Analysis of SMEs Readiness in Developing Countries to Implement the Circular Economy

Efni Cerya[(✉)], Idris, and Joan Marta

Doctoral Program of Environmental and Development Studies, Universitas Negeri Padang, Padang, Indonesia
`efnicerya@fe.unp.ac.id`

Abstract. The circular economy has become a hot issue to discuss in recent years with the improvement related to the environment. In this context, this article aims to develop mapping literature on the readiness to analyse SMEs in developing countries implementing a circular economy. According to the systematic database approach adopted and based on a rigorous process, 58 articles were selected for ScienceDirect. Based on a content analysis methodology, this report offers a bibliometric examination of this field and of the growing interest among academics in the adoption of circular economies by SMEs in poor nations. Cluster 1 shows the relationship between innovation, economy, business model, and resource efficiency; Meanwhile, cluster 2 oversees industry 4.0 in implementing a circular economy for SMEs in developing countries. The review also highlights the gaps in the literature that are indicative of future opportunities for environmental research, whether it be quantitative, qualitative, action-oriented, or hybrid.

Keywords: SMEs · Circular Economy · Developing Countries

1 Introduction

The growing world population is a consideration for industry and state policymakers in limiting its negative impacts, primarily environmental issues. The adverse effects of environmental problems can be in the form of depletion of natural resources, exacerbated by high demand and consumption of natural resources that have been exhausted [1]. Therefore, policymakers are increasingly highlighting the possibility of transitioning the economic system from a linear model to a circular economy business model to realize economic, social, and environmental development [2, 3].

The circular economy concept builds the relationship between resource use and waste disposal to turn a linear system into a circular one. The circular economy is a global economic model for consuming limited resources focusing on intelligent materials, products, and systems design [4, 5]. The circular economy is a response to the concept of an inefficient industrial system and has various definitions and interpretations stemming from the evolution of the idea spanning multiple sciences [6, 7]. The majority of circular economy literature emphasizes the benefits of its production [8], ability to create value [9], and social benefits that include economic models based on

renewable energy and resource efficiency [10]. Since there is no agreed-upon definition of the circular economy, there is much discussion regarding its application.

The circular economy has attracted much attention worldwide because it can balance economic, social, and environmental development in tackling resources and environmental problems. Over the years, in many low- and middle-income countries, little attention has been paid to the circular economy. The academic research community has recently begun to pay attention to circular economy practices in developing countries. Several articles have been conducted with case studies of specific economies in certain countries, such as China [4, 11], India [12, 13], and Pakistan [14]. The circular economy offers enormous opportunities in terms of waste reduction. There is less vulnerability to supply chain-related hazards from a business standpoint [15], such as volatility in raw material prices and procurement processes [16]. They found that implementing CE is considered a business opportunity by companies implementing CE practices. This is supported by research results showing a positive correlation between CE practices and business performance.

SMEs as business entities that significantly contribute to GDP and job creation has played a substantial role in economic development in developing countries. SMEs are essential actors in increasing innovation and competitiveness. SMEs formulate various strategies to optimize profits and sometimes ignore environmental sustainability. It is undeniable that SMEs also contribute to environmental pollution due to operational and non-operational activities. SMEs in developed and developing countries have begun to transition to a circular economy to maintain environmental balance in every business activity, from input to output. However, the readiness of the circular economy in SMEs, particularly in developing nations, is still the subject of very few studies.

In India, a study developed an Extended Theory of Planned Behavior (ETPB) model to explore circular economy readiness among MSME manufacturers [17]. The study's results demonstrate the importance of green economy incentives and environmental commitments. The findings also suggest the role of solid attitudes, increased social pressure, green economy incentives, and environmental responsibility in improving circular economy readiness among small firms.

Additional research on the main challenges to China's adoption of a circular economy [18]. With 43 million SMEs in China by 2020, they will continue to be the country's dominant economic force. The majority of SMEs continue to use conventional economic development strategies without taking into account resource availability and environmental impact. To address this issue, Chinese SMEs are beginning to implement a circular economy into their operations. According to Min et al. (2021), there are two perspectives from which the practice of adopting a circular economy can be examined: internal variables and external factors. Resources and capabilities are internal elements that affect SMEs, and political, economic, social, environmental, and legal aspects are external factors.

