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Review

Circular Economy and Sustainability-Oriented Innovation: Conceptual Framework and Energy Future Avenue

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Abstract: A circular economy emerged as an alternative transition model, which is considered to be a solution to massive environmental degradation. The transition from a linear economy to a circular economy requires companies to be actively involved in more sustainable practices. For such a transition, companies must rethink, innovate on business models, and encourage sustainability-oriented innovation to deliver customer value, while simultaneously considering environmental and social aspects. On the other hand, the role of the circular economy in energy conservation and infrastructure has not been mapped out in the current literature. This systematic literature review seeks to map out the main interrelated topics of the circular economy and sustainability-oriented innovation, describing internal and external factors that need to be considered in the transition to a clean energy future. Key lines of research are identified, and suggestions for future research and for how to facilitate the movement towards a circular economy are provided. This study contributes to an enhancement of the literature by identifying priority areas regarding the circular economy and sustainability-oriented innovation to encourage future research that contributes to sustainability and environmental preservation.

Keywords: sustainability-oriented innovation; circular economy; conceptual framework; energy transition

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1. Introduction

The principle of a linear economy that prioritizes take-make-dispose has implications for increasing the volume of waste [1] and wasted resources [2], which can be reused or used as an energy source based on the creation of energy transfer infrastructure from recycled materials. Coupled with the fact that the amount of waste will increase to 2.59 billion tons in 2030 and 3.4 billion tons in 2050 worldwide, our approach to this has changed [3]. Considering that sustainable development goals on 17 main agendas involve three components (economic, social, and environmental), dependence on sustainable resource management is very essential [4].

Given the important role of organizations in preserving the environment, the circular economy concept can be an alternative for managing resources, reducing waste, and reprocessing them into high-value products [4]. Consequently, a circular economy approach benefits businesses and society as a whole with a better supply chain, low volatility of resource prices, better customer relations, and new job opportunities [5]. In the energy context, the circular economy approach can provide a new perspective because it manages waste into energy and manages resources efficiently [6].

In a circular economy, the use of waste as an energy source is one of the ways to reduce the use of fossil fuels. The circular economy has an important impact on energy conservation and energy infrastructure efforts because it provides the direction of research and development in an innovative and sustainable manner. However, the circular economy transition process related to energy in various sectors needs to be revealed through the visualization of literature mapping to obtain a comprehensive picture as the basis for making relevant research and policies [7].

The transition to a circular economy involves systemic changes aimed not only at reducing the impact of a linear economy, but also at building long-term resilience that generates new business opportunities and returns social and environmental benefits [8]. On the other hand, the circular economy has produced a significant impact on environmental improvement from the threat of degradation [8,9]. All industrial sectors have played a role in reducing the potential for damage by reducing, reusing, and recycling [10]; however, the relationship with sustainability-oriented innovation is still not well explored.

A circular economy provides an alternative in order to integrate ecological approach criteria, such as the recycling, reuse, and replacement of materials into the routine activities of an organization [11,12]. This approach involves managing the internal environment [13,14] and an eco-friendly design [14], as well as the management and recovery of corporate assets [14]. The circular economy will be successful if it starts from the internal environment by developing environmentally oriented procedures, such as green human-resource-management practices [2,15], training, and development [16], as well as an environment-based performance-evaluation system; thus, supporting intra-organizational environmental goals builds environmental ethics and improves ecological performance [17]. On the other hand, organizations implement product design process policies by considering environmental impacts because they are considered promising in achieving eco-efficiency [18,19]. In addition to environmental efficiency, eco-friendly design practices offer opportunities for companies to provide a market share with differentiated products [20] and increase global value propositions [21]. Finally, the positive impact is an increase in the ability of the organization to recover investments, resell and reuse used materials [13]. This requires companies to think strategically about how to mitigate emerging issues in order to gain greater value and is an important goal to be achieved in a circular economy [22].

In the energy sector, the impact of circular economy practices can increase energy efficiency and facilitate an increase in the quality of human life [23]. However, the increase in energy consumption raises concerns about climate change, especially when accompanied by an increase in greenhouse gas emissions [23]. Thus, adopting a circular economy strategy helps countries meet their climate change mitigation goals [24,25]. Another study states that the combination of circular economy principles and the use of renewable energy can result in a reduction of 37.5% in greenhouse gas emissions [25]. Therefore, a circular economy strategy can mitigate global climate change by increasing the use of renewable energy and changing the energy structure to be more sustainable.

On the other hand, sustainability-oriented innovation is seen as a systematic effort by organizations to promote the role of competitiveness and human and social welfare in building environmentally friendly practices [26–28]. Furthermore, sustainability-oriented innovation requires strategic sustainability behavior by implementing an integrated environmental strategy, creating an environmentally friendly culture, extending the product life cycle, and initiating an environmental management system [28]. In the available literature, innovation practices that encourage sustainability-oriented innovation occur in two ways. The first is product innovation, which introduces new product or service improvements to improve sustainable performance [29]. The second is process innovation, which requires organizations to redesign operational mechanisms for resource efficiency, energy use, and building an eco-efficiency culture [29]. As a result, there is a consolidation of organizational practices and values to achieve economic, social, and environmental goals.

In this perspective, according to emerging characteristics, research on the circular economy associated with sustainability-oriented innovation remains fragmented with numerous variations and has been investigated in different dimensions. Although a circular economy is the basis for implementing sustainability-oriented innovation, research on these two constructs is still rare [30]; however, a circular economy provides innovative solutions and promotes sustainability. Therefore, understanding the interconnectedness of the circular economy and sustainability-oriented innovation is critical to bridging an organization's transition to sustainability [31]. Previous studies have focused on the drivers and barriers to the circular economy in various industries. However, the literature on the circular economy as a sustainability-oriented innovation trigger has not been well explored. Thus, this article maps out the main research topics at the intersection of the circular economy and sustainability-oriented innovation. The combined bibliography was used to identify the main lines of research in the literature on circular economy and sustainability-oriented innovation in a broad scope and to suggest topics for future research.

2. Methods

A systematic literature review is a research design used to systematically synthesize existing research evidence in terms of searching research articles, critical reviews, and synthesis of research results to answer trending topics [32]. Systematic literature reviews are research designs that enable robust investigation into the state of the art from a particular research field [33], systematic synthesis of evidence, and critical appraisals [34], while recognizing research gaps to promote future inquiry and knowledge advancement [35,36]. This study adopts the systematic literature review approach used by recent studies to holistically assess and synthesize the progress of the current relevant literature on the circular economy and sustainability-oriented innovation [37].

