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*Research article*

## **Exploring the paradigm shift towards sustainability: A systematic literature review on circular economy and eco-innovation**

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**Abstract:** Amidst the adverse effects of the existing linear model on economic, social, and environmental aspects, the circular economy has emerged as a more sustainable alternative for economic growth and environmental sustainability. Further, the increasing significance of the circular economy as a means to achieve sustainability has prompted researchers to suggest various approaches. In this study, we employed a systematic literature review to present a unified perspective on the concept of circular economy and emphasize the connection of it with eco-innovation. We found that the last three years have witnessed a sudden rise in the publications related to a circular economy, stating the rise in interest of researchers towards a circular economy. While in its nascent phase of execution, much research has been carried out on the importance of adopting a circular economy for achieving sustainability. However, most researchers have failed to explore the contribution of the circular economy in the UN sustainable development strategies (SDGs) and the role of eco-innovation in the circular economy. Therefore, this research is novel, and we explored the role of circular economy and

eco-innovation towards sustainability through a systematic literature review. This research indicated that while developed countries have shifted to a circular economy, developing countries need to transition to a circular economy for sustainable benefits. A correlation was also found between the circular economy and some SDGs. The results emphasized that the incorporation of eco-innovations can help in mitigating the environmental consequences of production and consumption activities. It also sheds light on notable instances of eco-innovations that have been developed for deployment in the circular economy. This research will be helpful to industries, universities, and other major sections of society in developing circular economy practices in their core processes and ensuring the attainment of sustainable development goals.

**Keywords:** circular economy; eco-innovation; sustainability; sustainable development goals (SDGs); systematic literature review

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## 1. Introduction

The world is facing enormous climate change issues, be it global warming or carbon footprint, and responsible production and consumption are needed to tackle such issues. Customers are more concerned with the environmental impact of the products that they are buying. They are more conscious about what happens to a product after its useful life. The circular economy has gained importance among varied stakeholders in society in the last few years. Various challenges arise from a linear economy model addressed by this concept of the circular economy faced in economic, social, and environmental areas [1]. Improving the efficiency of the resources is the main objective of the circular economy model, which evolved from various economic and environmental models [2].

However, common companies are operating on the principle of the “Take, Make, and Dispose” model, as they consume the raw material in the production of finished goods later, which they sell to the consumers [3]. The linear model of “take, make, and throw away” poses a threat to the economic and environmental sustainability of our planet [4]. High unemployment rates, poor working conditions, and increasing inequalities result in society facing social vulnerability [5]. Therefore, a balanced and sustainable production system needs to be developed, consisting of the economic, social, environmental, and technological aspects of society. The concept of Circular Economy (CE) contributes to the amalgamation of these elements [6].

Today, globally, we are facing enormous climate change issues, be it global warming or carbon footprint, and as one of the first steps, responsible production and consumption are important. Customers are more concerned with the environmental impact of the products that they are buying. They are more conscious about what happens to a product after its useful life.

There has been a radical shift in economic behavior from “cradle-to-grave” to “cradle-to-cradle” by many industries to support the growth of the circular economy [7]. The circular economy concept has gained eminence in the political arena [8] and as a national development strategy in China [9]. Developed countries have adopted the concept of circular economy at a rapid pace [10], particularly in the European region, followed by the UK, France, and Italy [11].

With increasing concerns about environmental issues and sustainability, its relevance is now in the worldwide spotlight, with a clear commitment by the United Nations to a set of 17 sustainable development goals (SDGs) defined to provide “a shared blueprint for peace and prosperity for people

and the planet, now and into the future” [12]. Circular business models are widely analyzed within broader sustainability principles and the achievement of SDGs [13]. However, it is in the infancy stage in developing countries as both the companies and consumers are in the habit of using the linear consumption model [14]. Therefore, developing countries must shift to a circular economy swiftly for long-term societal benefits [10]. Though it is an emerging concept, researchers have researched, in detail the benefits, drivers, and challenges of the successful implementation of a circular economy [15]. Countries like Spain, Italy, and the United Kingdom face various barriers like lack of information and awareness, persistent use of economic models based on unsustainable practices, and inadequate incentives for the adoption of circular practices [16]. A circular economy enhances quality by gradually decoupling the increase in consumption of non-renewable resources [17]. Circular economy practices include reuse, recycling, and remanufacturing of resources, thereby using the resources for the present without sacrificing the future. Therefore, circular economy impacts natural resource conservation, innovation, circular-driven business models, sustainability, and resilience [18]. The circular economy provides solutions to encourage the well-being of firms, entrepreneurs, practitioners, and policymakers thereby making it inevitable in the current landscape.

