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The Evolution of the Total Waste Generated and Recycled in Romania

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Abstract

The change in consumption patterns in the sense of growth and the evolution of technology can have side effects on the environment and thus on the health of citizens if it is not properly supported by a waste management process. Waste management includes all activities of collection, transport, treatment, recovery, and disposal of waste. Improper waste management can have negative effects on the environment, affecting the soil, animals, the atmosphere, etc. One of the major problems facing Romania is waste management. This paper analyzes the evolution of the main types of waste generated and recycled, but also those generated by economic activities in the period 2014-2018 in Romania. Thus, in 2018, were generated 203017193 tons, among which 200027786 tons were treated. The amount of waste recycled in 2014 has a proportion of 3.71% of the total, while in 2018, the degree of recovery decreased to 3.12%. Regarding the recycling by category, in 2018 from the amount of waste generated were recycled 26.18% metal wastes, 91.35% glass, 82.18% paper and cardboard and 72.85% plastic, the recycling rates being lower than in 2014. In order to achieve the objectives set out in the national and European waste legislation, Romania must make considerable efforts in the coming years.

Keywords: recycling rate, hazardous waste, primary waste, plastic.

JEL Classification: Q53.

1. Introduction

Current issues affecting the population include climate change, urbanization, and the scarcity of natural resources. To meet their effects, the emphasis is on stimulating waste recycling. Given the growing world population, the need for materials is also growing, and recycling must be a necessary condition. Raw materials are essential for ensuring the transition to green energy technologies, growth, and sustainable

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consumption. Waste recycling reduces the need for raw materials, having direct effects on natural resource reserves.

2. Problem Statement

Improper waste management is a major cause of environmental pollution and threats to human health, and at the same time reflects the inefficient use of natural resources (Olaru, Zecheru, 2016). Mankind is urged to contribute to reducing the impact caused by its activities on nature, by promoting sustainable development, which takes into account: economic development, social welfare, and environmental protection.

In recent decades, the economic growth of the European Union countries has led to an increase in living standards and consumption (Nastase et al., 2019). According to Eurostat, Europeans' waste generation is constantly rising, in 2018 the amount of waste reached 2.3 billion tons, which means 5.2 tons of waste per EU inhabitant (Waste statistics, 2021).

Waste treatment methods vary as well as is their source. In principle, waste can be taken out of the economic circuit (disposed of), stored or incinerated, or reintroduced into the circuit (recovered). In Europe, but also in Romania, the sorting and selective collection of waste is practiced, waste management being an objective to be achieved according to the 2030 Agenda. In Romania, as in other parts of the world, waste, the result of human activity, is a very topical issue, being a result of both the diversification and the increase of the generated quantities (Oroian et al., 2009).

Currently, environmental protection is a global priority, the green economy being the result of a process that can reduce inequality, resource scarcity, and environmental risks (UNEP, 2011). However, a significant share of the total amount of waste is non-biodegradable materials (plastic, glass, metal, etc.) which are considered by European legislation as agents of soil pollution and contamination. The current concept of waste is based on the adoption of new technologies that produce as little waste as possible, in a form that is as easy to treat. Waste management technologies such as storage and incineration are not a complete solution to existing problems (Olaru, Zecheru, 2016). In addition, institutions should continuously improve the use of waste by turning it into useful products. Successful implementation of a sustainable waste management system involves major changes in current practices, requiring the participation of all segments of society: individuals as consumers, businesses, social and economic institutions, and public authorities (Oroian et al., 2009).

Recycling is a key element of waste reduction. Researchers state that "waste recycling helps to extend the life and usefulness of products that have achieved their original purpose by producing many items that are usable (Baud et al., 2004). In order to achieve an optimal level of recycling for all products, new technological solutions are needed to improve both the quantity and quality of raw materials recovered from new sources, i.e., optimal recycling, such as recycling metals from complex final products (Sustainable supply of raw materials, 2016).

Recycled materials can be capitalized on by reintroducing them into the economy as new substances or products. The reconsideration of the human-environment-science equation in an intense period of modernization, rapid evolution, and technologicalization is mandatory, taking into account the extremely current and pronounced economic dimension of contemporary society (Vermesan et al., 2020). Although waste management continues to improve in the EU, the European economy is losing a significant amount of potential "secondary raw materials" (metals, wood, glass, paper, plastics) (Olaru, Zecheru, 2016).

