CIRCULAR AND GREEN ECONOMY – A COMPARATIVE ANALYSIS OF THE CURRENT STATE IN ROMANIA AND IN THE EU

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Abstract: *The green and circular economy is associated with the sustainable development concept and is an integrated part of the development strategies of all EU Member States. In line with the Union's objective of achieving climate neutrality by 2050 under the Green Deal, the European Commission proposed in March 2020 the first package of measures for the transition to a circular economy, included in the Circular Economy Action Plan. The Plan includes measures for encouraging the production of sustainable products, informing consumers about the green transition, reviewing building materials regulations, and a strategy for sustainable textiles. Against this background, this paper aims to present a comparative analysis of the green and circular economy principles implementation in Romania and the European Union. One of the conclusions of the paper is that even if some progress has been made in the last decade, the implementation of green and circular economy principles in Romania is still at the beginning of the road.*

Keywords: European Union, Romania, Green economy, Circular economy.

JEL Classification : O13, Q00, Q01, Q32

1. Introduction

The European Union has been at the forefront of the global efforts to transition towards a more sustainable economic model, with the circular and green economy playing a central role in this pursuit.

The circular economy is a fundamental component of the EU's strategy to address the environmental challenges it faces, including resource depletion, waste generation, and climate change. This economic model is based on the principles of reducing, reusing, and recycling resources, with the goal of minimizing waste and maximizing the value of products and materials throughout their entire lifecycle. The EU has implemented a range of policies and initiatives to promote the circular economy, including the EU Circular Economy Action Plan, which outlines a comprehensive set of measures aimed at transforming the way products are designed, produced, and consumed (European Commission, 2020).

The green economy, on the other hand, is a broader concept that encompasses the transition to a more environmentally sustainable and socially inclusive economic model. This transition involves the development of green technologies, the promotion of renewable energy sources, the implementation of sustainable agriculture and forestry practices, and the creation of green industries.

The circular and green economy are closely intertwined, as the principles of the circular economy – reducing, reusing, and recycling – are essential for the successful transition to a green economy. The EU has recognized the importance of this interconnection and has sought to integrate the two concepts into a comprehensive strategy for sustainable economic growth.

2. Methodology

The present paper aims to provide a comparative analysis of the current state of the green and circular economy in Romania and the European Union. This analysis will be conducted starting from the action areas outlined in the European Green Deal:

1. Biodiversity - measures aimed at protecting the fragile ecosystem.
2. From farm to fork - ways to ensure a more sustainable food chain (European Commission, 2020).
3. Clean energy - the use of renewable sources for energy production.
4. Sustainable industry - ways to ensure more sustainable production cycles that better respect the environment.
5. Building and renovating - the need for the construction sector to become cleaner.
6. Sustainable mobility - promoting more sustainable means of transportation.
7. Eliminating pollution - measures aimed at rapidly and efficiently reducing pollution.
8. Climate action - programs and actions through which the European Union aims to become pollution-neutral by 2050 (Agrointeligenta, 2020).

The research methodology includes a comparative analysis of the circular and green economy in Romania and European Union. Through this approach, the paper will highlight the differences and similarities between green and circular economy in Romania and European Union (EU). Based on the results of the analysis, the paper will draw some conclusions on the current status of green and circular economy in Romania and the EU, highlighting both positive and negative aspects. One limitation of the paper is related to data availability, since in the European database (Eurosat) the latest data are at the level of the years 2020-2022.

The importance of the work derives from the fact that green and circular economy has become a major area of interest both nationally and at the European level, as the world face significant challenges related to climate change, environmental degradation, and limited resources.