Researchers state that ecological innovations or eco-innovations are important for the development of new business models that lessen the environmental impact of production and consumption activities [19]. As a unique way to address environmental issues, eco-innovations play a huge role in developing innovative products and services, new jobs, and a change in the behavior of individuals towards environmental issues [20]. Eco-innovations create environment-friendly and sustainable products and hence provide business opportunities in areas such as technological, non-technological, and innovative products, its services, and business practices [21]. It also can renew the environmental, social, and economic dimensions of sustainable development [22].

Eco-innovations are associated with the circular economy and they play an important role in shifting from a linear to a circular economy [23]. The combination of innovation ecosystem elements and circular economy foster sustainable innovation leading to environmental and economic growth [24]. The combination of innovation ecosystem elements and circular economy principles contributes to the prosperity of the environment and fosters sustainable innovation, leading to economic growth. Collaboration, entrepreneurship, and technology transformation in the circular economy framework will lead to an economy that satisfies current and future generations [17]. Therefore, an understanding of the role of eco-innovations in circular economy is essential for bringing systemic change in business and industry and promoting sustainable development.

The circular economy plays an integral role in sustainability as the circular model attains all dimensions of sustainable development (economic, social, and environmental) [25]. Sustainability ensures the integration of environmental resilience, economic growth, and social inclusiveness to safeguard the wellness of current and future generations [25]. CE stresses the need to create and maintain a resource-efficient and effective economic system by reducing the amount of energy and materials used in production [17]. Sustainability and CE have together contributed to the structural changes needed to implement sustainability initiatives [26]. CE, as a sustainability initiative, addresses environmental issues through innovations aimed at reducing resource exploitation. In fact, as an accelerator for SDG delivery, CE could support each of the 17 SDGs and foster resilient economies in the future [27].

Much research has been done on eco-innovations, circular economy, and sustainability. However, no researchers has tried to explore the connection between eco-innovations, sustainable development

goals, and circular economy. Looking into the futuristic role eco-innovations, CE and SDGs will play towards sustainable development, a detailed study of these concepts and the way they are intertwined is important. Therefore, we attempt to study the circular economy concept in detail and explore its connection with sustainable development goals (SDGs) and eco-innovation. Our aim is to try to understand what role eco-innovation has in the successful implementation of a circular economy in a sustainable manner through a systematic literature review. We aim to answer the following research questions:

RQ1: What is the knowledge and understanding of the concept of Circular Economy derived from academic literature?

RQ2: What are various principles of the circular economy in co-relation to sustainable development strategies?

RQ3: What is the performance of eco-innovation in the Circular Economy?

The research has enormous social and managerial implications. It will guide companies with the knowledge of eco-innovations and help to address various challenges faced by implementers in the implementation of circular economy practices at their workplace. The findings of the research will also benefit society by achieving sustainable development goals.

