Green Deal and the Role of Circular Economy in Reaching Climate Neutrality

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Abstract

In 2019 the European Commission has introduced a new proposal, the European Green Deal (EGD), that is meant to adapt European Union's (EU) climate, energy, transport and tax policies to ensure a reduction of net greenhouse gas emissions by at least 55% by 2030 compared with 1990 levels and reach climate neutrality by 2050. An important pillar of the Green Deal is the new circular economy action plan.

Thus, in order to monitor the role of circular economy in reaching the objective of climate neutrality, the aim of this research is to highlight the importance of circular economy to the EU's zero emission economy, considering strict requirements found in literature based on a bibliometric analysis, shedding new light on the challenges facing the EGD. The results showed that a closed loop economy is at the core of the reaching climate neutrality. The research results and directions pointed in this paper have the potential to strengthen the sustainability of the EU's decarbonisation policy.

Key words: Green Deal, circular economy, climate neutrality, sustainability, circular economy action plan
J.E.L. classification: Q56

1. Introduction

The increasing environmental impacts caused by climate change led the European Commission (EC) to propose the European Green Deal (EGD) in 2019. The EGD emphasises the need for a holistic and cross-sectoral approach, with all relevant policy areas having a role in achieving a reduction of greenhouse gas emission by 55% in 2030 compared to 1990 levels and the ambitious goal of climate neutrality by 2050.

Kurze & Lenschow (2018) and Dupont et al. (2020) have argued that EGD represents a broad and more systemic approach to the transition to sustainability than previous EU initiatives and policy developments, which have mainly focused on mainstreaming climate change mitigation in the field of energy policy. Therefore, it could be understood as a critical juncture that sets the EU on a "new, potentially transformational path" (Dupont et al., 2020).

In order to reach the 55% emission reduction target, European Commission has introduced a set of measures, through the legislative package "Fit for 55" that are aimed to reshape EU's core, including changing consumer behaviour. The main objectives are: reduction of GHG emissions, tackling energy poverty, creating jobs for the future, concentrating on green innovation and boosting sustainable growth.

Furthermore, in 2020, the European Commission adopted an important pillar of the Green Deal, the new circular economy action plan (CEAP). It is considered that EU's transition to a circular economy will reduce pressure on natural resources and will create sustainable growth and jobs. The

new action plan is comprised of initiatives along the entire life cycle of products, including how products are designed, and aims to ensure that waste is prevented.

According to Elena Cristina Rada (2023), the concept of circular economy is the opposite of what was introduced in the 19th century - linear economy- which was based on the terms: take, make, consume, throw away.

In what concerns the existing circular economy policies, Morseletto (2020) argues that, even though they are highly popular, existing targets for recovery and recycling do not necessarily promote a circular economy. He goes on to say that because of these inefficiencies, other powerful circular economy strategies that have the potential to reduce waste, close production loops and maximise retention of the economic value of materials, should be considered.

The aim of the paper is to show the role that circular economy plays in achieving the decarbonisation targets and provide meaningful insight into what measures that can be taken in order to strengthen its position. Therefore, it aims to show the contribution that circular economy has brought in terms of reducing GHG emissions and prolonging the life span of materials and products.

The proposed research comprises five sections, starting with the introduction, which presents a brief literature review of the researched subject and the objective of the study. It then continues with the authors providing more detailed information of the subject of the study and the articles which were selected, structured in the literature review. Following the literature review is the research methodology section, which presents the databases and software used, together with the process for data collection. The findings section, which discusses the methodological aspects of the bibliometric analysis and, implicitly output of the data collection process, as well as proving a conceptual structure analysis of this research topic. Lastly, the fifth section presents the conclusions of the study, its limitations and possible research directions for the future.

2. Literature review

In line with the research objective mentioned above, the literature review consists of published papers, indexed in Web of Science (WoS) that explore the relationship between circular economy measures and decarbonisation levels in the context of Green Deal policy objectives that can result into climate neutrality. Having in mind that the EGD has been recently introduced (2019), the articles which were subject to the empirical analysis have been published between 2021- 2025, with the highest density between 2022 and 2024.