3. Literature review

There is a wealth of specialized literature which presents the circular economy definition, conceptual background and basic principles (Kristensen et al., 2020; Ioannis, Konstantinos, 2021; Kirchherr et al., 2017; Heshmati, 2015). For example, Morseletto (2020) defines circular economy as "an economic model aimed at the efficient use of resources through waste minimization, long-term value retention, reduction of primary resources, and closed loops of products, product parts, and materials within the boundaries of environmental protection and socioeconomic benefits. A CE has the potential to lead to sustainable development, while decoupling economic growth from the negative consequences of resource depletion and environmental degradation", Geissdoerfer et al., (2017) considers circular economy as "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling" and EU considers that the circular economy is the economy "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized" (European Commission, 2015).

As a consequence of the large number of the circular economy definitions, analyzing the specialized literature, we can observe that there is no unanimously accepted circular economy model. For example, the EU utilize the 4R "Reduce-Reuse-Recycle-Redesign" model (European Parliament, 2008), other authors utilize the 6R "Reduce-Reuse-Recycle-Reproduce-Redesign-Recover" model (Jawahir, Bradley, 2016) and others 9R "Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle" model (Potting, Hanemaaijer, 2018).

The Romanian specialized literature regarding the circular economy contains a series of studies which present: Romania's perspectives on the transition to the circular economy in an EU Context (Dobre-Baron et al. 2022) and the perspectives of circular economy in Romanian space (Vermeșan et al., 2020), the implementation degree of circular economy in Romania (Topliceanu et al, 2023**),** the challenges of the Green Economy in Romania (Mihai et al., 2021), packaging waste recycling in Romania (Jora et at, 2020), assessment of the circular economy's impact in the EU economic growth (Vuță et al., 2018).

In the context of the economies transition to the circular economy model, the monitoring of the process implementation became essential. The circular economy implementation and its indicators is found in a series of studies drawn up by international organizations like European union (European Commission, 2018), OECD (OECD, 2014), World Bank (World Bank, 2017) and researchers (Topliceanu et al, 2023; Marino, Pariso, 2020; Mazur-Wierzbicka, 2021; Păcurariu et al., 2021**).**

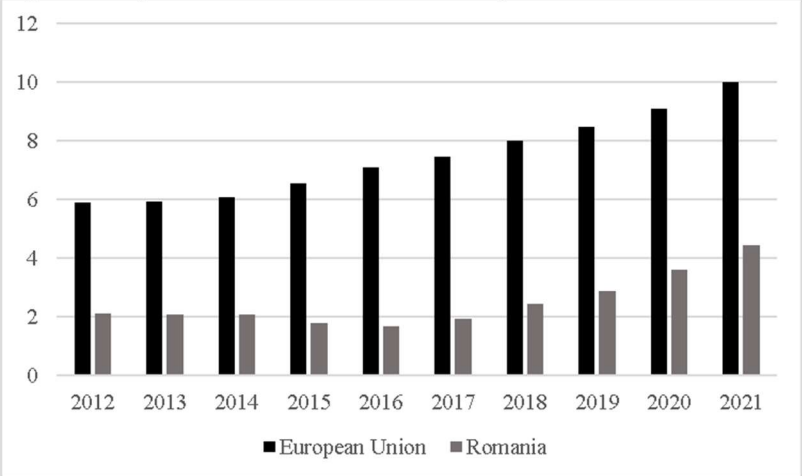
4. Circular and green economy in Romania and European Union

The EU Member States are determined to achieve climate neutrality by 2050, fulfilling their commitments under the Paris Agreement. The European Green Deal is the EU's strategy aimed at achieving of the 2050 objective (European Council, 2019). Starting from the action areas outlined in the European Green Deal, in the following, it will be accomplished a comparative analysis of the current state of the green and circular economy in Romania and the European Union.

Biodiversity. Currently, 23.4% of Romania's terrestrial area is designated as protected areas, which is below the EU average of 26.4% (Biodiversity, 2024). As a Member State of the EU, Romania should align with the European Union's objective of protecting 30% of EU land and sea by 2030 (European Commission, 2022). Achieving this target is unlikely, considering that Romania currently faces the highest number of infringement procedures within the EU for the destruction of protected areas, illegal deforestation, and environmental pollution (Florescu, 2022). Over the past decades the objectives of national socio-economic development strategies and the means used to implement them have been the main anthropogenic factors that have induced the modification of the structure and productive and supportive capacity of biodiversity in Romania. This capacity is threatened by the overexploitation of natural resources, inadequate exploitation of non-renewable resources, climate change, and pollution.