## **2. Materials and methods**

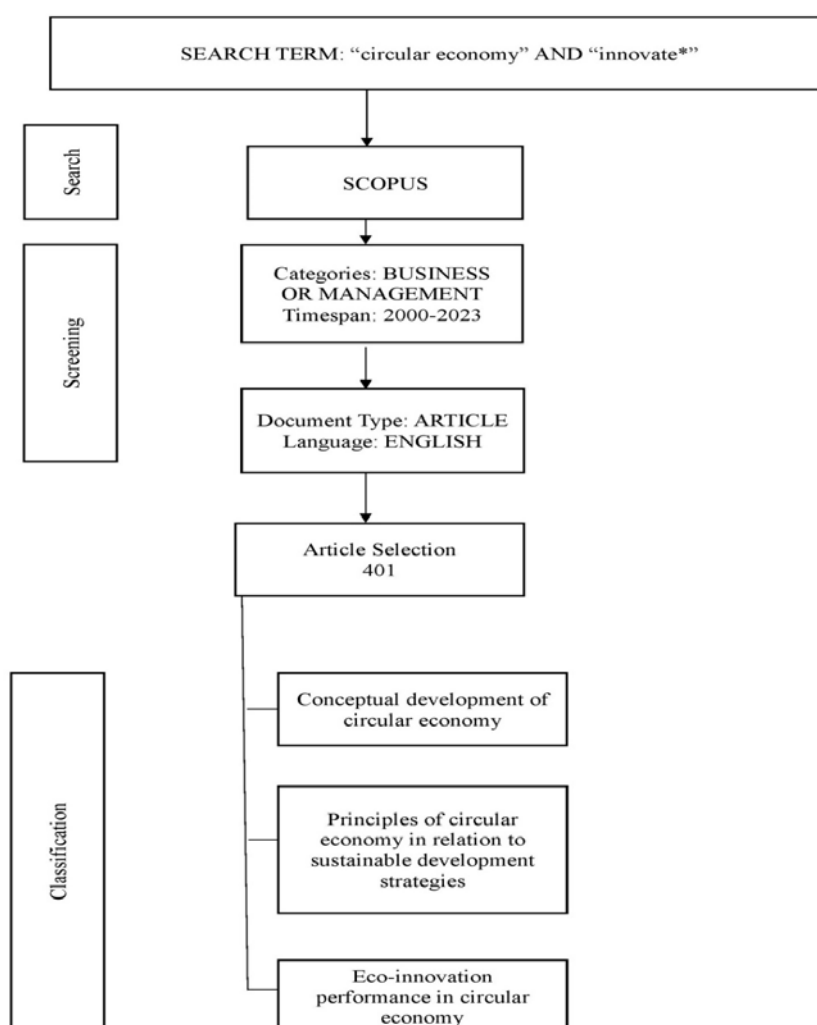
### *2.1. Research methodology:*

The research methodologies that can be used in the context of circular economy and eco-innovation include bibliometric analysis, content analysis, empirical, systematic literature review, and meta-analysis. Bibliometric analysis is a technique utilized to identify study topics and trends in a specific field of interest using metrics such as citation indexes. These metrics are made possible through the implementation of data-analytical algorithms capable of handling substantial amounts of data, in addition to visualization techniques. This approach uses keywords to identify study outcomes [28]. Content analysis is a method used to identify particular terms, topics, or ideas within qualitative data, like text. It helps researchers gain insights and understand patterns in the data. Scholars use it to quantify and analyze the frequency, importance, and relationships of particular words, subjects, or ideas [29]. The empirical analysis involves organizing data based on various risk factors, assessing the risks associated with the event that is important for each group, and conducting statistical tests to examine the relationships between them. When the data is adequate, this analysis can reveal a strong correlation between the risk under consideration and the factor that causes the risk [30].

A systematic literature review comprises an all-encompassing analysis of the existing literature concerning specific research matters and subjects. All available evidence about the area of interest is identified, evaluated, and compiled by a rigorous and regulated procedure. Owing to its simple and replicable methodology, a systematic review is generally considered the pinnacle of literature reviews. It requires an emphasis on a particular area of inquiry and works predominantly with qualitative analysis. On the other hand, meta-analyses offer robust empirical evidence, and concluding their patterns could yield valuable insights regarding the broader implications of the specific domain [31]. The process of searching, screening, and selecting the sample of articles for review is visually depicted in Figure 1. The database utilized for this purpose was Scopus. The first step involved the identification of suitable search terms, namely “circular economy” and “innovate\*,” which

encompassed variations of the term “innovation.” These search terms were selected to ensure comprehensive coverage of the topic, focusing on the intersection of circular economy and eco-innovation.

In the next step, the classifications within the Scopus database were subjected to a meticulous process of filtration and refinement, employing the specific keywords ‘MANAGEMENT’ and ‘BUSINESS.’ The results were then subjected to a screening process with criteria of the publication year along with a time frame between 2010–2023 being selected for inclusion. In addition, the document type chosen for this study was an article, which was deemed appropriate for the research objectives. Furthermore, the search process involved a language filter, specifically targeting publications written in English. The assessment of paper quality was conducted by evaluating the Scopus impact factor and categorizing the papers according to the Journal Citation Reports (JCR) categories.



**Figure 1.** Systematic literature review process.

Finally, a comprehensive collection of 401 articles was acquired, and an in-depth review and evaluation of each article was conducted to ensure their alignment with the study's parameters. Upon identification of the articles that aligned with the designated framework of investigation, a systematic

process of categorization and grouping was undertaken. However, it is worth noting that while certain researchers might not primarily focus on a particular research topic, they have made valuable contributions to other related topics.

