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Bibliometric Analysis on the Role of Sustainable Entrepreneurship in Addressing Circular Economy Challenges

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ABSTRACT

This bibliometric analysis delves into the burgeoning discourse surrounding sustainable entrepreneurship's role in addressing challenges within the circular economy framework. By synthesizing a vast array of scholarly literature spanning from 2006 to 2024, the study provides comprehensive insights into the intersection of these two pivotal areas. Through quantitative techniques such as co-citation analysis and keyword co-occurrence analysis, the analysis uncovers prominent themes, research clusters, and intellectual structures within the field. The results reveal a robust body of research exploring various dimensions of sustainable entrepreneurship and the circular economy, ranging from theoretical underpinnings to practical implications. Furthermore, the study identifies influential works and emerging trends, offering valuable guidance for future research directions. This research not only enriches our understanding of how sustainable entrepreneurship can contribute to a circular economy but also holds significant implications for academia, industry, and policymaking by informing strategic decision-making and inspiring innovative practices aimed at fostering sustainability and resilience in a rapidly changing world.

Keywords: *Sustainable Entrepreneurship, Circular Economy, Bibliometric Analysis*

1. INTRODUCTION

In recent years, the discourse surrounding sustainable entrepreneurship and the circular economy has gained significant traction within academic, industrial, and policy spheres [1]–[3]. As the global community grapples with pressing environmental challenges and the imperative for sustainable development becomes increasingly apparent, the intersection of sustainable entrepreneurship and circular economy principles emerges as a pivotal area of inquiry [4], [5]. This research embarks on a bibliometric analysis to comprehensively investigate the role of sustainable entrepreneurship in addressing challenges within the circular economy framework.

The concept of sustainable entrepreneurship encapsulates the pursuit of economic activities that not only generate profit but also prioritize environmental and social sustainability [6]–[8]. Simultaneously, the circular economy paradigm advocates for a regenerative approach to resource utilization, aiming to minimize waste and maximize resource efficiency through strategies such as recycling, reuse, and remanufacturing [9], [10]. Recognizing the intrinsic connection between these two concepts offers profound insights into how businesses can contribute to sustainable development while fostering economic growth.

Despite the growing interest and recognition of sustainable entrepreneurship and the circular economy, there remains a gap in understanding the precise nature of their intersection, the evolution of related research themes, and the contributions of scholars in advancing knowledge within this domain. Moreover, the complex interplay between sustainable entrepreneurship and circular economy principles necessitates a systematic analysis to elucidate key trends, identify research gaps, and guide future inquiries.

The objectives of this paper as follow:

1. To conduct a comprehensive bibliometric analysis of literature pertaining to sustainable entrepreneurship and the circular economy.
2. To identify prominent themes, research clusters, and intellectual structures within the field.
3. To assess the evolution of scholarly interest and the dissemination of knowledge over time.
4. To uncover emerging trends, gaps, and opportunities for future research directions.

This research holds significant implications for academia, industry, and policymakers alike. By synthesizing existing knowledge and mapping the intellectual landscape of sustainable entrepreneurship within the context of the circular economy, this study aims to provide valuable insights that can inform strategic decision-making, inspire innovative business practices, and shape policy interventions aimed at fostering sustainability and resilience in a rapidly changing world. Moreover, by identifying research gaps and emerging trends, this research seeks to catalyze further scholarly inquiry and collaboration, ultimately advancing our collective understanding of sustainable entrepreneurship and its role in transitioning towards a circular economy paradigm.

