

THE CIRCULAR ECONOMY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT-A BIBLIOMETRIC ANALYSIS

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Abstract

The circular economy represents one of the main topics nowadays. Because of its benefits and its huge potential, it represents a sure way to a sustainable economic system. The aim of implementing this model, despite the conventional linear one, is to increase the rates of long-term sustainability. The actual study goal is to show how important the CE from the perspective of current research. The research question represents the title of the paper and describes the importance of the CE. How important is the CE? The real significance of the research question is, by answering it, to identify and state how often the CE appears in multiple kinds of scientific articles in recent years. The importance of the circular economy has grown exponentially in recent years, with each year seeing an increase in interest. With the implementation of the first circular economy action plan, implemented by the EC in 2015, this topic has become very attractive for researchers. Even though the CE subject gained real success in the last years, its potential is not exploited to its maximum, and it represents a huge opportunity to study because of its numerous advantages.

Keywords: circular economy, bibliometric analysis, environment, sustainability.

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Introduction

Based on a critical analysis of the conventional linear economic system, a new economic model known as the circular economy was developed, which includes the concepts of the first and second laws of thermodynamics. This model emphasizes the link between the economy and the environment, which includes three economic functions of the environment: resource provider, waste assimilation, and utility source (Rizos et al, 2017).

A significant amount of literature from many disciplines has evolved over the last several years that has affected our current knowledge and perception of the circular economy. When it comes to human economic activity and sustainability, industrial ecology is a research field based on a systems approach and encompassing a holistic perspective (Garner & Keoleian, 1995). The idea that the natural ecosystem and the industrial system work similarly and are described by flows of materials, energy, and information are the roots of this topic. (Rizos et al, 2017).

The 'circular economy' is an industrial system that is intended to be regenerative. Rather than This method concentrates on each stage of a life cycle of the produce eliminating goods before their worth has been completely realized, the aim is to use and re-use them. Only a small fraction of the original product value is now restored after usage consumption (Wijkman et Skånberg, 2017).

The circular economy has the potential to deliver a wide range of economic, social, and environmental advantages, enabling high rates of long-term sustainability. This method

concentrates on each stage of the life cycle of the product, resulting in numerous possibilities and potential population advantages. This has the potential to not only minimize environmental effects, but also to improve raw material supply security, boost economic growth, maximize durability and lifetime, stimulate innovation, and boost competitiveness. The circular economy has the potential to generate a large number of new employment (Roberts et al., 2021).

The goal of the circular economy is to disassociate from the take-make-dispose linear pattern of production and consumption by proposing a circular system in which the value of goods, materials, and resources is preserved in the economy for as long as feasible. There has been an increase in the number of scholarly publications on the subject in recent years (Merli et al., 2018).

Moving the economy in the direction of a circular economy, which has the potential to offer significant social benefits, would necessitate systematic legislative actions as well as targeted investments over time, with the main goal being to minimize energy and material consumption by the population. It will be critical to see a circular economy not just as an environmental concern, but as an important component of creating employment and competitiveness initiatives (Wijkman et Skånberg, 2017).

