

COMPARATIVE ANALYSIS OF EU CIRCULAR ECONOMY INDICATORS

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Abstract: The paper aims to analyse the status of circular economy in each European country, especially in Romania, through a comparative analysis using circular economy indicators available on Eurostat, which are grouped in four categories and are constantly updated; were analysed the indicators from the "Waste management" category due to the importance of this fact in the circularity. The analysed statistics show us that the Nordic countries and other countries such as Belgium, the Netherlands and Germany have a high degree of circularity; unfortunately, Romania is close to the other extreme, alongside the Baltic, Balkan countries and others that have a long way to go towards a circular economy. Regarding the recycling targets of different types of waste, set by the EU, Romania has not yet met them. The analysed indicators show that more actions are needed in order to improve the circular economy in Romania.

Keywords: circular economy; indicators; European Union.

1 INTRODUCTION

The circular economy is an economy "in which the value of products, materials and resources is maintained in the economy for as long as possible and waste generation is minimized". This definition is given by the European Commission in the 2015 Action plan for the transition to the circular economy (European Commission, 2015; Rizos, Tuokko și Behrens, 2017).

In the present is well known the fact that the circular economy represents an solution to the planet's problems like global warming, resources' depletion, poverty etc. and to assure the possibilities to future generations to satisfy their own needs (Lakatos *et al.*, 2020). The circular economy aims to keep resources as long as possible in the economy and to reduce waste to a maximum, and the traditional life cycle model of the product in which the product reached the final stage is eliminated as waste (linear model) is replaced by a closed one (circular model) (Murray, Skene and Haynes, 2017; Winans, Kendall and Deng, 2017; SB Insight, 2019).

At European level, in December 2015, the European strategy for the transition from the linear to the circular economy materialized in an ambitious European Union (EU) plan, called the "Circular Economy Package". It was further improved in June 2018, after which, in March 2020, the New Circular Economy Action Plan was issued, which promotes a cleaner and more prosperous Europe, a plan that provides a new policy framework aimed at reducing waste and maximizing the use of materials, along with other objectives essential for the circularity of the economy (European Commission, 2020; Humphreys, 2020; Lakatos *et al.*, 2020)). The European Commission is proposing measures throughout the product life cycle so that resources remain in the economy as long as possible by closing the loop of this cycle, in order to facilitate the transition to a circular economy (Lakatos *et al.*, 2016). The measures set by the

European Union must be taken over and implemented by each EU member state to facilitate and support the transition to a circular economy, and indicators at European level are centralized on the European Commission's website - Eurostat (Elena Simina Lakatos *et al.*, 2018; Moraga *et al.*, 2019).

Romania needs to align with EU legislation on the circular economy, but data show we are at the bottom of the list on implementing the circular economy in Romania (along with Cyprus, Malta and Bulgaria) (Construcția, 2020; Vermeșan, Mangău and Tiuc, 2020), and the analysis presented below confirms this fact. Improving the values of the circular economy indicators would mean a better alignment with European standards, which can be translated in short by improving the living standards of the population, jobs, lower pollution, resource efficiency, reducing dependence on raw materials, business opportunities and environmental protection.

2 ANALYSIS OF CIRCULAR ECONOMY INDICATORS AT EU LEVEL

2.1 *Objective and methodology of the analysis*

The objective of the paper is to outline the implementation of the circular economy in Romania, comparing the indicators of our country with those of other countries in the European Union.

For accomplish the paper purpose, we used database available on official site of European Commission – EUROSTAT, which is the European Union' statistical office and it provides comparable statistics for EU. We accessed the Circular Economy branch, where we chose the Indicators section, where they are grouped into 4 categories: Production and consumption, Waste management, Secondary raw materials and Competitiveness and innovation. Given the space constraints, this article will only address

the indicators in the category "Waste Management", this process having a great potential to close the loop in the product life cycle, which is essential in a circular economy. The next step was to download the data in tabular form, then grouping the data so that we can generate comparative graphs, then finalizing with the graphs and the actual analysis of circular economy indicators in the EU, the process taking place according to the scheme in Figure 2.1.