A systematic literature review is a method that reviews previous studies with several stages as follows: first, identify studies and research questions; then, determine the relevant studies; third, collect and retrieve the information; fourth, synthesize the data; and finally, report the findings. This study also involved a review panel, consisting of two professors and a researcher, establishing the conceptual boundaries of this topic. Consultations were held at every level from the initial identification to the final selection of relevant studies. This consultation helped resolve differences of opinion among the authors and reach a final consensus to continue the research. We followed established protocols to ensure the replication and accuracy of our findings [32].

To achieve the research objectives, we used VOSViewer to combine the downloaded data in the form of a research information system [38,39] that was fed to Mendeley [40]. First, we searched for the keywords "circular economy" and "sustainability-oriented innovation". Considering that environmental concerns are starting to become a trend in various areas, we searched the Scopus-ScienDirect database in the following six main areas: (1) Environmental Science; (2) Business, Management and Accounting; (3) Decision Sciences; (4) Energy and Engineering; (5) Economics, Econometrics and Finance; and (6) Agricultural and Biological Sciences. A search conducted in August 2022 yielded 1832 articles. All articles went through a rigorous review process before being published. During Phase 2, we identified and analyzed articles into 1326 terms in which the minimum number of the occurrence term was 10. In this phase, we selected articles and discarded those that did not meet the criteria, such as duplication, country of research, unsuitable keywords, and inappropriate scope. In Phase 3, we performed bibliographic coupling, resulting in 402 items with seven clusters. In stage 3, we used VOSViewer software to analyze data in the form of a research information system.

Figure 1 presents the research protocols from the initial data collection process to the determination of the number of key articles, which were then researched to achieve the research objectives.

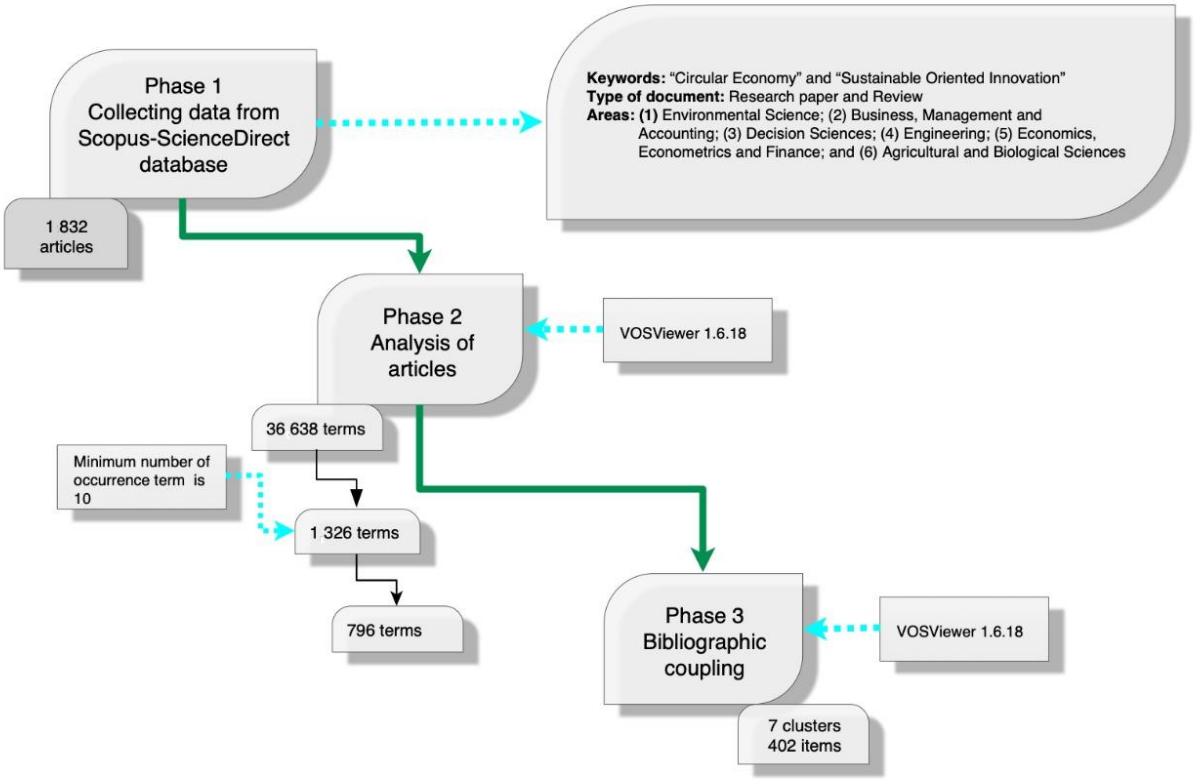

Figure 1. Research protocols of the systematic literature review.

3. Results

3.1. Descriptive Analysis

Considering the research trend in environmental management, we combined data sources from six main areas to enhance the analysis and achieve the research objectives. Figure 2 presents information that the topic of the circular economy and sustainability-oriented innovation began to be published in 2003, and then began to increase from year to year. There was especially a spike in publications in 2018 which doubled compared to that of 2017, increasing sharply in 2019 and 2021, and reaching a peak until this data was taken in 2022. This indicates that the linear transition of the economy to a circular economy has become the agenda of researchers in an effort to preserve the environment, especially in the context of the emerging need for a clean energy transition in the face of growing concerns about climate change and the need to increase access to energy [2,5,41–45].

The 1832 selected articles (Figures 3 and 4) were published in several journals including the following: Journal of Cleaner Production (939 articles—51.24%); Resources Conservation and Recycling (138—7.5%); Technological Forecasting and Social Change (131—7.1%); Sustainable Production and Consumption (126—6.8%); Journal of Business Research (88—4.8%); Journal of Environmental Management (73—3.9%); Science of the Total Environment (73—3.9%); Ecological Economics (59—3.22%); Environmental Innovation and Societal Transitions (44—2.4%); International Journal of Production Economics (41—2.2%); Industrial Marketing Management (38—2.1%); Technology in Society (35—1.8%); Waste Management (29—1.54%); and Forest Policy and Economics (28—1.5%). This provides information that this topic is a trending topic in line with environmental conservation efforts [46,47].