From farm to fork. Romania performs poorly in terms of organic agriculture, the latest Eurostat data showing that the organic crop area in Romania (as a percentage of the total) is among the lowest in Europe, nearly two and a half times smaller than the European Union average. However, as shown in Graph 1, compared to 2012, the organic crop area has doubled both in Romania and in the European Union, increasing in Romania from 2.10% to 4.42% and from 5.88% to 10% in the European Union.

Graph 1: Organic crop area in Romania and European Union, 2012-2021 (%)



Source: Authors based on data published by the Eurostat (2024).
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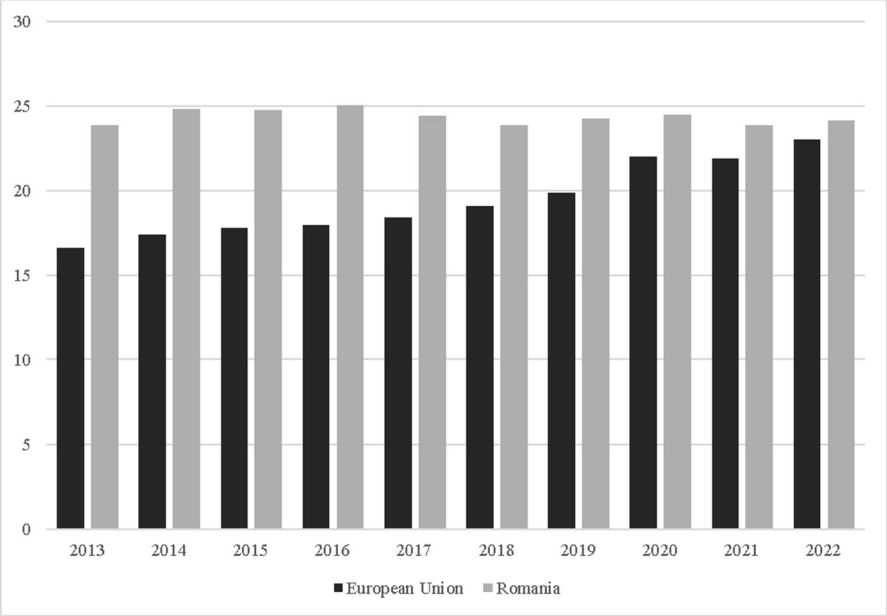
In 2021, Romania had only 578,718 hectares cultivated using organic methods. In order to align with the European Union's objective of stimulating organic production to reach 25% of the EU's agricultural land by 2030 (European Commission, 2020), the Ministry of Agriculture and Rural Development considers that the area used in organic agriculture in 2030 could reach a minimum of 800,000 hectares.

According to data published by the European Statistical Office, the organic crop area in the European Union is continuously increasing, from 14.7 million hectares in 2020 to 15.9 million hectares in 2021, equivalent to 9.9% of the total utilized agricultural area.

Clean energy. Achieving climate neutrality by 2050 is one of the objectives of the European Green Deal and using energy from renewable sources can contribute to the achieving of this goal.

In 2022, renewable energy represented 23% of energy consumed in the EU, up from 21.9% in 2021 and 38.35% higher than in 2013 (Eurostat, 2023). In comparison, in the same year, Romania exceeded the EU average share of renewable energy, reaching a value of 24.14% (representing an increase of only 1.06% compared to 2013).

Graph 2: Share of renewable energy used in consumption in Romania and European Union, 2013-2022 (%)



Source: Authors based on data published by the Eurostat (2024).
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Building and renovation. While at the European level, the building and services segment represents 40% of the total energy consumption, in Romania, the percentage rises to 45% in both household and tertiary sectors (offices, commercial spaces, and other non-residential buildings) (Matache, 2021).

