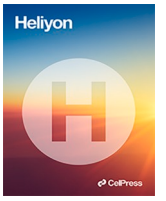
Heliyon 9 (2023) e21091

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Review article

# A review of literature on the integration of green energy and circular economy

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ARTICLE INFO

*Keywords:*
Circular economy
Green energy
Renewable energy
Sustainability
SDG'S
Systematic literature review

ABSTRACT

Green energy is being claimed as a sustainable solution to the socioeconomic concerns associated with environmental issues and the depletion of non-renewable sources of energy. The impacts of climate change, including global warming, ozone layer depletion, and rising sea levels, have underscored the emergent need for increased investment in green energy to curb down carbon dioxide emissions. Evolution of environmentalism in the 21st century, and the power of environmentally conscious population with their consumption driven demand is increasing which address a wide variety of economic, social, political, technological and legal topics, ranging from empirical analysis to philosophical theorization. This study aims to explore recent advancements in green energy, adaptations to it, and the role of the circular economy within this context. The research employed a review approach, combined with bibliometric analysis of articles published in the past two decades. These articles were obtained from the Scopus database and selected based on specific inclusion and exclusion criteria. To conduct the bibliometric analysis, the authors utilized Bibliometrix R and VOSviewer software, employing analysis like performance analysis, and bibliographic coupling. This study serves as an initiative to identify emerging themes and potential future research areas, with a specific focus on the impact of green energy on industrial and business-to-business sectors and the development of decision-making tools.

## 1. Introduction

Modern society has transformed from incomprehensible and uncontrollable forces of nature into manageable challenges though science and technology and evolved wisdom. Beginning in the late 1960s, the issues of ecological damage and overuse of natural resources emerged as societal pathologies in the form of negative externalities resulting from the production process [1]. The linear economy model, which has driven industrial development, has resulted in pollution and the disproportionate utilization of finite natural deposits. In contrast, the circular economy is sustainable and advocated as an essential pragmatic alternative to mitigate the negative environmental impacts, promote reduced energy consumption, and foster increased economic growth [2].The circular economy incorporates reuse, remanufacturing, restoration, and modernization of materials, with a key focus on biodegradable

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https://doi.org/10.1016/j.heliyon.2023.e21091
Received 25 June 2023; Received in revised form 12 October 2023; Accepted 15 October 2023
Available online 21 October 2023

materials that can be recycled into the atmosphere without generating waste using contemporary sciences as transforming force in production [3].

The question becomes doubly urgent given the immense new powers that mass production systems and global supply chain contributing to global warming, ozone depletion, jeopardizing human existence as dominant species on earth. The relentless rise in greenhouse gas concentrations, which is largely driven by human activity, has triggered global warming - one of the most urgent problems we face today. Its impact extends across various sectors, including the economy, society, technology, environment, politics, and ecology, and poses a significant threat to our planet's future [4]. The growing concern around climate change has sparked a widespread interest in related topics, such as the greenhouse effect, carbon footprint, and carbon dioxide emissions. These topics aim to address a wide variety of political, economic, social, technological, legal and externality to be mitigate for which humanity look for solution [5,6].

To address these issues, the United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992, leading to three climate agreements: the Kyoto Protocol, the Cancun Agreements, and the Paris Agreement. Countries have made pledges to emission reductions and action plans, and new ideas such as a low-carbon society, low-carbon cities, low-carbon lifestyles, carbon trading, carbon taxes, and carbon emission reduction strategies have emerged as a key component of global development [1,7]. Governments, organizations, and scholars have invested significant financial, social, and intellectual resources into researching and exploring ways to mitigate the impact of climate change. Together, they are working to identify a path towards a low-carbon future [5]. Recognizing the interdependence between resource development and its usually unforeseen repercussions while keeping in mind the welfare of future generations. The need for environmental discourse framing the legal structure by global institutions as guiding principles for SDGs.

Integration of Circular economy and green energy holds the potential solution to all problems related to environmental change and means of production. Thus, significant efforts have been made globally to promote the use of renewable energy, further investment in this sector is essential to achieve a marked reduction in Carbon dioxide ($CO_2$) emissions [8]. Sustainable power sources require development, innovation and examination, and this includes some significant pitfalls. To be sure, over time, sustainable power sources represent a bigger portion of the general creation limit of power in numerous nations [9]. At the end of the day, the more that nations depend on sustainable power sources, the more noteworthy this market will become, and afterward to an ever-increasing extent nations will foster venture approaches to draw in unfamiliar financial backers in the sustainable power sources area [8]. The integrated system will evolve by incorporating the principles rooted in the well-being of future generations and the sustainability of human existence, without necessarily curtailing current consumption patterns.

Extensive research is needed to address aforesaid arguments in adopting green energy in the circular economy for long-term sustainability. As a result, the following research topics are the focus of this study.

i. To examine the publication as well as citation performance of Circular economy and green energy research.
ii. To list the journals,and publications that accomplished the most work on the circular economy and green energy.
iii. To examine the major themes of research on the circular economy and green energy.
iv. To propose future research opportunities for Circular economy and Green energy research.

After comprehending the literature, the integration of circular economy and green energy have been determined using above objectives. The goal of this study was to identify and compare bibliometric views of circular economy and green energy that have been published in peer-reviewed journals. The literature was used to achieve this goal. The review focused on a search of all publications in the Scopus database. Scopus was chosen because of its online library of management and engineering journals [10].

The following parts make up the remainder of the study: The detailed description of Circular economy and green energy is highlighted in Section 2, along with the literature that supports sustainable development goals. The research methodology and suggested research framework for adopting Circular economy and green energy articles are illustrated in Section 3. In Section 4, the current state of circular economy and green energy is illustrated. In Section 5, the study's findings have been outlined and evaluated, along with its management ramifications. The entire essay is concluded in Section 6, which also outlines potential future study directions in this field. The invincibility of its conclusion is implicit in objective sustainable development.

## 2. Conceptual background

According to Abolhosseini, Heshmati and Altmann [11], waste disposal is considered the most effective solution for pollution issues that pose a threat to ecosystems at a global, national, and local level. Adopting a zero-waste approach can enhance a company's competitiveness and align with the industry's natural inclination towards efficiency. In recent times, the focus has shifted from the competence of work as well as capital to the efficiency of raw materials, which is known as "more with less." Thus, zero waste has become another standard for proficiency and integration in modern organizations [12]. On the other hand, the circular economy demands a paradigm shift away from the linear, fossil-based model that has prevailed since the industrial revolution. This model has contributed to global socio-economic and technological advancement at the expense of the environment [13]. To meet the Sustainable Development Goals (SDGs) of the Paris Climate Agreement by 2030, a challenging socio-economic transformation towards a new paradigm is required. Bio-based materials and goods should not compete with food production to prevent any harmful environmental impact [6].

The elimination of waste generating systems is a critical component of the move towards zero waste, such as through second generation biorefineries, which can produce clean consumer goods at scale [13]. Recovery technologies are essential for promoting the

reuse, recycling, and recovery of valuable elements once these commodities are in use in society, leading to overall economic benefits [11]. Overall economic benefits can be realized if biological variety is increased through collaborative efforts by producers and consumers in the pursuit of sustainability [14].

The circular economy, as proposed by the Ellen MacArthur Foundation (EMF), offers a promising path to eliminating material waste, reducing environmental harm, and mitigating climate change [15]. However, to avoid the circular economy becoming yet another flawed and ineffective sustainability concept, proper regulation and oversight are necessary [16,17]. Policies, such as deregulating trash trading, tax relief for circular products, and awareness-raising activities, can promote a healthier circular economy [18].

In order to employ renewable energy, it is important to get rid of dangerous chemicals, and cut waste, the circular economy looks into and creates chances for a cradle-to-cradle change in the design of resources, goods, systems, and operations [4]. It is a widely supported strategy for reducing environmental costs and boosting the economy, as it dissociates economic progress from the exploitation of natural resources [19]. Although the circular economy concept has been present in other EU programs for decades, such as resource efficiency and waste data, it has gained significant traction in recent years [20].

### 2.1. Circular economy

Since the late 1970s, the concept of the "Circular Economy" has captured traction among scholars and practitioners [21]. This idea challenges the linear and unsustainable nature of modern economic systems, which treat natural resources as mere inputs for production and consumption and waste as outputs. Various authors have examined how the economy and the environment are interconnected, drawing inspiration from Boulding's (1966) assertion that the earth is a closed, circular system with a finite ability for assimilation. In this framework, the Circular Economy seeks to initiate a more sustainable and regenerative economic model that mimics natural ecosystems and reduces waste, pollution, and resource depletion [22–24].

The approach of the Circular Economy has evolved to encompass several elements and ideas that promote closed-loop systems in economic and industrial processes. These include cradle-to-cradle [25], the laws of ecology [26], looped and performance economies [27], regenerative design, industrial ecology, biomimicry [28], and the blue economy [29], among others. The circular economy (CE) has gained a foothold in the last decade as a viable alternative to the current predatory take-make-dispose linear economic model. The Ellen MacArthur Foundation's work in 2012 played a significant role in popularizing the concept, leading to a 600 % increase in literature on the Circular Economy [30]. The Circular Economy aims to establish a shared economic platform that considers the needs of both the environment and capital, encompassing all services in commercial and industrial settings [31].

The Circular Economy is an emergent system that seeks to minimize resource input and waste, emissions, and energy leakage in order to reduce waste and advance sustainable development [2,32]. This can be achieved through various methods such as durable design, upkeep, repair, reuse, remanufacturing, refurbishment, and recycling. The concept of Circular Economy has been defined in various ways, with up to 114 different definitions attempting to describe this innovative term.

The Circular Economy as an academic discourse replaces the linear "end-of-life" approach with a circular process that focuses on reducing, reusing, recycling, and recovering materials and resources throughout the creation, circulation, as well as sustainable process. It operates at various levels, including the local, micro (products, businesses, and consumers), meso (eco-industrial parks), and macro (city, region, nation, and beyond) levels, with the goal of achieving sustainable development while promoting environmental stewardship, economic growth, and social equity for current and future generations [33].

The paradigm of the Circular Economy is made possible through new technologies, responsible consumers, and innovative business models. CE is a sustainable development initiative that aims to reduce the linear material and energy flow in society's production and consumption systems by using renewable energy flows [34]. By increasing the value of waste and reducing resource usage, the Circular Economy promotes a more efficient and sustainable approach to resource management. This encompasses material, product, and system design, as well as business concepts, to create a more circular and regenerative economy [31].

### 2.2. Green energy

The conception of a clean environment has gained importance in today's society, and using green energy is means to attain this objective. "Green energy refers to the belief that energy produced from renewable natural resources, such as sunshine, wind, rain, tides, plants, algae, and geothermal heat, has little to no negative environmental impact" [35,36]. This idea was first introduced in 2006 as part of a mission to make renewable energy commonplace.

Traditional sources of energy, such as fossil fuels, are major contributor to global warming and climate change. Green energy, on the other hand, aims to produce power while minimizing waste and pollution in order to lessen the environmental impact of energy production [37]. The utilitarian value of green energy on the other hand is crucial in slowing down the rate of climate change.

The notion of green energy is not only a concept but it has become a reality with the enactment of the Ontario Green Energy Act in 2009 which is considered as one of the successful climate policies. This act promoted the generation of renewable energy sources and energy efficiency through a 20-year feed-in tariff system for hydro, wind, solar (PV), and biomass projects [38].