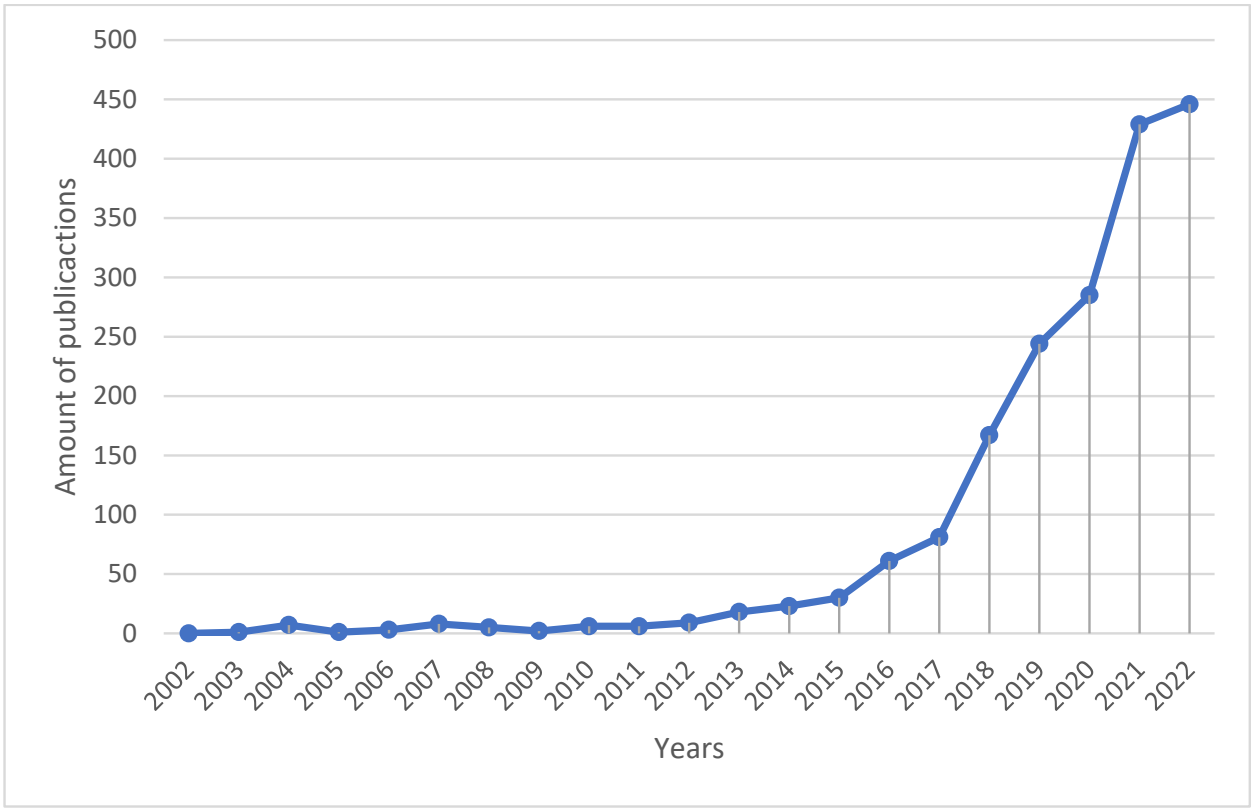

Figure 2. Annual growth in the number of publications.

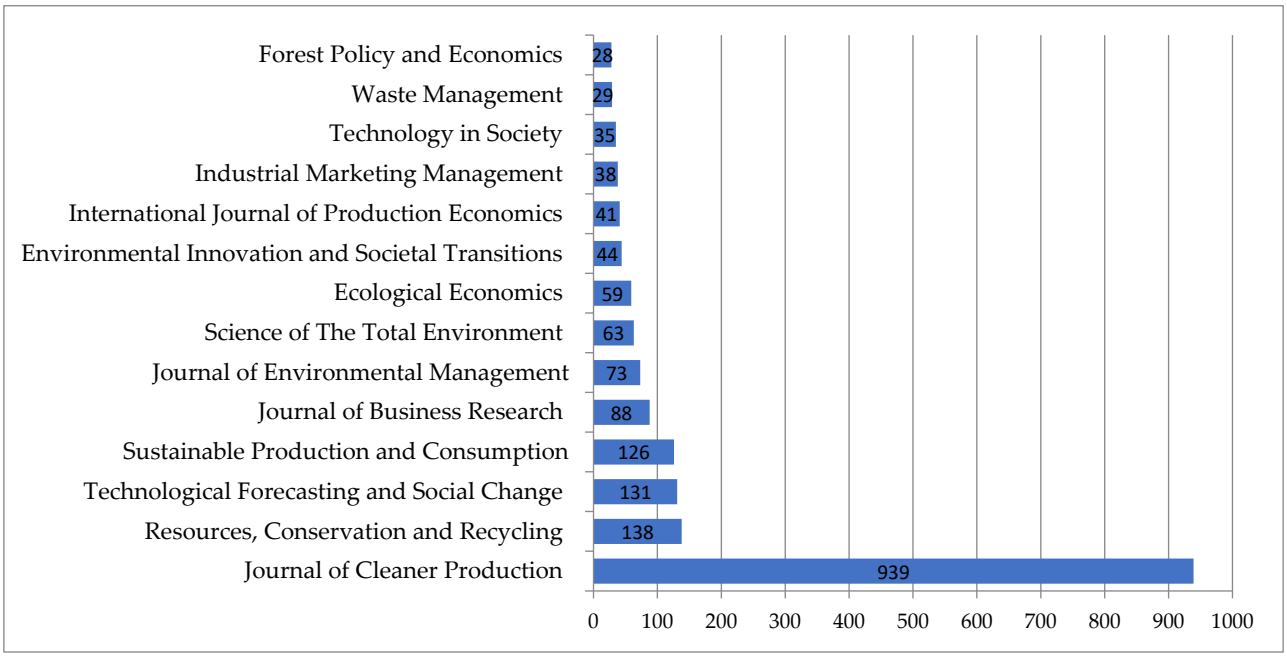

Figure 3. Journal venue for related topic.