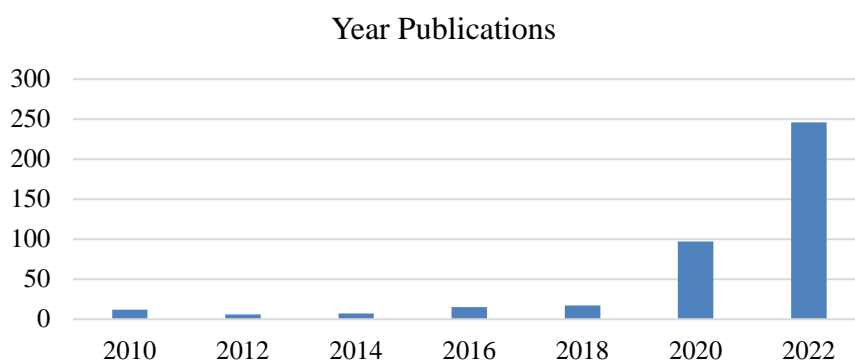
### 3. Results

The results obtained from the systematic literature review on circular economy and eco-innovation are discussed. With the results and findings of this analysis, the aim is to bring attention to the importance of incorporating a circular economy in eco-innovations to minimize environmental consequences and prevent its degradation by developing strategies.

The first sub-section deals with descriptive analysis, while the other three sub-sections deal with the prominent themes obtained. These three themes are (i) conceptual development of circular economy, (ii) principles of circular economy in relation to sustainable development strategies, and (iii) eco-innovation performance in the circular economy.

#### 3.1. Descriptive analysis

From 401 papers obtained, it was observed that 246 papers were published within 2022-2023, which was a significant rise from those published within 2020-2021 (97 papers). (Refer Figure 2) Further, it was found that there was a sudden decline in the number of papers published related to circular economy and eco-innovation in the timeframe between 2012-2013 (6 papers) as compared to those published between 2010-2011 (12 papers). These statistics demonstrate the increasing curiosity among authors to find the relationship between circular economy and eco-innovation, specifically in the post-Covid era. Also, there is a significant need to understand the impact of the implementation of the circular economy on ecological innovations.



**Figure 2.** Evolution of the number of reviewed studies over time on the Circular Economy.

The papers reviewed in the “Journal of Cleaner Production” and “Sustainable Production and Consumption” covered topics related to circular economy and eco-innovation and hence are the important journals covering total publications of 70 and 26, respectively. Moreover, using circular economy, eco-innovation, sustainability, and SDGs as keywords, most research papers were found in “Journal of Cleaner Production” and “Sustainable Production and Consumption” (Table 1).

**Table 1.** Top important journals.

Journal Name	Number of Articles
Journal of Cleaner Production	70
Sustainable Production and Consumption	26
Energy Procedia	17
She Ji: The Journal of Design, Economics, and Innovation	10
Resources, Conservation & Recycling: X	9

Among the various methodologies used in the context of circular economy and eco-innovation are bibliometric analysis, content analysis, empirical, systematic literature review, and meta-analysis. However, the prominent ones among these were systematic literature review and bibliometric analysis. The research methodology, systematic literature review employed in this study, involves the systematic selection and analysis of relevant publications about the circular economy, eco-innovation, sustainability, and SDGs (Table 2). These statistics also show the growing interest related to sustainability and Sustainable Development Goals (SDGs) post-2020.

**Table 2.** Methodologies used in the reviewed articles with author citation.

Methodologies used in the reviewed articles	Author Citations
Bibliometric Analysis	[32,33]
Content Analysis	[33–35]
Empirical	[36–38]
Systematic Literature Review	[39–41]
Meta-Analysis	[42–44]

### 3.2. Conceptual development of circular economy

The Circular Economy (CE) is commonly conceptualized as a cyclical process that involves the extraction and transformation of resources, as well as the subsequent distribution, utilization, and recovery of goods and materials. In the initial stage, companies engage in the acquisition of resources from the surrounding environment, which are subsequently subjected to a transformation process to yield various products and services. Subsequently, they disseminate the various products or services to end consumers through designated points of sale or to other enterprises, though they are utilized by consumers within the industry. At this stage, the CE proposes the implementation of a closed-loop system through goods recovery. The researchers in [45] emphasized the significance of innovation in the context of recovering and enhancing utilized materials, whether through environmental means or industrial processes, as opposed to their disposal or mere wastage.

In the context of CE, the primary objective is to prolong the lifespan of a product, thereby enabling a company's waste to be recycled as inputs for subsequent production cycles. This facilitates the diminishment of waste and the preservation of a significant portion of the intrinsic worth of goods, initial supplies, or materials throughout the production cycle for an extended duration [46], thereby constituting a novel avenue for generating additional revenue. Reconceptualizing waste refers to a resource that involves the adoption of novel and innovative strategies within established supply chains [47]. In link to this statement, we can further embrace and discover the integrated business

excellence framework with fundamental tenets such as environmental adaptability, responsibility, reliability, and innovation.