3. Methods

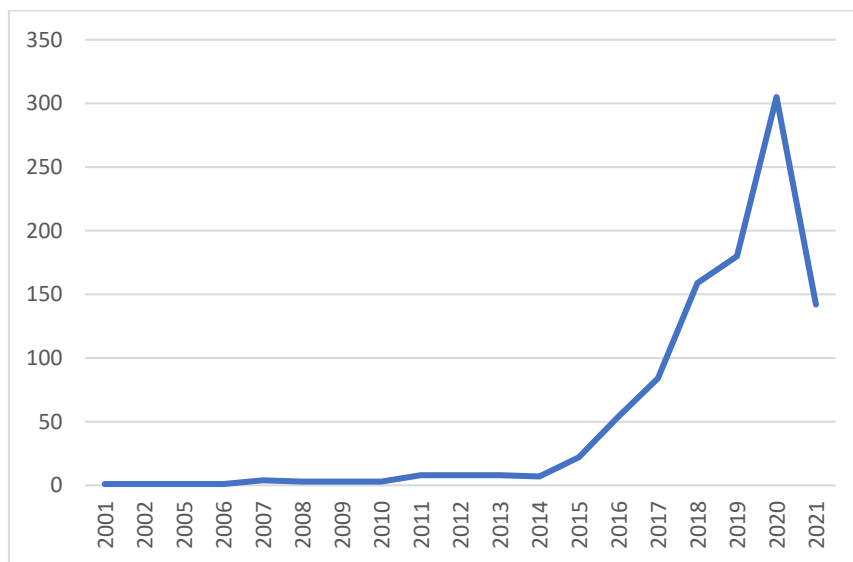


Figure 1. The dynamic of publication in the last 20 years (number of papers/year)

Source: Publish or Perish (Google Scholar) retrieved on 27th of September 2021

According to bibliometric statistics, the topic of circular economy is relatively young, since the first paper was published in 2001, following the release of Publish or Perish. In comparison to other areas with a long history of research, the Circular Economy shows a relatively unexplored field, both in Romania and globally.

Since 2014, when the European Commission set the framework for the first action plan, which was adopted in December 2015, the circular economy has gained popularity. From

2015 until today, researchers and many others' interest have grown exponentially, such that if there were about 10 papers on this topic in 2014, there was over 300 in 2020.

The first circular economy strategy plan's key dates and their implementation:

The measures detailed in the implementation strategy support Europe's transition by helping to complete the circle on product lifecycles through increased recycling and re-use, culminating in environmental and economic advantages. The first circular economy action plan was completed in 2019. Its 54 measures have been fulfilled, even if some of them will continue to be worked on beyond 2019.



Figure 2. The timeline of the first circular economy action plan

Source: https://ec.europa.eu/environment/topics/circular-economy/first-circular-economy-action-plan_en

The circular economy is the key factor for sustainable development that involves optimizing resource consumption, prevention, and reduction of waste and the reuse of materials.

Romania's Sustainable Development Strategy 2030, through its objectives, has the role of maintaining development paths within bearable limits for the planet, both in terms of climate change, resource consumption, air, and water quality, and the protection of terrestrial and marine biodiversity. This requires developed regions, such as Europe, to fundamentally reduce the ecological footprint of their economy through a change in production, consumption, and society towards a circular and low-carbon economy. In this sense, the analysis of the main indicators of Objective 12-Ensuring Sustainable Consumption and Production Models (SDG12) reflects the size of the circular economy in the context of sustainable development. This goal objective aims to militate against economic growth from improper resource use and emission levels. Also, the management of toxic substances and waste has been improved.

In this era, socioeconomic and demographic changes are useful, but on the other hand, the demand for limited natural resources will rise. That means humanity needs to find and develop equitable solutions for a better life. Many researchers have devoted their entire careers to studying the phenomenon and concept of the circular economy. According to VOS Viewer, the most popular topic in the last decades linked to this subject was about:

- Environmental Sciences (147 papers);
- Environmental Engineering (111 papers);
- Green Sustainable Science Technology (102 papers).

That means the research interest in the environmental sciences is increasing at a huge rate and is not yet explored to its maximum potential.