The rationale behind green energy is cleaner means of production for energy by society. Green energy subliminally reflect clean energy by minimizing waste and reducing negative externality of the environment impact of energy production [38]. Renewable energy sources, such as hydro, wind, solar (PV), biomass, plants, algae, geothermal heat, and others, are used to produce green energy, which is sustainable and has little to no negative environmental impact. Scientists suggest that employing green energy will slow the rate of climate change, making it a viable option for sustainable living [39]. Green energy is considered as a renewable energy source,

unlike traditional fossil fuel sources. It is mainly used for concerns like cogeneration, heating, and electricity. Customers or businesses can purchase green energy sources to support living that is environmentally friendly and to lower negative effects of energy generation [40]. Energy certificates or certificates for renewable energy are available to encourage the implementation of green measures. According to estimates, more than 1 million US homes and 35 million residences in Europe use Green Certificates to signify their use of green energy. Ultimately, green energy is clean energy and a sustainable solution for the planet [37,41].

### 2.3. Integration of circular economy and green energy

Achieving sustainable development goals and mitigating the damaging effects of human activity on the environment depend on the integration of green energy and the circular economy. The Circular economy involves reducing, reusing, recycling, and recovering materials and processes in a sustainable way that minimizes environmental impact. Green energy can contribute to the strength of the circular economy because it is derived from renewable sources and has minimal environmental impact [37]. Adopting green energy for industrial and residential purposes is essential for protecting the environment and ensuring a stable supply of energy. In order to combat global warming and protect ecosystems, environmentally friendly energy sources must be used to reduce carbon dioxide emissions through efficient use of energy and renewable energy [42,43]. The praxis Green energy and the circular economy can be combined to produce a more environmentally friendly and efficient system for the production and consumption of energy [39]. For instance, using renewable energy sources like solar and wind power to produce energy for industrial processes can significantly reduce greenhouse gas emissions and waste. This can be achieved by designing products and processes that use renewable energy sources and by adopting circular economy principles to reduce waste and promote source adeptness [36]. Researchers have shown that using green energy can also enhance economic growth and create new job opportunities. Therefore, incorporating green energy into our energy mix can help us achieve a sustainable, resilient and robust circular economy. Definitions of green energy and circular economy listed in Table 1.

## 3. Methodology

The literature review's objective is to enable the researcher to chart and assess the current intellectual landscape, as well as to develop a research enquiry that will add to the degree of knowledge already available [44]. For this study Scopus database was used and keywords used were "Circular Economy", "Green Energy". Data yielded 234,000 + results. After using the inclusion and exclusion criteria final data set becomes 2640 papers. For the analysis part VOSviewer, Bibliometrix R and Cite space were used.

The choices and actions involved in the data gathering, filtration, and analysis procedures in this regard are guided by the Scientific

**Table 1**
Definitions of Green energy and Circular economy.

| | Author's | Definition |
|---|---|---|
| Green Energy | Vijay Laxmi Kalyani, Manisha Kumari Dudy and Shikha Pareek | "Green energy reflects the idea about generation of energy from natural resources like sunlight, wind, rain, tides, plant, algae, geothermal heat, etc. having no or less impact on the environment and can be renewed". |
| | Hong Lina and XujunZhai | "Green Energy (GE) as a new concept of energy generation promotes the maximum reuse/recycling of natural resources like sunlight, wind, rain etc". |
| | ViktoriiaBrazovskaia and Svetlana Gutman | "Green energy entails cutting back on harmful emissions into the atmosphere and improving energy efficiency from current energy systems". |
| Circular Economy | Ghisellini, Ripa and Ulgiati | "Circular economy (CE) as a new model of economic development promotes the maximum reuse/recycling of materials, goods and components in order to decrease waste generation to the largest possible extent. It aims to innovate the entire chain of production, consumption, distribution and recovery of materials and energy according to a cradle to cradle vision". |
| | Geissdoerfer et al. (2017) | "A regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling ". |
| | Kirchherr et al., 2017 | "An economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (ecoindustrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economicprosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible Consumer". |
| | Korhonen, Honkasalo and Seppälä | "Circular economy is an economy constructed from societal production consumption systems that maximizes the service produced from the linear nature-societynature material and energy throughput flow. This is done by using cyclical materials flows, renewable energy sources and cascading1-type energy flows. Successful circular economy contributes to all the three dimensions of sustainable development. Circular economy limits the throughput flow to a level that nature tolerates and utilises ecosystem cycles in economic cycles by respecting their natural reproduction rates" |
| | Ellen MacArthur Foundation | "A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems". |

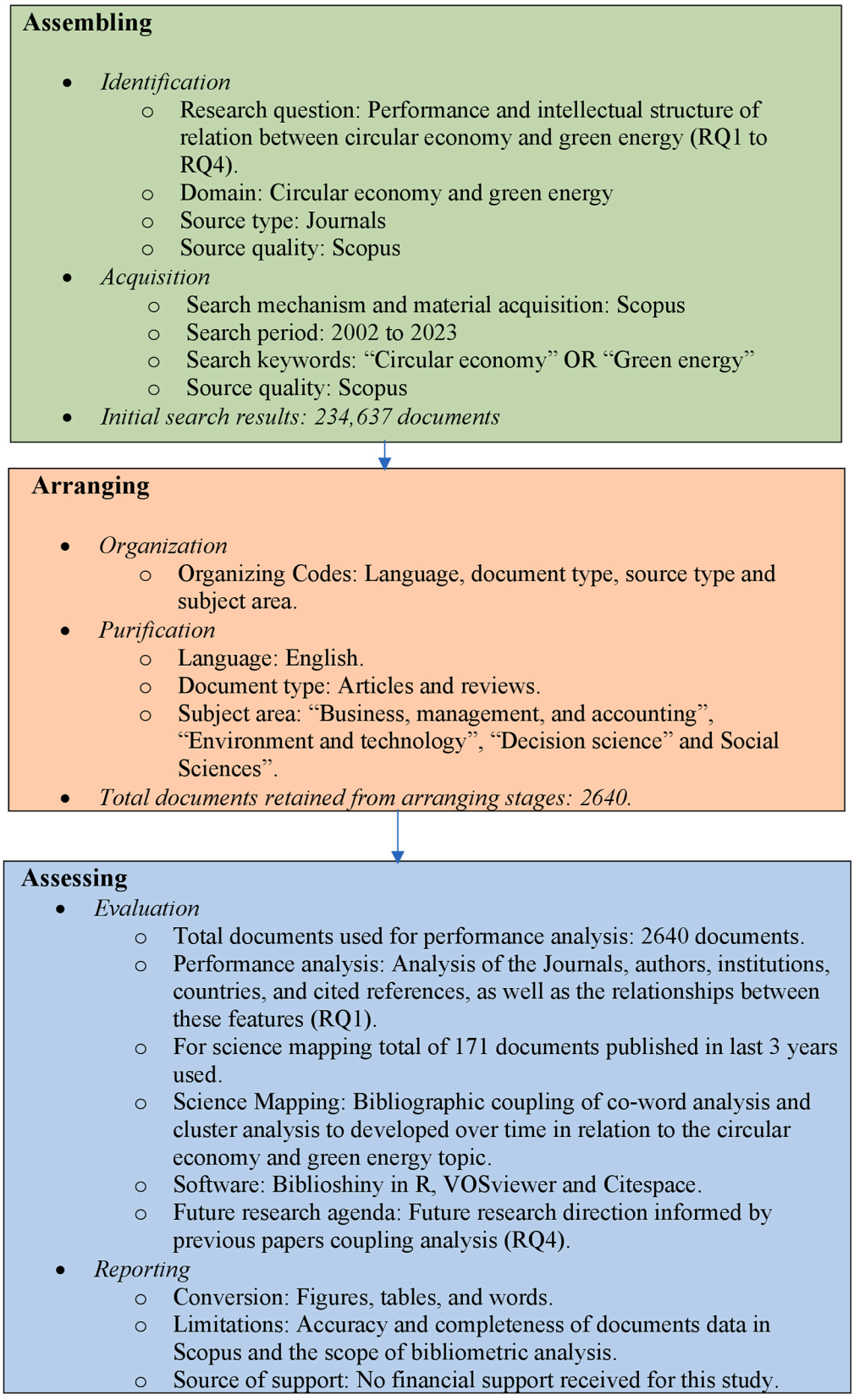


**Fig. 1.** Review Procedure using the SPAR-4-SLR Protocol.

Processes as well as Justifications for Systematic Literature Reviews protocol [45]. This process specifically comprises of three primary steps, namely assembling, arranging, and assessing. These stages' specifics are necessary for clarity of reporting and eliminating possible errors and biases. The stages are shown in Fig. 1 as well as discussed in the following segments.

### 3.1. Assembling

Assembling entails the identification and acquisition of previously written literature in a particular field. Regarding report labeling, this research's goal is to assess the usefulness (RQ1/RQ2) and conceptual underpinnings (RQ3/RQ4) of the existing article on tailored circular economies and green energy that has been published in journals (source type) indexed in Scopus (source quality). Scopus database is used as it offers comprehensive coverage, and reliable data quality. Scopus indexed Journals indexed are subjected to a peak level of peer review inquiry [45,46]. This study uses the keywords "Circular economy" and "Green energy" to retrieve bibliometric data and full-text articles from journals via Scopus. The search covers the period from 2002 to 2023. The search in the assembling step yielded 234,637documents in total.

### 3.2. Arranging

Arranging entails organizing and purifying text that is in the process of being synthesized. The study utilized Scopus' "refine results" rules or filters to categorize the retrieved papers based on factors such as language, content type, reference type, and subject matter. The rules, in specific, serve as report attributes that were utilized for report cleansing (or filtration), with reports being added or omitted based on these rules. The review specifically adds "English" (language) "articles" as well as "reviews" (report type) presented in "journals" (resource type) in areas deemed related to the Circular economy and green energy, namely "business, management, and accounting," "Environment and technology," "decision sciences," as well as "social sciences" (subject area). Some papers, such as editorials as well as other writing, were not added since they were not subjected to observation by peers, and non-English materials were eliminated because the researchers only spoke English (e.g., more than 26,400 titles by over 5000 publishers) [47].

A total of 2640 documents were returned after the organizing step's organization and Cleansing of search results.

### 3.3. Assessing

Assessing, which entails evaluating and reporting on synthesized literature.

In terms of evaluation, the 2640 reports on Circular economy and green energy that were preserved for revision were reviewed using a variety of bibliometric analytic methodologies (analysis method). The foundation of bibliometric analysis lies in the application of measurable or statistical methods to a particular corpus of texts that represents a field of research in the academic literature aiming to ensure replicability [9,48–51]. VOS viewer is used to generate maps of writers or periodicals based on co-citation data or maps of keywords based on coincidence data. The bibliometric review method, in contrast to other critique process (e.g., critical and systematic reviews), overcomes subjectivity bias because the quantitative measures used in bibliometric reviews can supply impartiality in the analysis and findings emerging from a large corpus of reports. Other examine approaches (e.g., important and planned reviews), which usually deal with a small corpus of reports (e.g., tens to low hundreds) using the qualitative techniques (e.g., content

**Table 2**
Publication and Information table for Circular economy and green energy research.

| Description | Results |
|---|---|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 2002:2023 |
| Sources (Journals, Books, etc) | 382 |
| Documents | 2640 |
| Annual Growth Rate % | 28.61 |
| Document Average Age | 2.76 |
| Average citations per doc | 27.15 |
| References | 149435 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 9647 |
| Author's Keywords (DE) | 6886 |
| AUTHORS | |
| Authors | 7440 |
| Authors of single-authored docs | 181 |
| AUTHORS COLLABORATION | |
| Single-authored docs | 203 |
| Co-Authors per Doc | 3.76 |
| International co-authorships % | 40.49 |
| DOCUMENT TYPES | |
| | 55 |
| article | 2584 |

and thematic analysis) [45,46,49,51]. This study, in particular, uses efficiency determination to define the metrics representing publishing as well as mention patterns (RQ1), and the most prolific authors, journals, as well as reports (RQ2) in circular economy and green energy research. In bibliometric analysis, the application of bibliographic coupling and co-word examination to investigate the intellective format of the area is type of triangulation which help in findings further research suggestions (RQ4; forming an agenda proposal). Citespace and Biblioshiny in R were used for the analysis, and VOSviewer was used to show the results [46,52,53].