At the micro-level, the implementation and embedding of circular business models have found several positive effects. These include savings embedded in the production cycle, possibilities for product differentiation, better communication with customers, increased marginal revenues, reduced environmental footprint, and enhanced brand security (through patent acquisition) based on the principles of the CE [48,49]. The researchers in [50] have shown that both environmental legislation and consumer demand for green products act as drivers in the implementation of renewable and circular economy technologies. In the course of transitioning from a linear to a circular economy model— in carrying out the different stages comprising it— some incompatibility features related to the traditional system may be present, giving several external challenges and hurdles to address when pursuing the successful implantation of circularity. The researchers in [49] further identified the following hindrances in the study: Transportation and components, foreign regulatory limitations and tariffs, and the consideration of associated expenses in which import bans on specific goods were included. According to the findings in [51], it is a major challenge for firms because there is a lot of uncertainty due to limited information visibility on circular business models and what their subsequent trajectories would be [52]. The control dimension on the factors related to the operations of the firm varies from lack of control to partial control. Any organization is capable of coming up with a strategic plan and implementing appropriate actions later, though they do not have direct control over those actions. We have to remember that these actions that are meant to bring about improvement may also bring out negative environmental impacts. For example, the implementation of energy-saving technologies and improvements in materials that aim at cutting down the cost may lead to an increase in consumption. Moreover, the entry into the market of a new product can result in unintended adverse environmental effects. One of the possible effects that has been mentioned is the rebound effect on consumption. Laurenti et al. (2015) argue that it could be possible to reduce this effect by implementing actions that would make consumption more expensive.

In summary, the existing body of literature indicates that the implementation of CE is accompanied by a multitude of challenges and barriers. However, it is important to note that there are also various benefits and drivers associated with CE that have the potential to surpass and mitigate these limitations.

**Table 3.** Conceptual development of circular economy.

Themes	Author citations
Conceptual development of circular economy	[53–56]

### *3.3. Principles of circular economy in relation to sustainable development strategies*

The CE is a concept that encompasses an economic system characterized by the adoption of business models that deviate from the traditional end-of-life approach. Instead, the CE emphasizes the reduction, reuse, recycling, and recovery of materials throughout the overall operations process. The application of this approach is at multiple levels; one of the levels is the micro level involving individual companies, consumers, and products, and another level is the macro level involving ecological industrial parks and encompassing regions, nations, cities, and the global scale. The predominant objective of the CE is to achieve sustainable development, which entails the creation of



an environment characterized by high-quality standards, economic prosperity, and social equality. Ultimately, the CE aims to benefit current and future generations [57].

At the micro level, to examine CE performance, extensive research on the subject has been conducted. In addition, a notable gap was identified in previous literature, indicating a scarcity of studies specifically focused on the micro-level analysis of CE performance [58]. It is important to acknowledge that there is a limited body of research available on the meso-level, particularly concerning China [42].

To evaluate CE intervention performance at the micro level, many research efforts were conducted. The primary focus of performance evaluation in the field of CE at the micro-level is centered around the environmental aspect, accounting for 55% of the studies. The economic component constitutes 28% of research followed by the environmental research. However, it is worth noting that the social component is considered by a relatively small number of studies, comprising only 11% of the total. Micro-level studies focus primarily on product and analysis at the industry level with a limited given scope. The impact of the above-specified studies on the SDGs tends to be more targeted and specific. Production and consumption are the focal areas for the micro-level studies as per the examination of data associated with primary SDGs, as outlined in SDG 12. The additional significant SDGs encompass SDG7, which focuses on the attainment of affordable and clean energy, and SDG9, which emphasizes the development of industry, innovation, and infrastructure. Conversely, the supplementary but comparatively lesser contributions are directed towards SDG6, which pertains to the provision of clean water and sanitation; SDG8, aiming to promote decent work and economic growth; SDG11, which emphasizes the establishment of sustainable cities and communities; and SDG13, which focuses on taking action to combat climate change. The only study on human health (SDG3) is [59]. The findings indicate that micro-level productivity gains do not contribute measurably to realizing SDGs 1, 2, 4, 5, 10, 14, 15, 16, and 17. Based on the literature, meso-level studies are primarily based on two major SDGs: SDG7 (affordable and clean energy) and SDG12 (responsible production and consumption). Other SDGs include 6, 8, 9, and 11. However, it is interesting to note that only two studies include climate change action under SDG13 [58,60].

