

## Trends in Municipal Waste Generation and Treatment in Romania. Comparative Statistics with the EU Average.

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### Abstract

*Although European Union statistics show that municipal waste is a small part of the total waste generated, their analysis is important, due to the complexity of the sources of generation and treatment, but also of the consumption patterns specific to each individual member state. The present research will analyze the indicators regarding the generation and treatment of municipal waste in Romania over a period of 10 years, compared to the average of the European Union. Through this analysis, we will be able to observe a trend in Romania, but also what is the current stage of reaching the targets set at the level of the European Union related to the generation and treatment of municipal waste.*

*The indicators taken into account are the amount of municipal waste generated expressed in kg/capita, the amount of municipal waste treated (total and by treatment operations) expressed in kg/capita and the recycling rate of municipal waste expressed in percentage. The main source for statistical data extraction was the statistical office of the European Union (Eurostat), in order to ensure a comparable and objective picture of the indicators.*

**Key words:** municipal waste, municipal waste generation, municipal waste treatment, recycling rate of municipal waste

**J.E.L. classification:** Q53, Q58

### 1. Introduction

Municipal waste is defined in Directive (EU) 2018/851 amending Directive 2008/98/EC, Article 3 paragraph 2b as "mixed/separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators and bulky waste such as mattresses and furniture, but also mixed/separately collected waste from other sources, when they are similar in nature and composition to household waste" ((European Parliament and Council of the European Union, 2018). Thus, municipal waste is supposed to be that waste generated by households, but also similar waste generated by public institutions, various offices or commercial activities. At the same time, it is mentioned in Directive (EU) 2018/851, that they will not be included in the definition of municipal waste those wastes that have as their source production activities, agricultural activities, forestry, fishing, septic tanks, the sewage network, treatment operations and sewage sludge, but neither the vehicles taken out of use nor those wastes that come from constructions and demolitions.

The amending Directive (EU) 2018/851 of the Directive 2008/98/EC brings new objectives regarding the recycling of municipal waste. Thus, by 2025, a share of at least 55% of the weight of municipal waste should be recycled. The share will increase by another 5 percent for the next 5 years and by another 5 percent until the year 2035 (European Parliament and Council of the European Union, 2018).

Waste management is the third component (part of pillar 1 Green Transition) of Romania's National Recovery and Resilience Plan (NRRP), as a strategic document of the Recovery and Resilience Mechanism. According to the NRRP (Ministry of Investments and European Projects,

2021), Romania's challenge is to reach the 55% recycling target set for 2025 in the circular economy package (while recent data provided by Eurostat show a recycling rate of 13.7 % in 2020), but also the reduction to 10% by 2035 of municipal waste eliminated by storage (this being still the main municipal waste treatment operation of the national authorities).

In 2017, Romania adopted the National Waste Prevention and Management Plan, as a condition imposed for accessing European funds for the 2014-2020 period. Municipal waste is included in the National Waste Prevention and Management Plan, and according to the proposals for revising the Circular Economy Package mentioned therein, Romania can benefit from an additional period of five years in reaching the municipal waste recycling targets, as long as it takes measures so that the rate of preparation for reuse and recycling of municipal waste increases to a minimum of 50% (by 2025 - that is, approximately 2,500 thousand tons/year) and to a minimum of 60% (by 2030). The National Recovery and Resilience Plan states that investments related to municipal waste management systems will contribute four and a half percent to the national target. And regarding the reduction of the amount of municipal waste stored, Romania can benefit from an additional period of 5 years, provided that measures are adopted to reduce landfilled municipal waste to 20% of the total waste generated by 2030.

## 2. Literature review

Studies regarding the issue of municipal waste generation and treatment are varied. For our research, we have considered only those that concern the European Union and its member states, so that we can outline a general framework of the theme.

