

Circular economy: barrier and opportunities for SMEs

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Abstract. The circular economy was a concept introduced by the European Union consortium, several national governments, and business people around the world. However, the scientific and research content of the circular economy concept is so superficial and disorganized that it is still a vague collection of ideas separate from several fields of science. The purpose of this study is to measure visual trends in the circular economy. This survey identified keywords related to the circular economy to find and identify related articles in the Scopus database for 1000 articles published from 2000 to 2021. The findings were a visual trend of the increasing number of publications each year, academic affiliation, author, article subject area, keywords, and authorship network. This literature review provides evidence that circular economy thinking attracts academic researchers to formulate relevant policies.

1 Introduction

Responding to human activities that cause environmental degradation at various levels, it is necessary to make comprehensive changes in production and consumption patterns [1]. In particular, it is necessary to start shifting from a linear "take, make, use and waste" production-consumption model to a circular model that minimizes, recovers, recycles, and reuses materials, water, and energy [2-3]. The circular economy concept describes a circular production-consumption model that maximizes the use of products, components, and materials throughout their life cycle [3]. This is a means of reducing environmental impacts while promoting economic growth [4].

Transition to circular economy requires commitment from many parties, including the government and the companies themselves [5]. In particular, circular economy requires companies to develop and adopt innovative technologies and business models [6] as part of a more circular economy -oriented organizational culture [7]. This can lead to new 'circular risks' due to the company's transition from the tried and tested linear production method to the new circular production method [8]. Limited resources for SMEs lead to potential

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impediments to circular economy implementation [9-10] although SMEs have an important contribution to a country's economic and social development [11].

To bridge the research mechanism of circular economy from the perspective of individuals, organizations, and the environment, the role of government, practitioners, and decision-makers is very important. The involvement of SMEs in achieving circular economy goals is very clear because they have a production line that can carry out the circular economy process holistically both from inputs, processes, outputs, and outcomes that are friendly to the environment, especially through a culture of innovation at the organizational and employee levels [12]. Despite receiving, until now, the role of SMEs in circular economy succession is still very rare [13] therefore it is necessary to map the literature to generate opportunities and potential for R&D through collaborative global writers networks.

On the other hand, although the topic of the circular economy has increased from year to year, there are still many unanswered matters, it has not been explored optimally because the circular economy concept has several limitations [14]. This study offers an extensive literature review and aims to highlight research outputs and trends in a circular economy to increase the amount of research and the need for interdisciplinary collaboration to increase the importance of global understanding [15] such as the increasing awareness of humans about lifestyle changes to focus more on nature and the concept of green [16]. research that focuses on circular economy focuses primarily on small samples, or single case studies, or literature reviews without visualization. To our knowledge, no study has presented a big picture and visualization of research trends concerning circular economy. To that end, we used VOSviewer [17] to map an extensive literature review and survey of 1000 articles on circular economy published and indexed by the Scopus database 2021. This means that the important contribution of circular economy research to science can be calculated by the quantity and quality of publications and citations from various perspectives, thereby increasing the authorship network which is useful for exploring scientific collaboration between researchers around the world.

2 Material and Methods

To obtain the final visualization with the help of VOSViewer [17], we identified peer-reviewed articles on the Scopus bibliography - as one indexer with a comprehensive database - in particular Elsevier and ScienceDirect. We identified the keywords "circular economy" and "SMEs" resulting in 1000 articles which we downloaded in the form of a research information system (* ris) and then transferred to Mendeley. This research was carried out in the range of January-February 2021 by identifying keywords that were used to find information related to circular economy.

From these 1000 articles, we feed them to VOSViewer and other open-source applications to analyze the corpus of text from the RIS databases. The reason for choosing VOSViewer is its function in making publication maps, journal maps and country maps, citation and keyword maps [17]. Besides that, VOSViewer is also used for data mining, articles. grouping, and mapping on various database sources [18].

3 Result

In general, the number of published articles about circular economy in the SME sector that are published on the Scopus database is increasing every year. The highest peak of publication occurred in 2019, but decreased in 2017 and increased again the following year. The growth and evolution of research on circular economy can be "measured" as well by a

great discussion about the increasingly familiar concept of sustainable development and the increasingly massive publications on circular economy in various sectors of life.

To analyze data with the help of VOSviewer, this study uses the minimum number of relationships with terms to be 10 terms. After being analyzed, there are 8 clusters (gray, red, pink, green, light green, blue, light blue, and yellow) that show the relationship and complexity between one topic and another. VOSviewer can display bibliometric mapping in three different visualizations namely network visualization (Figure 1), overlay visualization (Figure 2), and density visualization (Figure 3). Keywords are labeled with colored circles. Article size is positively correlated with the occurrence of keywords in titles and abstracts. Therefore, the size of letters and circles is determined by the frequency with which they appear. The more often the keyword appears, the larger the font and circle size.