Further, meso-level studies do not appear to be making significant contributions towards achieving the SDGs related to poverty eradication (SDG1), hunger eradication (SDG2), promoting good health and well-being (SDG3), ensuring quality education (SDG4), achieving gender equality (SDG5), reducing inequalities (SDG10), conserving life below water (SDG14), preserving life on land (SDG15), establishing peace and justice and strong institutions (SDG16), and fostering partnerships to achieve the goals (SDG17).

Our findings indicate that the primary focus at the macro level is centered on the environment, as evidenced by 26 studies. Additionally, there is a significant emphasis on the economic dimension, as indicated by 23 studies. However, it is noteworthy to mention that the social perspective appears to be relatively neglected, with only 12 studies considering this aspect. The analysis of the matching exercise conducted on the SDGs indicates that the primary SDG that the literature on CE performance focuses on is SDG12, which pertains to responsible production and consumption. The second significant impact of CE performance enhancement pertains to the advancement of affordable and clean energy, as outlined in SDG7. Among the studies analyzed, approximately 27 macro-level studies were found to have made notable contributions in this area. The research findings indicate that a minor but noteworthy contribution has been made towards the advancement of various SDGs. Specifically, efforts have been directed towards addressing the challenges related to clean water and sanitation

(SDG6), promoting decent work and economic growth (SDG8), industry, innovation, and infrastructure (SDG9), and climate change (SDG13). These areas have received attention and resources, albeit to a lesser extent compared to other priority SDGs. However, it is important to note that the technical cycle of CE does not currently make significant contributions towards achieving the goals of zero hunger (SDG2), gender equality (SDG5), and peace and justice strong institutions (SDG16). In addition, our research has uncovered the work of [61], which provides evidence in support of the objective of eradicating poverty (SDG1). Furthermore, [62] has made significant contributions towards reducing inequality (SDG10).

**Table 4.** Principles of circular economy in relation to sustainable development strategies.

Theme	Author Citations
Principles of circular economy in relation to sustainable development strategies	[63,64]

### 3.4. *Eco-innovation performance in a circular economy*

In sustainable societies, Eco-innovations (EI) have a crucial role as they facilitate the adoption of individual technologies. They necessitate greater collaboration compared to other forms of innovation due to their reliance on novel technologies that demand a higher degree of external expertise and information sources [65]. The researchers in [66] conducted a study that identified two primary avenues for EI: Environmental design of products and cleaner production. In addition, the origination framework, innovation methods, attributes, and backdrop of the industry have a favorable influence on innovation.

Environment restoration is an advantage when EI enables CE, which enhances the ability of systems to efficiently recycle materials and generate value for both nature and society. In their study, the researchers in [67] examined four categories of EI associated with CE: Investing in EI, environmental design, investments in innovative as well as renewable technological solutions to enhance energy efficiency, and investments in research and development. As per the findings, overall CE efficiency is enhanced by the influence of informal environmental management methods, which impacts the company's CE activities. Additionally, they recognized the increasing significance of emerging instruments that might facilitate the advancement of EI, like environmentally friendly accounting, human resources for the environment, as well as corporate governance.

The Oslo Manual (OECD, 2005) defines four types of innovation: Product, process, marketing, and organizational innovation. In addition, [68] proposes ten types of innovation: product performance, product system, process, service, network, structure, channel, brand, profit model, and customer engagement. Within this conceptual structure, we propose that the paradigm shift will be evident through the implementation of EIs, which are the concrete outcomes of the CE paradigm. Combining these two innovation proposals, the authors provide two types of innovative business models – user-oriented and results-oriented. The user-oriented business model involves offering a product for rent or lease while maintaining ownership. Other than that, the results-oriented business model prioritizes achieving certain goals, in which the leading business delivers a predetermined consequence to the consumer [51]. These are part of a set of products and services that propose a shift in the innovative business model. Instead of just selling a manufactured product and making a profit based

on the number of products sold, the new model offers a blend of products and services that cater to the consumer's needs. In this model, profit is also dependent on the number of services provided [69].