This study presents the outcomes of the bibliometric evaluation utilizing a blend of figures, tables, and text based on the output from Biblioshiny and VOSviewer. The study's basic restraint and suggested instructions for further research on the circular economy and green energy are taken into consideration and looked at near the end.

## 4. Performance of circular economy and green energy research

### 4.1. Research on the circular economy and green energy publication and citation trends

In this study, a total of 2640 documents obtained from 382 sources were selected for data analysis and data visualization, as shown in Table 2. Keyword Plus (ID) and Author's Keywords are the major contents of the document (DE). Single-authored papers, papers per author, co-authors per paper, and a Collaboration Index have all been added to this Author's Collaboration. From 2002 to 2023, all information was gathered from Scopus.

### 4.2. Most prolific authors for circular economy and green energy research

Table 3 (RQ2) highlights the most prolific authors in the realm of circular economy and green economy research. The results reveal that Liu Y. (Tennessee TECH, China) emerges as the most productive author with an impressive 26 publications, closely followed by Kazancoglu Y. (Yasar University, Izmir, Turkey) and Kumar A. (Indian Institute of Technology Roorkee, India), who each have 22 and 25 publications, respectively. Notably, all publications from these top three authors have also been cited (TC), further cementing their impact and relevance in the field.

In terms of research influence, Liu Y., Kazancoglu Y., and Kumar A. emerge as the top three most impactful authors with 884, 650, and 659 citations in Scopus, correspondingly. The findings are reinforced by research impact (h) and influence (g) measures, consolidating the positions of these authors as the prominent torch bearer in the field. Overall, the results highlight the significance of these authors' contributions to the study of circular and green economies and their potential to shape future research in this area of enquiry.

### 4.3. Most prolific journals for circular economy and green energy

The most productive journals for research on the circular economy and green energy are shown in Table 4 (RQ2). The chart/analyses indicates that the journals "Cleaner Production" and "Business Strategy and the Environment" are the top two highest-performing journals generating research in this topic. In addition to these leading journals, the table highlights a mix of circular economy and green energy publications, such as "Technological Forecasting and Social Change," "International Journal of Production Economics," "Journal of Business Research," "Production Planning and Control," "Management Decision," and "Corporate Social

**Table 3**
Most prolific authors for Circular Economy and Green Energy Research.

| Authors | Institute Affiliation | Country Affiliation | h-index | g-index | m-index | TC | NP | PY-start |
|---|---|---|---|---|---|---|---|---|
| Liu Y | Tennessee TECH | China | 15 | 26 | 1.875 | 848 | 26 | 2016 |
| Kazancoglu Y | Yasar University, Izmir | Turkey | 13 | 22 | 2.167 | 650 | 22 | 2018 |
| Kumar A | Indian Institute of Technology Roorkee | India | 13 | 25 | 2.6 | 659 | 25 | 2019 |
| Iraldo F | ScuolaSuperiore di StudiUniversitari e di PerfezionamentoSant'Ann | Italy | 11 | 14 | 1.571 | 586 | 14 | 2017 |
| Luthra S | Department of Mechanical Engineering, Ch. Ranbir Singh State Institute of Engineering & Technology | India | 11 | 14 | 1.833 | 870 | 14 | 2018 |
| Mangla Sk | Department of Mechanical Engineering, Graphic Era University, Dehradun | India | 11 | 19 | 1.833 | 1021 | 19 | 2018 |
| Daddi T | ScuolaSuperioreSant'Anna | Italy | 10 | 12 | 1.429 | 404 | 12 | 2017 |
| Garza-Reyes Ja | Derby Business School | U.K. | 10 | 18 | 1.667 | 599 | 18 | 2018 |
| Geng Y | Institute of Applied Ecology, Chinese Academy of Sciences | China | 10 | 10 | 0.833 | 1617 | 10 | 2012 |
| Kumar V | University of the West of England, Bristol | U.K. | 10 | 11 | 1.667 | 685 | 11 | 2018 |
| Bag S | Rabat Business School | Morocco | 9 | 10 | 1.8 | 721 | 10 | 2019 |
| Bocken N | Maastricht Sustainability Institute, Maastricht University | Netherland | 9 | 11 | 1.286 | 899 | 11 | 2017 |
| Sarkis J | Worcester Polytechnic Institute | U.S. | 9 | 13 | 0.643 | 1321 | 13 | 2010 |
| Ulgiati S | Parthenope University of Napoli | Italy | 9 | 14 | 0.9 | 3054 | 14 | 2014 |
| Govindan K | University of Southern Denmark | Denmark | 8 | 11 | 1.333 | 846 | 11 | 2018 |

Abbreviations: TC, total citation; NP, Number of publications; PY, publication year.

**Table 4**
Most prolific journals by productivity for circular economy and green energy research.

| Sources | Articles | TP | TC | ABDC rank | h-index | g-index | m-index |
|---|---|---|---|---|---|---|---|
| Journal of Cleaner Production | 1243 | 1243 | 44328 | A | 95 | 158 | 5.278 |
| Business Strategy and the Environment | 162 | 162 | 4619 | A | 36 | 63 | 2.571 |
| Technological Forecasting and Social Change | 52 | 52 | 1762 | A | 41 | 41 | 1.158 |
| International Journal of Production Economics | 44 | 44 | 1268 | A | 18 | 35 | 1.5 |
| International Journal of Production Research | 40 | 40 | 2045 | A | 22 | 40 | 2.444 |
| Journal of Business Research | 39 | 39 | 1421 | A | 14 | 37 | 1.167 |
| Journal of Enterprise Information Management | 27 | 27 | 368 | A | 10 | 18 | 1.667 |
| Production Planning and Control | 27 | 27 | 1559 | A | 15 | 27 | 2.5 |
| Management Decision | 24 | 24 | 1288 | B | 17 | 24 | 3.4 |
| Corporate Social Responsibility and Environmental Management | 22 | 22 | 584 | C | 9 | 21 | 0.75 |
| Operations Management Research | 16 | 16 | 140 | C | 7 | 11 | 1.167 |
| International Journal of Logistics Research and Applications | 15 | 15 | 184 | B | 8 | 13 | 2.667 |
| International Journal of Productivity and Performance Management | 15 | 15 | 159 | B | 8 | 12 | 2.667 |
| International Journal of Applied Ceramic Technology | 12 | 12 | 163 | B | 6 | 12 | 1.5 |
| Technology In Society | 11 | 11 | 117 | C | 7 | 10 | 0.467 |

Abbreviations: TP, total publication; TC, total citation; ABDC, Australian Business Deans Council 2023 report.

Responsibility and Environmental Management."

Top 8 journals cover almost more than 60 % of the total documents, and these documents are categorized as “A” journal by Australian Business Deans Council. This criterion serves to ensure that the results are based on high-quality and influential journals, further underlining the significance and relevance of the identified publications.

### *4.4. Most prolific publications on circular economy and green energy*

Table 5 (RQ2) showcases the most impactful disclosure on circular economy and green energy in terms of citation impact. The article titled "A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems" by Ghisellini et al. [30], is the highly cited article with 2425 citations.

Following this, Murray et al. [54], article consolidating prior research insights on Circular economy into a concept and use in a global setting, and Su, Heshmati and Yu [55] article on Sustainable Supply Chain Management and the Transition towards a Circular Economy come in at second and third place with 1180 and 742 citations, respectively.

Ghisellini et al., [30,56] discussed the concept of the circular economy, highlighting its potential to address the shortcomings of the linear "take-make-dispose" model. The paper discussed the environmental benefits of the circular economy, including reduced greenhouse gas emissions, waste reduction, and resource conservation. It also explored the economic implications, focusing on new business models that promote resource efficiency and innovation. The study acknowledged potential challenges, such as legislative barriers and technology constraints, that may hinder the widespread adoption of circular economy principles. Overall, the paper underscored the need for a more sustainable and regenerative economic structure.

Murray et al., [54] conducted a comprehensive study on the theoretical foundations of the circular economy, tracing its historical development and elucidating its core principles and benefits. The paper highlights the crucial role of collaboration among diverse stakeholders, including governments, corporations, consumers, and researchers, in driving the transition to a circular economy. By analyzing case studies and successful initiatives from various countries and regions, the study offers a global perspective on circular economy. It examines the key factors that contribute to the effectiveness of circular economy efforts, such as supportive regulatory

**Table 5**
Most prolific publications by citation impact on circular economy and green energy.

| Title | Author(s) | TC | TCPY |
|---|---|---|---|
| A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems | Ghisellini, Cialani and Ulgiati (2016) | 2425 | 303.13 |
| The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context | Murray, Skene and Haynes (2017) | 1180 | 168.57 |
| A review of the circular economy in China: Moving from rhetoric to implementation | Su et al. (2013) | 742 | 67.45 |
| Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications | Genovese et al. (2017) | 668 | 95.43 |
| Circular economy as an essentially contested concept | Korhonen et al. (2018) | 561 | 93.5 |
| Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern | Hartmann and Apaolaza (2012) | 559 | 46.58 |
| A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective | Govindan and Hasanagic (2018) | 544 | 90.67 |
| Towards a national circular economy indicator system in China: An evaluation and critical analysis | Geng et al. (2012) | 508 | 42.33 |
| Green, circular, bio economy: A comparative analysis of sustainability avenues | D'amato et al. (2017) | 470 | 67.14 |
| Towards a consensus on the circular economy | Prieto-sandoval et al. (2018) | 458 | 76.33 |

Abbreviations: TC, total citation; TCPY, total citation per year.

frameworks, technological advancements, and shifts in consumer behavior. Additionally, the authors address the barriers to widespread adoption of circular economy practices and propose potential solutions to overcome them.

Su et al., [55] conducted a review focusing on China's commitment to the circular economy concept, which emphasizes waste reduction, resource recycling, and efficient resource utilization. The study examines the evolution of China's circular economy strategy, starting from its introduction in policy documents to its implementation. The authors identify key challenges that hinder the realization of the circular economy vision in China, such as the prevalence of the linear production model, limited understanding among stakeholders, and the requirement for substantial investments in infrastructure and technology. The paper also evaluates the effectiveness of existing policies and projects, highlighting areas that require further attention and improvement.

## 5. Intellectual structure of circular economy and green energy research

The intellectual framework of a research field represents its foundational topics and epistemological structure that underpins it. Finding this epistemological framework in the study of the circular economy and green energy involves a thorough science mapping activity that makes use of the bibliometric analysis methods of co-word analysis and bibliographic coupling. These techniques are powerful tools that can reveal clusters to visualize research on the likeness of references or co-occurrence of keywords, respectively. By creating these clusters, researchers can identify coherent subjects within the field and further enrich the knowledge base of circular economy and green energy research.