Analyzing the performance of the member countries of the European Union in the management of municipal waste in the period 1995-2016, (Castillo-Giménez *et al.*, 2019) concluded that Central and Northern European countries have better results. Contrary to them, many of the Eastern European countries do not have good results, and measures are needed to improve the situation. (Rios and Picazo-Tadeo, 2021) also support the idea that most Eastern European states that joined after the 2000s and some Southern states have poor results in municipal waste treatment. In addition, they concluded that good results in municipal waste treatment are related to the level of economic development. (Minelgaitė and Liobikienė, 2019) note the existence of important differences in the generation of municipal waste within the European Union and they also claim that the level of generation is related to economic development. At the same time, in addition to the importance of reducing waste generation, the authors note the importance of sustainable production and consumption, considering that the population of the European Union does not know well the relationship between waste reduction and the efficiency of the resources involved.

(Mena-Nieto *et al.*, 2021) analyzed the municipal waste situation in the Canary and Balearic Islands, given that these two Spanish regions have some of the highest rates of municipal solid waste generation per capita. The biggest factor identified by the authors as generating municipal waste is the tourist population; other factors contributing to high waste rates are resident population and per capita income. Thus, (Mena-Nieto *et al.*, 2021) considers that the two islands are far from reaching the European Union targets set by the year 2035 in terms of municipal waste.

(Bayar *et al.*, 2021) concluded that the developing countries of the European Union need to carefully monitor waste management and recycling rates, because in their case there is uncontrolled waste and there is a lack of awareness of the population in terms of environmental protection and recycling regulations are also needed. The authors note that international support given by agencies in developed countries to those in developing countries, consisting of advice and assistance may be welcome, ensuring the transition to the circular economy.

(Banacu *et al.*, 2019) show in their analysis of the 27 EU states that factors such as companies' research and development expenditures, GDP expenditure on research and development, private investments or resource productivity is in a direct and important relationship with the municipal waste recycling rate and therefore public policies should focus on them.

(Magrini *et al.*, 2020) emphasize in their research the importance of combining traditional "command and control" measures with market instruments and various economic incentives, as proposed by the environmental legislative packages of the European Union. At the same time, the authors believe that market instruments should be chosen depending on the implementation area or

the specific behavior of a certain place, but also that there should be an unanimously accepted and used definition of municipal solid waste.

Romania, as a member state of the European Union since 2007, is no exception to the results obtained in the works mentioned above. Thus, the results regarding the generation and treatment of municipal waste are not encouraging, considering the targets set at the level of the European Union and the behavior of the population towards aspects of waste and environmental protection in general. Next, through a 10-year analysis of the municipal waste indicators, we will try to conclude the trends in Romania and its degree of fulfillment regarding the European targets.

### 3. Research methodology

The current research analyzes the trends in the generation and treatment of municipal waste in Romania, in the period 2011-2020. For this purpose, based on data published by Eurostat (Eurostat, 2022), we have selected the following relevant indicators for the research carried out, as follows: the amount of municipal waste generated, the amount of municipal waste treated, the recycling rate of municipal waste (table no.1).

Table no. 1. Indicators used in research

Name	Unit of measure
Municipal waste generation	- Kilograms per capita
Municipal waste treatment - total - treatment operations	- Kilograms per capita
Recycling rate of municipal waste	- Percentages

Source: Eurostat data processing

The generation of municipal waste per capita is an indicator used by Eurostat in monitoring the transition to a circular economy, in which the reduction of waste generation is considered extremely important in the waste hierarchy. This indicator measures the waste collected by municipal authorities or on their behalf.

The municipal waste treatment approach included the following operations: landfill/disposal (D1-7, D12), incineration/disposal (D10), energy recovery (R1) and recycling. The classifications were approached according to the definitions included in the OECD/Eurostat Joint Questionnaire (Guidance on municipal waste data collection, October 2021), but also taking into account the Waste Framework Directive (Directive 2008/98/EC) and Directive (EU) 2018/851 amending Directives 2008/98/EC, as Eurostat considers for statistical data.