In Romania, in order to meet the energy efficiency objectives, set at the European and national levels, a considerable portion of the existing building stock nationally will need renovation. A significant aspect in implementing energy renovation policies is that, following widespread privatization after the fall of the communist regime, the vast majority of the population in Romania lives in privately owned homes (94.7%), which is one of the highest rates in Europe. However, some of these homes fall well below EU standards regarding minimum conditions for providing public utility services (The Government of Romania, 2020).

Sustainable mobility. Regarding the transport sector, Romania falls below the European average in all aspects related to infrastructure and investments. The road network is the least developed in the EU, while also having the lowest road safety standards. Additionally, Romania's transport system increasingly relies on private cars and trucks, while rail transport usage has consistently declined, despite the targets set in the EU Sustainable and Smart Mobility Strategy. The result of the EU Sustainable and Smart Mobility Strategy will be a 90% cut in transport sector's emissions by 2050, delivered by a smart, competitive, safe, accessible and affordable transport system (European Commission, 2020). For the achieving of the sustainable, smart and resilient mobility objectives are set a various milestone, such as: at least 30 million zero-emission vehicles will be in operation on European roads and high-speed rail traffic will double by 2030 and by 2050 nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission, rail freight traffic will double and high-speed rail traffic will triple (European Commission, 2020).

Emissions from transport account for one quarter of the EU's greenhouse gas emissions. To achieve climate neutrality, the European Green Deal calls for a 90% reduction in greenhouse gas emissions from transport by 2050 (EEA, 2024). Following six years of steady growth in greenhouse gas emissions from the EU's transport sector, transport emissions dropped substantially in 2020 because of reduced activity during the COVID-19 pandemic. Preliminary estimates of emissions in 2021 indicate a rebound of 8.6% in transport, followed by further growth of 2.7% in 2022 (EEA, 2023).

In Romania, due to the increase in road transportation, emissions from transport have risen. According to Eurostat, in 2020, transport emissions were 50% higher than in 2005 and accounted for 17% of Romania's total greenhouse gas emissions. The transport sector is one of the most challenging sectors to decarbonize because, in the absence of firm policies and measures, emission levels will continue to rise. Urban transportation is a major source of emissions because individual car trips constitute a significant portion of overall transportation modes in Romanian cities, with over 76% of the country's population residing in urban areas. Another important factor contributing to the rapid increase in greenhouse gas emissions in urban transportation in recent decades is related to the sustained growth in the number of registered cars. Moreover, vehicles operating in cities are old and inefficient in terms of fuel consumption.

Eliminating pollution. According to the most recent Eurostat data, in 2021 compared to 2010, the level of fine particulate matter $PM_{2.5}$ emissions decreased by 25.35% in the European Union and by 9.71% in Romania. Although a reduction in $PM_{2.5}$ emissions has been recorded, Romania must continue its efforts to fulfill the commitments provided by the Directive on National Emission Ceilings for the period 2020-2030. Air pollution is a serious problem in Romania, with three-quarters of the population continuously being exposed to harmful levels of air pollution, and resources for monitoring air quality are quasi-nonexistent. For this reason, Romania has come to be cited as a negative example by many European and international organizations (Florescu, 2022).

Climate actions. According to the latest available data from Eurostat, greenhouse gas emissions decreased comparing with 2008, both in the European Union and in Romania. In 2021, greenhouse gas emissions from EU economic activities stood at 3.6 billion tonnes of CO_2 equivalent, 22% lower than in 2008 (European Parliament, 2023). Romania has nearly achieved its target for reducing greenhouse gas emissions in the industrial sector, where they have decreased by 71%, but in other sectors, such as transportation or residential, we rather have a negative progress. The transport sector's emissions have been on a persistent upward trend over the last two decades and according to the European Environmental Agency (EAA), this trend is projected further upward, with emissions in the sector transport expected to surge by 84 percent by 2030 relative to the level in 1990 (Panton, 2023). The reduction of the greenhouse gas emissions in the industrial sector can be attributed to a combination of economic and legislative factors related to the implementation of climate change policies and measures at the EU level. Also, this decrease is due to the disaggregation of the Romanian industry, especially the energy-intensive one, structural changes in the economy during the pre-accession and post-accession period to the European Union, the national economic crisis during the 2008-2010 period, increased production of energy from renewable sources, and natural gas.