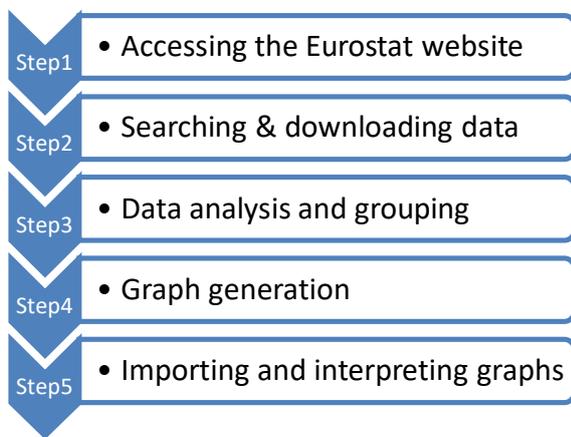


Figure 2.1. Steps of analysis

2.2 The results of the analysis

The process of transforming waste into resources is of great importance, especially in the context of the circular economy. The category of indicators analyzed on waste management includes: municipal waste, packaging waste (plastic, wooden, glass, paper, metal), construction and demolition waste, E-waste and biowaste.

2.2.1 Municipal waste

In the context of the transition towards a circular economy, the European Commission set the following minimum levels of preparation for re-use and recycling of municipal waste: 50% by 2020, 55% by 2025, 60% by 2030 and 65% in 2035 with the possibility of extending the deadlines by 5 years for each level (E S Lakatos *et al.*, 2018; Parlamentul European, 2018). In the European Union, municipal waste accounts for about 10% of the total waste generated and is considered the most difficult waste category for management due to the multitude of waste types.

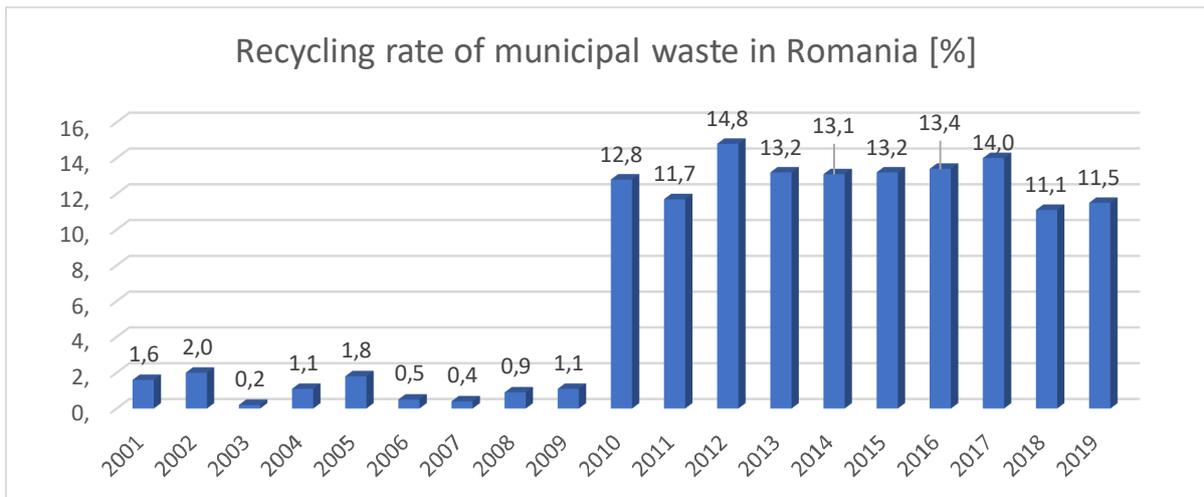


Figure 2.2. Municipal waste recycling in Romania

The figure above shows the recycling rates of municipal waste in Romania for the years 2001-2019. In the period 2001-2009, we notice that the recycling process was almost non-existent, registering a maximum of 2%. In the next 10 years (2010-2019), the value of the recycling rate fluctuates between 11.1% (2018) and 14.8% (2012). Contrary to the scale of the

circular economy, in the last 2 years the trends of the recycling rate are decreasing.

The following figure (Fig. 2.3) shows the recycling rate of municipal waste in Europe for 2019. For the countries that do not appear on the chart, no data were available for the analyzed year.