This article aims to develop literature on the analysis of the readiness of SMEs in developing countries to implement a circular economy. This article will discuss this topic by conducting systematic literature (SLR). The research developed here reviews the existing literature systematically, namely several 58 articles obtained from the ScienceDirect database with the keywords "circular economy," "SMEs," and "developing

countries." These documents were obtained from the ScienceDirect database, which was first identified to match the topics discussed, and then bibliometric analysis was carried out through VOS-viewer software. The selection of topics to search for on a scientific platform is an important component of the bibliometric analysis. Previous studies have shown that authors from a variety of scientific domains have taken into account bibliometric analyses [19, 20].

2 Methods

This study uses the Systematic Literature Review (SLR) research method. A literature review is a process of identifying, assessing, and interpreting studies in a particular field through examining and systemizing concepts, practices, and theories [21]. A literature review summarizes and critically assesses the available literature on a particular subject [22]. The Systematic Literature Review (SLR) includes a list of the peer-reviewed and grey literature research as well as rigorous criteria for identifying, evaluating, and synthesizing the literature. SLR tries to limit system faults or biases while also testing hypotheses and theories or developing new ideas [23, 24].

The approach and steps taken in this study follow the instructions for SRL from the study of Thomé et al. (2016). First, the scope and objectives of the review are clearly defined, then select the database, keywords, and criteria for searching. Second, search for articles in the database with predetermined filters and criteria. Third, perform a bibliometric analysis to determine how the study topic has changed over time, identifying the most pertinent publications and authors, nations, and organizations to comprehend the stage of theme development. By combining the key contributions of the research in the examined sample, content analysis is done in the fourth phase to deepen understanding on the issue. Finally, the data obtained from bibliometric analysis and content analysis are interpreted. Figure 1 presents the stages of SRL.

1) *Planning the Systematic Literature Review*

In this phase, the scope of the review is determined. The scope of the review in this study is to analyze existing studies related to the readiness of SMEs in developing countries to implement a circular economy. The database of choice was ScienceDirect (Elsevier) to locate these studies. This platform was chosen because it is the largest database in the world dedicated to significant scientific and medical research, with 16 million unique visitors every month. This platform provides more than 80,000 peer-reviewed references to researchers in more than 100 developing countries, and as many
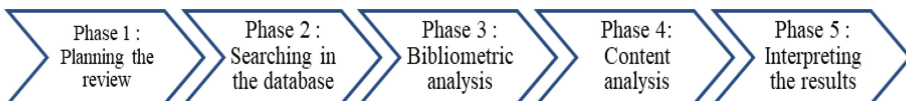
Fig. 1. General stages of SRL, according to Thomé et al. (2016)

as 1 billion articles are downloaded by researchers [26]. The keywords used in this research are "circular economy", "SMEs", and "developing countries".

2) *Searching in the database*

Data were collected in May 2022 and resulted in an initial sample of 401 documents on the ScienceDirect platform. After that, the researchers filtered by limiting the years, namely 2012–202, and obtained 307 documents. Furthermore, it was filtered by type of article. Namely, only research articles were considered, so 204 documents were obtained. The number of papers still being searched for, and the search criteria are shown in Table 1.

The next step is to re-filter the ScienceDirect documents. Only a small portion of the chosen papers match the study's objectives and findings, with a total of 58 articles being deemed pertinent. In light of comparable studies that apply for systematic literature reviews and bibliometric analysis, such as Gonçalves et al. (2022) with 69 articles and Ferreira et al. (2018) with 53 articles.

3) *Bibliometric analysis*

Bibliometric analysis maps the academic literature on a certain topic to analyze scientific articles quantitatively. In order to comprehend and draw conclusions, this bibliometric method maps pertinent publications, authors, institutions, and terms on the basis of academic achievement. This study uses bibliometric analysis to identify scientific research areas, combine previous works, and comprehend the stages of subject development. VOSviewer is the program used to aid in bibliometric analysis and data visualization. Additionally, the examined material is read and organized using Mendeley software, and graphs are produced outside of the database using Microsoft Excel.