2. LITERATURE REVIEW

2.1 Sustainable Entrepreneurship

Sustainable entrepreneurship refers to the practice of creating and managing a business that is economically viable, socially responsible, and environmentally friendly. It involves recognizing opportunities for sustainable development and using innovative approaches to address social and environmental challenges while generating profits. Sustainable entrepreneurship competence (SEC) is a significant factor that can explain entrepreneurial intentions, and it has a direct effect on entrepreneurial intentions in both higher education and secondary education contexts [11]–[13]. Perceived behavioral control (PBC) moderates the relationship between SEC and entrepreneurial intentions, and the effect of SEC decreases when PBC increases. Sustainable entrepreneurship is gaining popularity worldwide, particularly in the US, due to promoting regulations for some sustainability areas, the high availability of impact investment, and the large-scale entrepreneurial ecosystem of the country [14]. Digital platform ecosystems are being used as living labs for sustainable entrepreneurship and innovation, and a conceptual model has been proposed to research and develop sustainable entrepreneurship and innovation with the use of digital platforms. Sustainable entrepreneurship is not limited to large corporations, and SMEs can also practice sustainable entrepreneurship [15].

2.2 Circular Economy

The circular economy (CE) is a regenerative economic system designed to eliminate waste and pollution, keep products and materials in use, and restore natural systems. Unlike traditional linear "take-make-dispose" economics, where resources flow through a one-way process, the circular economy promotes closed loops and continuous cycles. In essence, the circular economy seeks to minimize waste generation and maximize the value extracted from existing resources. Key aspects of the circular economy include reducing waste, extending lifetimes, keeping products and materials in use, and

regenerating natural systems. The circular economy encompasses several interconnected concepts, such as cradle-to-cradle design, biomimicry, and the 3Rs (reduce, reuse, recycle). These ideas aim to create a more efficient and sustainable use of resources, leading to reduced greenhouse gas emissions, lower levels of pollution, and improved resource security.

Various industries have adopted circular economy principles, adapting their operations and business models accordingly [16]. For example, the aerospace industry focuses on designing aircraft components that can be easily disassembled and repaired, while the fashion sector emphasizes the use of sustainable fabrics and garments made from recycled materials [16], [17]. Digital technology plays a crucial role in advancing the circular economy, providing new ways to optimize resource usage, improve efficiency, and facilitate collaboration among stakeholders. The smart circular economy paradigm combines digital technologies with circular economy principles, leveraging big data analytics, IoT devices, blockchain, and AI algorithms to enhance resource management and drive innovation [17], [18]. Challenges associated with implementing the circular economy include changing consumer behaviors, developing effective policies and regulatory frameworks, and overcoming technical barriers related to material recovery and processing. However, the benefits of transitioning towards a circular economy far outweigh its obstacles, offering a pathway towards a more equitable, prosperous, and sustainable future.

3. METHODS

This research employs a systematic bibliometric approach to analyze the scholarly literature on sustainable entrepreneurship and the circular economy. The primary dataset comprises peer-reviewed articles, conference papers, and other relevant academic publications sourced from reputable databases such as Web of Science, Scopus, and Google Scholar. Keywords including "sustainable entrepreneurship," "circular economy," and related terms will be used to retrieve relevant literature. The bibliometric analysis will encompass various quantitative techniques such as co-citation analysis and keyword co-occurrence analysis to uncover patterns, relationships, and intellectual structures within the literature. Additionally, VOSViewer software will be utilized to generate visual representations of the bibliometric networks. The analysis will be conducted over a specified time frame (2006-2024) to capture temporal trends and assess the evolution of research themes. The findings of this methodological approach will provide a comprehensive understanding of the state of research in sustainable entrepreneurship and its intersection with the circular economy, thereby facilitating informed insights and guiding future scholarly inquiry.

4. RESULTS AND DISCUSSION

4.1 Research Data Matrics

Table 1. Research Data Metrics

Publication years	: 2006-2024
Citation years	: 18 (2006-2024)
Paper	: 980
Citations	: 112765
Cites/year	: 6264.72
Cites/paper	: 115.07

Cites/author	: 43459.14
Papers/author	: 414.09
Author/paper	: 2.98
h-index	: 126
g-index	: 328
hI,norm	: 83
hI,annual	: 4.61
hA-index	: 69
Papers with ACC	: 1,2,5,10,20:824,691,513,336,209