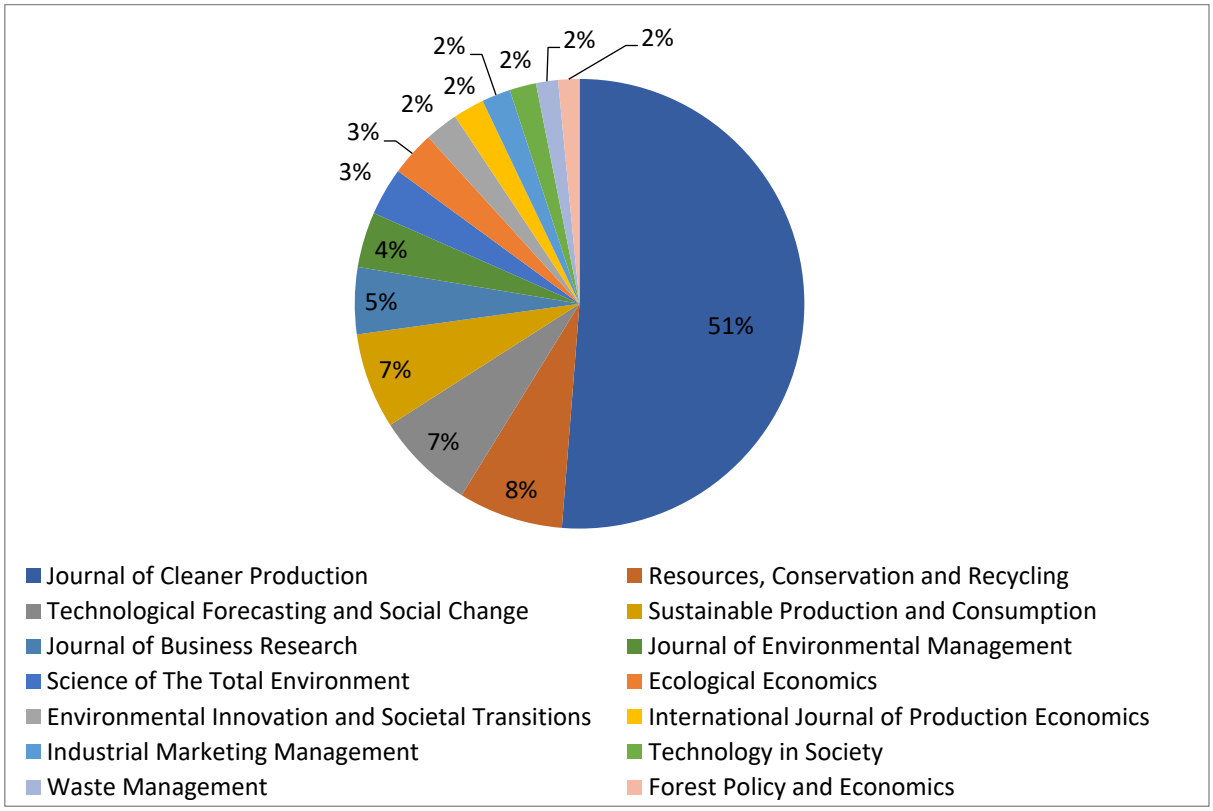

Figure 4. Percentage of article publication on journals.

Figures 3 and 4 show the increasing research on the circular economy as an alternative strategy to increase environmental awareness. This provides opportunities and challenges for every country, industry, and business entity to jointly maintain sustainability and environmental preservation. All stakeholders are involved in implementing circular economy practices. First, governments and countries that are concerned about the environment can apply for green subsidies to increase sustainable practices [48,49]. Second, for business managers, they must increase commitment to the environment, build a culture of action for sustainable development [17], and create sustainable business model innovations [50,51]. Third, there is an environment-oriented standard-operating procedure as environmental ethics guidance [2,15]. Thus, the increase in these publications is an important indication of increased environmental awareness and insight in related fields.

3.2. Bibliographic Analysis

To identify the main research themes in circular economy and sustainability-oriented innovation, we combined the bibliography of these documents with VOSviewer 1.6.18 software. All articles were analyzed by linking a minimum of three articles per cluster. The cluster network is shown in detail in Figure 5.

The results of the network visualization show that there were seven main clusters related to the two research topics. Some of the relevant items in each cluster are described as follows.

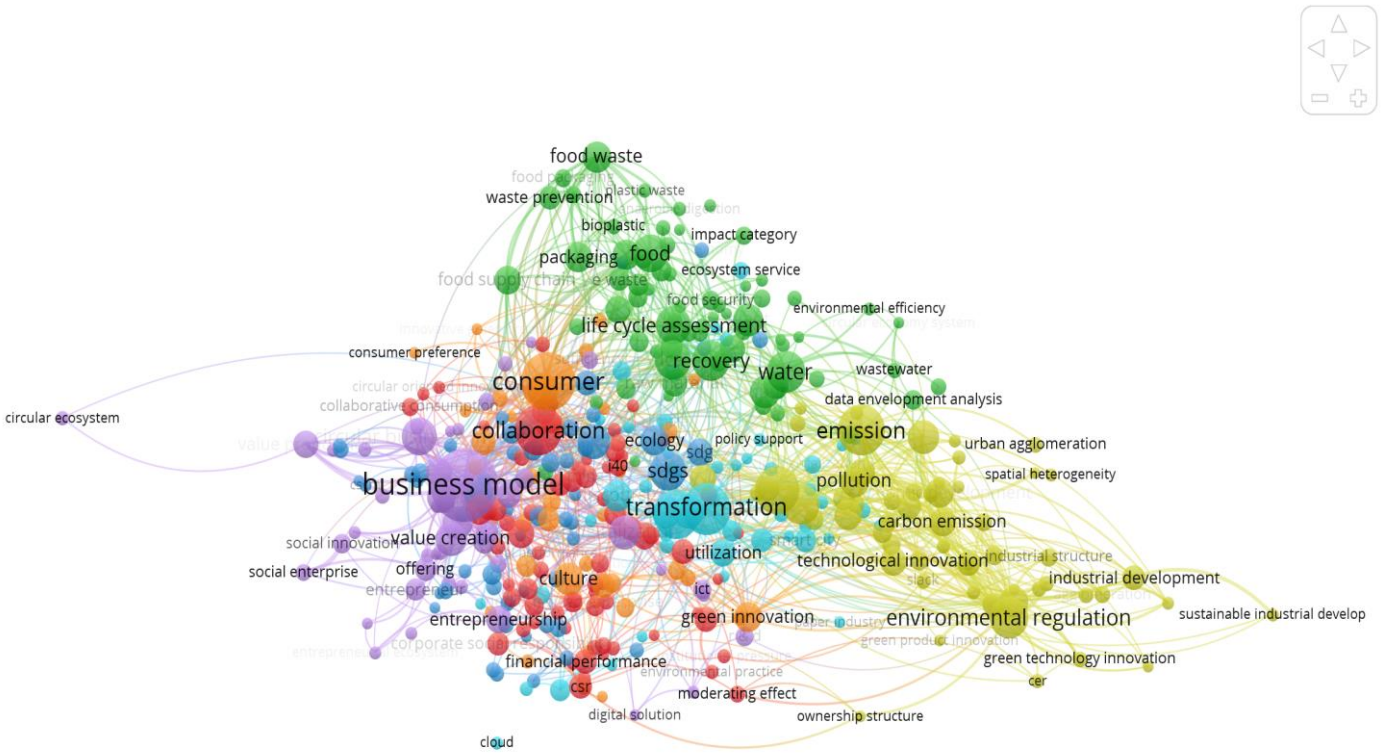

Figure 5. Network visualization of circular economy and sustainability-oriented innovation.