Table no. 1 Review of the papers that are exploring the relationship between circular economy and climate neutrality

Authors	Research objective and main findings	Circular economy role and approach in the context of Green Deal
Cifuentes-Faura, J. (2022)	The research aims to review the main policies that have been implemented in the EU to reduce environmental problems. It also includes a review of the climate change policies and their impact. The paper also proposes solutions to be followed, such as those based on the Circular Economy. One of the solutions is teaching sustainability in educational institutions in order to make future professionals aware of the importance of protecting the environment. Furthermore, the paper proposes measures such as giving incentives to industries that meet the established GHG emission targets, in order to further promote environmental protection.	The circular economy model should be the foundation for EU policies, where sustainable consumption is encouraged and resources maintained for as long as possible. Reducing waste generation is also at the core of circular economy. Focus should be placed on solidarity when defining the principle of the European Green Deal, with collaboration between all Member States and different parts of society. Achieving climate neutrality will require collective efforts, and involving young people will lead to a change their consumption patterns and will provide sufficient information to limit their carbon footprint and live in a greener and healthier environment.

Witjes, S. and Lozano, R. (2016).	The paper aimed to contribute to circular economy by providing knowledge on the relationships between sustainable public procurement (SPP) and the development of more sustainable business models. The research has been able to prove that by incorporating sustainability criteria into their business models (Lay et al., 2009) companies are likely to fulfil SPP process specifications. Hower, it is argued that for this to happen closer proximity between the supplier and the procurer in the procurement process is needed.	The author provides information about the purpose of the introduction of the circular economy concept, arguing that it has been proposed to address environmental issues by transforming waste into resources, and bridging production and consumption activities. The author continues to say that a systemic multi-level change is required in order to transition to a circular economy that actually work.
Larsen, et al (2022)	The authors have conducted an analysis of forty-two articles in an effort to identify the knowledge gaps in this area of integrated life cycle thinking, encompassing Life Cycle Assessment (LCA), Life Cycle Costing (LCC), and Social Life Cycle Assessment (S-LCA) into Life Cycle Sustainability Assessment (LCSA). The aim of the research was to discover if an integrated assessment methodology, that can support the transition of the construction and real estate industry to a circular economy, has been applied. The paper found that further research in evaluating circular economy should be done and proposes the practice of integrating LCA, LCC and S-LCA into LCSA, so it can support the transition.	For circular economy, in the construction sector, to succeed in contributing significantly to climate neutrality, a comprehensive and circular view upon buildings' life cycle phases is necessary. This will have an impact the building's value chain, regarding the involvement of more stakeholders, not only in the early phases of project development (decision-making) but particularly in the design phase. Furthermore, specific focus upon making integrated life cycle sustainability assessment operational and useable for practitioners in the building processes is necessary.
Klavins, M., et al (2024)	The study proposes an assessment tool for evaluating airport strategic plans and environmental reporting to promote sustainability. The research introduced an application, Data centre Energy Sustainability Score (DESS), in order to demonstrate the use of material and social views on sustainability strategy.	In the author's opinion, the Green Deal is not only about the introduction of environmental policies and the development of innovative technological but, about changing of mindsets in societies. Furthermore, the paper aims to prove the close relationship between the transformation of the current model of consumption to reduce waste and circular economy. It Continues with the idea that in order to reach Green Deal's objectives, redesign of economies and decoupling economic growth from material consumption, carbon emissions, and waste generation is needed.
Drewnowski, J., et al. (2024)	The article proposes integrating and using a resource database for the recovery and reuse of coffee industry residues, focusing Circular Economy Model. The paper is aimed to consolidate existing knowledge coffee grind output, management, characterization, treatment, and various methods for resource recovery and recycling. The results of the paper show that research is lacking timely exchange of information. Therefore, the development of high value-added products within the framework of Green Deal Implementation and Circular economy model is strongly encouraged.	The authors mention that the circular economy model considers the issues of mitigating the impact of production and consumption on the environment and emerged as a reaction to the existing unsustainable linear "take, make, consume, and waste" economic model.

