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A Comprehensive Examination of the Impacts of the Circular Economy Within the ESG: Evaluating New Metrics and Interactions

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This paper provides an examination of the impacts of the circular economy within the framework of ESG criteria, emphasizing the interplay between these domains. The research aims to explore how circular economy principles can enhance ESG performance while identifying synergies and trade-offs across the three pillars. A methodology leveraging European Union datasets and indicators is applied, comparing to the ESG performance values of individual European Union member states. The findings indicate that integrating circular economy practices into ESG strategies enhances environmental outcomes, such as resource efficiency and waste reduction, while fostering social equity and improving governance transparency. However, challenges related to metric standardization and data harmonization across regions present limitations. The paper provides implications for policymakers, businesses, and investors by offering a framework for embedding circular economy principles within ESG strategies to drive sustainable development. The novelty of the research lies in the use of the first coherent and comprehensive index database for comparisons, leveraging European Union data to deepen the understanding of the relationships between circular economy principles and ESG (environmental, social, and governance) domains. By addressing a gap in the literature, this work contributes to the development of actionable tools for assessing and improving sustainability practices across industries.

Keywords:
circular economy, sustainability, ESG, performance metrics, impact assessment

JEL:
C43, O13, Q56

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1 Introduction

The circular economy (abbreviation: CE) has gained significant attention in recent years as a potential solution to the environmental and economic challenges posed by traditional linear production and consumption models (Geissdoerfer et al., 2017). This popularity stems from its capacity to bridge production and consumption at the system, technological, and product levels (Morseletto, 2023). This approach primarily aims to maintain products, components, and materials at their highest utility and value for as long as possible, thereby minimizing waste and maximizing the efficient use of resources throughout their lifecycle. By promoting the circularity of materials and products, this approach seeks to reduce reliance on virgin resources and enable a more sustainable and regenerative economic model. The central aim of the CE is to develop innovative approaches that sustain products, components, and materials at their optimal utility and worth throughout their entire lifecycle, while generating long-lasting and sustainable economic, environmental, and social benefits for the wider societal system (Ranta et al., 2020). By adopting CE principles, businesses and communities can minimize waste, conserve natural resources, and create closed-loop systems that continuously recycle and reuse materials (Bódizs, 2022), thereby reducing their environmental impact and contributing to a more sustainable future (Ranta et al., 2020). Implementing the CE can catalyze relevant social, technological, institutional, and economic changes that intersect with various aspects of the sustainability transition, such as business model innovation, institutional roles, and governance rules and instruments (Urbinati et al., 2017). As the CE concept continues to evolve, it is essential to understand its impacts on the Environmental, Social, and Governance (abbreviation: ESG) metrics that are increasingly used to evaluate the sustainability and responsible business practices of organizations (Kyriakopoulos, 2021). Although the CE has been extensively examined from an environmental and economic standpoint (García-Barragán et al., 2019), its integration within the broader Environmental, Social, and Governance framework remains a topic that has received relatively less scholarly attention.

2 Theoretical Background

Corporate efficiency, or the CE, and ESG disclosures are two interconnected concepts that have gained significant attention in recent years (Khamisu & Paluri, 2024; Nyantakyi et al., 2023). The CE, which emphasizes the efficient use and reuse

of resources, is closely aligned with the environmental aspect of ESG, as it aims to reduce waste, emissions, and environmental impact (Khan, 2024; Sánchez-García et al., 2024). At the same time, the social and governance components of ESG, such as corporate social responsibility and ethical practices, can serve as enablers for the transition to a more CE (Santiago et al., 2025). The CE, which emphasizes the efficient use and reuse of resources, is closely aligned with the environmental aspect of ESG, as it aims to reduce waste, emissions, and environmental impact (Khan, 2024). At the same time, the social and governance components of ESG, such as corporate social responsibility and ethical practices, can serve as enablers for the transition to a more CE (Palea et al., 2024). One key aspect of the relationship between CE and ESG is the issue of "greenwashing", where companies may misrepresent their environmental practices to appear more sustainable than they truly are (Abouarab et al., 2024). This can undermine the credibility of both the CE and ESG disclosures and highlights the importance of transparent and verifiable reporting on sustainability measures (Dempere et al., 2024). The transition from a linear "take-make-dispose" model to a more circular approach is not without its challenges (Chirumalla et al., 2024). Small and medium-sized enterprises may face barriers in adopting CE practices, such as a lack of resources or knowledge (Mishra et al., 2022). However, the potential benefits of the CE, both in terms of environmental impact and economic gains, make it an increasingly attractive proposition for businesses of all sizes (Knäble et al., 2022). As research on the CE continues to evolve, it will be important to consider the broader context of ESG and how these two concepts can be mutually reinforcing in driving sustainable business practices (Sánchez-García et al., 2024). This includes examining the ways in which the environmental, social, and governance factors that comprise ESG can enable and support the transition to a more circular economic model (Khan, 2024). For instance, strong corporate governance and transparency around sustainability metrics can help build trust and credibility in CE initiatives, while social responsibility programs that prioritize community engagement and worker welfare can facilitate the adoption of circular practices (Zhang & Hao, 2024). Ultimately, a comprehensive understanding of the linkages between CE and ESG will be crucial in developing holistic strategies for achieving long-term sustainability in business operations (Garcia-Saravia Ortiz-de-Montellano et al., 2023). ESG factors are all crucial components of the CE, and a holistic approach that considers the interplay between these elements will be key to realizing the full potential of this shift towards a more sustainable future (Kyriakopoulos, 2021; Yu et al., 2020).