4) *Content analysis*

Then, we conducted a thorough content analysis to go over our core goals, pinpoint and examine the primary research streams, summarize the most recent findings, and identify key openings for new research routes. We constructed and displayed a bibliometric network using the VOS-Viewer software version 1.6.18 in order to identify the primary research streams [29]. Content analysis is a method for researching document and text analysis that uses a systematic methodology to characterize and gauge the clarity of content in relation to predetermined categories [30], and permits repeatable and

Table 1. Search criteria on the ScienceDirect platform

Search Criteria	Entry	Results
Search filed	Article title, Abstract, Keywords	
Keywords	"Circular economy", SMEs", and "Developing countries"	401
Filter 1	Years: 2012–2021	307
Filter 2	Article type: Research articles	204
Total documents		204

reliable inferences. Despite being a methodical approach, content analysis is nevertheless subjective because many possibilities and interpretations must be taken into account while conducting the research.

This analysis is not just a process of listing papers; rather, it is a critical and evaluative report that examines what has been published in a specific field, synthesizes it, and explores the consistency and inconsistency seen in prior research, thereby identifying gaps in the literature and suggesting new research topics. The primary goals of the literature review are to establish the conceptual underpinnings of the discipline, to discover patterns, themes, and issues in current research, and to contribute to theory development [31].

5) *Interpreting the result*

The analysis's findings are currently interpreted and discussed. The results of this investigation will be explained in the section that follows.

3   Results

3.1   Presentation of Result

From 2012–2021, as many as 58 research articles were obtained from the ScienceDirect platform, which was then filtered to suit the topics of "circular economy", "SMEs", and "developing countries". Figure 2 presents a graph with the evolution of annual publications on the topic. The following figure shows the growing trend in the last decade. The most publications are in 2021, with as many as 25 publications. Meanwhile, in 2012, 2015, and 2016 there were no publications related to this topic. And in 2017, the number of studies related to this topic increased until 2021.

Figure 3 presents the number of published articles by the journal. It can be seen that the most publications on this topic are Journal of Cleaner Production (23 publications), Resource, Conservation and Recycling (6 publications), and Sustainable Production and Consumption (4 publications).

Table 2 presents the top 10 articles based on the number of citations. The following table shows that the highest number of citations was 663, with the article "A review of the circular economy in China: moving from rhetoric to implementation" written by Su et al. and produced in 2013.

3.2   Bibliometric Analysis

The bibliometric analysis enables us to draw attention to pertinent data in the literature and might aid in a planned literature review. The analysis performed in this part is founded on the maps-based output from the VOSviewer software. Figure 4 shows the network visualization display, Fig. 5 the overlay visualization, and Fig. 6 the density visualization.