For a good management of the generated waste, Romania must have a good collection infrastructure, to have well-defined environmental policies, and to integrate the environmental concerns in the economic and social decisions. Thus, a first step towards solving it is the increasing involvement of people for the correct collection of waste and the awareness that it can be a real resource if it is managed correctly.

Although Romania is not completely fulfilling its goal of recycling materials, it still has efforts to make to reach the required target. This may be due to the fact that Romania probably does not have the necessary capacity for processing or fails to export some of the waste to other countries for recycling. It can also capitalize on these recycled materials by making smart use of materials and increasing the use of recycled materials. In this sense, the purpose of the study is to assess the situation of waste generated and recycled in Romania in the period 2014-2018.

3. Research Questions / Aims of the Research

The research aimed to evaluate the waste generated and recycled in Romania in the period 2014-2018.

4. Research Methods

In order to achieve the aim of the research, official statistics from international databases (Eurostat) were used until the last available date regarding the waste generated and recycled in Romania in the period 2014-2018. The research is also based on studies from the literature. The data were extracted and processed in dynamics, as average and percentage, by graphical representations in order to highlight the situation in the mentioned period. The indicators taken into account were: the amount of total waste generated, both by component and by category, the amount of waste treated, the waste generated by main activities, the amount of waste recycled, and by category, the recycling rate of waste.

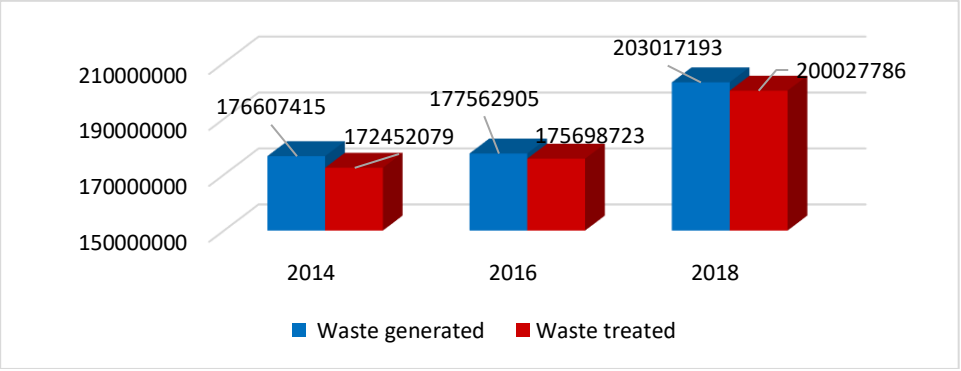
5. Findings

Waste generated

The total amount of hazardous and non-hazardous waste generated in Romania during 2014-2018 has steadily increased (Figure 1) despite legislative efforts to reduce it. In 2014, the total amount of waste generated by Romania was

176,607,415 tons, of which 99.48% were primary waste and 0.53% secondary. The situation will be similar for the following years.

Figure 1. The evolution of hazardous and non-hazardous waste generated and treated in the period 2014-2018 (t)