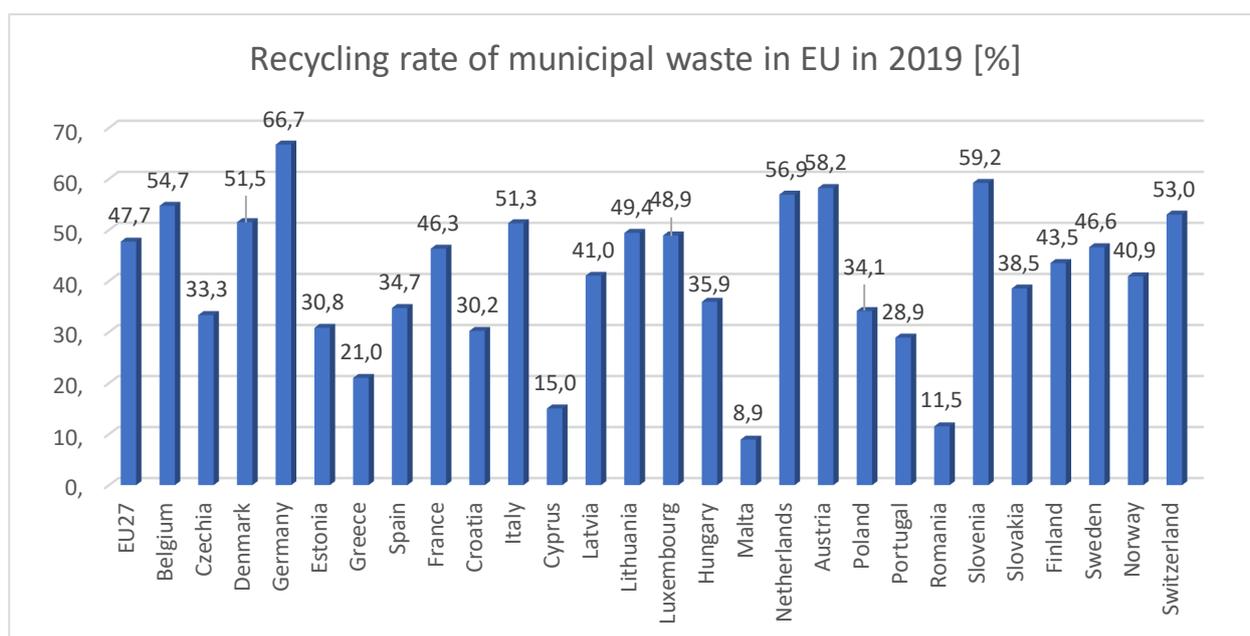


Figure 2.3. Municipal waste recycling in EU

The data show that the highest municipal waste recycling rates are recorded in Germany, Slovenia, Austria and the Netherlands, rates that are above the European Union average (47.7%) and at the opposite pole are countries like Cyprus, Romania and Malta, with more than 30% below the European Union average.

2.2.2 Packaging waste

Packaging waste accounts for approximately 3.4% of total waste. Directive 94/62 / EC sets the following recycling targets (Table 2.1) for packaging for total quantity and material group (European Commission, 2018; Hodecek, 2018; Parlamentul European, 2018).

With regard to plastic packaging, the aim is to replace them with reusable ones by 2030 (Matthews, Moran and Jaiswal, 2021).

Table 2.1. Recycling targets for packaging

Packaging recycling	65% by 2025	70% by 2030
Plastic	50 %	55 %
Wood	25%	30%
Ferrous metals	70 %	80%
Aluminium	50%	60%
Glass	70%	75%
Paper and cardboard	75%	85%