Figure 4 shows a keyword network generated from a sample drawn from ScienceDirect and includes terms with at least 2 occurrences, the number of publications in which those words occur together. The term "china" was removed from the network because
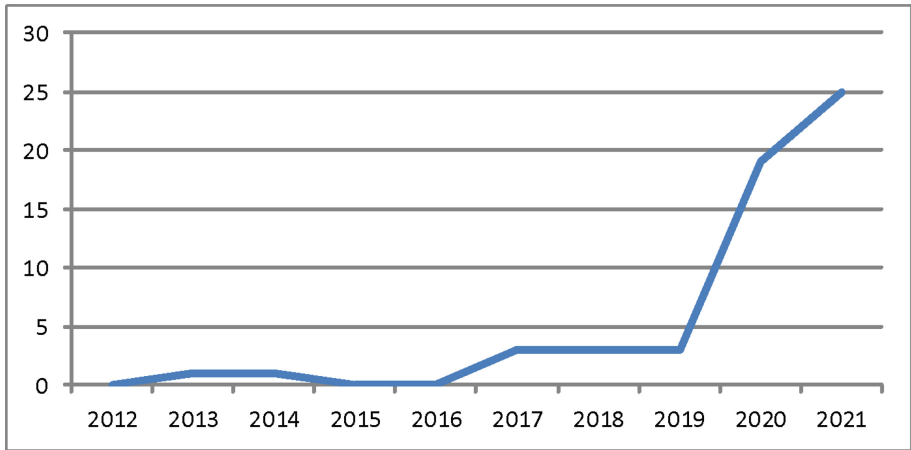
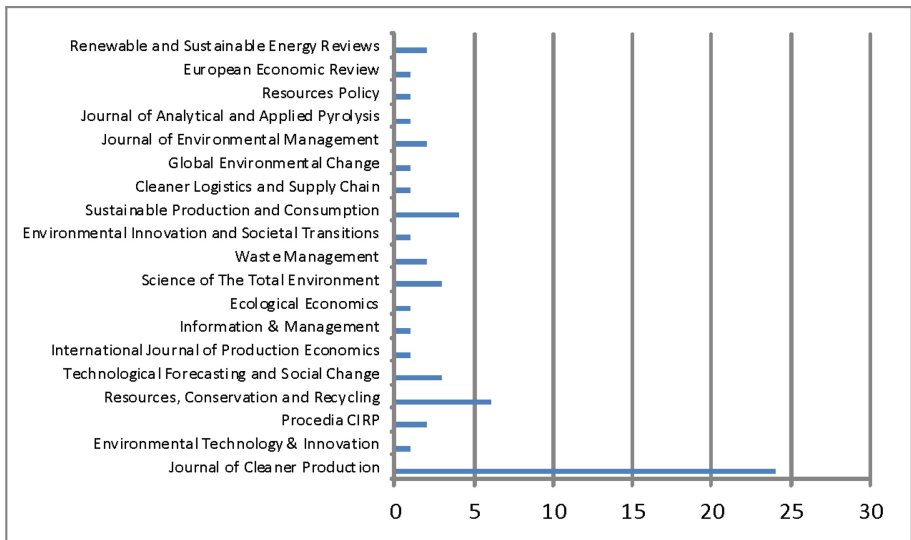**Fig. 2.** Trends by Year

Fig. 3. Publications by Journal

it was unrelated to the topic. From the processed results of the VOSviewer, 6 clusters or groups are produced. The most popular words are "circular economy", "sustainability", "sustainable development", "recycling", and "industry 4.0". Figure 5 is an overlay visualization that shows the relationship between keywords in terms of the year, where the latest study is marked in yellow. The picture shows that the latest topic discussed is related to "innovation".

Table 2. Top 10 Articles Based on Number of Citations

Number	Item Title	Authors	Years Publication	Citation Received
1	A review of the circular economy in China: moving from rhetoric to implementation.	Su, B., Heshmati, A., Geng, Y., & Yu, X.	2013	663
2	The circular economy: new or refurbished as CE exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options.	Reike, D., Vermeulen, W. J., & Witjes, S	2018	423
3	Lost in transition Drivers and barriers in the eco-innovation road to the circular economy.	De Jesus, A., & Mendonça, S.	2018	311
4	Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh.	Moktadir, M. A., Rahman, T., Rahman, M. H., Ali, S. M., & Paul, S. K.	2018	184
5	A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies. *Resources, Conservation and Recycling*, *164*, 105169.	Ibn-Mohammed, T., Mustapha, K. B., Godsell, J., Adamu, Z., Babatunde, K. A., Akintade, D. D.,… & Koh, S. C. L.	2021	176
6	Circular economy at the micro level: A dynamic view of incumbents' struggles and challenges in the textile industry.	Franco, M. A.	2017	164
7	An exploration of firms' awareness and behavior of developing circular economy: Empirical research in China.	Liu, Y., & Bai, Y.	2014	146

Table 2. (*continued*)