Dynamic remanufacturing capabilities (DRC) are the subject of several studies, which indicate evidence of a sustainable competitive advantage. These capabilities include the ability to spot needs, opportunities, and system adjustments by utilizing micro-foundations made up of diverse skills, processes, and business operations. They are also engaged in environmentally friendly production systems that reuse the residual value of expired products rather than throwing them away. It refers to the ability also to improve and effect changes in production systems by altering the period of specific components [70]. 3D printing is another example of an EI that promotes recycling by employing its manufacturing processes. According to [71,72], it can be used in the execution of CE. It is a developing technological innovation that can enable and drive the change to a CE by bringing forth new DRC and changing linear economies of many manufacturing sectors. Product design makes recycling possible by ensuring that the product lives longer and that a local logistics system is put in place, an approach that relies on economies of vision rather than economies of scale, leading to great savings. The implementation of the circular economy to enable easy reach and merchandising of goods needs technological changes and institutional reorientation [73]. An alternative view is to consider them as evolving features from a set of options rather than from an optimal and effective realization of the concept. The companies capable of tracking back the components and materials that are used in the reverse logistics cycle of 3Rs will be more competitive than those unaware of the origin of their products. Another EI involves the integration of CE concepts into software, thereby expanding its boundary from just the physical elements of the software. The adoption of circular practices is important in the electronics industry, which covers both hardware components and software solutions. A tangible product does not share similar rights with a holder of an item where ownership of the software is licensed only for use under ownership; this acts as a limitation in terms of being able to reuse or repair that item and its software [74]. Thus, EI will act as a channel through which the implementation of CE will be possible across different industries. The primary enablers under which the CE will be encouraged include the DRC ecosystem of products and services, 3D printing, the origin of the product, and the recycling of software.

**Table 5.** Eco-innovation performance in a circular economy.

Theme	Author Citations
Eco-innovation performance in circular economy	[75,76]

#### 4. Discussion

This paper contributes to a better comprehension of the circular economy concept and its link with eco-innovation performance. The circular economy is a loop system that integrates the 3Rs into the functioning of the economy: Reduction, reuse, and recycling. Implementing the CE brings several advantages for firms and economic growth in terms of decoupling. The researchers in [46] found evidence supporting the idea that applying circular principles directly affects resource productivity positively, thereby contributing to economic growth. Circular literacy, according to [77], is the application-oriented knowledge capacity of implementing sustainable development through the operational methods of the circular economy. This study argues that the realization of CE potentials

for production and consumption as sustainable drivers and solutions to the manifold challenges within global political dynamics and uncertainties requires this kind of knowledge.

The researchers in [78] express that the establishment of CE results from the orientation to market functioning rather than from focusing on sustainable development. They argue that environmental considerations do not appear to be a major driver of CE but that it is being propelled by economic rationality. The authors found very little research on the subject, with one notable exception: China. For example, progress on the circular economy among OECD countries has been analyzed using reference indicators such as resource efficiency, environmental and economic growth factors, population dynamics, and waste management. In this study, the indicators used covered all three dimensions of sustainability, thus making simultaneous contributions to a large part of the Sustainable Development Goals (SDGs) [61]. At the micro-level, there is a high focus area within organizations toward the improvement of their internal processes and to encourage eco-innovation. Also, note that there is a direct relationship between how mature an organization is from the environmental management perspective with their inclination towards adopting CE practices. This correlation can be attributed to the favorable influence that CE implementation has on the organization's image among consumers, as well as the subsequent cost reductions that are associated with such practices [79].

The authors found two innovation models: User-oriented and results-oriented. The identified product innovations are directly linked to the improvement in both environment quality and product performance [80]. The primary focus of service innovations lies in the development of infrastructures that reduce ownership and promote renting services [81]. Further, efficient operations of DRC necessitate two key components: Adaptable systems that can be modified based on the number of products retrieved and the preferences of customers and control systems that enable cost-effective supervision of operations and minimize the associated risks [70]. It was also found that CE can be used in conjunction with EI in areas like 3D printing, product origins, and software recycling.

## 5. Conclusions

We provide a systematic literature review related to the circular economy and eco-innovation with the data extracted from the Scopus database within the timeframe of 2010-2023. The descriptive analysis confirms that there is an evolution in the number of research studies conducted between 2018-2023. This showcases that there is a rapid growth in the research associated with CE and its implementation in alignment with SDGs. It is also evident that the Journal of Cleaner Production has a maximum number of articles published to date. We found that the Circular Economy is an emerging topic that has attracted increasing research interest. Further, the themes obtained during the systematic literature review include the Conceptual development of Circular Economy, Principles of Circular economy in relation to sustainable development strategies, and Eco-innovation performance in the circular economy.