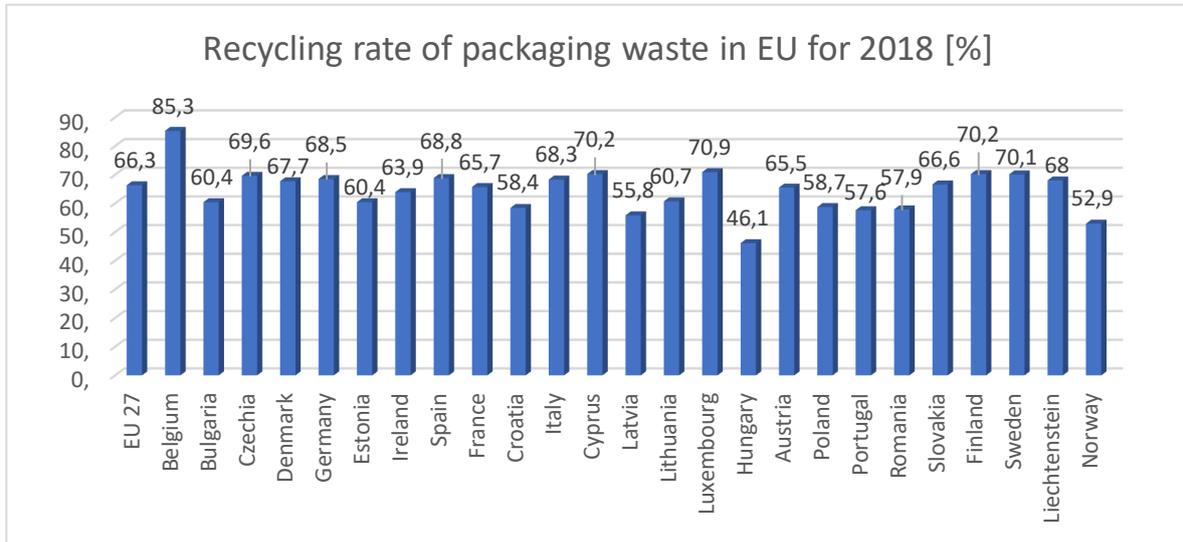


Figure 2.4. Recycling of packaging waste in EU

Regarding the recycling of packaging waste in the EU, the highest rate is recorded in Belgium, Luxembourg, Cyprus and Finland - over 70%, and the lowest rate is found in Latvia, Norway, Hungary, Romania being a short

distance from Latvia, with 57.9%, which is below the EU average (66.3%).

In the following, the recycling rates of packaging waste by types of materials will be illustrated: plastic, wood, metals, glass, paper and cardboard.