Overall, applying bibliometric analysis techniques can provide a comprehensive understanding of the intellectual framework of a research field [49]. In the case of circular economy and green energy research, this approach can help researchers identify key themes, gaps in the literature, and emerging trends.

### 5.1. Descriptive analysis

Fig. 2 depicts the trends and variations in the number of scholarly papers published each year in the field of circular economy and green energy research. The graph shows a steady increase in the number of publications since 2002, with a notable upsurge in publications from 2016 onwards. In 2022, a total of 748 papers were published in this field, indicating a growing interest and awareness in the area. The average citations per document are 27.15, highlighting the impact and influence of research in this area. The annual growth rate of publication is 28.61, indicating a robust and expanding body of knowledge in the field. These statistics mention the significance and relevance of circular economy and green energy research, which has gained increasing attention and momentum in recent years. The growing number of publications and citations in this field reflects the urgent need to address environmental challenges and the importance of sustainable solutions. The insights from these trends can inform future research and policy initiatives aimed at promoting a more sustainable and environmentally responsible world in order to have impactful research agendas.

### 5.2. Analysis of bibliographic coupling

The process of identifying primary study themes in the field of circular economy and green energy is a crucial step in comprehending the current research landscape. In this study, we employed bibliographic coupling in conjunction with VOSviewer to analyze a

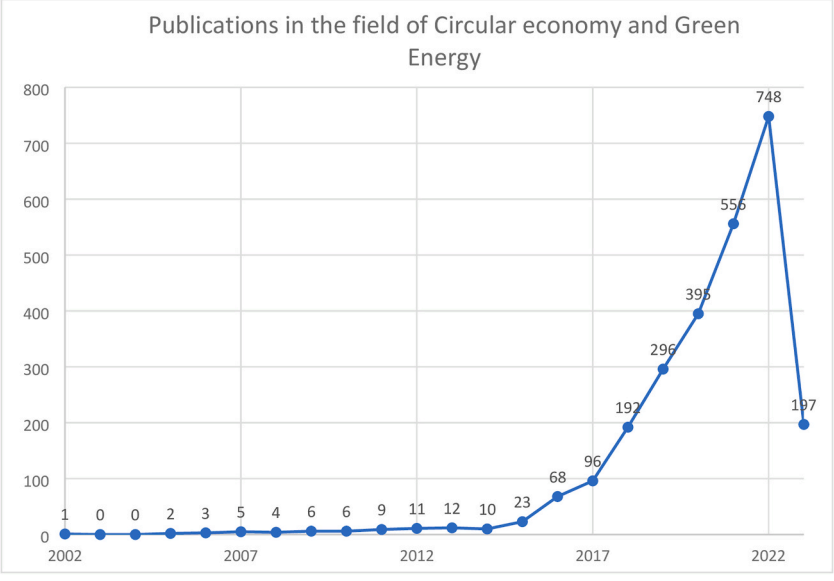


**Fig. 2.** Annual growth in the number of publications on green energy and the circular economy (CE) per year.

total of 171 publications spanning the years 2021–2023. To ensure the inclusion of influential publications, we excluded uncited articles and set a minimum citation threshold of 20.

By conducting this analysis, a total of six distinct clusters were generated that capture the primary study themes within the field of circular economy and green energy. These clusters were formed based on the co-occurrence of bibliographic references, enabling us to identify highly relevant and interconnected publications [46,57]. The insights gained from this analysis serve as a useful resource for researchers seeking to identify areas of focus for future investigations and gain a comprehensive understanding of the key issues and trends in the field. Ultimately, this analysis makes a valuable contribution to the existing literature on this significant and rapidly developing subject.

Fig. 3 displays the composition of the clusters. Each cluster corresponds to a different approach: (1) Technology in Circular Economy transition Sustainability; (2) Strategic Coalition for circular economy in green energy; (3) Circular economy concept helps in innovative business model; (4) Role of Circular economy in allied domain; (5) Energy generation collaboration and sustainability performance in circular economy; (6) Barrier and facilitators in Circular economy. A detailed description of each cluster is provided below.

### 5.2.1. *Bibliographic cluster 1: Technology in Circular Economy transition sustainability (N = 49)*

The first cluster, comprising 49 studies, showcases cross-disciplinary collaboration and cooperation in technology to promote sustainability and develop the Circular economy. The studies cover various supply chain issues, the potential to expand manufacturing capacities for sustainable development, and the moral and financial performance of business-to-business (B2B) value creation.

Recent studies propose innovative approaches for supporting the circular economy and sustainable business models. Bag, Gupta, and Kumar [58] suggest using digital Industry 4.0 manufacturing automation solutions to enhance the circular economy. Bag et al. [59], emphasize the examination of institutional pressures on workforce skills and resources when adopting big data analytics-powered artificial intelligence (AI) for sustainable manufacturing practices. Furthermore, Mastos et al. [60], highlight the ability of blockchain science in reducing costs, improving supply chain performance, and addressing trust and security issues in the circular economy. Researchers have shown how the next generation of waste-to-energy solutions can be used to manage a circular supply chain. Technologies associated with Industry 4.0 have been shown to provide circular supply chain management in the framework of supply chain management, boosting sustainability [61]. Future research should explore integrating closed-loop supply chain management in specific industries, considering the impact of artificial intelligence (AI) and Machine learning (ML) integration

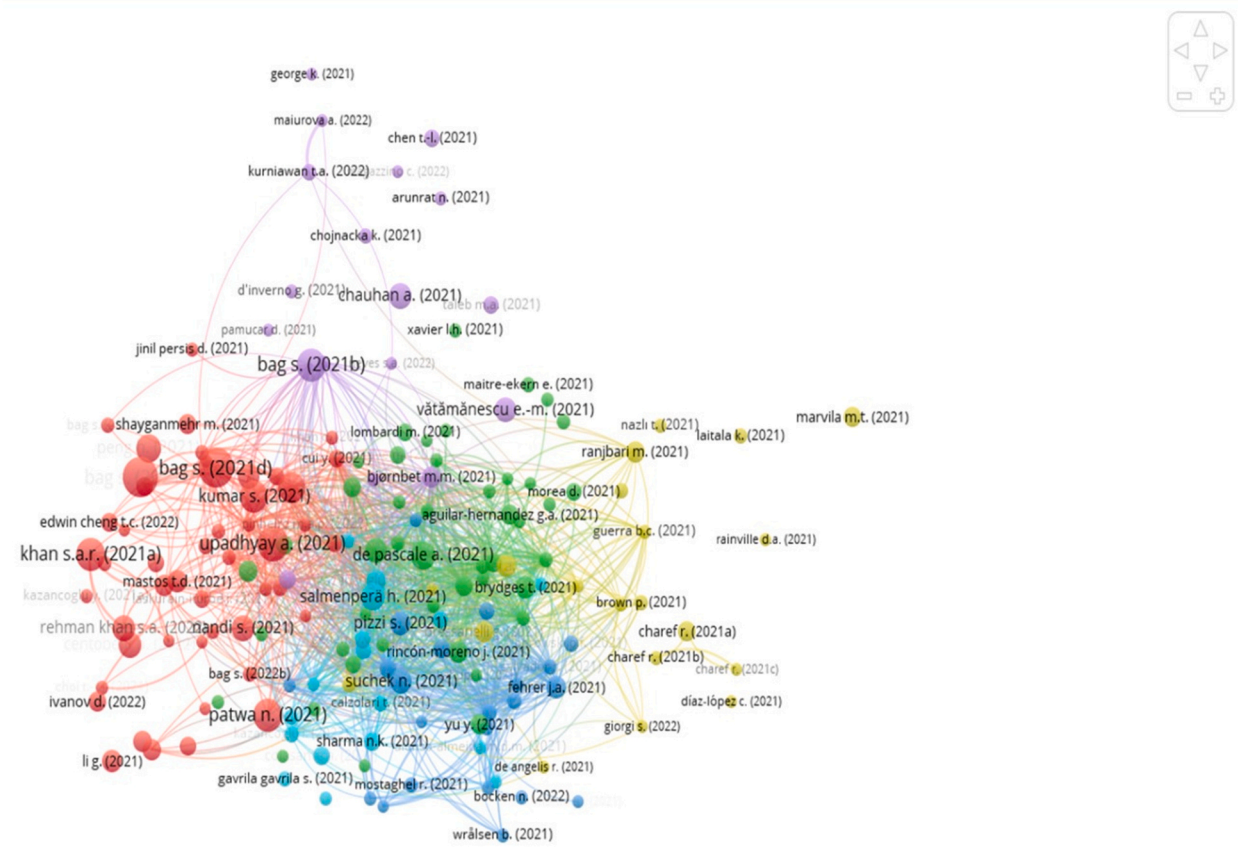


**Fig. 3.** Major Bibliographic clusters on green energy and circular economy.

and organizational structure on firm-level innovation.

Few research has also highlighted the unique challenges faced by emerging economies in adopting circular economy practices, including resource availability, changing government policies, and consumer behavior [62]. Implementing waste-to-energy principles, renewable energy, and effective resource utilization can contribute to economic efficiency and circular economy practices [62]. To assess the sustainability performance of manufacturing organizations, a framework was created that combines the circular economy, sustainable cleaner production, and industry 4.0 requirements [63]. Additionally, it has been emphasized how industry 4.0 enablers can promote circular economy and cleaner production methods within corporate ethics [64]. These studies contribute valuable insights for policymakers, managers, and researchers in advancing sustainability and circular economy goals by using internet of things.

Awan, Sroufe and Shahbaz [65] investigated the role of IoT in governing the circular economy, emphasizing the influence of stakeholders such as suppliers, customers, and rivals. They highlighted the importance of these stakeholders in shaping circular economy practices. Kristoffersen et al. [66], examined the impact of business analytics competence on circular economy implementation, resource orchestration capability, and firm performance. Their study, based on survey data from 125 top-level managers in European organizations, developed an instrument for measuring business analytics capability for the circular economy. The instrument acts as a foundation tool for future research in the field of information systems and applications of circular strategies. Overall, these studies demonstrate the potential of new technologies, such as blockchain and IoT, and business analytics competence for facilitating the implementation of circular economy practices and improving organizational performance by enhancing system's efficiency and efficacy. The findings highlight the importance of collaboration among stakeholders in creating an effective circular economy ecosystem. These insights can inform policymakers, business leaders, and other stakeholders in developing strategies to promote a more sustainable and circular economy by understanding praxis of circular economy and green energy.

#### *5.2.2. Bibliographic cluster 2: Strategic Coalition for circular economy in the green energy (N = 45)*

The second cluster focuses on the Strategic Coalition for Circular Economy in Green Energy through 45 publications. These studies and their epistemological contributions provide valuable insights into the subject matter. Significant changes are imperative in human society and business organizations to achieve sustainable coexistence between human civilization and the natural world. The central argument revolves around whether the current pattern of consumption and production, driven by demand-based production, can lead to sustainable living for human civilization. In this context, energy production assumes a fundamental role, serving as a vital input for various production processes.

In a study by Kurdve and Bellgran [67], the integration of the waste hierarchy model and the Green Performance Map proved effective in promoting circular economy principles in the manufacturing and pharmaceutical industries. This research offers practical guidance to managers for enhancing circularity in production processes. Dorr et al. [68], conducted a life cycle assessment of a circular urban mushroom farm, highlighting the environmental impacts and benefits of circular economy practices in food production. Narvanen, mattila and Mesiranta [69] examined institutional work by start-ups to minimize food waste, while Lehtokunnas et al. [70], explored household food waste behaviors and their connection to the transition to a circular economy. According to the research, in procedure to comprehend the circular economy as a moral economy, it's critical to acknowledge the moral Complication of daily living, which sometimes contradicts ethical sensibilities and behaviour.