3 Methodology

The paper employed a methodological approach that leveraged Eurostat's existing circular economy indicators to analyze the interplay between circular economy principles and environmental, social, and governance performance. Instead of creating new composite indicators, the research focused on exploring the relationships between the circular economic utilization rate and individual countries' ESG index values, providing valuable insights into their interconnections and interactions.

3.1 Data

This research employs Eurostat's comprehensive CE indicators (Eurostat, 2025), with the circular material use rate as a key measure incorporated in the study. By incorporating the most up-to-date data available, spanning multiple years, the study ensures a robust and relevant analysis of the prevailing trends and conditions. The utilized ESG Index (Risk Watch Initiative, 2025) assesses the environmental, human rights, and health & safety performance of 183 countries using 65 variables. Countries are scored on a scale from 0 to 100, with 0 representing the lowest risk and 100 the highest. This index helps organizations implement effective CSR policies and align with ESG regulations.

3.2 Methodology for analysing interrelationships

The methodology centers on evaluating the interrelationships between circular economy indicators and ESG index values across European Union (abbreviation: EU-27) member states. By comparing the circular material use rate with ESG performance metrics, the study identifies synergies and trade-offs within and between the environmental, social, and governance dimensions. These relationships were analyzed using statistical tools and data visualization techniques, offering a comprehensive framework for assessing the impact of circular economy practices on ESG outcomes. The study explores how the implementation of circular economic principles can influence and shape the environmental, social, and governance aspects of business operations and national policies within the EU-27. Through in-depth analysis, the researchers provide insights into the potential

synergies and tensions that may arise as organizations and governments strive to achieve both operational efficiency and sustainable, responsible practices.

4 Results

The analysis of circular material use and ESG indices across various countries reveals intriguing insights regarding the relationship between these two metrics and their potential impact on sustainable development. The countries with the highest circular material use ratios are Holland, Italy, and Malta. These nations also show relatively strong ESG indices, with Holland scoring 22.61, Italy at 25.73, and Malta at 26.10. The correlation between high circular material use and robust ESG indices indicates a potential synergy between material circularity and overall sustainability performance. This synergy suggests that a focus on circular material use may contribute to the achievement of broader environmental, social, and governance objectives, leading to more holistic and impactful sustainability initiatives. On the other hand, countries with low circular material use rates such as Finland, Ireland, and Romania present a paradox in their ESG indices. Finland, with a modest circular material use rate, exhibits a notably low ESG index, while Ireland's ESG index is higher despite a similar circular material use. Romania, while having the lowest circular material use rate, has a relatively higher ESG index, suggesting that the country's broader sustainability initiatives may not yet be fully reflected in its circular economy performance. This discrepancy highlights the need for further investigation into the factors influencing the disparity between circular economy metrics and ESG indices. Specifically, this discrepancy suggests that ESG indices may not fully capture the nuances of a country's circular economic efforts, and that a deeper examination of the relationship between circular economy metrics and broader sustainability indicators is warranted. By understanding the complex interplay between these factors, policymakers and researchers can gain a more comprehensive view of a country's environmental, social, and governance performance. Analysis of the countries with the highest ESG scores, such as Hungary, Bulgaria, and Romania, reveals a mismatch between their ESG performance and circular material use. Despite having notable ESG scores, Hungary and Bulgaria exhibit very low circular material use rates of 5.9% and 4.9%, respectively. This indicates that while these countries excel in other areas of sustainability, their circular economy strategies may be underdeveloped, potentially hindering their progress towards comprehensive sustainability goals.