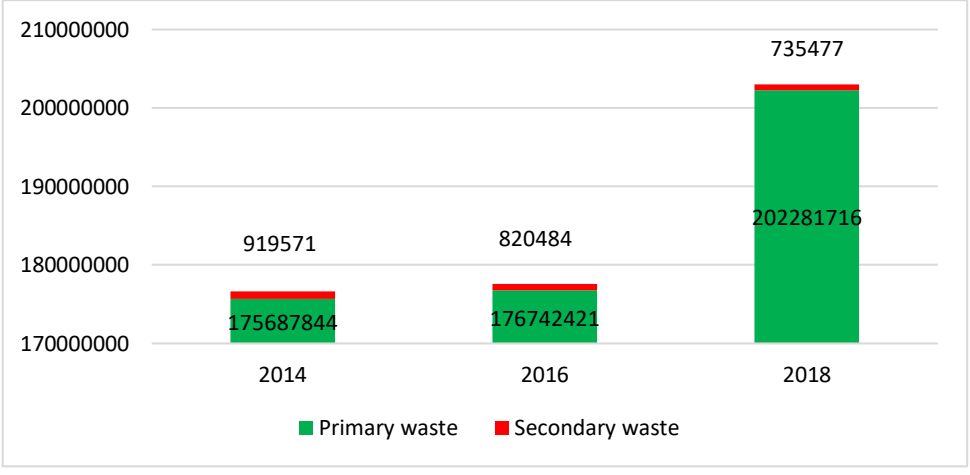


Source: own representation based on data available at https://ec.europa.eu/eurostat.

As other other authors have identified, the amount of waste people generate has increased with the evolution of technology and the increase in the number of daily activities (Jigani et al., 2020). According to other authors (Iacoboaea et al., 2013), some of the reasons for this increase may be economic growth and intense urbanization. Additionally, the amount of treated waste increased at the same time, but the quantities differ, from 172,452,079 t in 2014 to 200,027,786 t in 2018. This fact is also due to the need to treat this waste and increase the attention paid to environmental protection.

Regarding the amount of total waste, they include primary waste and secondary waste.

Figure 2. Total waste generated by source in the period 2014-2016 (t)



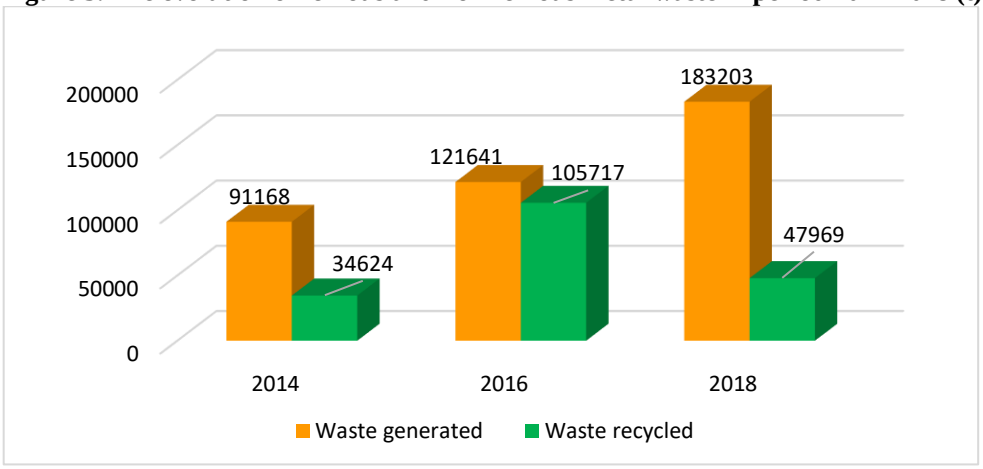
Source: own representation based on data available at https://ec.europa.eu/eurostat.

In the period 2014-2018, the amount of primary waste increased from 175,687,844 t to 202,281,716 t, while the secondary one decreased from 919,571 t to 735,477 t (Figure 2). Thus, if at the beginning of the analyzed period of the total waste generated in 2014 and 2016 the proportion was 99.6% primary waste and secondary waste being only 0.5%. This is mainly due to the materials and means used in production.

During the analyzed period, there is an increase in both the total amount of waste generated and in waste by category.

Regarding the waste of ferrous and non-ferrous metals, the quantity generated in 2014 was 91,168 t (representing 0.5% of the total waste generated), while the recycled one was smaller, namely 34,624 (Fig. 3). In 2018, the situation was similar, the waste generated being 183,203 t (representing 0.9% of the total waste generated), and recycled only 47,969 t. Thus, the amount of metal waste generated in 2018 doubled compared to 2014, representing a 100% increase. In 2016, the amount of recycled waste was closer to that generated. These differences may be due to the fact that the metals are difficult to process and require certain special treatments in order to be reused.