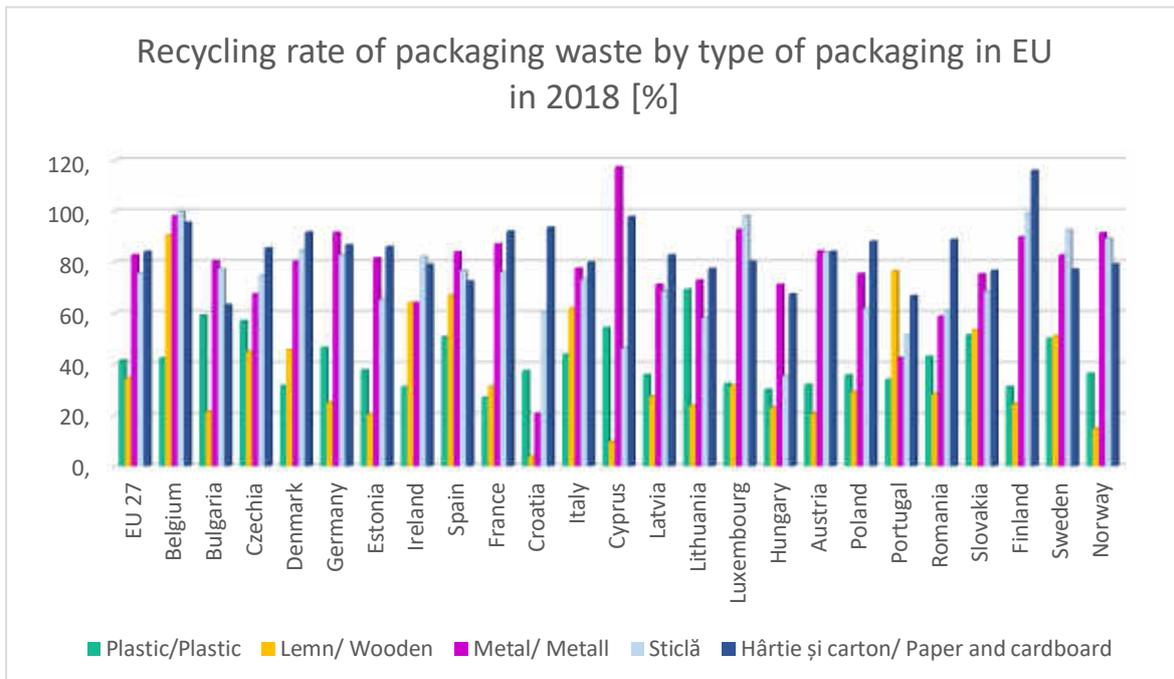


Figure 2.5. Recycling of packaging waste by types of materials in the EU

a) Plastic packaging: Figure 2.5 shows that the highest recycling rate for plastic packaging is recorded in countries such as Luxembourg, Bulgaria, the Czech Republic, and the lowest rate corresponds to countries such as Ireland, Hungary, France, which are below the EU average of over 10%; in this respect, Romania is slightly above the EU average.

b) Wood packaging: The previous graph shows that wooden packaging is recycled at a low rate in the EU, given the EU average of only 34.5%, above which there are few countries, the highest rates being in Belgium, Portugal and Spain, and at the pole opposite are Norway, Cyprus and Croatia. Romania is also below the European average, with 28.4%.

c) Metallic packaging: Graph 2.5 shows that this type of packaging has much higher recycling rates at EU level than the previous one, with an average of 82.9%, above which countries such as Cyprus, Belgium, Luxembourg, Germany, and the lowest rates being in Romania, Portugal and Croatia, Romania is a rate of almost 60%.

d) Glass packaging: As seen in the previous figure (Fig. 2.8), this type of packaging waste is also recycled at a high rate at EU level, so the European average for the recycling rate of glass

packaging waste is 75.8%. Above the European average is Belgium, Finland. Luxembourg and not only, and at the opposite pole, below the European average we find Portugal, Cyprus and Hungary. Romania is almost 15% below the European average, with 61.1%.

e) Paper and cardboard packaging: The previous graph shows that wooden packaging is recycled at a low rate in the EU, given the EU average of only 34.5%, above which there are few countries, the highest rates being in Belgium, Portugal and Spain, and at the pole opposite are Norway, Cyprus and Croatia. Romania is also below the European average, with 28.4%.

2.2.3 E-waste

This category of waste is a category with a significant annual increase in the EU, with a recycling rate of less than 40% at European level, even if the recycling target is set at at least 65% of the average placed on the market in the last three years (European Commission, 2020; Shittu, Williams and Shaw, 2021). Data for 2018 are missing for several countries, which is why in the following chart we will illustrate both 2017 and 2018, the labels with percents are for 2017.