Yunan et al. [71], investigated the mutual influence of enterprise, government, and consumer behavior on the circular economy, focusing on livestock and poultry pollution control. Pascale et al. [72],reviewed indicators for quantifying the circular economy and emphasized the need for standardized metrics to assist managers in fostering a conducive market economy and promoting a green economic and social environment for the adoption of the circular economy model. The implementation of more impactful policies can yield significant benefits for both the well-being of industries and mankind as a whole. Massaro et al. [73], analyzed the professional and scientific discussion on Industry 4.0, recognizing the potential for environmentally sustainable production. Aguilar- Hernandez et al. [74], conducted a meta-analysis of circular economy strategies, examining their macroeconomic, social, and environmental implications. Rincon- Moreno et al. [75], developed a data-driven method for evaluating the value of circular economy initiatives. These studies provide valuable insights for future research and the development of best practices in promoting circular economy and green energy practices.

Based on a cluster of research papers, scholars have provided valuable insights to guide future endeavors in the field. One significant area of inquiry is the role of institutional operations in reducing food waste, fostering the growth of green energy, and facilitating the transition to a circular economy. To further advance in this field, it is crucial for researchers to investigate whether an optimal level of green energy knowledge exists, and how it can be effectively combined with more distant knowledge. Additionally, the concept of solar energy holds great potential in enhancing green energy practices and promoting the principles of a circular economy. Analyzing and leveraging these aspects will contribute to the development of sustainable solutions for a knowledgeable and efficient integration of green energy, furthering circular economy practices.

#### *5.2.3. Bibliographic cluster 3: circular economy transition innovative business model (N = 22)*

The third cluster, consists of 22 studies, focuses on CE transitioning from linear business models to circular business models through innovative approaches for creating value. Carraresi and Broring [76] explain how businesses can evolve their business models to increase resilience and respond to contemporary ecosystem issues, such as the introduction of new cross-industry expense chains in the circular economy. They primarily followed an analytical path to study the phenomenon of new bio-based technologies being adopted at the organizational level. Despite the need for bio-based technology to address the world's environmental challenges, businesses face several problems in forging new paths and pursuing uncharted territory. The findings showed that even though businesses have noted the often low or ambiguous profitability of the new technology, they might consider possible Business Model Innovation in the medium

term, requiring a complete rethinking of the business model.

In contrast to prior studies in the fields of social and sustainable business models, Fehrer and Wieland [77]suggest an alternative logic. Authors methodically seems more logical to create five core ideas for a brand-new institutional Circular Business Model framework, and then they talk about a research agenda based on these core ideas. This study specifically provides three important contributions. First of all, it represents a significant step towards the creation of a more robust business model logic that answers to the demand for group effort and cooperation in overcoming the enormous obstacles to social and sustainable innovation. It presents five core ideas to aid comprehension of Circular Business Models and explains the complexity of creating social and sustainable innovation through business model design. Second, this study offers a thorough research agenda outlining the normative needs for functioning in complex adaptive systems like the circular economy, relying on these five core claims. Because of concerns about climate change and rising demands from both governments and consumers for ethical and ecological products, Mostaghel and Chirumalla [78] also examine the significance of customers in circular business models. This is because the retailing industry is changing. The study closes the knowledge gap by identifying the crucial variables influencing consumers' intentions to make ethical purchases for circular business models in the retail industry. This study provides a hypothetical foundation that might fully account for the essential components and variables that influence consumers' ethical purchasing intentions with regard to the circular business model. It is based on macro-theories of human behaviour. By examining the problem from the customers' point of view, the research adds to the body of literature on circular business models in the retail industry.

Circular economy strategies on business modelling are also identified by Salvador et al., [79]. A systematic literature analysis was done to identify viable circular economy techniques for this goal, yielding sixteen such strategies, most significant elements that affect how circular business models. The evaluation done in the current study identifies areas where businesses should concentrate them when implementing/putting forth their business management coordinating many CE initiatives. The CE strategies listed below use a general approach, such not referring to a certain type of business strategy, but being an all-encompassing depiction of the CE cosmos. Hence, they are relevant to all resource-related companies (including, for example, agriculture, manufacturing (process-based and assembly-based), business, mining, tourism, forestry, transportation, and utilities. The methods described here can be used to check for circularity, significance of business models, given that they are determinants of business modelling circularity.

Hina et al. [80], discusses about circular economic business model (CEBM) and its applicability in modern strategy. Critical analysis of the existing literature has not drawn scholarly attention, despite the fact that they had looked at CEBM from a number of angles, including the green business model, waste management, digital technology, the supply chain, and the financial impact of Circular Economy Business Model. According to Loon et al. [81], the circular economy is a way to boost economic growth while lessening its negative effects on the environment. It is argued that encouraging "inner loops," such as reuse, refurbishing, and remanufacturing, promotes resource efficiency while maintaining the value of goods, components, and materials. The findings demonstrate the urgent need for more life cycle assessment (LCAs) that are conducted in a manner that better reflects the potential advantages and drawbacks of circular products. The environmental sustainability of circular products, circular business models, and ultimately the circular economy as a whole can only be asserted with confidence after that.

Finally, Wralsen et al. [82], focuses on technical and economic challenges based on recycling and the second use of batteries rather than circular business strategies. The goal of this study is to investigate the circular business models, motivators, obstacles, and stakeholders needed to facilitate value recapturing. The panel in Delphi technique was used to speak with battery experts from different fields. According to the study's conclusions, the preferred circular business model contains a number of circular methods. As the volume of batteries increases, appropriate waste management systems, including logistics and infrastructure development, must be developed to recover the precious materials contained within them. Future researchers may broaden their keyword choices in order to examine other aspects of the Circular Economy Business Model.

#### *5.2.4. Bibliographic cluster 4: Role of Circular economy in allied domain (N = 20)*

The fourth cluster focuses on the role of the circular economy (CE) in allied domains. Charef, Ganjian and Emmit [83] explored innovative applications of Business Information Modelling (BIM) for CE adoption. Through interviews with sustainable building and BIM specialists, they identify seven new uses of BIM, such as digital models for sustainable end-of-life (SEOL), product passport development, project databases, completeness evaluation, and materials recovery processes. They also create an entity connections diagram to illustrate how challenges related to CE implementation can be overcome. This study highlights the impact of these new BIM uses on asset lifecycle models.

Geissdoerfer et al. [84],discuss the environmental impacts of buildings and the increasing interest in CE solutions to address resource consumption and waste generation. Despite the proliferation of CE activities in the building industry, the widespread adoption of CE practices remains limited. The study suggests further research and offers a taxonomy that categorizes 16 general building design and construction strategies to promote the development and implementation of CE methodologies. Similarly, Marvila et al. [85], explore the circular economy in cementitious ceramics by replacing hydrated lime with a balanced blend of clay and marble waste. They conduct tests to evaluate the properties of ceramics produced with different ratios of marble and clay. The findings demonstrate that the proper balance of marble and clay residues significantly enhances the technological properties of cementitious ceramics, particularly in the 1:1 composition.

Rizos and Bryhn [86] investigate the use of circular economy concepts in the electrical and electronic equipment (EEE) industry. Their multi-case study, based on the EU-funded CIRC4Life project, reveals gaps that require policy attention despite existing legislative tools. These gaps include a lack of regulations on supply chain openness, insufficient enforcement of EU waste legislation, limited application of circularity requirements in public bidding processes, and the absence of CE standards.

Shojaei et al. [87], examines the power of blockchain science as a facilitator of the CE in the built environment. They develop a

blockchain model and test its viability through a fictitious case study. The results indicate that blockchain can enable complete material and energy traceability, allowing for proactive planning of reuse and recycling in the built environment. The study demonstrates that blockchain implementation offers a practical and innovative approach to realizing CE ideas in the built environment and can be extended to smart communities and cities.

These studies provide frameworks, approaches, and practical insights into various industries for locating and addressing circular economy activities. Policymakers and practitioners interested in promoting the adoption of CE concepts in their respective domains can benefit from these research findings.

#### 5.2.5. Bibliographic cluster 5: energy generation collaboration and sustainability performance in circular economy (N = 18)

The fifth cluster delves into the collaboration between energy generation and sustainability to promote a sustainable circular economy. Arunrat et al.'s study of greenhouse gas (GHG) emissions from both small- and large-scale farming operations was completed in 2021. According to their research, there was an 11 % decrease in GHG emissions in large-scale farming as compared to traditional farming. Large-scale farming also resulted in significant reductions in transportation and rice seed consumption. Moreover, farmer profits increased by 31.2 %, while production costs decreased by 28.3 %. The study suggests merging individual agricultural units into larger ones to increase farmers' earnings and reduce GHG emissions through the manufacturing of raw materials from co-products and their recirculation in paddy fields.

Bjornbet et al. [88], provide a summary of empirical research on circular economy (CE) in manufacturing and analyze research partnerships between academics and industry actors. They note an expansion of case study-based literature since 2015, demonstrating increased empirical analysis of industrial firms' adoption of CE practices. Chauhan, Parida and Dhir [89] review the intersection of CE and digital technologies, emphasizing the role of the Internet of Things (IoT) and artificial intelligence (AI) in facilitating the shift towards CE. The review highlights challenges in the digitalization-led CE transformation, including policy difficulties, lack of predictability, psychological issues, and information vulnerability. The study also recognizes the significance of product-service systems (PSS) as a critical business model innovation for enabling CE through digitalization.

Dulia et al. [90], addresses the risks associated with circular economy methods and solutions. The study includes perspectives from supply chain experts in various fields, such as supply chain management, resource management, textile manufacturing, and environmental health and safety. They highlight the need for in-depth case studies to comprehensively understand the threats and explore creative ways to mitigate risks in order to realize circular supply chains.

Dutta et al. [91], investigates reverse logistics (RL) strategies that promote cleaner production and operational efficiency. They propose a framework to overcome RL implementation challenges in the Indian context, prioritizing the identified hurdles based on a literature review and internal discussions. The study provides managers with practical insights on implementing RL strategies, emphasizing the importance of consumer education, network utilization, effective storage, and assessing the existing situation before adopting recommended tactics.

Taleb and Farooque [92] look at accounting techniques and case studies for environmentally friendly municipal trash management. In order to optimise MW management and achieve "zero waste disposal" at the lowest cost while producing economic, environmental, and social benefits, they created a Pay-As-You-Throw (PAYT) pricing model based on Full Cost Accounting (FCA).

These studies contribute to the advancement of knowledge in the fields of sustainable farming, manufacturing, digital technologies, supply chain management, reverse logistics, and waste management, offering valuable insights for practitioners and policymakers.

#### 5.2.6. Bibliographic cluster 6: barriers and facilitators in CE (N = 17)

The sixth cluster focuses on understanding the drivers, barriers, and necessary capacities for implementing the Circular Economy (CE). Awan et al., [65] conducted a study on recycling flexible packaging, highlighting the challenges and potential solutions. They found that regulatory barriers were interconnected with technical and economic constraints, emphasizing the need for policymakers to consider these connections to drive the industry towards CE. The study also revealed diverse stakeholder perspectives on how regulations could advance the industry, emphasizing the importance of addressing these perspectives for successful implementation.