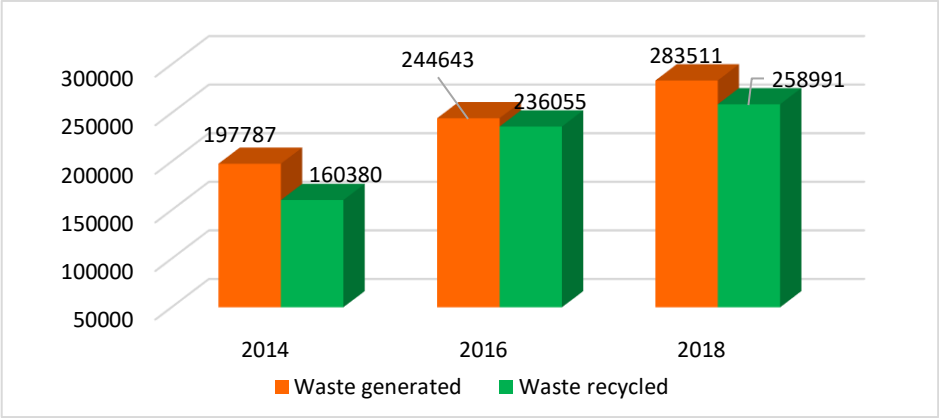
Figure 3. The evolution of ferrous and non-ferrous metal waste in period 2014-2018 (t)



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

Regarding the glass waste, it was found that in the period 2014-2018, the quantities of waste generated gradually increased from 197,787t to 283,511 t, meaning an increase of approximately 43%. Compared to the total amount of waste generated in Romania, it is found that glass waste represents very low values of 0.11% and 0.14%, respectively, in this period. Also, comparing the quantity of waste generated with the recycled one, it is found that almost all the quantity generated during this period was recycled, this having an ascending trend from 160,380 t in 2014 to 258,991 t in 2018.

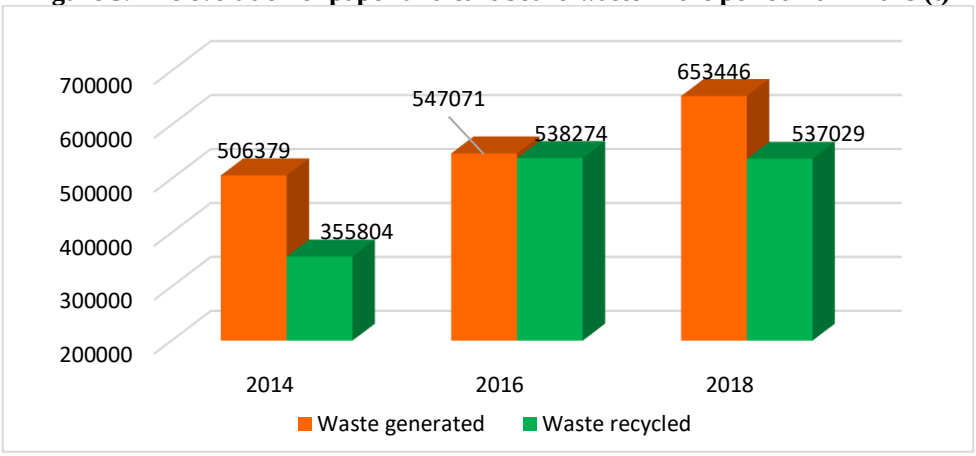
Figure 4. The evolution of glass waste in the period 2014-2018 (t)



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

Regarding paper and cardboard waste, the amount generated in 2014 was 506,379 t, gradually increasing until 2018 to 653,446 t, representing an increase of approximately 30%. Taking into account the quantity generated, it is found to be higher both in 2014 and in 2018, compared to the quantity recycled. The biggest difference is in 2014 when only 70% of the generated quantity was recycled (out of 506,370 t, only 355,804t were recycled). The exception is the year 2016, when almost all the amount generated was recycled using different methods. This may be due to the fluctuations in the consumption patterns of the citizens, but also to the applied national legislation.