Number	Item Title	Authors	Years Publication	Citation Received
8	Pyrolysis of plastic waste: Opportunities and challenges.	Qureshi, M. S., Oasmaa, A., Pihkola, H., Deviatkin, I., Tenhunen, A., Mannila, J.,… & Laine-Ylijoki, J.	2020	117
9	Application of industry 4.0 technologies in SMEs for ethical and sustainable operations: Analysis of challenges.	Kumar, R., Singh, R. K., & Dwivedi, Y. K.	2020	85
10	Strategy development in the framework of waste management.	Zorpas, A. A.	2020	80
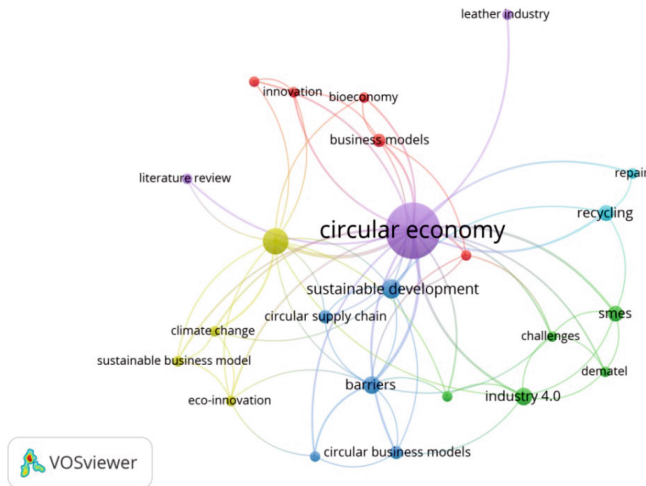
Fig. 4. Network Visualization

4 Discussion and Conclusion

This study aims to map the literature on the analysis of the readiness of SMEs in developing countries to implement a circular economy. This study uses VOSviewer software for bibliometric analysis and takes the ScienceDirect database as the primary source of the observed reference. From the results of the platform and further screening, 58 research articles were identified. This bibliometric effort identifies that some of the problems related to the circular economy of SMEs in developing countries are starting
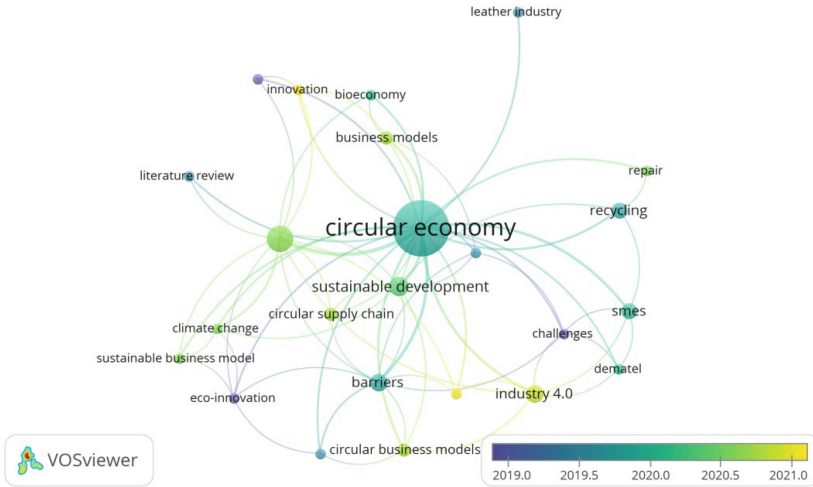
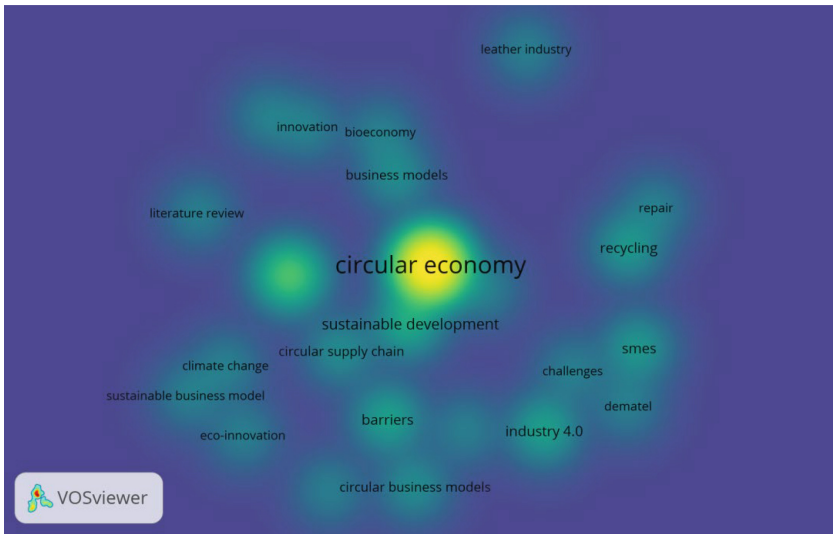**Fig. 5.** Overlay Visualization