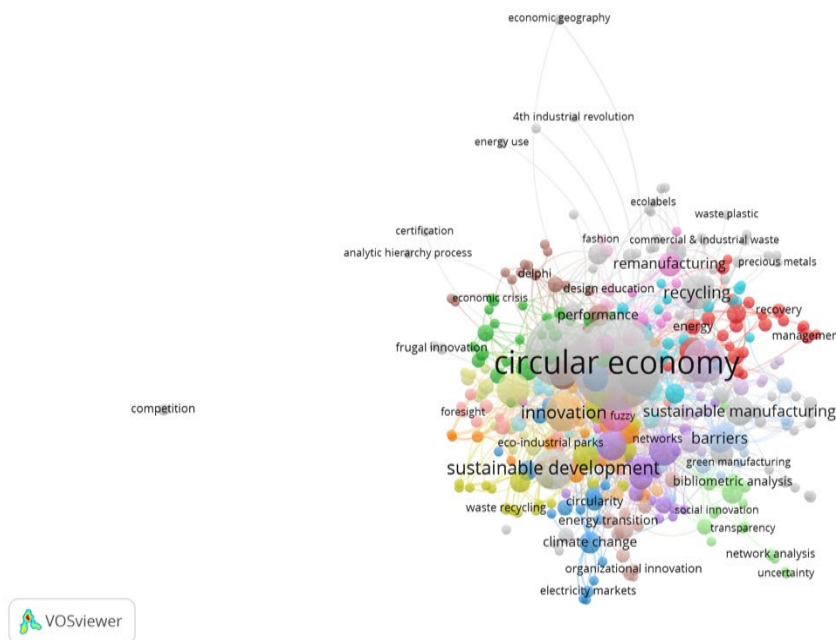


Fig. 1. Visualization Topic area using Network Visualization.

Extraction of titles, keywords, and abstract obtained 1000 documents consisting of 3142 authors. The data consisted of two types of publications, namely research papers (912) and literature reviews (88). Figure 1 shows the clusters of each of the topic areas studied. It can be seen that the keywords "circular economy" are in the largest cluster, followed by "sustainable development", "innovation" and "recycling" which indicate a close relationship between these keywords.

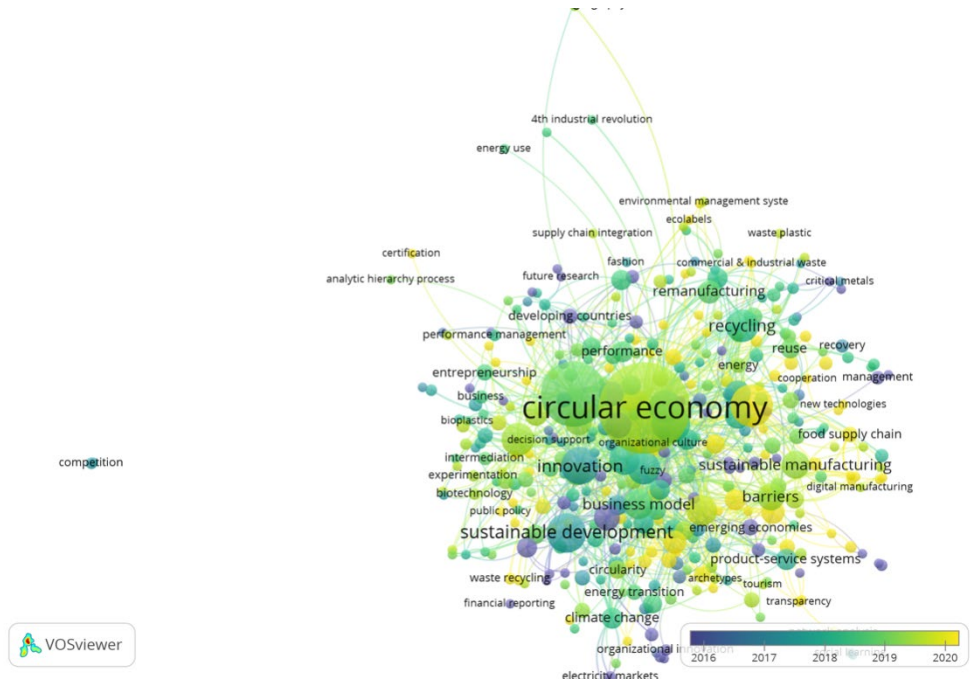


Fig. 2. Visualization Topic area using Overlay Visualization.

Meanwhile, Figure 2 shows the trend from year to year related to this research. In 2016 there was more research on business models and cooperation management, in 2017 on climate change, innovation, and recycling, in 2018 on performance, while in 2019 the focus was on research on sustainable manufacturing and several other studies (such as barriers, food supply chain, circularity), the latest research in 2020 is to focus on organizational learning to support a circular economy [19-23].

The analysis that will be carried out on the topic of "business models" to create "sustainable development" is to reduce "barriers" which can be seen from the amount of research that has been done. From Figure 2 it is presented that recycling and business models show relatively small numbers compared to sustainable manufacturing and sustainable development [24-30]. This means that there is a great opportunity to research sustainable development as part of the impact of circular economy [19] through the use of green technology [20], individual and organizational innovation [21], to reduce various barriers in it [22, 31-34].

Furthermore, to measure the depth of research on circular economy in SMEs, (see Figure 3), it is shown by the colour texture, where the darker the colour appears, the more research will be done. The conclusion from Figure 1-3 shows that the keywords that often appear are "circular economy", "innovation" and "sustainable development". From these data, we can look for new circular economy research, especially in the SME sector. For example, research related to the process of "recycling", "performance management" and "organizational innovation" is because is still little researched.

For this reason, further researchers can contribute to increasing insights about circular economy by conducting studies on the use of "new technologies", "building organizational culture" in "reuse", "recycle" and "waste management" [23]. Besides, the availability of information on each topic area can be searched by entering more specific keywords.

4 Conclusions

This study aims to measure the visual trend in the circular economy, especially in the SME sector. The findings of this literature review provide evidence that circular economy thinking attracts academic researchers through the visualization of related topics but we still find many opportunities to explore future research. This research has limited objectives, tools, and data sources. The study attempts to investigate visual and network trends in the circular economy field. However, the study did not measure the contribution and impact of the research in terms of citations. This is because VosViewer as a research tool is not designed to analyze citations. The analysis in this paper is based solely on the Scopus dataset, while there are more relevant papers not indexed by Scopus, especially those written in local (non-English) languages. For this reason, the next research is to analyze the contribution and impact of the research by measuring citations based on a combination of Scopus, WoS data, and other database sources.

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