Figure 5. The evolution of paper and cardboard waste in the period 2014-2018 (t)

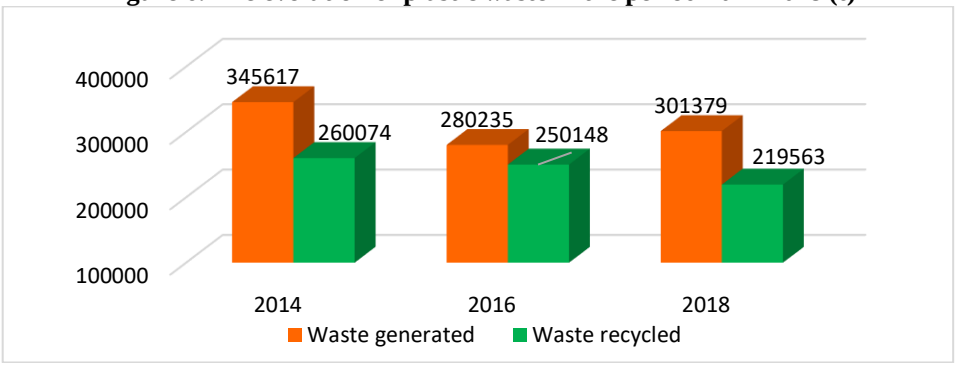


Source: Own representation based on data available at https://ec.europa.eu/eurostat.

If we refer to plastic waste in the period 2014-2018, it is found that in 2014 the amount generated was 345617 t, and in the following years it decreased, reaching in 2018 to 301379 t (being a decrease of approximately 12%). This fact demonstrates

that Romania is trying to align itself with the regulations imposed by the European Union, being at the same time a global concern to reduce the plastic and replace it with less environmentally harmful materials. Also, out of the amount of plastic generated in 2016 of 280235 t, almost all was recycled, approximately 10% remaining unrecycled.

Figure 6. The evolution of plastic waste in the period 2014-2018 (t)



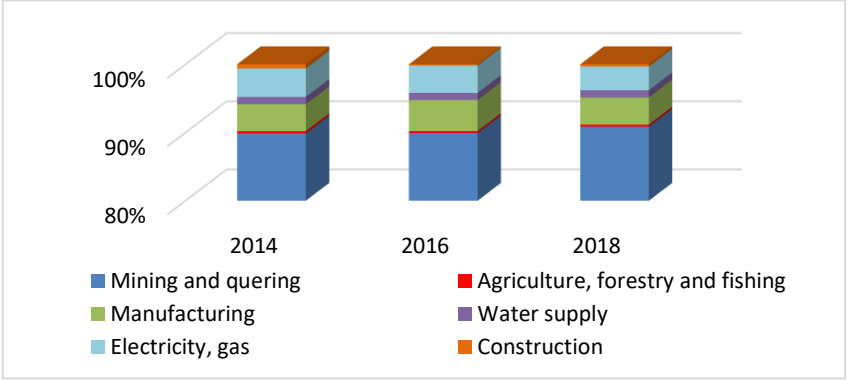
Source: own representation based on data available at https://ec.europa.eu/eurostat.

Waste generated on the main activities

In the period 2014-2018, in the mining industry, the largest amount of hazardous industrial waste is generated, representing approximately 90% of the total amount of waste generated from the activities of the economy. Furthermore, the activities with important shares are those of production (manufacturing of approximately 4% in 2018) and those of electricity of approximately 3.5% in 2018.

Regarding the amount of waste generated by the main activities of the economy, it is found that the largest share in the period 2014-2018 has the activities in the mining industry. Waste from agriculture, forestry, fishing, and construction waste have the lowest shares below 1% of the total amount of waste generated by all activities.

Figure 7. Waste generated by main activities in the period 2014-2018 (t)



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

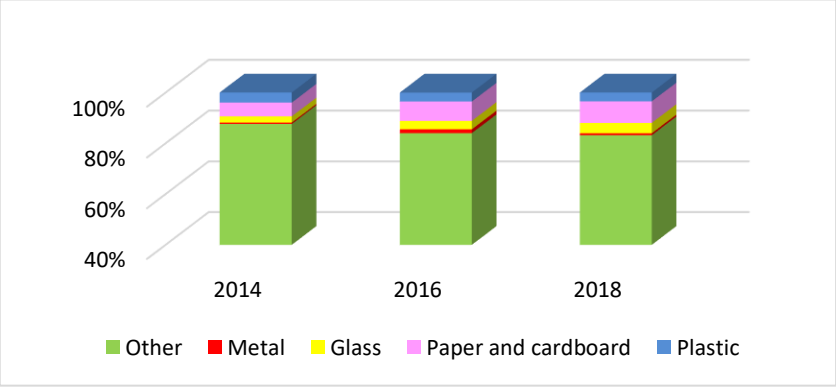
These weights can be attributed to the low recovery of waste, and as stated by some authors (Oroian et al., 2009), over 90% of industrial waste generated in Romania is eliminated by storage.