Fig. 6. Density Visualization

to attract the attention of researchers. This study highlights the importance of the circular economy as an area of research because of the large number of publications that have been indexed; however, for publications discussing the implementation of the circular economy by SMEs in developing countries, there are still relatively few.

The output obtained from VOSviewer produces 6 clusters. Cluster 1 is the red group which can be seen in Fig. 4. This cluster consists of the keywords "bibliometric", "bioeconomy", "business model", "innovation, and "resource efficiency". The study

by Henry et al. (2020), which examines the circular business model tactics and inno-vations employed by circular start-ups, is the most cited article in this cluster. In this study, a typology of circular start-ups is proposed, including those that are design-based, waste-based, platform-based, service-based, and nature-based.. The study results show that circular start-ups tend to implement appropriate strategies with a higher level of circularity than older companies implementing CE. This shows that circular start-ups can significantly contribute to the transition to a circular economy.

Another relevant article in this cluster is the study by Pizzi et al. (2021), which discusses efforts to systematize and identify the factors that facilitate the transition of technology-based companies to adopting a sustainable business model. This study helps us comprehend how industry 4.0 may be used to create and use a sustainable business strategy that adheres to CE guidelines. The study's findings demonstrate that fintech, a sector that was influenced by industry 4.0, may play a significant role in helping SMEs migrate to more sustainable business models, which improves the integration of circular economy practices. Fintech can help SMEs integrate practices from the circular economy. The advantages of adopting fintech are not just beneficial for businesses. Nevertheless, they benefit the entire community by promoting more eco-friendly production, bettering environmental management, and sustainable neighborhood development.

Cluster 2 contains words such as "industry 4.0", "Dematel", and "SMEs". The article by Bassi & Dias (2019) explores the practice of circular economy in SMEs in European Union member countries. The CE measures investigated include reorganizing water use to minimize use and maximize reuse, utilizing clean energy planning energy use differently to reduce consumption, reducing waste through trash recycling, waste reuse, waste sale to other businesses, and redesigning goods and services to use fewer materials or recovered materials. The findings of the study demonstrate the extreme heterogeneity of CE size between EU nations. The size of the firm (number of workers and total revenue in 2015) and the proportion of revenue invested in R&D in 2015 are found to be important factors in explaining differences between nations at the firm level. The stratified structure (difference in size between countries) is responsible for 6.1 percent to 15.1 percent of the total variation in the circular size.

Mainly related to "industry 4.0", the most relevant article is the work of Kumar et al. (2020) which was followed 85 times and discussed the application of industry 4.0 technology in SMEs. Utilizing industry 4.0 technologies can help businesses operate ethically and sustainably. Due to several operational and budgetary restrictions, espe-cially in developing nations like India, Industry 4.0 technology is difficult for SMEs. The use of industry 4.0 technology in SMEs faces fifteen obstacles, according to academics, given the role that technology plays in ethical business and the circular economy. The Dematel technique was used to investigate the degree of influence and the connections between issues. Researchers in the study have shown that a major obstacle to applying industry 4.0 technology is partners' and customers' lack of motivation. A big effect group challenge is the concern that industrial 4.0 technologies may fail. The research's conclusions will help SMEs develop implementation plans for industry 4.0 technologies for moral and sustainable business practices.

In cluster 3, the most discussed topics are related to sustainable development. The article with the most citations in this cluster is the study conducted by Ngan et al.