Pakuła, N.,et al. (2025)	The study offers a critical discussion providing insights into the progress of the European Union (EU) strategies for transitioning into circular economy (CE). It has been presented that there are unexplored aspects and identified limitations, this study being one of the few that tackle Member states' performance in regards to EC. The paper concludes that further research, as well as raising implications of conducting analyses and ranking CE performance of countries should be carried out. The study contributes to the effectiveness of research and policy developments, offering new possibilities for refining the design of concrete measures towards better circularity performances.	The paper stars by presenting information on policy objectives set at the level of the European Commission (EC), stating that it perseveres in striving for advancements in its circular economy policies. The authors believe that circular economy is in the heart of the sustainability agenda through initiatives such as the European Green Deal (European Commission, 2019) and the Circular Economy Action Plan (CEAP).
Saari, U.A., et al. (2021)	The research aims to provide insight into how individuals' sustainable consumption behaviour is influenced by environmental knowledge and risk perception. In their findings, the authors have indicated that sustainable consumption behaviour can be associated with environmental concern, particularly in Europe. This results from increased levels of environmental knowledge and environmental risk perception.	The authors consider that changes in the sustainable consumption behaviour of Europeans is closely linked to the knowledge that they have on the need to transition to a green and circular economy, that derives from policies such as the European Green Deal and EU Circular Economy Action Plan.
Mehmet B., et al. (2023)	The paper analyses if and how is the EU Green Deal a successful tool to maintain the EU's role as a normative power during carbon neutrality. It examines both opportunities and challenges of the EU Green Deal. Based on specific keywords, 631 studies were found, with 117 sources considered relevant for the analysis. The study aims to contribute to the literature on EGD, in particular the "Normative Power Europe" concept, suggesting a link between the normative power of Europe and its "norm diffusion" mechanisms related to the EGD.	EU Green Deal is considered to be one of the most significant policies that can help amend and prevent climate change and environmental problems, leaving sustainable resources for future generations. The EGD sustainability is linked to its feasibility and acceptance of all third parties involve The article identified the unequal distribution of resources and inequality of opportunities as challenges affecting the normative power of EU. It is considered that focusing just transition principles and encouraging stakeholder engagement in energy transition would strengthen Eu position.

Source: Authors' own summary of the examined papers

3. Research methodology

To understand the role and the contribution that circular economy has in the context of Green Deal's objective of climate neutrality, the bibliometric analysis is the most suitable research method, allowing for all dimensions of circular economy to be analysed. Having in mind that circularity is multi – sectoral, we are faced with challenges when trying to map the extent to which it contributes to climate neutrality and the progress made since its introduction. The bibliometric research method, therefore, is able to shed light in understanding how and to what extent does circular economy contribute to a zero - emission economy. This approach aims to efficiently monitor the policies, measures, resources and performance indicators introduced in order to meet the objectives CEPA and EGD. In the opinion of Velez-Estevez et al. (2023) is a highly useful tool for exploring research trends.

In order to conduct the bibliometric research, VOSviewer version 1.6.20 has been used, providing empirical evidence to support research findings. According to Moral-Muñoz, J.A., et al. (2020) from the many tools available for bibliometric analysis, VOSviewer is becoming increasingly popular, because it presents outstanding visualization capabilities, giving the user the possibility to export information from many sources for creating maps based on network data. Therefore, based on correlation coefficients, the tool allows for the creation of network maps, which are visually represented according to the metadata extracted from various scientific databases (van Eck and Waltman, 2010).

In this particular case, we have resorted to WoS database in order to conduct the bibliometric analysis, based on two criteria "Green Deal" and circular economy (All Fields). We have not included other filters to the publication and indexing dates. Furthermore, we have considered only those publications that respected the proposed word structures. The output consists of 570 WoS-indexed publications corresponding to the keywords mentioned above, which provided basis for elaborating the quantitative study of the field of circular economy in connection to the Green Deal objectives. Table 2 incorporates fundamental methodological aspects of the bibliometric analysis carried out in this paper.

Table no. 2 Methodological aspects of the bibliometric analysis

Criteria	Results
Number of WoS-indexed publications	570 publications corresponding to the keywords
Number of keywords	292 keywords associated to the 570 publications

Source: Author's own criteria for the bibliometric analysis

4. Findings

In what concerns the bibliometric analysis, we have analysed the most relevant clusters which resulted from the specifications provided in table 2. Methodological aspects of the bibliometric analysis and, implicitly WoS output. Table 3 presents the structure of each cluster and the most relevant keywords per selected cluster. Furthermore, the paper presents the keyword mapping of the concept of circular economy in the context or Green Deal, as displayed in Figure 2.