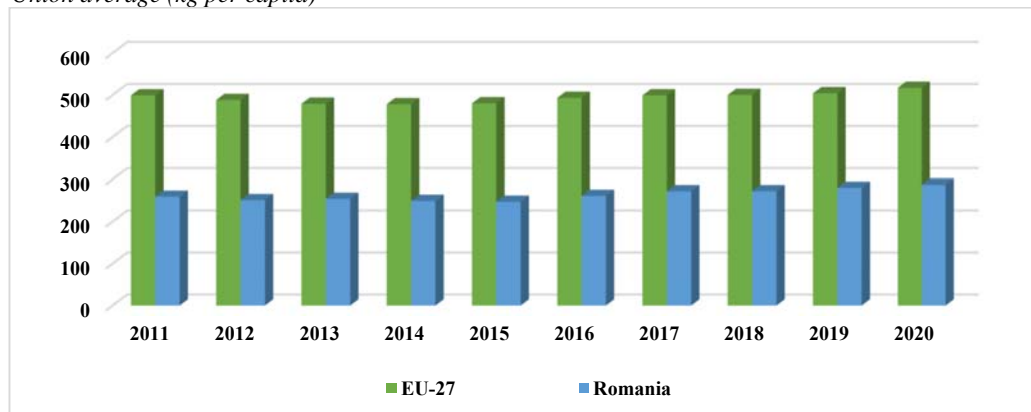
For a complete research we also considered the municipal waste recycling rate. It is also part of the set of indicators used by Eurostat to monitor the transition to a circular economy. According to the Eurostat methodology, this indicator measures the share of recycled municipal waste in the total municipal waste generated; for recycling, material recycling, composting, anaerobic digestion will be considered. The recycling rate of municipal waste was also used to monitor the objective included in the Waste Framework Directive related to reaching the share of at least 50% until the year 2020 of preparation for reuse and recycling of municipal waste (at least paper, metal, plastic, glass).

### 4. Findings

The most recent Eurostat statistics show that in 2020, 5,534 thousand tons of municipal waste were generated in Romania, registering an increase of over 6 percent in the last 10 years. The statistical expression of municipal waste generated in kilograms per capita shows a decrease from 259 kg/capita in 2011 to 247 kg/capita in 2015, followed by an increase up to 287 kg/capita in 2020. Thus, according to figure no.1, in the period 2011-2020, we have a 10.8% increase in municipal waste generated per capita. An increase in the generation of municipal waste shows that waste prevention measures are still needed in Romania, but also a change in the consumption model, and the involvement of citizens to be more active.

The trend is similar to that of the European Union, but the quantity is far below the Community average; in 2020, the municipal waste generated (kg/capita) in Romania had a weight of 55.51% of the EU average. In 2020, Romania generated the lowest amount of municipal waste per capita compared to the other members of the European Union. Differences between states may be caused by the regulation of municipal waste collection and management at the level of each economy (certain sources of waste may or may not be assimilated to household waste, being considered municipal waste or not), but also by the consumption model existing at the national level.

Figure no. 1: Municipal waste generated in Romania in the period 2011-2020 compared to the European Union average (kg per capita)

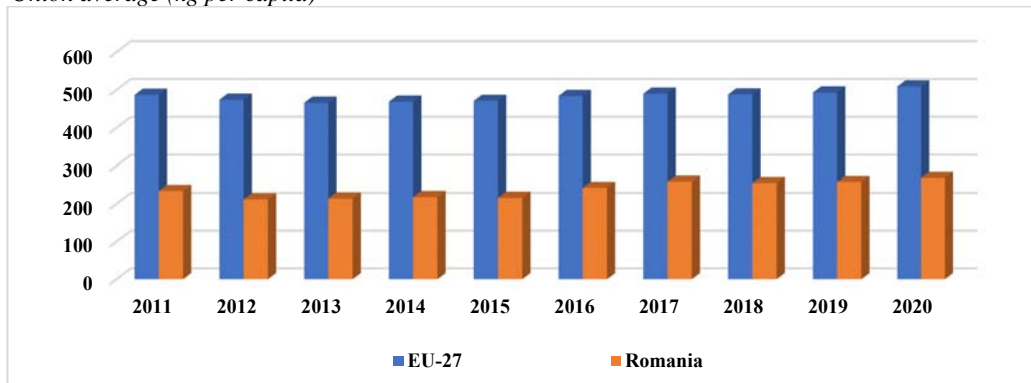


Note: Estimated data for the European Union - years 2019 and 2020

Source: Data extracted by the author from Eurostat, available online at [https://ec.europa.eu/eurostat/databrowser/view/ENV\\_WASMUN\\_\\_custom\\_4016808/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/ENV_WASMUN__custom_4016808/default/table?lang=en)