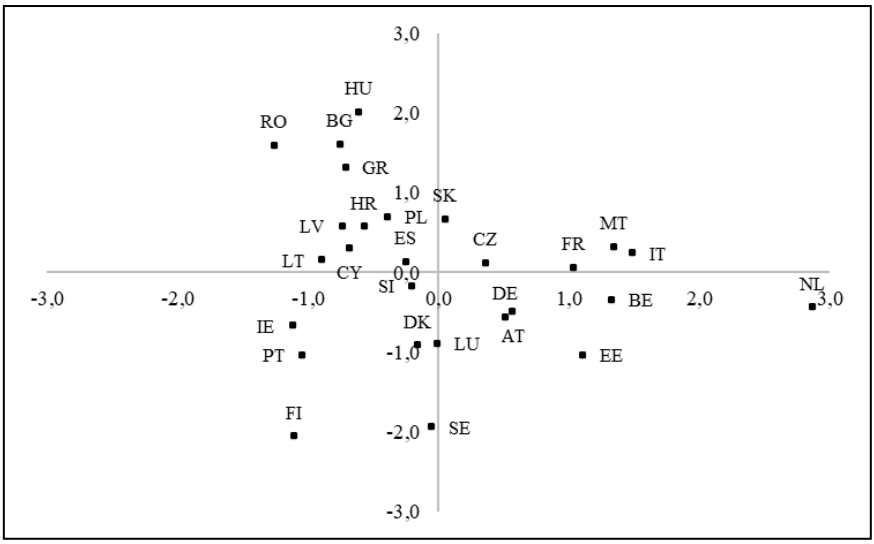

Figure 1: Relationship between ESG index and circular material use rate for EU-27.

The countries with the lowest ESG indices, such as Finland, Sweden, and Portugal, represent some of the best ESG performers globally. Finland, despite its relatively low circular material use rate, excels in other key sustainability measures, likely due to its strong environmental policies, high levels of innovation in sustainable technologies, and effective waste management strategies. Sweden's low ESG index further supports this notion, as the country is widely recognized as a leader in renewable energy generation and sustainable business practices, although its circular economy metrics may still be gradually improving. Similarly, Portugal, with a modest ESG score of 19.87, demonstrates that a country can achieve notable ESG success through comprehensive efforts across social, environmental, and governance dimensions, even if its circular economy practices are still evolving and maturing.

5 Discussion

The relationship between ESG performance and circular economy is complex and multifaceted. Circular material use can have a positive impact on economic development and resilient growth, reducing dependency on resource markets and exposure to resource price shocks (García-Barragán et al., 2019). However, the transition to a circular economy model necessitates profound transformations in existing production and consumption patterns, which can have far-reaching social

implications that must be carefully considered and addressed. However, it is important to recognize that high ESG performance is not solely contingent on circular economy metrics, as a multitude of other factors, such as a country's commitment to innovation, the strength of its governance structures, and the comprehensiveness of its environmental policies, also play a pivotal role in shaping overall sustainability outcomes. Countries with high circular material use tend to have stronger ESG indices, as circular economy principles can promote environmental protection, social responsibility, and robust governance practices (De Pascale et al., 2021). However, the connection between circular material use and ESG indices is not entirely linear. As highlighted in the literature, countries with high circular material use, such as Hungary and Bulgaria, tend to have stronger ESG indices. This suggests that improving circular material use could enhance ESG performance, leading to improved environmental protection, social responsibility, and robust governance practices (García-Barragán et al., 2019).

6 Conclusions

In conclusion, while there is some correlation between circular material use and ESG indices, the relationship is complex and not entirely linear. Countries with high circular material use do tend to have stronger ESG indices, but other factors, such as innovation, governance, and environmental policies, also play a significant role in shaping these outcomes. For countries like Hungary and Bulgaria, improving their circular material use could further enhance their ESG performance, potentially leading to improved environmental protection, social responsibility, and robust governance practices. On the other hand, nations like Finland and Sweden demonstrate that high ESG indices are achievable through holistic sustainability strategies, even with lower circular economy metrics, by prioritizing a diverse range of sustainability initiatives beyond just material circularity. The interplay between circular material use and ESG performance is multifaceted, with various socioeconomic, political, and environmental factors contributing to the overall sustainability outcomes of a country. A comprehensive approach that addresses not only material circularity but also innovation, governance, and environmental policies is crucial for achieving meaningful and lasting progress in environmental, social, and governance practices. The paper is limited by its reliance on secondary data, constraining the ability to establish causal relationships; addressing this through the integration of primary data and a deeper exploration of indicator relationships and

standardization challenges could provide a more holistic understanding of the interplay between circular economy practices and ESG performance.

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