3.2.1. Cluster 1 (Strategic Adoption for Circular Economy)

Within this cluster, all studies contribute to the inherent need for collaboration among stakeholders to drive the circular economy in strengthening sustainability-oriented innovation. To build this agenda, big data analyses and digital transformations are needed [52], along with a strengthening of circular economy practice and collaboration to build green innovation [53,54]. On the other hand, business operations that take into account sustainability will improve the global value chain [55], thereby increasing social value and competitive advantage. The impact of this is the creation of a collaborative economy and economic performance in environmental collaboration for sustainable performance [56]. Other scholars have concluded that the circular economy concept adopted in routine organizational activities, such as green supply-chain management, waste reduction, circular economy-oriented innovation, collaborative consumption, and clean energy, will improve environmental practices in accelerating the circular economy transition [57].

3.2.2. Cluster 2 (Waste Management in Circular Economy Practices)

By implementing a circular economy strategy, environmental conservation can be conducted because it builds an integrated and systematic system for waste demolition, food waste, municipal solid waste, plastic waste, recycled material, and disposal [58]. In addition, the implementation of the circular economy has an impact on eco design [59,60] by conducting food packaging, food production, and the food supply chain. That is, the circular economy process provides stimulation on how to build environmentally friendly products [61].

On the other hand, by building environmentally oriented products, resource recovery, low carbon transition, and even waste recycling are indirectly carried out [62]. Otherwise, this is done by reducing greenhouse gas emissions [63] towards environmental efficiency and the improvement of human health [64]. The development of waste management patterns can be an opportunity to develop electric equipment towards renewable energy [65] which facilitates the manufacturing process. To achieve all of that, systematic efforts are

needed for organizations, governments, communities, and even the media unite to carry out social acceptance.

3.2.3. Cluster 3 (Factor Affecting Circular Economy Practices and Sustainability)

In this cluster, we group the determinants of the circular economy into building sustainability. So far, the circular economy has been carried out in companies with a high level of readiness, such as the automotive industry, because they have circular supply-chain management [66,67], sustainable product development [68], and value co-creation [69]. The literature reveals that the circular economy approach is an important trigger in building environmental economics towards a green economy [70]. Assuming that the green economy can be stimulated by circular economy practices, it will have an impact on the realization of three things: first, social sustainability; second, sustainability transformation; and third, corporate sustainability [71,72].

The challenge of implementing the circular economy is that the organization is not ready to implement this due to a lack of method [19], the adoption of technology that costs a lot [73], and sustainability challenges [56]. For this reason, it is necessary to increase understanding of knowledge management and open innovation [74] to make product designs and product development in building environmental organizational legitimacy [75]. Obviously, the positive impact is that corporate leaders have profitable options to realize sustainability goals [30,71].

3.2.4. Cluster 4 (Environmental Process and Its Impacts)

The available literature has revealed that the circular economy is the process of reworking the various outcomes of a linear economy to reduce the use of resources [40,76]. Reductions in carbon emission, resource consumption, and carbon dioxide emissions are a pattern in arranging eco-efficiency, environmental protection [77], and energy conservation [78]. As is well known, energy consumption, energy efficiency, energy intensity, and energy saving involve the implementation of environmental regulations that have an impact on economic development and economic growth [17,77]. In fact, countries that are concerned about efforts to preserve the environment obtain investment faster so that they can sustainably carry out green product innovation, green technology innovation, green total factor production, and green development [79]. Assuming that all resource allocations are effective, the circular economy transition will have an effect on changes in technological innovation, technological progress, productivity [80], and industrial development [4]. Thus, the relationship between energy consumption, economic growth, and climate change depends on parameters that vary over time, which are observed and debated through political implications [23].

3.2.5. Cluster 5 (Circular Business Model and Mechanism)

In this cluster, the results of the analysis produce various keywords related to the business model and business activity associated with innovation. A circular economy business model is a business model innovation that can affect organizational growth and sustainability [81,82]. The application of the circular business model can be implemented to strengthen the circular supply chain and value proposition [21]. Furthermore, organizations need to improve information communication technology considering that the circular economy requires digitalization and the strengthening of dynamic capabilities [83]. Following the input-process-output logic, all processes from building a sustainable business model, adopting technology, forming an entrepreneurial ecosystem to innovating an ecosystem and a product service system will have implications for increasing social enterprise, social innovation (which ultimately results in profitability), sustainable growth, and sustainable competitive advantage [84].

3.2.6. Cluster 6 (Aligning the Circular Economy for Sustainable Energy Development)

The literature reveals that the circular economy is an important transition in increasing environmental awareness [46]. With various ways to apply it to all industrial sectors, circular economy practices are expected to stimulate the environmental value proposition [85] and become a new business model [82]. In cluster 6, there are links between numerous variables that can be explored more deeply in relation to the circular economy. A circular economy applied to various industrial sectors will harmonize sustainable development [86,87]. In addition, the ecosystem formed from the circular economy transition allows for an energy transition for sustainable development. A sustainable energy transition leads to regional developments that can mitigate risks, encourage green development, and minimize the effects of industrialization. On the other hand, the development of information technology allows the government to build smart cities to improve the sustainable energy transition [88], circular bioeconomy, and climate change mitigation towards sustainability [86]. Thus, the proposed operation to increase the efficient solar energy system is an alternative energy solution to meet energy needs in the context of economic and environmental growth [89].

3.2.7. Cluster 7 (Circular Economy and Behavior)

The effectiveness of implementing a circular economy lies in the ability to educate all parties to be responsible for the environment [44]. That is, the internal and external aspects of the organization are very influential on the success of circular economy practices.

From the internal aspect, organizations or managers are expected to apply the characteristics of pro-environmental behavior by implementing green human resource management [90,91], green intellectual capital [92], and environmental orientations [93]. The routine activities of an environment-oriented organization are expected to build a culture that is sensitive to environmental changes. As a result, both employees and organizational leaders will feel responsible and committed to the environment [93,94] in order to build environmental organizational legitimacy [75].

From the external aspect, the alignment of the interests of the organization and the government is a mutually beneficial collaboration mechanism. Governments can provide green economic incentives to organizations to increase their commitment to the environment [95]. Incentives can be in the form of financial or non-financial incentives. The aim is to provide a stimulus to make the circular economy transition more focused and sustainable. Furthermore, the government can carry out pro-social and pro-environmental incentives as a strategic effort to carry out conservation [44]. On the other hand, the incentives given can be a trigger for the organization to share knowledge and communicate about the environment [96,97].

In cluster 7, environmental-saving behavior can also be associated with social capital and creativity. In some of the literature, the circular economy has not been explored in the context of creativity and social capital much. In fact, these two constructs can play an important role in implementing a circular economy. The authors of [98] revealed that social capital is the basis for innovation, while building innovation requires creativity [99]. As such, the role of sustainability-oriented innovation resulting from a circular economy will encourage organizational output, such as sustainability performance, a sustainable future, sustainable manufacturing, a sustainable society, and technological change [43,100–102]. Sustainability-oriented innovation translated into various kinds of innovations, such as green innovation, green product, green technology, product innovation, technological innovation, and process innovation, will increase the chances of winning the competition in the international market and increase [98,103,104].