As seen in figure no. 2, the amount of treated municipal waste registered small fluctuations during the analyzed period. Currently, at the level of 2020, treated municipal waste averaged 269 kg/capita in Romania, which means a 15% increase compared to 2011. Thus, in 2020, 5,179 thousand tons of municipal waste were treated in Romania, this means an increase of 466 thousand tons compared to the base year of the analysis. Also, in the case of treated municipal waste, the trend was similar to that of the European Union.

Figure no. 2: Municipal waste treated in Romania in the period 2011-2020 compared to the European Union average (kg per capita)



Note: Estimated data for the European Union - years 2018, 2019 and 2020

Source: Data extracted by the author from Eurostat, available online at [https://ec.europa.eu/eurostat/databrowser/view/ENV\\_WASMUN\\_\\_custom\\_4016760/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/ENV_WASMUN__custom_4016760/default/table?lang=en)

Table no. 2 shows the amount of municipal waste by treatment category, both at the level of Romania and at the level of the European Union, as well as the change percentage of each category during the analyzed period.

*Table no. 2 Municipal waste by the treatment operations in Romania in the period 2011-2020 compared to the average of the European Union (kg per capita)*

Operation	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change 2020/2011 (%)
<b>Romania</b>											
Disposal - landfill and other	201	171	175	179	178	181	207	210	213	214	6,46%
Disposal - incineration	0	0	0	0	0	0	0	0	0	0	0%
Recovery - energy recovery	2	4	5	7	6	11	12	12	13	15	650%
Recycling	30	37	34	33	33	35	38	30	32	39	30%
<b>EU-27</b>											
Disposal - landfill and other	167	153	142	134	127	121	127	125	124	122	-26,95%
Disposal - incineration	27	20	14	14	18	11	3	2	2	2	-92,60%
Recovery - energy recovery	99	102	112	114	110	119	128	128	129	134	35,35%
Recycling	194	199	199	207	216	226	231	232	238	251	29,38%

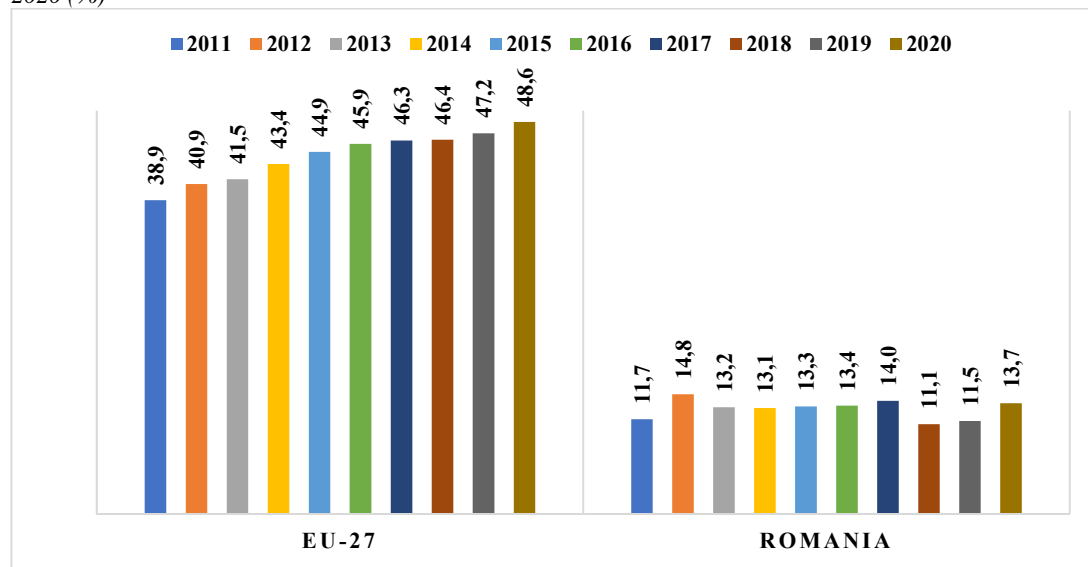
*Source:* Data extracted and processed by the author based on information provided by Eurostat