Source: Publish or Perish Output, 2024

Table 1 provides key metrics derived from the bibliometric analysis of the research data encompassing publications from 2006 to 2024. The dataset comprises 980 papers with a total citation count of 112,765, resulting in an average of approximately 115 citations per paper. The analysis reveals a steady growth in citations over time, with an average of 6,264.72 citations per year. On average, each author has contributed to approximately 414 papers and has been cited over 43,459 times. The collaborative nature of the research is evident, with an average of nearly three authors per paper. The h-index, a measure of both productivity and citation impact, is calculated at 126, indicating the presence of a substantial core body of highly cited work within the dataset. The g-index, a variant of the h-index, is 328, further reflecting the impact of the research output. Additionally, the table presents various hI indices, indicating the number of papers with a certain level of citation count, with hI,norm standing at 83 and hI,annual at 4.61. The hA-index, a measure of authorship impact, is determined to be 69. Furthermore, the table outlines the distribution of papers with different levels of accumulated citation counts, indicating the prevalence of highly cited papers within the dataset. Overall, these metrics offer valuable insights into the citation impact, productivity, and collaborative dynamics of the research in sustainable entrepreneurship and the circular economy.

4.2 Prominent Themes and Clusterization

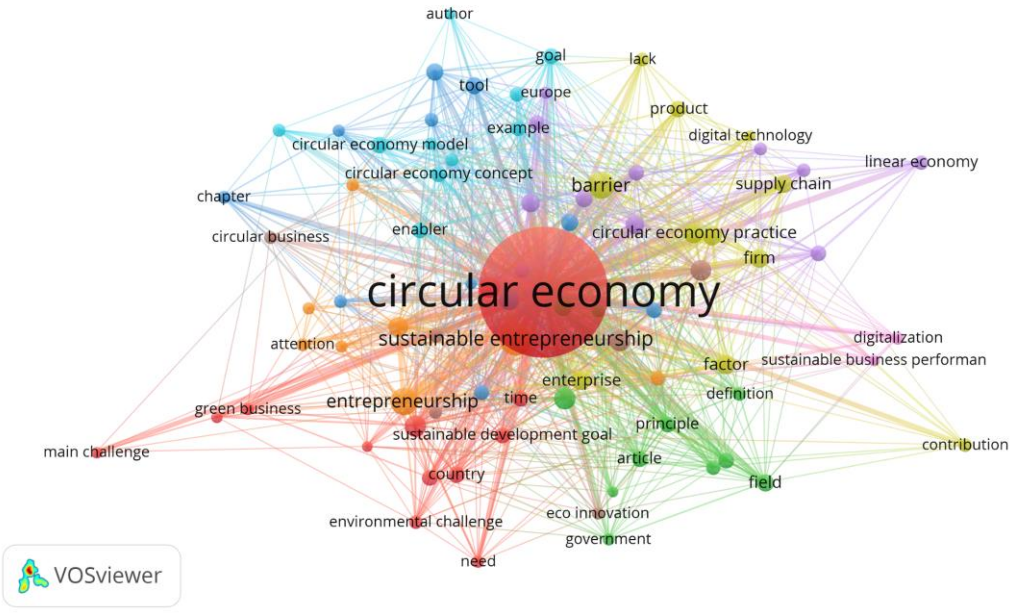

Figure 1. Network Visualization
Source: Data Analysis Result, 2024

The visualization seems to have different clusters indicated by different colors. Each cluster may represent a group of terms that are frequently associated with each other within the literature on circular economy. The most prominent part of the network is labeled "circular economy," which is the central node and likely the main subject of the analysis. This suggests that the network visualization is based on a bibliometric analysis of literature pertaining to the circular economy.