Upon further analysis, we identified the history on the topic of circular economy and sustainability-oriented innovation in the last three years (Figure 6).

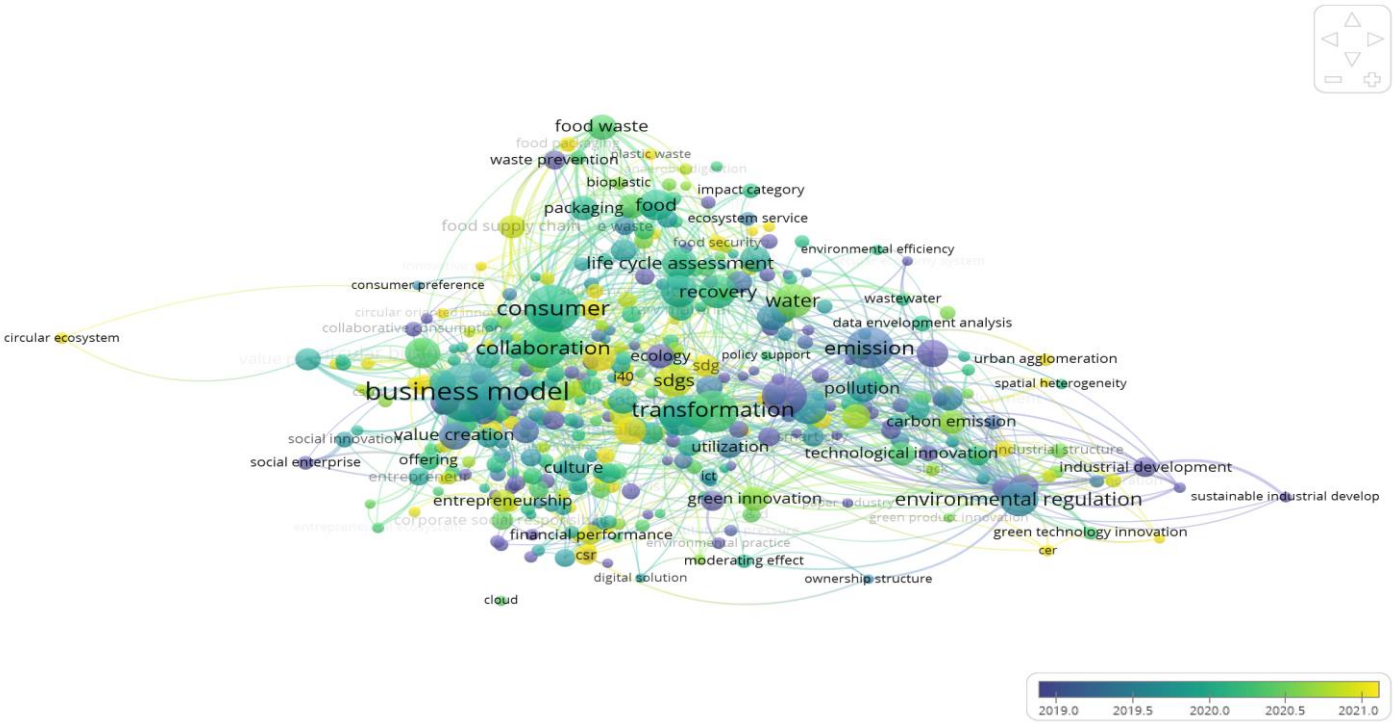

Figure 6. Overlay visualization of circular economy and sustainability-oriented innovation.

The results show that at the beginning of 2019, circular economy and sustainability-oriented innovation were mostly related to emissions, followed by value creation, ecology, industrial development, waste prevention, social enterprise, sustainable industrial development, collaboration consumption, and environmental practice. After mid-2019, the most relevant topics related were business models and environmental regulation, followed by culture, pollution, smart city, and utilization. In early 2020, the most relevant topics were consumer and transformation, followed by life cycle assessment, recovery, collaboration, packaging, food, technological innovation, spatial heterogeneity, wastewater, environmental efficiency, information communication technology, social innovation, data development analysis, green technology innovation, digital solutions, and green technology innovation. After mid-2020, the most relevant was water, followed by green innovation, carbon emission, industrial structure, green product innovation, bioplastic, entrepreneurship, corporate social responsibility, and cloud. The most relevant in 2021 was sustainable development goals, digitalization, and food supply chain, followed by circular ecosystem, entrepreneurship, financial performance, food packaging, food security, industry 4.0, urban agglomeration, and corporate social responsibility. The results of this overlay analysis show that 2022 has a high probability for research because the most recent research was detected in early 2021.

The results of density visualization (Figure 7) show research on circular economy and sustainability-oriented innovation, concentrated on three main topics, namely business model, transformation, and consumer. It then concentrates on several smaller groups, namely collaboration, food, life cycle assessment, recovery, water, emission, environmental regulation, value creation, ecology, industry 4.0, sustainable development goals, pollution, culture, and entrepreneurship.