According to the data presented in the table above, we can see that the hierarchy of municipal waste treatment categories differs between Romania and the European Union. Thus, most of Romania's municipal waste is disposed of through landfilling and other similar operations, reaching 214 kg/capita in 2020, registering an increase of 6.46% compared to the base year of our analysis. Recycling is the second operation used by Romania for the treatment of municipal waste, registering a 30% increase in the analyzed period, from 30 kg/capita to 39 kg/capita. Recovery through energy recovery is still modest in Romania, but with a promising trend. Thus, this treatment operation registered a change of 650%, from 2 kg/capita to 15 kg/capita.

Comparatively, in the European Union the most used treatment operation is recycling (with a change of +29.38% compared to 2011), followed by recovery through energy recovery (with a change of +35.35% compared to 2011) and disposal through landfilling and other operations (with a change of -26.95% compared to 2011). A significant downward trend in the European Union was registered by incineration, which decreased from 27 kg/capita to 2 kg/capita.

The municipal waste recycling rate had a constant upward trend at the level of the European Union, from 38.9% in 2011 to 48.6% in 2020. On the other hand, in Romania there were fluctuations in the recycling rate of municipal waste, as we can see in figure no. 3. Overall, the recycling rate increased from 11.7% to 13.7% in the analyzed period, but places Romania in the last places among the EU states, surpassing only Malta (with a municipal waste recycling rate of 10.5% in 2020).

Figure no. 3: Municipal waste recycling rate in Romania and the European Union in the period 2011-2020 (%)



**Note:** Estimated data for the European Union - years 2019 and 2020

*Source:* Data extracted by the author from Eurostat, available online at [https://ec.europa.eu/eurostat/databrowser/view/CEI\\_WM011\\_custom\\_4019127/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/CEI_WM011_custom_4019127/default/table?lang=en)

## 5. Conclusions

Although municipal waste is a small part of the total waste generated, its analysis is important, given the complexity of its sources, but also because it provides information on the consumption choices of the population. We list below some of the conclusions offered by our research:

- In the period 2011-2020, in Romania, a 10.8% increase in municipal waste generated per capita was recorded. The trend is similar to that of the European Union, but the quantity is far below the Community average; in 2020, the municipal waste generated (kg/capita) in Romania represented 55.51% of the EU average.
- The existing differences between the European Union states regarding the generation of municipal waste can be explained by the uneven regulation of the collection and management of municipal waste at the level of each economy and by the existing consumption model at the national level.
- The increase in the generation of municipal waste during the analyzed period reinforces the idea that waste prevention measures are still needed in Romania, a change in the consumption model, and the involvement of citizens to be more active.
- In 2020, the municipal waste treated in Romania had an average of 269 kg/capita, which means a 15% increase compared to 2011.
- The preferred order of municipal waste treatment categories differs between Romania and the European Union. Most of Romania's municipal waste is disposed of through landfilling and other similar operations, reaching 214 kg/capita in 2020, registering an increase of 6.46% percent compared to the base year of our analysis. Recycling is the second operation used by Romania, and energy recovery is still modest, but with a promising trend. In the European Union the most used treatment operation is recycling, followed by recovery through energy recovery, while disposal through landfilling and other operations has a decreasing trend.
- The recycling rate of municipal waste increased modestly during the analyzed period, from 11.7% to 13.7% and ranks Romania last among the EU states (in 2020, the recycling rate of the European Union was 48.6%).

Thus, Romania risks not meeting the targets set by the Framework Directive on waste, considering that its municipal waste recycling rate was 13.7% in 2020, compared to a rate of 48.6% recorded at the level of the European Union. At the same time, in 2020, a share of over 79% of treated municipal waste was eliminated by landfilling and others, compared to a share of 25% as recorded by the European Union, thus Romania is far from the established target.

It is also noted that Romania lacks the necessary infrastructure to ensure a separate collection of municipal waste. Finally, incentives to encourage reuse and citizen information campaigns are needed.

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