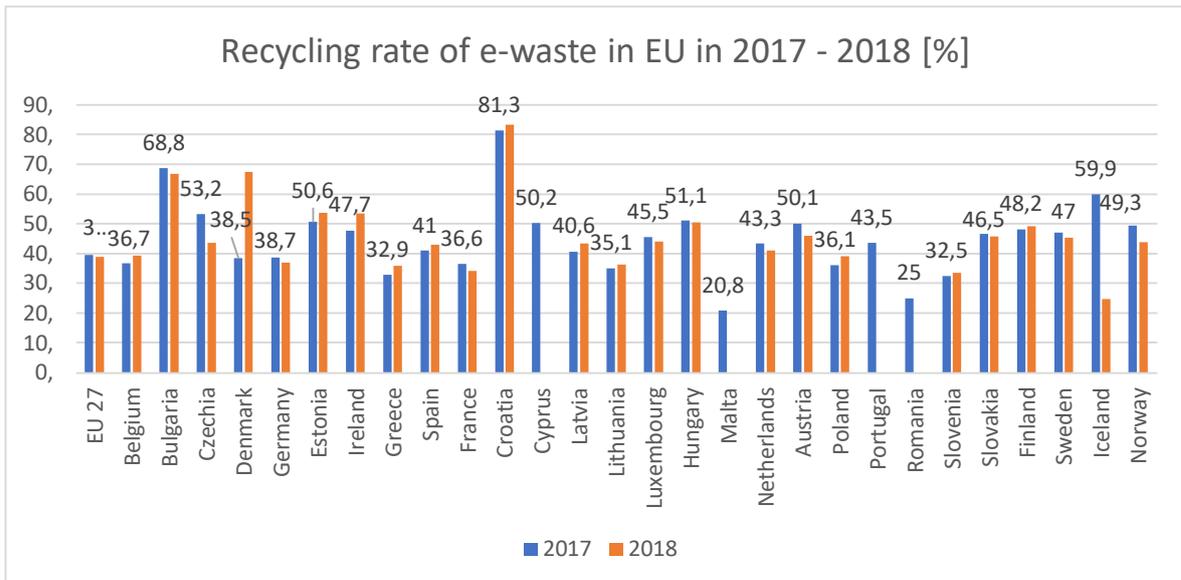


Figure 2.6. Recycling of e-waste in the EU

Above we can observe that highest recycling rate of e-waste in 2017 is recorded by Croatia (81.3%), Bulgaria (68.8%) and Iceland (59.9%), while the lowest recycling rate is recorded by Malta (20.8%) while European Union average is about 40%. Regarding the situation of Romania at this chapter, the data for 2018 are not available, so we can see the data from 2017 - 25%. If we look the chart, in 2018, from the available data we can see that in the most of the states the indicator decreases, registering a positive trend in very few countries, the highest increase can be observed in Denmark.

2.2.4 Recycling of biowaste

Household biowaste is of significant importance because it can influence climate change, being an important source of green energy and can be successfully used in the production of biofuels, as a substitute for fossil fuels. In a circular economy, the most appropriate treatment of biowaste is composting and anaerobic digestion (Rolewicz-Kalińska, Lelicińska-Serafin and Manczarski, 2020; Angouria-Tsorochidou, Teigiserova and Thomsen, 2021).

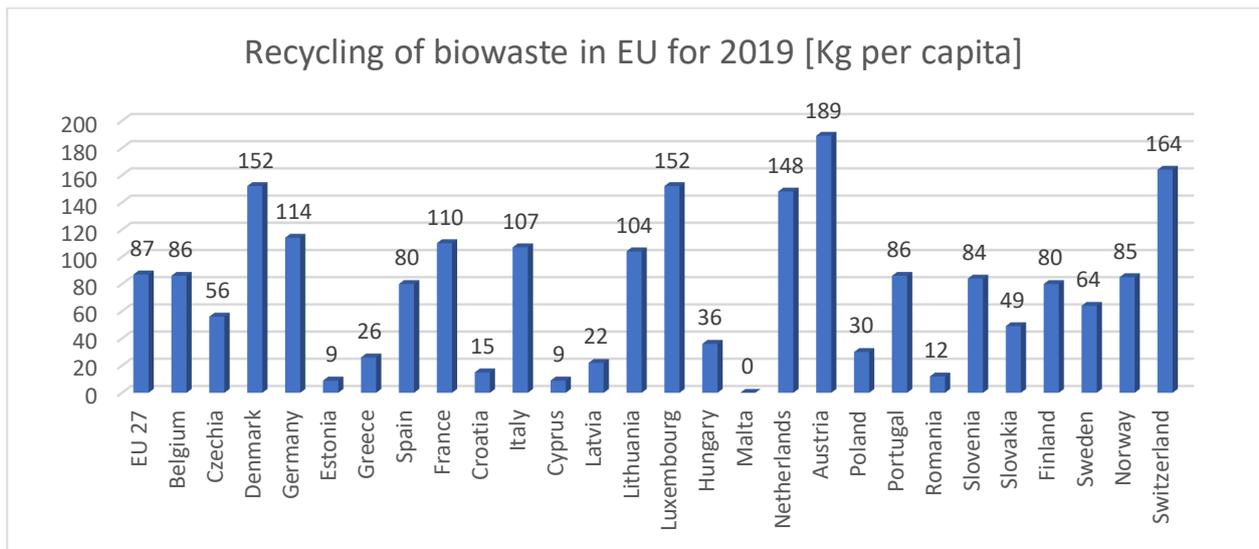


Figure 2.7. Recycling of biowaste in the EU

Graph 2.7 shows that the largest amounts of bio-waste are recycled by Austria, Switzerland, Denmark and Luxembourg, well above the European average (87 kg / capita), and at the other extreme we find Romania, Estonia, Cyprus and Malta.