1. Red Cluster: This cluster includes terms like "sustainable entrepreneurship," "green business," "main challenge," and "environmental challenge." This suggests a focus on the challenges and entrepreneurial aspects within the circular economy.
2. Yellow Cluster: The terms include "circular economy practice," "circular economy model," "circular economy concept," and "barrier." This cluster seems to focus on practical and conceptual aspects of implementing the circular economy.
3. Blue Cluster: This includes "linear economy," "supply chain," "digital technology," and "product." It is likely focusing on the technical and logistical aspects of the circular economy, in contrast to the traditional linear economy.
4. Green Cluster: This cluster includes "government," "eco innovation," "field," and "need." It could emphasize the role of innovation and government in the circular economy.
5. The purple cluster with terms like "linear economy," "digitalization," and "sustainable business performance" suggests a focus on how businesses can use technology to be more sustainable and perform better in the long run, while moving away from a traditional use-and-throw-away economy towards a more recycle-and-reuse approach.

4.3 Trend Analysis Overyear

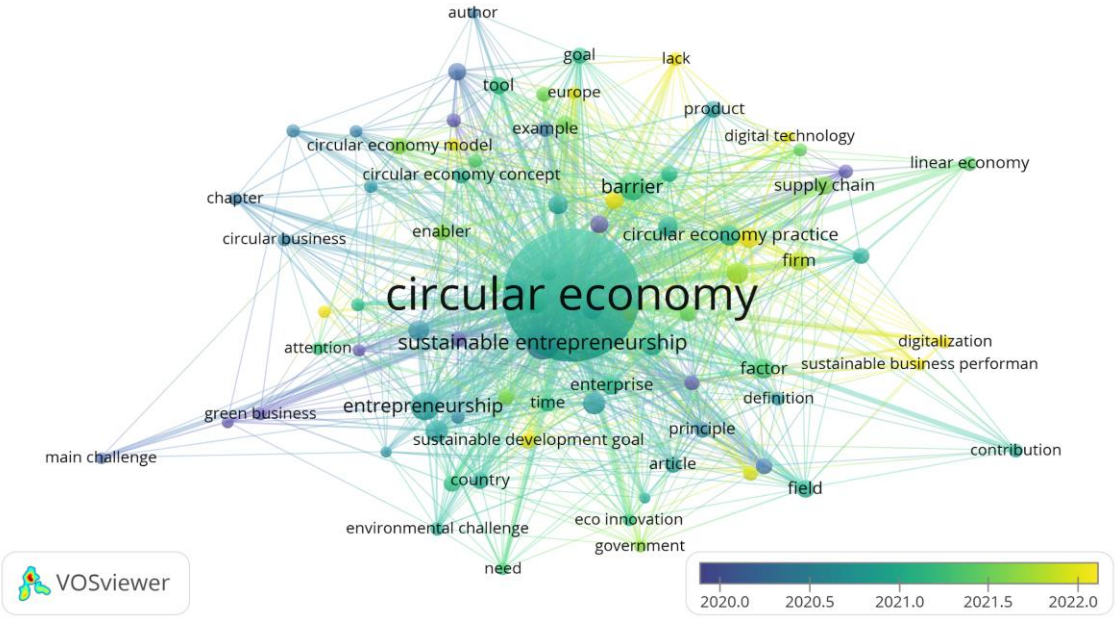

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2024

The visualization indicates a shift in research focus within the circular economy field over time. The nodes, representing different research topics, are color-coded to signify the year of the research, with darker colors indicating earlier research and lighter colors representing more recent work. By observing the gradient from darker to lighter nodes, one can deduce the trajectory of research themes. Topics associated with darker nodes were likely to have been more prevalent or

foundational in earlier years. In contrast, those represented by lighter nodes have gained prominence in more recent studies, suggesting a potential shift in the research community's interest towards these newer topics. Furthermore, if there is a clustering of lighter-colored nodes in certain areas of the network, it would suggest that recent research has been particularly focused on those issues. Conversely, a concentration of darker nodes would indicate areas that were once central to the discourse but may not be at the forefront of recent studies.