Major multinational businesses (MNEs) in Europe that have supported activities with a focus on the circular economy were examined by Calzolari, Genovese and Brint [93]. To create a database of CE practises, they used template analysis to analyze the text of sustainability reports. The study looked at the level of adoption, the participation of supply chain partners, and the reasons for implementing such practises. A conceptual framework was additionally put out to describe the application of CE principles as a supply chain process. The impact of institutional forces and supply chain integration on the adoption of CE practises in international supply networks was also investigated in the study.

Kazancoglu et al. [94], focused on stakeholder perspectives on challenges to circular supply chains in the textile industry. They proposed a framework that identified circular supply chain barriers and revealed causal relationships among these barriers within the industry. The Fuzzy-Decision Making Trial and Evaluation Laboratory (DEMATEL) approach was used to determine the causal linkages, and suggested consequences were provided based on the cause-and-effect classification of the barriers.

Salmenpera et al. [95], examined the perspectives of developers and intermediaries in the context of CE implementation. They discovered that the current barriers had varied effects on these groups, with developers lacking systemic thinking and intermediates noticing hurdles additional up the material supply chain and in various forms. The study highlighted the complex nature of barriers to CE and the need for collaboration across multiple fields to address them. It emphasized the importance of improved understanding of the financial benefits of CE, better information exchange on waste, and enhanced communication and cooperation among relevant stakeholders.

These studies offer valuable insights into the barriers, perspectives, and potential solutions for implementing circular supply chains

and driving the adoption of CE standard. The proposed frameworks and methodologies can assist policymakers and practitioners in identifying and addressing these barriers in their respective industries.

## 6. Final considerations and future Lines of research

Praxis of circular economy and a green energy production have much in same, both rely on proportion and balance, often maintain connection between the apparently differ. Green energy is a key component of the circular economy, the transition to a circular economy has become increasingly crucial for businesses seeking to achieve sustainability. In order to make the transition towards sustainability, it is necessary to innovate business models that incorporate technological advancements. This will drive radical innovation and enable businesses to remain competitive in the market. Technology plays a vital role in managing waste, enabling the conversion of waste into new sources of raw materials and significantly impacting the production of green energy.

Industry 4.0, the Internet of Things, artificial intelligence (AI), automatization, and digitalization have all been the subject of research in recent years to see how they may be utilized to advance a circular economy [89,96,97]. The potential legislative and policy repercussions for the development of the blockchain and circular economy must be taken into account. Furthermore, any move to a circular economy must acknowledge trash as a crucial link in the value chain. For successfully transition to a circular economy, firms must alter their business models, ensure senior management's support, measure and track sustainability performance, comprehend client demands for sustainable products and services, and work with interested parties. Strategic alliances play a crucial role in facilitating this transition, especially in the reverse value chain cycle. Ecological innovation can support the bio-circular economy and contribute to the reduction of various types of waste.

The literature on strategic alliances for circular economy in green energy, particularly in the reverse value chain cycle, focuses on ecological innovation that supports bio-circular economy and highlights the reduction of various types of waste. However, all of these topics are connected to regulatory difficulties, including government regulation, implementation and adaptation by various enterprises, and risk-related issues within the context of organizations' acceptance of innovative and sustainable services to pursue sustainable paths. Through an innovative business strategy and various technologies, this endeavour aimed to uncover the prerequisites for circular economy advancement. The literature places significant value on stakeholder engagement, new business models, and green energy, as evidenced by the number of articles in clusters 1–3. However, other emerging topics, as seen in clusters 4–6, also warrant sustained development, such as the function of circular economy in related fields. Additionally, there is a need for a deeper understanding of the potential of waste management in energy generation, as well as the role of disruptive and emerging technologies in this process.

The papers in clusters 1 & 3 mainly focus on technology and investigate the impact of major technologies on different extent of action covered by the circular economy, such as Additive Manufacturing, Artificial Intelligence, Artificial Vision, Big Data and Advanced Analytics, Cybersecurity, Internet of Things, Robotics, and Virtual and Augmented Reality. The findings suggest that Industry 4.0 technologies have a wide range of influences on enterprises, enabling them to improve circularity by reducing waste generation, energy and material use, and emissions. These findings can help future researchers integrate Industry 4.0 solutions for circular supply chain management.

In the second cluster, earlier studies highlight the benefits of utilizing the Green Performance Map, a green lean environmental improvement tool, and incorporating the waste hierarchy model in the industrial and pharmaceutical industries. The objective is to operationalize the circular economy concept and get shop floor managers and operators involved in green kaizen. In order to encourage circularity on the shop floor, the study offers eight industrial examples of Green Performance Map pilot experiments that use the waste hierarchy model as an operationalization tool. This study offers managers a practical plan for boosting circularity on the production floor, contributing to the circular economy and green lean theory in a manufacturing context. Future researchers can explore the function of institutional operations in food waste reduction, which can increase green energy and contribute to the transition to a circular economy.

The bibliography coupling analysis indicates that innovative business models are essential for the transition to the circular economy, as they can address current ecosystem concerns and increase resilience by creating cross-industry value chains. Some research proposes a new institutional Circular Business Model framework, based on five key concepts, which offers an alternate logic to earlier studies in the fields of social and sustainable business models. This framework can inform future research programs in the circular economy.

Previous research also explored the concept of circular economy in various sectors, such as construction and new economic business models, as well as government conflicts, resource efficiency measurement, and business model modifications. However, there is a need for more life cycle assessments (LCAs) that accurately reflect the potential benefits and downsides of circular products. It is crucial to emphasize that circular products, circular business models, and ultimately the circular economy as a whole are environmentally sustainable.

Moreover, the literature suggests the importance of expanding research on green energy in the circular economy beyond the construction and manufacturing sectors. Engaging new businesses and startups can offer an effective approach to introducing a green energy approach and identifying new opportunities.

## 7. Conclusion

It is commonly established that circular economy concepts have the greatest impact and longevity on human development. In the circular economy, environmental sustainability and green energy are at the forefront of having the ability to solve environmental

concerns. Therefore, additional investment in the renewable energy sector is required to achieve a significant decrease in $CO_2$ emissions. The circular economy has the potential to surpass the conventional production and consumption model, which is limited by the availability of energy resources and follows linear production model. The transition to green energy and its infusion to the circular economy certainly provide decision tools for sustainable future which will evolve from researchers' minds, business behavior, and profitability through analysis based on various theoretical viewpoints as outcome of the Bibliographic analysis. The study has found that new business models are crucial for the transition to the circular economy because they may solve current ecological concerns and boost resilience by forming cross-industry value chains. Recent research has presented an alternative logic in the fields of social and sustainable business models by proposing a new institutional Circular Business Model framework based on innovative fundamental ideas. The analysis presented in this study centers around the relationship between the circular economy and green energy. The conclusion drawn from these assessments is that the concepts of green energy and sustainability have rapidly merged, leading to new commercial opportunities. The idea of moving towards a "Recycling" concept, which involves reducing waste by eliminating waste-generating systems, is supported by study findings and hypotheses. This shift towards a closed-loop system has sparked the emergence of new biological and technological ideas. If producers and consumers work together to improve all processes towards sustainability, benefits can be gained for the total economy.

Both circular economy and green energy advocate for environmental sustainability, seeking to reduce randomness and promote the inevitability of sustainable living for human civilization. These concepts align with the aspirations of modern society, amidst ongoing scholarly contributions and debates. Scholars have long discussed whether advancements in the field of circular economy are inventions or discoveries. Similarly, the question arises regarding whether the discourse on 'green energy' is a product of human ingenuity or the revelation of an eternal reality that existed before its discovery. This same inquiry can be applied to the conversion process, which often simplifies complex input-process-output models without considering the concept of 'externality discourse.' Circular economy serves as a bridge to fill this gap and currently addresses this issue, while the discourse on green energy considers a broader framework.

Focusing on how circular economy can achieve sustainability and finding the appropriate form of green energy to address pollution issues may appear disconnected from the discourse on externalities. This is particularly the case because sustainability encompasses more than just the natural environment, as evident from numerous studies on circular economy and green energy. In essence, sustainability is primarily concerned with ensuring the sustenance, safety, and survivability of human civilization, as well as responsible resource extraction from the Earth. Therefore, our efforts should be dedicated to developing systems that offer long-term solutions, taking into account the needs of human civilization and the preservation of our planet.

At the end, the theory development process and criteria for judging praxis of circular economy and green energy need to be broadly understood and accepted. This is essential so that the means of production and conversion process from input to output as finished goods and services intertwined with sustainable circularity in the form of robust supply chain management system, using existing models or new technologies like IoT. The building block of circular economy is green energy as primary ingredient at factor of production. Hopefully green energy will fully substitute the energy produced from fossil fuels in near future which ultimately helps humanity. This bibliometric review gives direction in the light of aforesaid statement for future research discourse and agenda setting the framework of integrating green energy and circular economy.

## Funding statement

The authors did not receive support from any organizations for the submitted work.

## Data availability statement

Data included in article/supplementary material/referenced in article.

## CRediT authorship contribution statement

**Dr Sarvesh Kumar:** Conceptualization, Investigation, Visualization, Writing – review & editing. **Arvind Darshna:** Data curation, Formal analysis, Methodology, Software, Visualization. **Deepak Ranjan:** Data curation, Formal analysis, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e21091.

## References


[1] H.L. Lam, J.J. Klemeš, P.S. Varbanov, H. Lund, Green strategy for energy generation and saving towards sustainable development, Energy 116 (2016) 1257–1259, https://doi.org/10.1016/j.energy.2016.11.062. Elsevier Ltd.

[2] N. Ralph, A conceptual merging of circular economy, degrowth and conviviality design approaches applied to renewable energy technology, J. Clean. Prod. 319 (Oct) (2021), https://doi.org/10.1016/j.jclepro.2021.128549.

[3] M. Chiappero, et al., "Review of Biochar Role as Additive in Anaerobic Digestion Processes," Renewable and Sustainable Energy Reviews, vol. 131, Elsevier Ltd, 2020, https://doi.org/10.1016/j.rser.2020.110037. Oct. 01.

[4] T. Lahti, J. Wincent, V. Parida, A definition and theoretical review of the circular economy, value creation, and sustainable business models: where are we now and where should research move in the future? Sustainability 10 (2018) https://doi.org/10.3390/su10082799, 8. MDPI, Aug. 07.

[5] T. Gao, Q. Liu, J. Wang, A comparative study of carbon footprint and assessment standards, Int. J. Low Carbon Technol. 9 (3) (2014) 237–243, https://doi.org/10.1093/ijlct/ctt041.

[6] L.M. Orejuela-Escobar, A.C. Landázuri, B. Goodell, Second generation biorefining in Ecuador: circular bioeconomy, zero waste technology, environment and sustainable development: the nexus, Journal of Bioresources and Bioproducts 6 (2) (2021), https://doi.org/10.1016/j.jobab.2021.01.004. KeAi Communications Co., pp. 83–107, May 01.

[7] W. Rees, M. Wackernagei, URBAN ECOLOGICAL FOOTPRINTS: WHY CITIES CANNOT BE SUSTAINABLE and WHY THEY ARE A KEY to SUSTAINABILITY Introduction: Transforming Human Ecology, 1996.

[8] A. Omri, H. Omri, S. Slimani, F. Belaid, Environmental degradation and life satisfaction: do governance and renewable energy matter? Technol. Forecast. Soc. Change 175 (Feb. 2022) https://doi.org/10.1016/j.techfore.2021.121375.

[9] S. Goyal, S. Chauhan, P. Mishra, Circular economy research: a bibliometric analysis (2000–2019) and future research insights, J. Clean. Prod. 287 (Mar. 2021), https://doi.org/10.1016/j.jclepro.2020.125011.