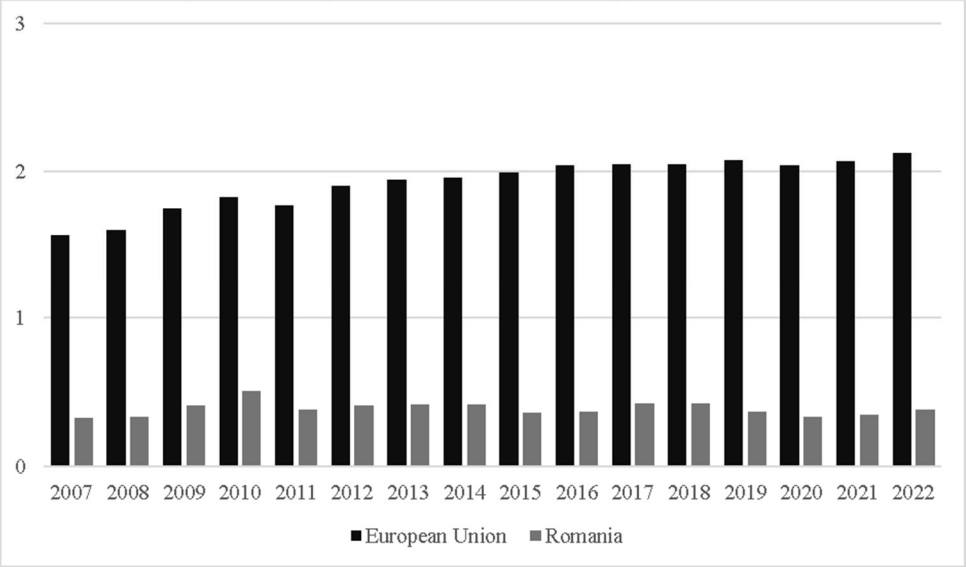
Despite these positive trends, fossil fuels are still the largest source of energy and emissions. Decarbonizing the economy will require further reductions in greenhouse gas emissions over the next 30 years, as the EU aims to become a climate-neutral economy by 2050.

Sustainable industry. Concerning resource efficiency, measured through resource productivity, Romania is one of the least performing economies in the European Union. Thus in 2022, for every kilogram of primary resources extracted from the natural environment and used in the economy, it was generated an economic value of 0.382 EUR/kg, well below the EU average of 2.126 EUR/kg (as observed in Graph 3).

Improving resource productivity in the European Union is the result of concerns related to enhancing resource efficiency and reducing environmental impact. These concerns have been reflected in EU strategies and policies, such as the Europe 2020 Strategy and, more recently, the European Green Deal. These initiatives aim to encourage sustainable economic growth, decoupled from excessive resource consumption and negative environmental impact.

Romania is rich in natural resources, and sustainable management of these resources is essential to ensure long-term benefits and avoid their depletion. However, the analysis of Eurostat data shows a negative trend for Romania, namely that in 2022 compared to 2010, resource productivity decreased by approximately 25%. Starting in 2021, there is an observed increase in resource productivity, with an 8.5% increase in 2022 compared to 2021.

Graph 3: Resource productivity in Romania and European Union, 2007-2022 (euro/kg)



Source: Authors based on data published by the Eurostat (2024).
(https://ec.europa.eu/eurostat/databrowser/view/cei_pc030/default/table).