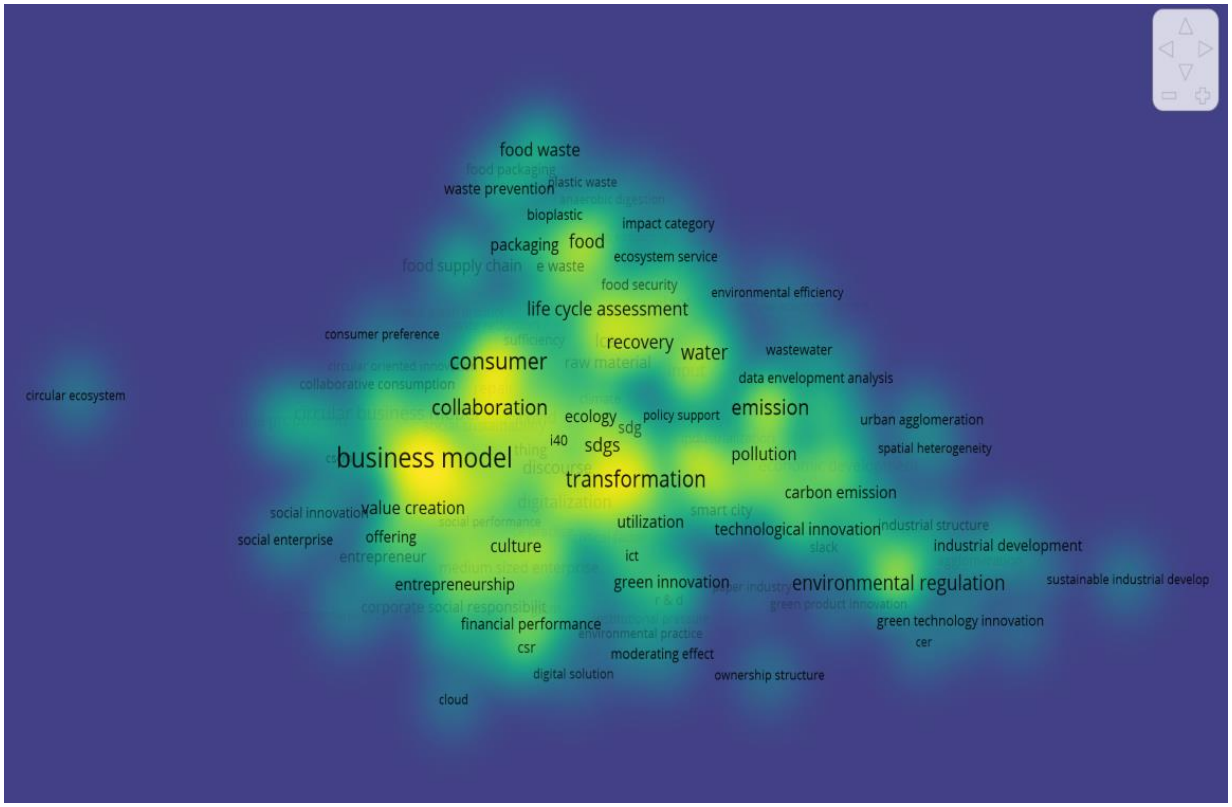

Figure 7. Density visualization of circular economy and sustainability-oriented innovation.

Other topics are still evenly distributed and there is no visible grouping which is indicated by the position of the items in the dim area. That is, it has great opportunities for research, one of which is the circular ecosystem, as well digital solution, ownership structure, sustainable industrial development, green technology innovation, urban agglomeration, environmental efficiency, social innovation, social enterprise, social innovation, corporate social responsibility, environmental practice, green product innovation, circular oriented innovation, food waste, waste prevention, food packaging, plastic waste, anaerobic digestion, and food supply chain.

4. Discussion

Based on the groups identified through a bibliography of 1842 selected articles from six fields, the proposed framework for a circular economy and sustainability-oriented innovation is presented in Figure 8. In general, circular economy and sustainability-oriented innovation relies on establishing strategic options and taking a multi-level approach that incorporates stakeholders into the practice of a circular economy [9].

This strategy enables the exchange of knowledge, provision of higher quality raw materials, and the adoption of technology and information that enables faster transitions for companies to build appropriate conditions to seize opportunities and develop a circular economy and sustainability-oriented innovation. The impact of this provides an environmentally oriented development pattern to spread the proposition of environmental values globally and to innovate, in a sustainable manner, towards the achievement of sustainable development goals (SDGs).

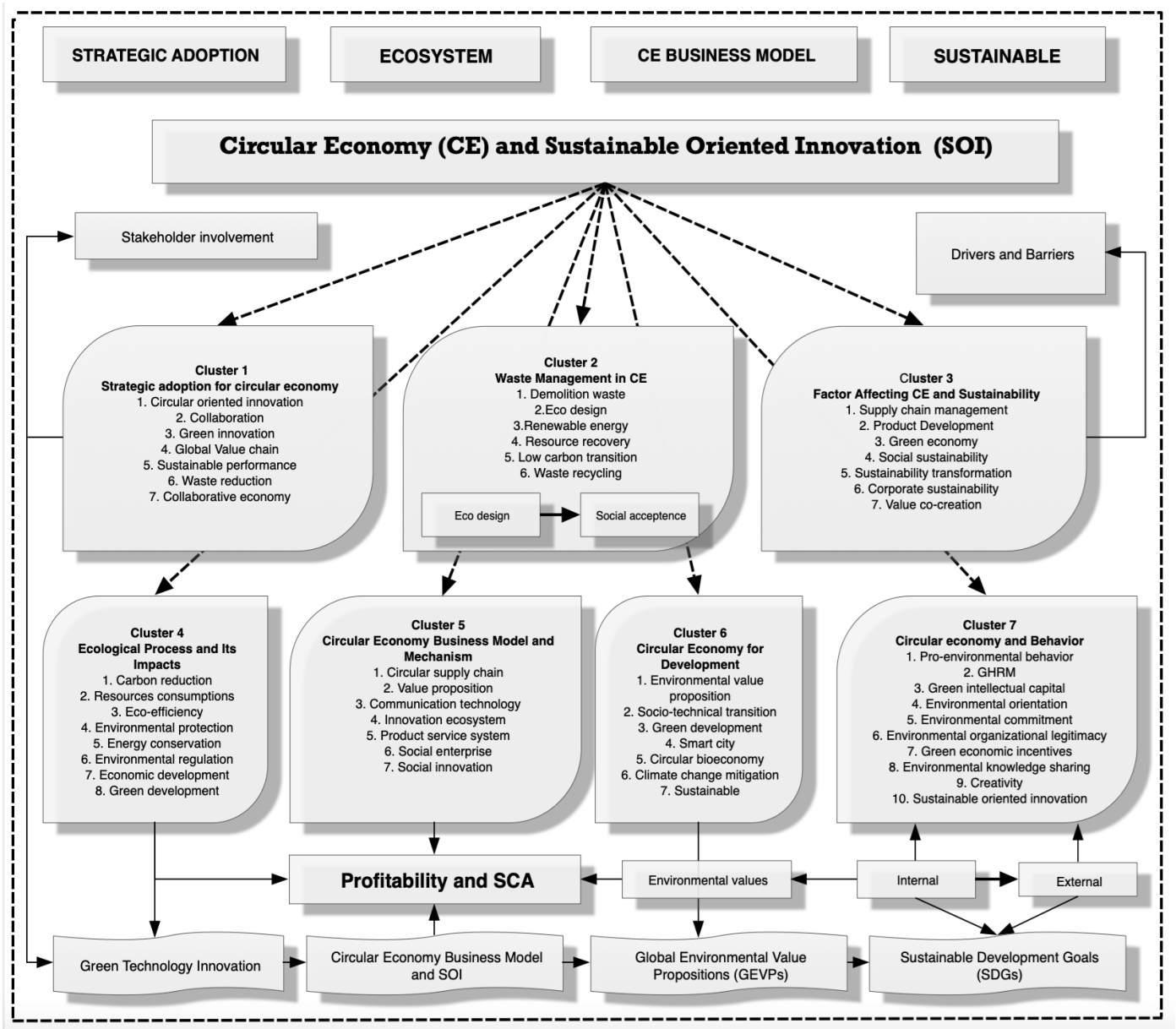

Figure 8. Framework for examining sustainability-oriented innovation in circular economy.