Table no. 3 Cluster structure based on relevant keyword structure

Red cluster	Green cluster	Mustard cluster	Blue cluster	Orange cluster	Brown cluster
circular economy	recycling	green transition	environmental benefits	consumer attitudes	green growth
environment	waste	green deal challenges	circular economy principles	development goals	eco-innovation
emissions	resource recovery	sustainable development	cleaner production	environmental impacts	maximum likelihood estimation
climate change	municipal Solid waste	climate neutral Europe	sustainable consumption	green public procurement	environmental pressure
policy	closed loop economy	corporate social responsibility	raw materials	plastic waste management	drivers
investment on environment	activated carbons	Green economy	value creation	sustainable food system	heterogeneity
pollution	anaerobic digestion	principles	circular business model	solid waste	productive performance

Source: Extracted from VOSviewer version 1.6.20

When visualising the red cluster, we can observe that it goes around the concept of circular economy. As means to mitigate climate change and reach the objective of climate neutrality, the introduction of policies that target specific areas such as air pollution, reduction of CO2 emissions, environmental protection through circular economy, as well as investments on environment are considered of absolute necessity. The "circular economy" and "climate change" keywords multiple occurrences suggest a strong relevance of the circular economy in terms of climate change. Even though they are interlinked, and mitigating climate change can be achieved only if there is a joint effort, introduction of targeted measures is needed to produce a real change. In order to do so, collaborations between the most crucial actors, as defined by Henry Etzkowitz and Loet Leydesdorff (1998) as being academia, corporations, and government through the tripe helix model, need to be established.

Figure no. 1 Mapping of red cluster keywords
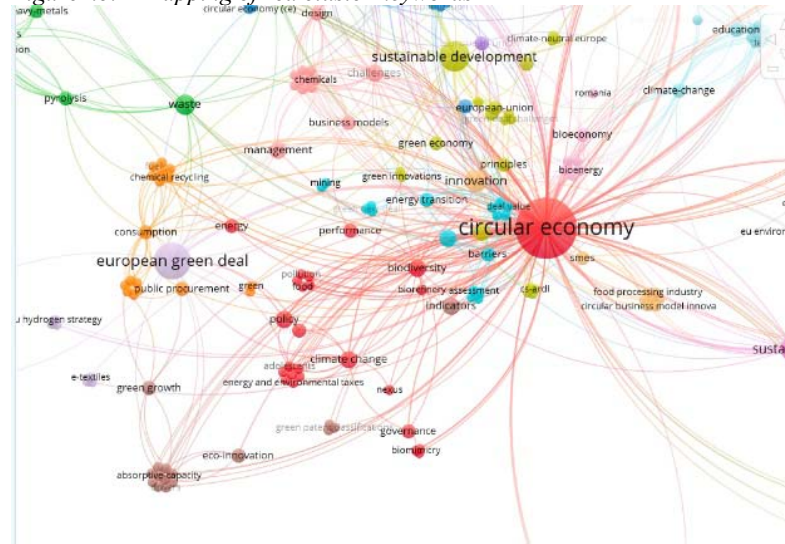
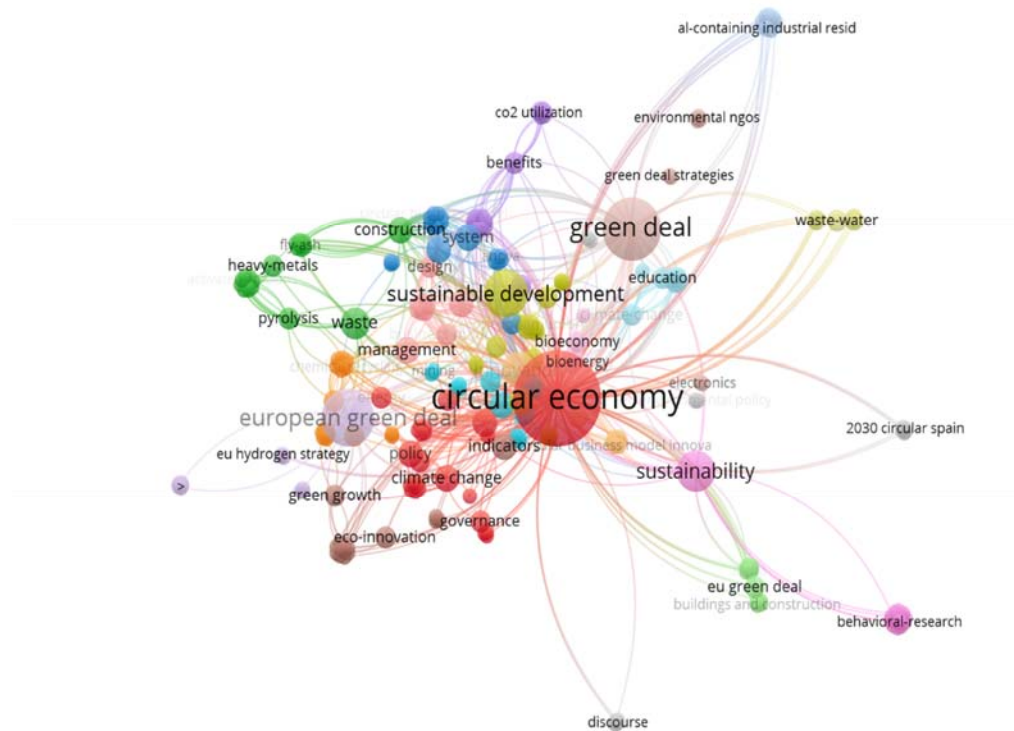*Source*: Author's own computation in VOSviewer 1.6.20