When it comes to Romania and the European Union, there are significant differences regarding domestic material consumption and resource use patterns. In terms of domestic material consumption (tons per capita), Romania recorded a growth of over 60% in the period 2012-2022, while the EU average slightly increased from 14.045 tons per capita to 14.445 tons per capita (Table 1).

Table 1: The evolution of domestic material consumption in UE and Romania, 2012-2022 (tons/ capita)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
European Union	14.045	13.676	13.778	13.793	13.721	14.056	14.314	14.373	13.763	14.391	14.445
Romania	17.910	17.903	18.685	22.407	22.811	21.215	22.993	27.525	29.034	29.734	28.811

Source: Authors' computations based on (Eurostat, 2024).
(https://ec.europa.eu/eurostat/databrowser/view/ten00137/default/table?lang=en).

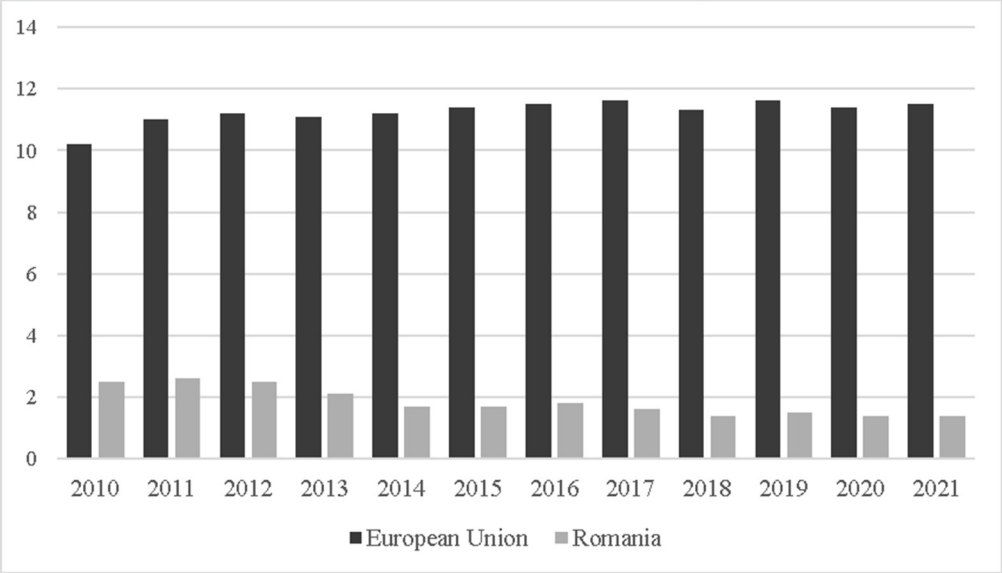
Certainly, this growth is not necessarily a negative signal, because during the same period Romania experienced an increase in GDP and implicitly in the economy.

The circular material use rate (the proportion of recycled and reintroduced materials into the economy) is a good indicator of the circularity of an economy. As observed in Graph 4, the circular material use rate increased in the European Union by 12.74% from 2010 to 2021. Therefore, it can be concluded that the EU's objective of increasing the circular material use rate and reducing dependence on finite resources, as well as diminishing the impact on the environment, is on the right track.

In Romania, the circular material use rate was only 1.4% in 2022, well below the EU average of 11,4% and decreased by 0.1 percentage points compared to 2021, which positions us at the bottom among EU Member States in this regard.

Under these circumstances, in order to achieve the EU objective of doubling the circular material use rate by 2030, as outlined in the EU Circular Economy Action Plan, Romania must undertake ambitious measures, targeting the entire product lifecycle. Increasing this rate—either by increasing the quantity of recycled waste or by decreasing the quantity of materials used—would reduce the amount of raw materials extracted for production and the associated negative impact on the environment and climate.

Graph 4: Circular material use rate in Romania and European Union, 2010-2021 (%)



Source: Authors based on data published by Eurostat (2024).
(https://ec.europa.eu/eurostat/databrowser/view/ENV_AC_CUR/default/table?lang=en).

