect connection between the analysed variables. This means that large sums were collected for environmental and waste management fees, but small amounts of materials were recycled. In other words, collected taxes and environmental funds were used ineffectively for the organisation and operation of collection and recycling systems.

6. Conclusions

All stakeholders, including governments, municipalities, businesses, and residents, must be involved in sustainable development in the area of municipal waste management. The two states under study have lower amounts of waste generated/capita and treated than the EU average, which results in a higher rate of landfill disposal than the EU average. This condition results from the employment of alternative waste management techniques on a smaller scale.

The values regarding organic waste composting, energy recovery, and especially recycling are far below those recorded in the EU, especially in Romania, and far below the targets provided in the European Directives.

The degree of waste recycling is influenced by the economic development of each nation, the facilities created for recycling, the income of the population, and the degree of education regarding selective collection. Recycling is an action with a beneficial effect on the environment and represents a major EU objective, so the population should actively contribute to the collection and recycling of the waste they generate, and public authorities must use the funds allocated to waste management more efficiently.

In conclusion, the two EU member countries are below the European average for most indicators on waste management and must make sustained efforts to implement the principles of efficient waste management and to achieve the objectives assumed upon accession.

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