[10] P. Ahi, C. Searcy, A comparative literature analysis of definitions for green and sustainable supply chain management, J. Clean. Prod. 52 (2013) 329–341, https://doi.org/10.1016/j.jclepro.2013.02.018.

[11] S. Abolhosseini, A. Heshmati, J. Altmann, A Review of Renewable Energy Supply and Energy Efficiency Technologies, 2014.

[12] N.A. Mahizan, et al., Terpene derivatives as a potential agent against antimicrobial resistance (AMR) pathogens, Molecules 24 (14) (2019), https://doi.org/10.3390/molecules24142631. MDPI AG, Jul. 19.

[13] T. Curran, I.D. Williams, A zero waste vision for industrial networks in Europe, J. Hazard Mater. 207 (2012), https://doi.org/10.1016/j.jhazmat.2011.07.122, 208, pp. 3–7, Mar.

[14] S. Weber, R. Gerlagh, N.A. Mathys, D. Moran, CO2 embodied in trade: trends and fossil fuel drivers, Environ. Sci. Pollut. Control Ser. 28 (22) (Jun. 2021), https://doi.org/10.1007/s11356-020-12178-w, 27712–27730.

[15] D.G. Garcia, E. Kipnis, E. Vasileiou, A. Solomon, Consumption in the circular economy: learning from our mistakes, Sustainability 13 (2) (2021), https://doi.org/10.3390/su13020601. MDPI AG, pp. 1–23, Jan. 02.

[16] M. Kouhizadeh, Q. Zhu, J. Sarkis, Blockchain and the circular economy: potential tensions and critical reflections from practice, Prod. Plann. Control 31 (11–12) (Sep. 2020) 950–966, https://doi.org/10.1080/09537287.2019.1695925.

[17] X. Zhao, S. Huang, J. Wang, S. Kaiser, X. Han, The impacts of air pollution on human and natural capital in China: a look from a provincial perspective, Ecol Indic 118 (2020), https://doi.org/10.1016/j.ecolind.2020.106759. Nov.

[18] L.F. Dumée, Circular materials and circular design—review on challenges towards sustainable manufacturing and recycling, Circular Economy and Sustainability 2 (1) (2022) 9–23, https://doi.org/10.1007/s43615-021-00085-2. Mar.

[19] V. Kouloumpis, X. Yan, Sustainable energy planning for remote islands and the waste legacy from renewable energy infrastructure deployment, J. Clean. Prod. 307 (2021), https://doi.org/10.1016/j.jclepro.2021.127198. Jul.

[20] E. Brad, S. Brad, Algorithm for designing reconfigurable equipment to enable industry 4.0 and circular economy-driven manufacturing systems, Appl. Sci. 11 (10) (May 2021), https://doi.org/10.3390/app11104446.

[21] TALIS 2013 Results, TALIS. OECD, 2014, https://doi.org/10.1787/9789264196261-en.

[22] S. Stavropoulos, M.J. Burger, Modelling strategy and net employment effects of renewable energy and energy efficiency: a meta-regression, Energy Pol. 136 (Jan) (2020), https://doi.org/10.1016/j.enpol.2019.111047.

[23] N. Antoniou, F. Monlau, C. Sambusiti, E. Ficara, A. Barakat, A. Zabaniotou, Contribution to Circular Economy options of mixed agricultural wastes management: coupling anaerobic digestion with gasification for enhanced energy and material recovery, J. Clean. Prod. 209 (Feb. 2019) 505–514, https://doi.org/10.1016/j.jclepro.2018.10.055.

[24] J. Gallagher, et al., Adapting Stand-Alone renewable energy technologies for the circular economy through eco-design and recycling, J. Ind. Ecol. 23 (1) (Feb. 2019) 133–140, https://doi.org/10.1111/jiec.12703.

[25] G. Torma, J. Thøgersen, A systematic literature review on meta sustainability labeling – what do we (not) know? J. Clean. Prod. 293 (2021) https://doi.org/10.1016/j.jclepro.2021.126194. Elsevier Ltd, Apr. 15.

[26] C. Sassanelli, P. Rosa, R. Rocca, S. Terzi, Circular economy performance assessment methods: a systematic literature review, J. Clean. Prod. 229 (2019), https://doi.org/10.1016/j.jclepro.2019.05.019. Elsevier Ltd, pp. 440–453, Aug. 20.

[27] A.S. Homrich, G. Galvão, L.G. Abadia, M.M. Carvalho, The circular economy umbrella: trends and gaps on integrating pathways, J. Clean. Prod. 175 (2018), https://doi.org/10.1016/j.jclepro.2017.11.064. Elsevier Ltd, pp. 525–543, Feb. 20.

[28] T.T. Sousa-Zomer, L. Magalhães, E. Zancul, L.M.S. Campos, P.A. Cauchick-Miguel, Cleaner production as an antecedent for circular economy paradigm shift at the micro-level: evidence from a home appliance manufacturer, J. Clean. Prod. 185 (Jun. 2018) 740–748, https://doi.org/10.1016/j.jclepro.2018.03.006.

[29] V. Prieto-Sandoval, L.E. Torres-Guevara, M. Ormazabal, C. Jaca, Beyond the circular economy theory: implementation methodology for industrial smes, J. Ind. Eng. Manag. 14 (3) (2021) 425–438, https://doi.org/10.3926/jiem.3413.

[30] P. Ghisellini, C. Cialani, S. Ulgiati, A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems, J. Clean. Prod. 114 (Feb. 2016) 11–32, https://doi.org/10.1016/j.jclepro.2015.09.007.

[31] J. Martínez-Cabrera, F. López-Del-pino, The 10 most crucial circular economy challenge patterns in tourism and the effects of covid-19, Sustainability 13 (9) (2021), https://doi.org/10.3390/su13094940.

[32] A. Dwivedi, D. Agrawal, A. Jha, M. Gastaldi, S.K. Paul, I. D'Adamo, Addressing the challenges to sustainable initiatives in value chain flexibility: implications for sustainable development goals, Global J. Flex. Syst. Manag. 22 (Dec. 2021) 179–197, https://doi.org/10.1007/s40171-021-00288-4.

[33] S.Z. Mahjabeen, A. Shah, S. Chughtai, B. Simonetti, Renewable energy, institutional stability, environment and economic growth nexus of D-8 countries, Energy Strategy Rev. 29 (May 2020), https://doi.org/10.1016/j.esr.2020.100484.

[34] J. Kirchherr, D. Reike, M. Hekkert, Conceptualizing the circular economy: an analysis of 114 definitions, Resour. Conserv. Recycl. 127 (2017) 221–232, https://doi.org/10.1016/j.resconrec.2017.09.005. Elsevier B.V.

[35] A. Midilli, I. Dincer, M. Ay, Green energy strategies for sustainable development, Energy Pol. 34 (18) (Dec. 2006) 3623–3633, https://doi.org/10.1016/j.enpol.2005.08.003.

[36] S.S. Oncel, Green energy engineering: opening a green way for the future, J. Clean. Prod. 142 (Jan. 2017) 3095–3100, https://doi.org/10.1016/j.jclepro.2016.10.158.

[37] V.L. Kalyani, K. Dudy, S. Pareek, M.K. Dudy, GREEN ENERGY: the NEED of the WORLD, 2015 [Online]. Available: http://lunar.thegamez.net/greenenergyimage/non-.

[38] J. Byrne, K. Hughes, W. Rickerson, L. Kurdgelashvili, American policy conflict in the greenhouse: divergent trends in federal, regional, state, and local green energy and climate change policy, Energy Pol. 35 (9) (Sep. 2007) 4555–4573, https://doi.org/10.1016/j.enpol.2007.02.028.

[39] O. Adeleke, S.A. Akinlabi, T.C. Jen, I. Dunmade, Sustainable utilization of energy from waste: a review of potentials and challenges of Waste-to-energy in South Africa, Int. J. Green Energy 18 (14) (2021) 1550–1564, https://doi.org/10.1080/15435075.2021.1914629.

[40] J. Chaisse, Renewables re-energized? The internationalization of green energy investment rules and disputes, J. World Energy Law Bus. 9 (4) (Aug. 2016) 269–281, https://doi.org/10.1093/jwelb/jww018.

[41] S. Lyeonov, T. Pimonenko, Y. Bilan, D. Štreimikiene, G. Mentel, Assessment of green investments' impact on sustainable development: linking gross domestic product per capita, greenhouse gas emissions and renewable energy, Energies 12 (2019), https://doi.org/10.3390/en12203891, 20, Oct.

[42] A.A. Alola, K. Yalçiner, U.V. Alola, S. Saint Akadiri, The role of renewable energy, immigration and real income in environmental sustainability target. Evidence from Europe largest states, Sci. Total Environ. 674 (2019) 307–315, https://doi.org/10.1016/j.scitotenv.2019.04.163. Jul.

[43] D. Sangroya, G. Kabra, Y. Joshi, M. Yadav, Green energy management in India for environmental benchmarking: from concept to practice, Manag. Environ. Qual. Int. J. 31 (5) (2020) 1329–1349, https://doi.org/10.1108/MEQ-11-2019-0237. Jul.

[44] D. Tranfield, D. Denyer, and P. Smart, "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review *".

[45] J. Paul, W.M. Lim, A. O'Cass, A.W. Hao, S. Bresciani, Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR), Int. J. Consum. Stud. (2021), https://doi.org/10.1111/ijcs.12695.

[46] S. Chandra, S. Verma, W.M. Lim, S. Kumar, N. Donthu, Personalization in personalized marketing: trends and ways forward, Psychol. Market. 39 (8) (2022), https://doi.org/10.1002/mar.21670. John Wiley and Sons Inc, pp. 1529–1562, Aug. 01.

[47] B. Fahimnia, J. Sarkis, H. Davarzani, Green supply chain management: a review and bibliometric analysis, Int. J. Prod. Econ. 162 (2015), https://doi.org/10.1016/j.ijpe.2015.01.003. Elsevier B.V., pp. 101–114, Apr. 01.

[48] N.J. van Eck, L. Waltman, Software survey: VOSviewer, a computer program for bibliometric mapping, Scientometrics 84 (2) (2010) 523–538, https://doi.org/10.1007/s11192-009-0146-3.

[49] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, W.M. Lim, How to conduct a bibliometric analysis: an overview and guidelines, J. Bus. Res. 133 (Sep. 2021) 285–296, https://doi.org/10.1016/j.jbusres.2021.04.070.

[50] B. Kumar, A. Sharma, S. Vatavwala, P. Kumar, Digital mediation in business-to-business marketing: a bibliometric analysis, Ind. Market. Manag. 85 (Feb. 2020) 126–140, https://doi.org/10.1016/j.indmarman.2019.10.002.

[51] E.C. Luis, D. Celma, Circular economy. A review and bibliometric analysis, Sustainability 12 (16) (2020), https://doi.org/10.3390/SU12166381. Aug.

[52] M. Aria, C. Cuccurullo, bibliometrix: an R-tool for comprehensive science mapping analysis, J Informetr 11 (4) (Nov. 2017) 959–975, https://doi.org/10.1016/j.joi.2017.08.007.

[53] C. Chen, CiteSpace: A Practical Guide for Mapping Scientific Literature, 2016 [Online]. Available: https://www.researchgate.net/publication/308204148.

[54] A. Murray, K. Skene, K. Haynes, The circular economy: an interdisciplinary exploration of the concept and application in a global context, J. Bus. Ethics 140 (3) (2017) 369–380, https://doi.org/10.1007/s10551-015-2693-2. Feb.