As it can be observed in Table 2, which centralizes the value of indicators used in EU the circular economy monitoring framework, Romania's performance regarding the circular economy is below the EU average.

Table 2: The indicators of the European circular economy monitoring framework the, Romania-EU

Indicator	Unit of measure	Romania	EU
Material consumption			
Material footprint	tonnes per capita	29.991 (2022)	14.896 (2022)
Resource productivity	Euro/ Kg	0.382 (2022)	2.1261 (2022)
Waste generation			
Total waste generation per capita	kg per capita	7338 (2020)	4815(2020)
Generation of waste excluding major mineral wastes per GDP unit	kg per thousand-euro, chain linked volumes (2010)	107(2020)	65(2020)
Generation of municipal waste per capita	kg per capita	301(2022)	513(2022)
Generation of packaging waste per capita	kg per capita	127.21(2021)	189.75(2021)
Generation of plastic packaging waste per capita	kg per capita	26.41(2021)	36.11(2021)
Waste Management			
Recycling rate of municipal waste	%	12.1(2022)	48.6(2022)
Recycling rate of all waste excluding major mineral waste percentage	%	38.3(2021)	58(2020)
Recycling rate of overall packaging percentage	%	39(2020)	64(2020)
Recycling rate of WEEE separately collected	%	76(2021)	81.1(2021)
Secondary raw materials			

Circular material use rate	%	1.4(2022)	11.5(2022)
Trade in recyclable raw materials			
Imports from non-EU countries		272565(2023)	39835.343(2023)
Exports to non-EU countries		1883.254(2023)	39267.596(2023)
Competitiveness and innovation			
Private Investments	% GDP at current prices	0.5(2021)	0.8(2021)
Persons employed	% of total employment	1.2 (2021)	2.1(2021)
Gross value added	% GDP at current prices	1.0 (2021)	2.1(2021)
Patents related to waste management and recycling	number	5.0	206.55
Global sustainability and resilience			
Consumption footprint	Index: 2010=100	114(2022)	109(2022)
GHG emissions from production activities	kg per capita	4775.5(2022)	6481.2(2022)
Material import dependency	%	10.6(2022)	22.4(2022)
EU self-sufficiency for raw materials, aluminum	%	N/A	11(2022)

Source: Authors' computations based on Eurostat (2024).(https://ec.europa.eu/eurostat/web/circular-economy/monitoring-framework)

In terms of sustainable production and consumption, Romania falls far below the EU average, demonstrating once again that Romania is still at the beginning of transitioning from a linear economic model to a circular one.

The situation regarding waste management is also unfavorable, only the indicator (Recycling rate of WEEE separately collected) being close to the European Union average, while the rest of the rates are much lower than the EU average.

Romania ranks last in the EU hierarchy regarding the circular use rate of materials, with a circular material use rate value of the only 1.4%, compared to almost 12% in the EU, meaning that only a small portion of recycled materials are reintroduced into the economy.

5. Conclusion

The implementation of circular economy principles in Romania is still in its early stages and is not yet fully understood at all levels by stakeholders. Although some progress has been made over the past decade, Romania is still at the beginning of the transition to a circular economic model. Romania's economic growth is not yet decoupled from waste generation, and waste management is not efficient, given that the dominant form of waste management is still landfilling (which often remains illegal).

Furthermore, Romania's situation regarding sustainable production and consumption is far from favorable, falling well below the EU average, indicating that Romania is still at the beginning of transitioning from a linear economic model to a circular one. According to Eurostat data, Romania is among the EU Member States with poor performance in terms of resource productivity, waste generation, waste treatment, and the use of recycled materials in the economy. Additionally, according to the European Commission, Romania risks not meeting the objectives for preparing for reuse and recycling of municipal waste and recycling of packaging waste by 2025. Insufficient progress in meeting the objective of landfilling municipal waste by 2035 also raises concerns.

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