5. Considerations and Research's Future Line

The circular economy provides a fundamental input for creating sustainability-oriented innovation in this transitional model. Waste management, green product development, pro-environmental behavior, and green technology are the main drivers that form the basis for the transition to a sustainability-oriented innovation model. The fundamental dimensions of circular economy and sustainability-oriented innovation are behavior that manifests in the form of green human resource management, green intellectual capital, environmental orientation, and environmental commitment. Green behavior is the backbone of how the circular economy can be applied to build sustainability-oriented innovations. In addition, it is necessary to strengthen communication for knowledge transfers so as to increase creativity [105,106].

At this stage, it is necessary to pay attention to various obstacles such as a system that does not support a circular economy, has limited resources, and exhibits resistance to technology. As such, companies that are able to explore all green behaviors will have long-term environmental strategies and establish environmental organizational legitimacy. Regarding waste management, companies need to design environmentally friendly products and implement eco-designs and even waste recycling. In this stage, the process starts from the determination and selection of raw materials so as to reduce production waste [107,108].

This study seeks to identify the various conditions necessary to advance sustainability-oriented innovation through the circular economy. The number of articles in each cluster of bibliographic coupling shows that the literature recognizes the importance of the interaction between stakeholder engagement, waste management, and the identification of factors in the circular economy (clusters 1–3). However, other emerging topics, reflected in clusters 4–7, are also worth considering and developing, such as ecological processes and their impacts, circular economy business model mechanisms, and circular economy business model for development. As such, an exploration of dynamic resource capabilities and internal resources and activities is needed to take advantage of opportunities to strengthen sustainability-oriented innovation.

In addition, the literature shows the need to expand research on sustainability-oriented innovation in a circular economy to all industrial sectors given that many studies focus on specific sectors, such as manufacturing and sectors dealing with biological cycles. There is a need to research all industry sectors, as this represents a more efficient and effective way to introduce innovations and identify new market opportunities. Opportunities for the circular economy will enable a more rational use of raw materials and energy sources. Moreover, overall, the studies only focus on European countries, so there is a need to explore developing countries and capture differences due to regulations, social and cultural conditions, markets, and technology. The role of consumers in sustainability-oriented innovation also needs serious attention because they are the main contributors and users of environmentally friendly products. Finally, we suggest a longitudinal study to conduct empirical studies of organizations that are adopting circular economy and sustainability-oriented innovations around the world. The transition to clean energy through the use of sustainability-oriented innovation and the introduction of sustainable energy technology in the context of a circular economy can help reduce greenhouse gas emissions in industries.

This study also succeeded in identifying organizational internal factors, such as campaigning for pro-environmental behavior, implementing green human resource management, green intellectual capital, environmental orientation, environmental commitment, and creativity. While they are external factors, more emphasis is placed on optimizing green economic incentives and environmental knowledge sharing towards environmental organizational legitimacy. Finally, this study maps out the main topics in the literature at the intersection between sustainability-oriented innovation and themes related to the circular economy so that it is expected to serve as a starting point for conducting future research (Table 1). This study differs from previous systematic reviews, primarily in the extent and temporal range of the articles analyzed, including a large number of recent articles that convey the increasing prominence of this theme. However, utilizing only one database is a limitation that may have prevented the inclusion of relevant research studies.

Table 1. Suggestion for future research.

No	Clusters	Suggestions for Future Research
1	Strategic adoption for circular economy	Strengthening collaboration between parties Conducting empirical studies on global value chains and the drivers Examining the relationship between green innovation, waste reduction and sustainable performance
2	Waste management in circular economy	Research regarding nexus between eco-design and waste recycling for resource recovery Expanding the research sample to be able to generalize the results
3	Factors affecting CE and sustainability	Carry out research that focuses on product development and value co-creations Mapping resources and capabilities to build a green economy
4	Environmental process and its impact	Verify the impact of carbon reduction on energy conservations Examine the relationship between environmental regulation, economic development, and green development in various sectors Testing the impact of ecological processes on sustainable development
5	CEBM and mechanism	Investigation of technology adoption, circular supply chain and social innovation in building an innovation ecosystem Examining product service system and social enterprise
6	CE for development	Investigate environmental value proposition and circular bioeconomy and sustainable energy transition
7	CE and behavior	Identify key competencies, specific resources, and capacities Investigating customer perception about companies that implement sustainability-oriented innovation (SOI) Researching the role of knowledge sharing in strengthening collaboration and CE practice

6. Conclusions

This study produces three main conclusions that are useful in increasing understanding of the circular economy and sustainability-oriented innovation. First, this study succeeded in mapping 1832 articles on circular economy and sustainability-oriented innovation into seven main clusters. Cluster 1 is about strategic adoption with a total of seven keywords, which contains organizational efforts to collaborate to strengthen the mechanisms for building infrastructure to strengthen the circular economy. Collaboration will have implications for strengthening social capital and exchanging knowledge so as to produce important ideas that are useful in developing environmentally friendly programs. Cluster 2 discusses waste management with six main parameters, while cluster 3 discusses factors affecting the circular economy and sustainability with seven main indicators. Meanwhile, cluster 4 reveals the ecological process and its impact on achieving green development with eight parameters. Furthermore, cluster 5 discusses the circular economy business model and the mechanisms in it, including seven important indicators from the circular supply chain to social innovation. Cluster 6 discusses the topic of circular economy for energy development with seven main parameters. Finally, cluster 7 reveals the circular economy and behavior that supports pro-environmental behavior, environmental legitimacy, and sustainability-oriented innovation.

Second, research on the circular economy and sustainability-oriented innovation concentrates on three main topics, namely business model, transformation, and behavior. These three topics provide opportunities for understanding how the circular economy business model provides insight into all the industrial sectors make efforts to preserve the environment by changing strategies, mechanisms, and routine activities that are environmentally friendly.

This transformation requires the contribution of all elements of the organization, an innovative approach and the achievement of the vision, mission, and objectives of the orga-

nization. Finally, the transformation from a linear economy to a circular economy requires a behaviorally relevant approach. Recognizing that environmental conservation is a complex construct, the smallest changes start from the individual aspects of the organization. If each individual has the characteristic of pro-environmental behavior in routine activities, it will form an environmentally friendly organizational culture, environmentally oriented environmental strategies, and strategic planning.

Third, we recommend a total of 16 future agendas from seven clusters resulting from this systematic literature review. Thus, this study is expected to be a starting point and a reference for empirical research conducted in the future. All the ideas expressed based on the seven clusters are strategic efforts to improve the quality and quantity of research on the topic of the circular economy and sustainability-oriented innovation. By identifying various research agendas and opportunities for collaboration, citation and expanding expertise will be achieved towards sustainable development goals.

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