4.4 Citation Analysis

Table 3. The Most Impactful Literatures

Citations	Authors and year	Title
6970	M Geissdoerfer, P Savaget, NMP Bocken (2017)	The Circular Economy-A new sustainability paradigm>
6695	J Kirchherr, D Reike, M Hekkert (2017)	Conceptualizing the circular economy: An analysis of 114 definitions
5967	P Ghisellini, C Cialani, S Ulgiati (2016)	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems
3625	J Korhonen, A Honkasalo, J Seppala (2018)	Circular economy: the concept and its limitations
3567	NMP Bocken, I De Pauw, C Bakker (2016)	Product design and business model strategies for a circular economy
3294	A Murray, K Skene, K Haynes (2017)	The circular economy: an interdisciplinary exploration of the concept and application in a global context
2702	M Lieder, A Rashid (2016)	Towards circular economy implementation: a comprehensive review in context of manufacturing industry
2177	A Tukker (2015)	Product services for a resource-efficient and circular economy-a review
2160	B Cohen, MI Winn (2007)	Market imperfections, opportunity and sustainable entrepreneurship
1646	M Lewandowski (2016)	Designing the business models for circular economy-Towards the conceptual framework

Source: Publish or Perish Output, 2024

The table titled lists scholarly articles that have made significant contributions to the field of circular economy based on their citation counts, which is a common metric used to measure the influence or impact of academic work. At the top of the list with 6,970 citations is a 2017 paper by Geissdoerfer, Savaget, and Bocken, which presents the circular economy as a new paradigm for sustainability. This suggests that the paper has been highly influential in shaping contemporary discussions and research in the field. Following closely is another 2017 article by Kirchherr, Reike, and Hekkert, with 6,695 citations, that offers a critical analysis of 114 definitions of the circular economy, indicating a significant interest in defining and conceptualizing the circular economy among scholars and practitioners. The third article, by Ghisellini, Cialani, and Ulgiati from 2016, has 5,967 citations and provides a review that frames the circular economy as a transition towards a balanced environmental and economic system, pointing to its foundational role in the academic discourse. With 3,625 citations, Korhonen, Honkasalo, and Seppala's 2018 publication critiques the concept of the circular economy and discusses its limitations, which is crucial for developing a balanced and critical understanding of the concept. Bocken, De Pauw, and Bakker's 2016 paper, cited 3,567 times, explores product design and business models for a circular economy, highlighting the practical application of the concept in business. Murray, Skene, and Haynes's 2017 work has received 3,294 citations and explores the circular economy from an interdisciplinary perspective, indicating the broad appeal and relevance of the topic across different academic disciplines. Lieder and Rashid in 2016, with 2,702 citations, offer a comprehensive review of circular economy implementation in

the manufacturing industry, underscoring the industrial application of the concept. Tukker's 2015 review, cited 2,177 times, focuses on product services in the context of a resource-efficient and circular economy, reflecting the early scholarly efforts to integrate circular economy principles into service design. The 2007 article by Cohen and Winn, which has been cited 2,160 times, discusses market imperfections and opportunities for sustainable entrepreneurship, predating many other works on the list and indicating a longer-term influence on the topic. Lastly, with 1,646 citations, Lewandowski's 2016 work contributes to the conceptual framework for designing business models for a circular economy, suggesting its utility for academic and practical applications in business strategy.