(2019) which conducted a comprehensive review of the circular economy concept in developing countries. A popular strategy for promoting sustainable development is the circular economy. However, the adoption of this idea in the industrial sector is still comparatively slow, particularly in emerging nations, despite the fact that these nations collectively have a great potential to have the largest economies and labor forces on the planet. It is crucial to make sure that these nations' progress is sustainable and does not burden future generations. In order to quantify the priority weights of sustainability indicators to industry stakeholders at different stages of the industrial cycle for the shift to a circular economy, a new model is suggested in this work by applying the Fuzzy Analysis Network Process (FANP). According to the study's findings, growing economic performance and public acceptance are the main motivators for stakeholders to support sustainable development. The findings are used as a guide to help stakeholders in the sector make better decisions overall. To promote economic development without undermining environmental welfare and risking social benefits, local governments might embrace ideas for creating rules and incentives that encourage implementing a circular economy in actual industrial activities.

Cluster 4 consists of words such as "climate change", "eco-innovation", "sustainability", and "sustainable business model". The most discussed topic is related to eco-innovation. The article with the most citations in this cluster is a study conducted by de Jesus & Mendonça (2018) with 311 citations. The evidence for several elements that support and obstruct the development of CE is examined in this study. This study focuses on the eco-innovation (EI) pathway to CE and makes an effort to combine the disparate yet currently available research on how "transformative innovation" can accelerate this transition while addressing sustainability-related obstacles. The results imply that a perspective suitable for comprehending the shift to CE can be obtained by combining the innovation systems approach with the more recent "transformation change" in innovation studies.

In the next cluster, the article with the most citations is the study conducted by Moktadir et al. (2018) with 184 citations. This study examines Bangladesh's "leather industry" as a force behind sustainable manufacturing methods and a circular economy. In order to lessen environmental issues, the manufacturing sector has begun to implement sustainable manufacturing methods and a circular economy in the supply chain. This is because these practices and a circular economy result in less waste creation and less energy and material consumption. The growth and stability of an economy are substantially influenced by the leather industry. Nevertheless, it has a bad reputation because to its contribution to environmental pollution. In order to improve their reputation with customers and to comply with government regulations, the Bangladesh leather sector is therefore attempting to embrace sustainable manufacturing techniques as part of green supply chain initiatives. The primary contribution of this study is an evaluation, prioritization, and ranking of the factors that influence sustainable manufacturing practices in the leather sector of Bangladesh. The findings demonstrate that adopting sustainable production techniques in the Bangladesh leather sector requires knowledge of the circular economy. This study will assist managers of leather companies in developing plans for making the best use of available resources and minimizing waste in the framework of a circular economy.

Cluster 6 has two keywords, "recycling" and "repair". One of the articles discussed on this topic is a study conducted by [39] which discusses the circular economy in the plastic waste sector in Taiwan and lessons for developing countries. The study looks into how Taiwan's industrialization process used network-based communal bricolage together with an adaptable institutional governance framework to build its plastic waste business into an industrial-level circular economy. The study comes to the conclusion that the industrial manufacturing sector is the basis on which developing nations can accumulate endogenous social skills and can facilitate the emergence of network-based collective bricolage; for developing nations trying to build circular economies based on their endogenous small and medium enterprises, developing network-based collective bricolage in conjunction with adaptive institutional governance is a crucial and effective strategy. While supporting the construction of a circular economy, the shift to a green environment-related industry can further encourage economic development and create new projects, businesses, and employment possibilities.

Meanwhile, the results of the network analysis show that a topic that is still rarely discussed related to the circular economy by SMEs in developing countries is one of them is "sustainability". One study that discusses this is the study conducted by Moktadir et al. (2018). The paper analyzes how the manufacturing sector, namely the leather sector in Bangladesh, is attempting to apply sustainable production methods as part of green supply chain activities to enhance their reputation with consumers and to comply with legal requirements. In order to address environmental concerns, the manufacturing sector has started using circular economies and sustainable manufacturing methods in its supply chains. As a result, less waste is produced and less energy and material is consumed. The findings of the study indicate that adopting sustainable manufacturing techniques in the leather sector of Bangladesh requires a thorough understanding of the circular economy. This study will support managers of leather businesses in developing strategies for waste reduction and the best use of available resources in a circular economy.

Authors' Contributions. The title "AUTHORS' CONTRIBUTIONS" should be in all caps.

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