[55] B. Su, A. Heshmati, Y. Geng, X. Yu, A review of the circular economy in China: moving from rhetoric to implementation, J. Clean. Prod. 42 (2013) 215–227, https://doi.org/10.1016/j.jclepro.2012.11.020.

[56] P. Ghisellini, M. Ripa, S. Ulgiati, Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review, J. Clean. Prod. 178 (Mar. 2018) 618–643, https://doi.org/10.1016/j.jclepro.2017.11.207.

[57] N. Donthu, S. Kumar, D. Pattnaik, Forty-five years of journal of business research: a bibliometric analysis, J. Bus. Res. 109 (Mar. 2020) 1–14, https://doi.org/10.1016/j.jbusres.2019.10.039.

[58] S. Bag, S. Gupta, S. Kumar, Industry 4.0 adoption and 10R advance manufacturing capabilities for sustainable development, Int. J. Prod. Econ. 231 (Jan. 2021), https://doi.org/10.1016/j.ijpe.2020.107844.

[59] S. Bag, J.H.C. Pretorius, S. Gupta, Y.K. Dwivedi, Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities, Technol. Forecast. Soc. Change 163 (2021), https://doi.org/10.1016/j.techfore.2020.120420. Feb.

[60] A. Upadhyay, S. Mukhuty, V. Kumar, Y. Kazancoglu, Blockchain technology and the circular economy: implications for sustainability and social responsibility, J. Clean. Prod. 293 (2021), https://doi.org/10.1016/j.jclepro.2021.126130. Apr.

[61] T.D. Mastos, et al., Introducing an application of an industry 4.0 solution for circular supply chain management, J. Clean. Prod. 300 (2021), https://doi.org/10.1016/j.jclepro.2021.126886. Jun.

[62] N. Patwa, U. Sivarajah, A. Seetharaman, S. Sarkar, K. Maiti, K. Hingorani, Towards a circular economy: an emerging economies context, J. Bus. Res. 122 (Jan. 2021) 725–735, https://doi.org/10.1016/j.jbusres.2020.05.015.

[63] H. Gupta, A. Kumar, P. Wasan, Industry 4.0, cleaner production and circular economy: an integrative framework for evaluating ethical and sustainable business performance of manufacturing organizations, J. Clean. Prod. 295 (May 2021), https://doi.org/10.1016/j.jclepro.2021.126253.

[64] M. Shayganmehr, A. Kumar, J.A. Garza-Reyes, M.A. Moktadir, Industry 4.0 enablers for a cleaner production and circular economy within the context of business ethics: a study in a developing country, J. Clean. Prod. 281 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.125280.

[65] U. Awan, R. Sroufe, M. Shahbaz, Industry 4.0 and the circular economy: a literature review and recommendations for future research, Bus Strategy Environ 30 (4) (May 2021) 2038–2060, https://doi.org/10.1002/bse.2731.

[66] E. Kristoffersen, P. Mikalef, F. Blomsma, J. Li, The effects of business analytics capability on circular economy implementation, resource orchestration capability, and firm performance, Int. J. Prod. Econ. 239 (Sep) (2021), https://doi.org/10.1016/j.ijpe.2021.108205.

[67] M. Kurdve, M. Bellgran, Green lean operationalisation of the circular economy concept on production shop floor level, J. Clean. Prod. 278 (2021), https://doi.org/10.1016/j.jclepro.2020.123223. Jan.

[68] E. Dorr, M. Koegler, B. Gabrielle, C. Aubry, Life cycle assessment of a circular, urban mushroom farm, J. Clean. Prod. 288 (Mar. 2021), https://doi.org/10.1016/j.jclepro.2020.125668.

[69] E. Närvänen, M. Mattila, N. Mesiranta, Institutional work in food waste reduction: start-ups' role in moving towards a circular economy, Ind. Market. Manag. 93 (Feb. 2021) 605–616, https://doi.org/10.1016/j.indmarman.2020.08.009.

[70] T. Lehtokunnas, M. Mattila, E. Närvänen, N. Mesiranta, Towards a circular economy in food consumption: food waste reduction practices as ethical work, J. Consum. Cult. 22 (1) (Feb. 2022) 227–245, https://doi.org/10.1177/1469540520926252.

[71] X. Yunan, L. Weixin, Y. Yujie, W. Hui, Evolutionary game for the stakeholders in livestock pollution control based on circular economy, J. Clean. Prod. 282 (Feb. 2021), https://doi.org/10.1016/j.jclepro.2020.125403.

[72] A. De Pascale, R. Arbolino, K. Szopik-Depczyńska, M. Limosani, G. Ioppolo, A systematic review for measuring circular economy: the 61 indicators, J. Clean. Prod. 281 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.124942.

[73] M. Massaro, S. Secinaro, F. Dal Mas, V. Brescia, D. Calandra, Industry 4.0 and circular economy: an exploratory analysis of academic and practitioners' perspectives, Bus Strategy Environ 30 (2) (Feb. 2021) 1213–1231, https://doi.org/10.1002/bse.2680.

[74] G.A. Aguilar-Hernandez, J.F. Dias Rodrigues, A. Tukker, Macroeconomic, social and environmental impacts of a circular economy up to 2050: a meta-analysis of prospective studies, J. Clean. Prod. 278 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.123421.

[75] J. Rincón-Moreno, M. Ormazábal, M.J. Álvarez, C. Jaca, Advancing circular economy performance indicators and their application in Spanish companies, J. Clean. Prod. 279 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.123605.

[76] L. Carraresi, S. Bröring, How does business model redesign foster resilience in emerging circular value chains? J. Clean. Prod. 289 (Mar. 2021) https://doi.org/10.1016/j.jclepro.2021.125823.

[77] J.A. Fehrer, H. Wieland, A systemic logic for circular business models, J. Bus. Res. 125 (Mar. 2021) 609–620, https://doi.org/10.1016/j.jbusres.2020.02.010.

[78] R. Mostaghel, K. Chirumalla, Role of customers in circular business models, J. Bus. Res. 127 (Apr. 2021) 35–44, https://doi.org/10.1016/j.jbusres.2020.12.053.

[79] R. Salvador, M.V. Barros, F. Freire, A. Halog, C.M. Piekarski, A.C. De Francisco, Circular economy strategies on business modelling: identifying the greatest influences, J. Clean. Prod. 299 (May 2021), https://doi.org/10.1016/j.jclepro.2021.126918.

[80] M. Hina, C. Chauhan, P. Kaur, S. Kraus, A. Dhir, Drivers and barriers of circular economy business models: where we are now, and where we are heading, J. Clean. Prod. 333 (Jan) (2022), https://doi.org/10.1016/j.jclepro.2021.130049.
[81] P. van Loon, D. Diener, S. Harris, Circular products and business models and environmental impact reductions: current knowledge and knowledge gaps, J. Clean. Prod. 288 (Mar. 2021), https://doi.org/10.1016/j.jclepro.2020.125627.
[82] B. Wrålsen, V. Prieto-Sandoval, A. Mejia-Villa, R. O'Born, M. Hellström, B. Faessler, Circular business models for lithium-ion batteries - stakeholders, barriers, and drivers, J. Clean. Prod. 317 (Oct) (2021), https://doi.org/10.1016/j.jclepro.2021.128393.
[83] R. Charef, E. Ganjian, S. Emmitt, Socio-economic and environmental barriers for a holistic asset lifecycle approach to achieve circular economy: a pattern-matching method, Technol. Forecast. Soc. Change 170 (2021), https://doi.org/10.1016/j.techfore.2021.120798. Sep.
[84] M. Geissdoerfer, P. Savaget, N.M.P. Bocken, E.J. Hultink, The Circular Economy – a new sustainability paradigm? J. Clean. Prod. 143 (2017) https://doi.org/10.1016/j.jclepro.2016.12.048. Elsevier Ltd, pp. 757–768, Feb. 01.
[85] M.T. Marvila, A.R.G. de Azevedo, J. Alexandre, H. Colorado, M.L. Pereira Antunes, C.M.F. Vieira, Circular economy in cementitious ceramics: replacement of hydrated lime with a stoichiometric balanced combination of clay and marble waste, Int. J. Appl. Ceram. Technol. 18 (1) (Jan. 2021) 192–202, https://doi.org/10.1111/ijac.13634.
[86] V. Rizos, J. Bryhn, Implementation of circular economy approaches in the electrical and electronic equipment (EEE) sector: barriers, enablers and policy insights, J. Clean. Prod. 338 (Mar. 2022), https://doi.org/10.1016/j.jclepro.2022.130617.
[87] A. Shojaei, R. Ketabi, M. Razkenari, H. Hakim, J. Wang, Enabling a circular economy in the built environment sector through blockchain technology, J. Clean. Prod. 294 (Apr) (2021), https://doi.org/10.1016/j.jclepro.2021.126352.
[88] M.M. Bjørnbet, C. Skaar, A.M. Fet, K.Ø. Schulte, Circular economy in manufacturing companies: a review of case study literature, J. Clean. Prod. 294 (Apr) (2021), https://doi.org/10.1016/j.jclepro.2021.126268.
[89] C. Chauhan, V. Parida, A. Dhir, Linking circular economy and digitalisation technologies: a systematic literature review of past achievements and future promises, Technol. Forecast. Soc. Change 177 (Apr) (2022), https://doi.org/10.1016/j.techfore.2022.121508.
[90] E.F. Dulia, S.M. Ali, M. Garshasbi, G. Kabir, Admitting risks towards circular economy practices and strategies: an empirical test from supply chain perspective, J. Clean. Prod. 317 (Oct) (2021), https://doi.org/10.1016/j.jclepro.2021.128420.
[91] P. Dutta, S. Talaulikar, V. Xavier, S. Kapoor, Fostering reverse logistics in India by prominent barrier identification and strategy implementation to promote circular economy, J. Clean. Prod. 294 (Apr) (2021), https://doi.org/10.1016/j.jclepro.2021.126241.
[92] M.A. Taleb, O. Al Farooque, Towards a circular economy for sustainable development: an application of full cost accounting to municipal waste recyclables, J. Clean. Prod. 280 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.124047.
[93] T. Calzolari, A. Genovese, A. Brint, The adoption of circular economy practices in supply chains – an assessment of European Multi-National Enterprises, J. Clean. Prod. 312 (Aug) (2021), https://doi.org/10.1016/j.jclepro.2021.127616.
[94] I. Kazancoglu, Y. Kazancoglu, A. Kahraman, E. Yarimoglu, G. Soni, Investigating barriers to circular supply chain in the textile industry from Stakeholders' perspective, Int. J. Logist. Res. Appl. 25 (4–5) (2022) 521–548, https://doi.org/10.1080/13675567.2020.1846694.
[95] H. Salmenperä, K. Pitkänen, P. Kautto, L. Saikku, Critical factors for enhancing the circular economy in waste management, J. Clean. Prod. 280 (Jan. 2021), https://doi.org/10.1016/j.jclepro.2020.124339.
[96] I. Laskurain-Iturbe, G. Arana-Landín, B. Landeta-Manzano, N. Uriarte-Gallastegi, Exploring the influence of industry 4.0 technologies on the circular economy, J. Clean. Prod. 321 (Oct) (2021), https://doi.org/10.1016/j.jclepro.2021.128944.
[97] Y. Shen, C. Wang, Optimisation of garbage bin layout in rural infrastructure for promoting the renovation of rural human settlements: case study of yuding village in China, Int J Environ Res Public Health 18 (21) (2021), https://doi.org/10.3390/ijerph182111633. Nov.