The traditional linear model is unsustainable as the “take, make, and throw away” approach poses a threat to not only the economic but also the environmental sustainability of the organizations and society at large [82]. It is found that most of the developed countries are already using circular practices, and developing countries must also shift to circular economy practices for long-term sustainable benefits. United Nations has also specified a clear commitment to a set of 17 sustainable development goals (SDGs) as there is a rise in concerns about the environment and sustainability. The integration and implementation of circular practices have shown the multiple benefits for waste

reduction, resource conservation, reuse, recycling, optimal use of resources, and the mitigation of environmental and social impacts [48]. We found that there is a synergetic relationship between circular economy and eco-innovation. This emphasizes the need for innovative approaches, critical thinking, and a multidimensional approach to drive sustainable and competitive initiatives across industries [83]. This is a preponderance of Thematic Indicators that are tied to conservation, which suggests a conservative attitude to cultural sustainability, particularly with regard to environmental resilience, wealth, and livelihoods.

This study encompassed all three aspects of sustainability contributing to SDGs. We also found a correlation between CE and some of the SDGs in the literature review. The mesh-level analysis was primarily focused on two SDGs, but during further analysis, we found that it encompasses four more SDGs. Environment-focused mesh-level analysis and Eco-innovation performance were evident in the analysis of the existing work of CE, and it can be executed by EI and DRC. As per the study, circular EI will not only have an impact on the operations but on various other fields, such as environment-friendly accounting, human resources for the environment, and corporate governance [73]. The EI, and for adopting the same, it is necessary to overcome or replace the current linear economic model, committing to new business models and new ways of operating in the supply chains that allow the circle to be closed and all the waste to be taken advantage of. EI is providing technological and eco-friendly innovations such as the ecosystem of products and services, dynamic remanufacturing capabilities (DRC), 3D printing, and recycling of software-

CE is one of the solutions to the environmental concerns that are directly or indirectly created by organizations that have been facing mortality for several years now. Although it is at a very early stage of implementation, its benefits and drivers and challenges and barriers to implementation have been investigated. It also encourages the reversal cycle of the 3Rs, i.e., Reduce, Reuse, and Recycle, and it gives the business impact in a positive manner [84]. Dynamic remanufacturing capabilities (DRC) provide a competitive edge to the business as it has the capabilities and ability to identify needs, exploit opportunities, and adapt the system by utilizing micro-foundations consisting of various talents, processes, and commercial activities. DRC has sustainable production methods primarily focused on reutilizing the residual value of products that are no longer available [85].

We wish to navigate towards a more sustainable future, that is, driving the business with SDGs and with corporate governance strategies. Therefore, it is evident that a circular economy should be an integral component of business strategies and societal norms. The two innovation models, user-oriented and results-oriented, found in the literature review can be researched further [52]. The systematic literature review underscores the importance of fostering a holistic understanding of sustainability that transcends traditional linear models of production and consumption. We also explain notable instances of eco-innovations that are developed for deployment in the circular economy.

## 6. Implications

We provide details of the theoretical framework for CE and eco-innovation. In the future, it can help in validating the data in real-time through an expansion in the scope of data collection and research methodology. This will help industries and societies in adopting circular practices in their respective relevant areas. With the help of studies associated with CE and SDGs, researchers can gather further information on the industry practices and validate the same. Studies on the impact that the dynamics of trade with recycling and secondary raw materials may have on some macroeconomic variables or

the impact of CE on social, political, economic, and technical aspects would also be interesting to clarify the path toward CE.

## 7. Scope for future research

One of the notable limitations inherent in this research endeavor pertains to its exclusive reliance on one specific methodology, namely the systematic review literature. Further, the analysis conducted thus far has solely relied on the utilization of a single database, namely Scopus. Consequently, it would be better to broaden the scope of the sample by incorporating additional databases into the research methodology. Future research can be synthesized by expanding research studies using diverse research methodologies and more data sources, which will integrate and extend existing research. It is apparent in the literature review that developed countries are using Circular Economy practices, and it is yet to be adopted by developing countries; hence, there is a scope for further research on how these developing countries can adopt it. The impact of CE on SDGs and challenges associated with CE can be tested in a real-time environment. Case study analysis can be carried out to study the contribution of eco-innovation in CE which can provide detailed analysis along with challenges associated with it. The two innovation models, user-oriented and results-oriented found in the literature review can be studied by global researchers as this will help enhance the effectiveness of environment-friendly production and consumption of the product.

## Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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## Conflict of interest

All authors declare no conflicts of interest in this paper.

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