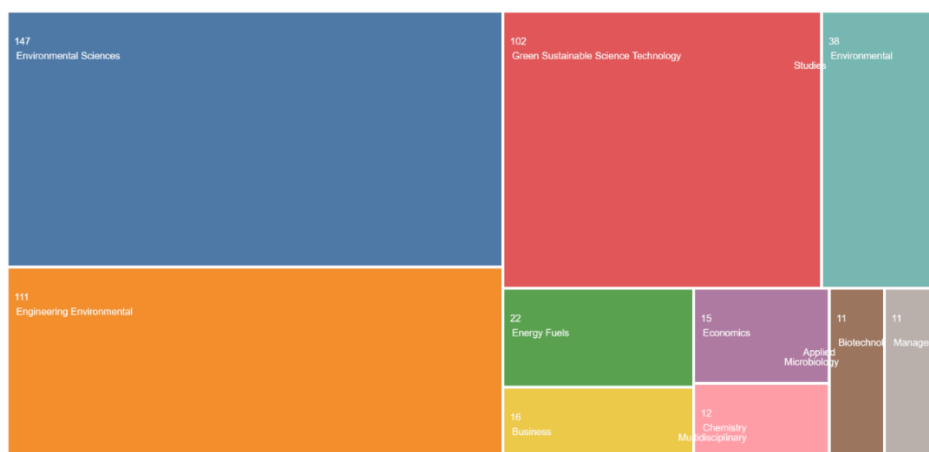


Figure 3. VOS Scheme regarding the most numerous papers during 2012-2021

Source: VOS viewer, retrieved on 1st of October 2021

On the contrary, at the opposite pole, referring to the above VOS diagram, the bibliometric is more reduced when it comes to topics such as:

- Environmental (38);
- Energy fuels (22);
- Economics (15);

- Business(16);
- Chemistry Multidisciplinary (12);
- Biotechnology (11);
- Management (11).

That means the research interest in the environmental sciences is increasing at a huge rate and is not yet explored at its maximum potential.

For instance, the implementation of the first circular economy action plan led to several positive changes, such as the increasing Circular Material Use rate.

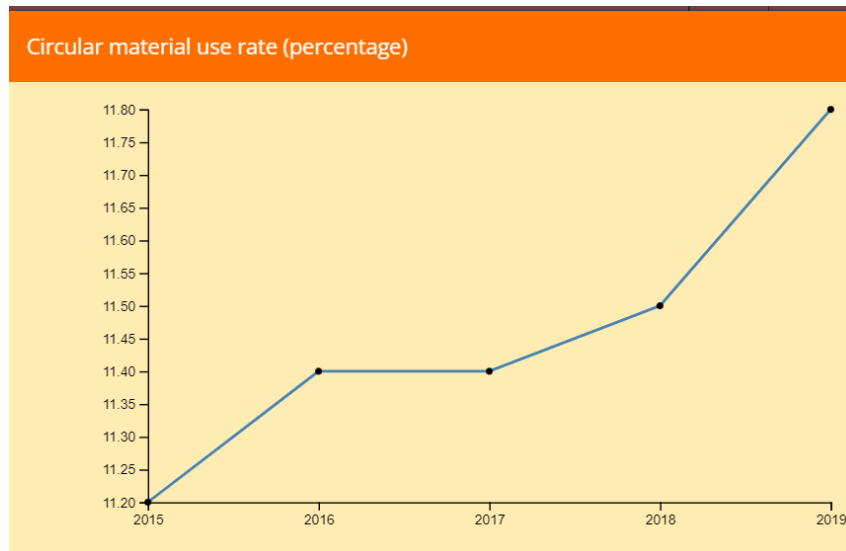


Figure 4. Circular material use rate

Source: Eurostat EU 27

<https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

At the Eurostat level, 7 sustainable development indicators have been proposed at Objective 12. Of these, 6 indicators are in the national set or are similar to the indicators in the national set.

Eurostat Indicators:

- Generation of waste excluding major mineral wastes by hazardousness;
- Consumption of chemicals by hazardousness - EU aggregate;
- Gross value added in the environmental goods and services sector;
- Average CO2 emissions per km from new passenger cars;
- Energy productivity;
- Circular material use rate (CMUR);
- Resource productivity and domestic material consumption (DMC).

The European Commission has developed a circular economy plan that highlights the dangers posed by geopolitics and proposes a set of goals to be met, including climate change adaptation, reduced reliance on finite resources and their consequences, food security, and rural jobs development. The transition to the circular economy, as defined by the European Commission, demands knowledge and understanding of how a CE model works—specifically, information on recycling systems, economic goals, and governmental policy—

to assess the stage of the transition process. The following phase is economic modeling, which is used to meet the decision-makers expectations. Economic research used in the CE sector will be that which will substantially add to knowledge in the fields of recycling and bioenergy reuse using biotechnology (Busu and Trică, 2019).