2.2.5 Construction and demolition waste

Construction and demolition are among the largest sources of waste in Europe, being the

heaviest of all types of waste and accounting for about 30% of total waste in Europe (Akanbi *et al.*, 2018; Bertino *et al.*, 2021). The target set for recycling this category of waste was 70% by 2020 (Ghisellini *et al.*, 2018). Many of the materials are recyclable or reusable, but reuse and recycling rates currently vary across the EU, as can be seen in Figure 2.8; they refer to mineral waste, with the exception of hazardous waste.

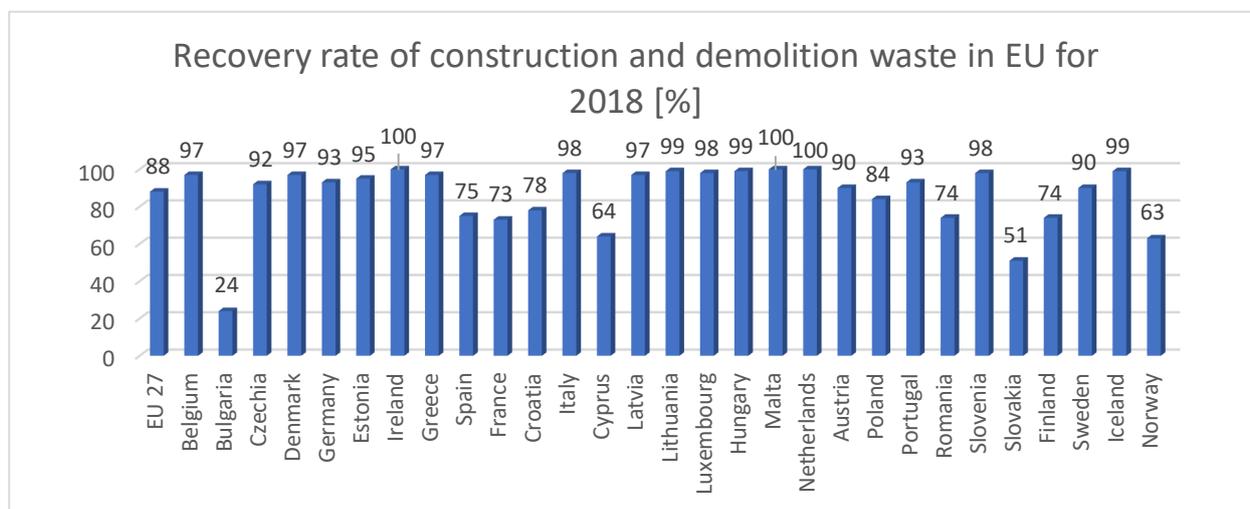


Figure 2.8. Recycling of construction and demolition mineral waste in the EU

The figure above shows that the percentage of mineral waste from construction and demolition is very high throughout Europe, with few exceptions, as can be seen in countries such as Slovakia and Bulgaria. The percentage of recycling this type of waste in Romania is 74%, thus being below the European average of 88%.

3 CONCLUSIONS

The circular economy is a concept that has experienced great effervescence at European level, being a desideratum for which there is an ambitious plan of laws, measures and proposals that must be adopted by each member country.

In terms of the circular economy and the associated benefits, it is an optimal solution to the problem of depleting the planet's resources, harmonizing the three plans of sustainable development (environmental, economic, social).

Romania, through the values of its indicators, is in most cases below the European average, or even in the negative extreme, this means that we are in an incipient phase in terms of the path to circularity; there are also chapters in which Romania is doing well, being close to reaching the indicators set at EU level, this being the case for the recycling of packaging waste.

The results of the analysis show that some countries are doing well in terms of circular economy indicators, while others are at the beginning of the road or at a medium level and still have a lot of efforts to make in the direction of the circular economy. The high values of circularity indicators lie in increasing the efficiency of resource use and high capacity to transform waste into secondary raw material, which are essential in a circular economy.

As a future research direction, a qualitative analysis of the data on the mentioned indicators will be performed with the purpose of identifying the main categories of waste generated in Romania, using the method of document analysis - content analysis.

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