4.5 Density Visualization

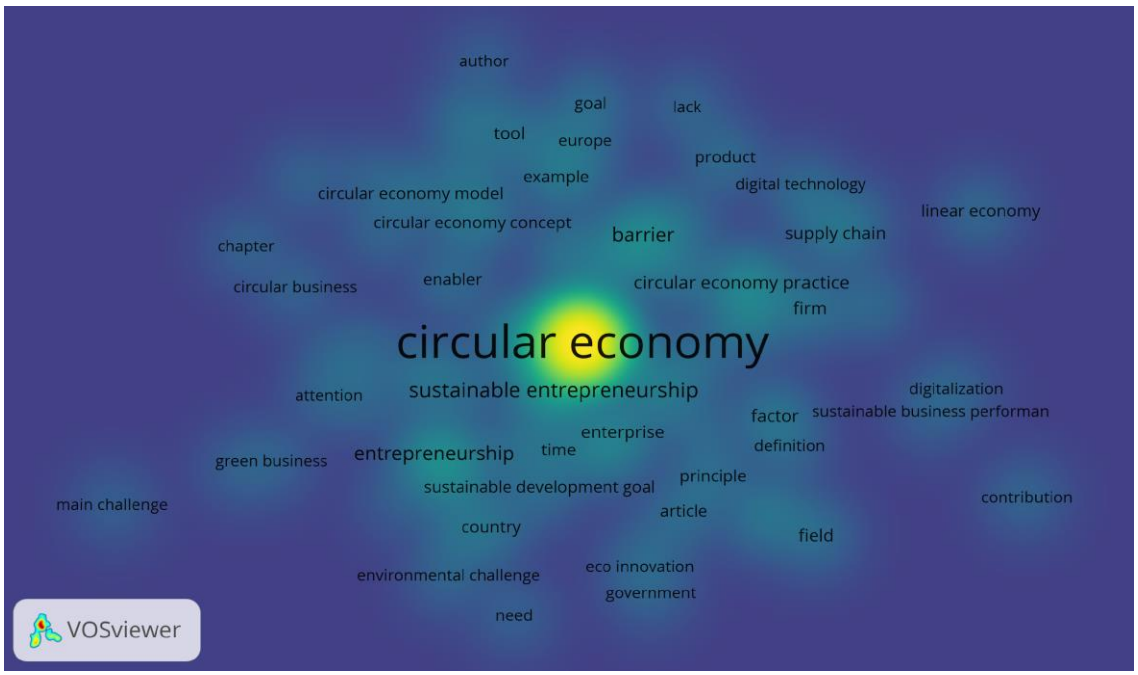

Figure 3. Density Visualization
Source: Data Analysis Result, 2024

Based on the visualization from VOSviewer in the image, several potential research topics within the field of circular economy can be identified. The image suggests a multitude of interrelated research topics within the circular economy domain. One prominent area of investigation is the development and implementation of "circular economy models and practices," focusing on the adaptation of business and industrial processes to circular principles. Closely linked is "sustainable entrepreneurship," which examines how new business ventures can integrate sustainability at their core. Another critical research theme is "environmental challenges and solutions," where the goal is to pinpoint environmental issues and conceive innovative strategies within the circular economy framework to mitigate them. The role of "digital technology" and "digitalization" also emerges as a significant area, with research delving into how technological progress is shaping the transition towards more sustainable economic systems.

Additionally, there is a scholarly discourse contrasting "linear vs. circular economy" models, exploring their respective benefits and drawbacks. Within this discourse, there's a focus on identifying the "barriers" that impede and the "enablers" that support the shift to a circular economy. Another related field is the transformation of "supply chain" operations to reduce waste and increase efficiency, indicating a move towards systemic changes in how goods are produced and consumed. Lastly, the term "government" points to an exploration of the impact of policies and regulations in

fostering circular economy practices, highlighting the intersection of public policy and sustainable economic development.

CONCLUSION

In conclusion, this bibliometric analysis provides valuable insights into the evolving landscape of research on sustainable entrepreneurship and the circular economy. The study reveals a substantial body of literature exploring various facets of these interconnected domains, ranging from theoretical frameworks and conceptualizations to practical applications and policy implications. Key themes identified include challenges and opportunities in implementing circular economy principles, the role of sustainable entrepreneurship in driving innovation and sustainability, and the integration of digital technologies to enhance resource efficiency and collaboration. Moreover, the analysis highlights influential works and emerging trends, shedding light on the trajectory of scholarly inquiry and potential avenues for future research. Overall, this research contributes to a deeper understanding of how businesses can contribute to sustainability within the context of a circular economy, offering insights that can inform strategic decision-making, inspire innovative practices, and shape policy interventions aimed at fostering a more sustainable and resilient future.

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