Recycled waste

The amount of waste recycled in 2014 is 6,554,814 tons, the highest recovery / recycling rates being obtained from the activities of waste recovery and recycling of paper and cardboard waste (5.43%), followed by plastic (3.97%), glass (2.45%) and metals (0.53%). In 2018, the recycled quantities increased for the studied categories, so the recycled amount of paper and cardboard increased by about 3 percent, reaching 8.49%, in the case of recycled quantities of glass it reached 4.09%, and ferrous metals and non-ferrous at 0.76%. The exception is the amount of recycled plastics which has decreased to 3.47%. This situation may also be due to the promotion of the use of landfills in Romania and also in other countries with low recycling rates (Bulgaria, Greece, Poalnd and Finland) compared to other countries (Italy and Germany) that have had very high recycling rates (https://www.europarl.europa.eu/news/ro/headlines/society/2018).

The increases for certain categories may be due to national and international legislation, but also to Romania's concern for environmental protection. Achieving European targets requires further efforts in this area. In order to achieve an optimal level of recycling for all products, new technological solutions are needed to improve both the quantity and quality of raw materials recovered from new sources, i.e. optimal recycling, such as recycling of metals from complex products (Sustainable supply of raw materials, 2016).

Figure 8. Quantity of recycled waste by category (tons)



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

The analyzed period shows a low waste recycling rate, but also an oscillating one, possibly being a consequence of the current legislation in the field of environment.

Also, the amount of waste recycled at the beginning of the analyzed period, 2014, occupies a proportion of 3.71% of the total, following a slight increase in 2016 of 3.98%, while at the end of 2018, the degree of recovery decreased to 3.12%

(Table 1). In Romania, waste disposal is the main option for waste management, so that, in the analyzed period, less than 4% of the total hazardous and non-hazardous waste generated is recycled.

Table 1. Recycling rate for total hazardous and non-hazardous waste

Year	Generated (T)	Recycled (T)	Recycling rate (%)
2014	176607415	6554814	3,71
2016	177562905	7070019	3,98
2018	203017193	6326465	3,12
Average	185729171	6650432	3,6

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

Regarding waste by categories, in 2018 waste was recycled from the amount generated 26.18% of ferrous and non-ferrous metals, 91.35% of glass, 82.18% of paper and cardboard, and 72.85% of plastic (Table 2). The proposed recycling targets are 55% of the amount of plastic waste, 75% metal, 75% glass, 75% paper and cardboard by 2025 (PNGD, 2014-2020).

Table 2. Recycling rate by waste category in 2018

Year	Generated (T)	Recycled (T)	Recycling rate (%)
Ferrous and non-ferrous metals	183203	47969	26,18
Glass	283511	258991	91,35
Paper and cardboard	653446	537029	82,18
Plastic	301379	219563	72,85

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

These low recycling rates in Romania, during the analyzed period, may be due to the selective waste collection systems that may not work at their optimum potential to provide wider access to recyclable products.

6. Conclusions

In the period 2014-2018, the total amount of waste generated in Romania increased from 176607415 t to 203017193 t, respectively, by 14.95%, of which on average 99.6% were primary waste and 0.4% secondary.

Regarding the amount of waste recycled at the beginning of the period, in 2014, it occupies a proportion of 3.71% of the total. Although progress has been made in this sector, in 2018 the rate decreased to 3.12%.

Implementing effective waste reduction programs can reduce the negative impact of waste on human quality of life and the environment. It can be appreciated that waste can be taken out of the economic circuit by obtaining higher recycling rates as a method of recovery. Good waste management in Romania needs the application

and observance of the legislation in force and of innovative technologies that will reduce the use of the raw material or to include the capitalization of the waste.

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