Thus, having in mind the EGD has a multi - sectoral dimension, through stakeholder engagement and introduction of tailor-made policies across all sectors, it aims to increase the contribution of these sectors to the reduction of CO2 emissions through a regulatory framework, as well as investments.

The implementation of eco- innovation and green growth is empowered through EGD with the objective of incentivising a circular business model and increasing cleaner production of goods. This in turn will result in consumer attitude change, resulting in sustainable consumption. There is an interconnection between blue cluster ad brown cluster, the inputs from the brown cluster, when implemented, lead to the results mentioned in the blue cluster.

Additionally, the mustard cluster consists of "corporate social responsibility" and "green transition" keywords, adding to the idea of the importance of education and the introduction climate change courses in the educational curricula, because starting early means that responsible consumption, putting the environment first.

Blum et. al (2013) argues that even though climate change education is highly necessary and important towards achieving climate neutrality by involving children in decision making mechanisms, it remains an under-theorised area of inquiry as considered independently from fields such as environmental education and science education. The green cluster encompasses elements that impact the contribution that circular economy has in reaching climate neutrality, under the influence of waste control measures. The "waste recovery" keyword occurrence brings forward the fact that cultivating the idea of a "closed loop economy" (another occurring keyword structure) requires a solid environmental protection-oriented foundation, able to efficiently introduce measures that can be operationalised irrespective of the region, local climate policy or stakeholder implication. Thus, "value creation" and "resource recovery" are at the centre of the EGD.

Figure no. 2 Mapping the concept of circular economy in the context of Green Deal

Source: Author's own computation in VOSviewer 1.6.20

5. Conclusions

Throughout the paper, the authors aim identify the challenges the European Green Deal has brought with its introduction, the strategic measures that have been in place to overcome or dimmish the intensity of these challenges and the policies that have been implemented to achieve climate neutrality. Ultimately, it envisages a bibliometric analysis that aims to analyse where circular economy stands and the contribution it has brought to achieving climate neutrality. A shared effort centred around circular economy should be considered by all member states.

Ever since the Russian aggression in Ukraine, the EU policy has focused mainly on reducing dependency on Russian fossil fuels, increasing the share of renewable energy and increasing EU competitiveness in the field of net- zero technologies, with limited focus being placed on end-of-life cycle of products and enhancing the life span of certain products. The message still has been "replace" instead of repair and reuse.

The keyword cluster analysis of the circular economy in the context of Green Deal is characterized by several dimensions. Each of the clusters embody areas and dimensions of circular economy, proving the multi – sectoral approach of the policy. Having started with the red cluster, we could observe that the investment on environment is the key determinant of reducing pollution, CO2 emission levels, and implicitly contributing to alleviating climate change effects. Moreover, based on the insights gathered from the blue cluster analysis, the circular economy contribution to EGD objectives was highlighted through the occurrence of the "clean production" and "sustainable consumption". keywords. The brown cluster brings forward the circular economy commitment to green growth and eco- innovation in an equitable manner that can benefit all dimensions. The emphasis is put on the need for sustainable development and corporate responsibility, as means for accommodating the increase demand of goods and the continues expansion of economies.

In conclusion, through the bibliometric analysis the authors highlighted that even through EGD policy has introduced measures aimed at reducing dependency on fossil fuels, increasing CO_2 emission reduction and encouraging a circular approach of the economy, there are area which have been left behind. One of these areas is early teaching of the challenges the environment is facing due to climate change and ways in which the impact of climate change can be diminished. Learning from a young age about sustainable consumption, the obligation that we have towards keeping our environment clean for future generations, the concept of use, repair, reuse, recycle, could help increase the likelihood of achieving climate neutrality by 2050.

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