Circular material rate use (CMRU) increased from 11.2 percent to 11.8 percent between 2015 and 2019, according to Eurostat reports, representing a 0.4 percent increase across Europe. CMRU, on the other hand, remained constant between 2016 and 2017 at 11.4 percent. At the same time, this signifies the involvement and collaboration of EU member states in implementing sustainable economic models.

Results	Help
Publication years:	2001-2021
Citation years:	20 (2001-2021)
Papers:	994
Citations:	73417
Cites/year:	3670.85
Cites/paper:	73.86
Authors/paper:	3.13
h-index:	106
g-index:	241
hI,norm:	73
hI,annual:	3.65
hA-index:	66
Papers with ACC >= 1,2,5,10,20:	990,966,839,605,329

Figure 5. The number of publications after the circular economy keyword

Source: Publish or Perish (Google Scholar) retrieved on 27th of September 2021

According to Publish or Perish software's interrogation using the keywords *circular economy*, 994 papers were published between 2001 and 2021.

This topic has also around 70000 citations in total and only around 4000 cites per year which means that this topic was not enough exploited and it offers a lot of opportunities in this field of research.

On the other hand, having a look on Web of Science, via Publish or Perish and using the same coordinates, the first year's publication on the *Circular Economy's* subject have appeared in 2012. The pant is the same, from 2014 starting to increase the interest for this topic, and having to descend from 2020 (the peak of interest) until today. A major impact concerning the reduction of the number of papers was the pandemic context. J.Walker et al (2021) noted that individual characteristics and organizational research interests were modified by the pandemic's huge media exposure.

Nowadays, the topic of circular economy is closely related to many keywords, which have attracted considerable interest in public and political agendas during the last few years. The circular economy has been defined as the path of the future for suitable and sustainable natural resource management. Such mechanisms are currently coexisting with other social and economic transformation processes, such as urbanization, digitalization, and revolutions in the mobility and energy sectors, to name a few (Alberto Bezama, 2018).

Last but not least, the circular economy study conducted for this article reveals that this topic is present in a variety of industries, including business, economy, environment, agriculture, and the health care system. Everything that surrounds us has the potential to be about and for a sustainable lifestyle, mentality, and approach.

Conclusions

The revised literature that we utilized to develop this paper was evaluated to demonstrate the significance of adopting and implementing the Circular Economy model. According to bibliometric statistics, the topic of circular economy is relatively young. In comparison to other areas with a long history of research, the Circular Economy shows a relatively unexplored field, both in Romania and globally. From 2015 until today, researchers and many others 'interest has grown exponentially, such that if there were about 10 papers on this topic in 2014, there were over 300 in 2020.

Romania's Sustainable Development Strategy 2030 has the role of maintaining development paths within bearable limits for the planet. This requires developed regions, such as Europe and not only, to fundamentally reduce the ecological footprint of their economy through a change in production, consumption, and society towards a circular and low-carbon economy. Analysis of the main indicators of Objective 12-Ensuring Sustainable Consumption and Production Models (SDG12) reflects the size of the circular economy in the context of sustainable development.

However, the Circular Economy appears to be an underappreciated and untapped topic, not only in Romania, but globally, but with the establishment of the framework for the first action plan in 2015, this has changed and it has begun to regain popularity. At the same time, subordinating itself to the objectives of the 2030 Agenda, this is a sustainable and safe way to follow, especially through the advantages it has to offer.

The circular economy is the path of the future for suitable and sustainable natural resource management. The topic of circular economy is closely related to many keywords, which have attracted considerable interest in public and political agendas during the last few years. Thus, the question of the research was raised by the increasing number of articles on this topic. As for the future, the CE has all the prerequisites to replace the classic model of the linear economy, due to the huge potential it has. Everything that surrounds us has the potential to be about and for a sustainable lifestyle, mentality, and approach. It has the potential to deliver a wide range of economic, social, and environmental advantages, enabling high rates of long-term sustainability.

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