

Article

Exploring the Nexus of Eco-Innovation and Sustainable Development: A Bibliometric Review and Analysis

Nosheen Fatma * and Abid Haleem 

Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India; ahaleem@jmi.ac.in

* Correspondence: nosheenfatma131@gmail.com

Abstract: Eco-innovation promotes sustainable economic growth while mitigating environmental impacts. It has evolved into an essential tool for firms seeking to align with the 2030 Sustainable Development Goals. A total of 723 articles from Web of Science and Scopus databases were analyzed in the timespan of 2001–2022 to unveil the contributions and interconnections among eco-innovation, sustainable development, and the SDGs. This study aims to conduct a comprehensive performance analysis and science mapping using Bibliometrix R-package and VosViewer, respectively. The analysis highlights the influential authors, journals, countries, and thematic trends of research articles. The trend analysis shows that carbon emission limitation, targeting SDGs in isolation, and environmental economics are gradually becoming mainstream. Eco-innovation's transformative potential spans economic, social, and environmental dimensions of sustainable development, though its studies have primarily focused on its environmental implications. This can offer new research directions to researchers and will be beneficial for framework development.

Keywords: eco-innovation; sustainable development goals; network analysis; science mapping; PRISMA



Citation: Fatma, N.; Haleem, A. Exploring the Nexus of Eco-Innovation and Sustainable Development: A Bibliometric Review and Analysis. *Sustainability* **2023**, *15*, 12281. <https://doi.org/10.3390/su151612281>

Academic Editor: Davide Settembre-Blundo

Received: 2 July 2023

Revised: 31 July 2023

Accepted: 9 August 2023

Published: 11 August 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

While industrial advancements have undoubtedly brought about positive changes, they have also given rise to significant global challenges. The limitation of resource usage necessitated the development of new technologies, products, and services. Organizations began actively seeking ways to develop technologies while reducing their impacts. In 1987, the Brundtland report also stressed that technological innovations aimed at reducing environmental impact need to be encouraged. And then, “eco-innovation” was introduced by James Fussler in 1996 in his book, which fit this criterion. Eco-innovation helps in reducing environmental risk, pollution, and other negative impacts of energy use without undermining economic performance [1]. At the beginning of this millennium, the United Nations established the Millennium Development Goals, which were a set of eight international development objectives to be accomplished by 2015. While MDGs made significant contributions in eradicating extreme poverty, providing free primary education, and reducing infant mortality, this growth was uneven. And to address this issue and the increasing climate crisis at a global level, 17 Sustainable Development Goals (SDGs) were adopted by the UN in 2015 to strengthen the economic, environmental, and social aspects of sustainable development [2]. Hence, businesses need to act responsibly to support these goals. It was seen that companies incorporating eco-innovation by themselves or through collaboration are economically successful [3]. Apart from providing a competitive edge to businesses and improving resource efficiency, it also improves the environmental performance of firms. Consequently, amidst the global pursuit of sustainable development, eco-innovation emerged as a vital catalyst. This has expanded the field of research investigating the effect of eco-innovation on sustainable development.

The relationship between eco-innovation and sustainability has been studied, and important conclusions have been drawn. Characterization of eco-innovation along the

dimensions of user, design, product service, and governance help to cater different aspects of sustainable development [4]. The eco-innovation index was developed, deriving factors from the literature on supporting sustainable development [5]. Eco-innovation research is multi-faceted as it has been studied in different fields. In the field of ecological economics, eco-innovation is integrated with the social and economic aspects of sustainable development [6]. Fernandez et al. [7] studied the effect of drivers of eco-innovation on sustainable sensitiveness, which signifies reduction of environmental impact by also incorporating health improvements. Another study was aimed at transformation of businesses to embrace sustainable development through eco-innovation. It emphasized that business management is moving toward empirical research where ideas and theories can be put into real practice in companies [8]. Ilic et al. [9] analyzed data from international organizations to expand the knowledge on the potential of eco-innovation in the business sector to achieve sustainable development. Eco-innovation adoption by firms provides a win-win situation, as apart from improving resource efficiency, greening the processes, it also positively impacts turnover and provides competitive advantage [10–12]. Moreover, there was evidence that it helped businesses survive the COVID-19 pandemic [13].

This signifies that there is a lot of diversity in this field of research, which combines eco-innovation and sustainable development. Most studies have adopted a holistic approach and provide a general overview of how eco-innovation promotes sustainable development. But there are very few research articles that, in addition to this, have also analyzed the SDGs in isolation. Hence, there is a need to group these themes so that we can equip the practitioners with an idea of how different goals are being targeted. This study aims to provide important information on the scientific studies, which have used eco-innovation for fostering sustainable development and the 17 SDGs. To achieve this objective, we have explored the following research questions (RQ):

RQ1: What are the descriptive properties of the literature on eco-innovation pertaining to sustainable development?

RQ2: What are the intellectual structure and most addressed research topics in this field?

RQ3: Which specific goals are addressed via the implementation of eco-innovation?

These have been approached by applying bibliometric methods to the generated data sample. The Bibliometrix package has been used to address the RQ1, by analyzing the metrics related to journals, authors, and countries. The data were extracted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method. The RQ2 was addressed by generating bibliometric maps with the help of VosViewer. And finally, a systematic review of the article targeting specific SDGs was carried out (RQ3).

This study will help researchers in identifying the hot spots in these areas and provide direction for future research. In Section 2, the data sources and research methodology used in this study are discussed. In Section 3, a descriptive analysis of the results has been provided. It includes both descriptive statistics and visualization of science mapping. In Section 4, the SDGs that are specifically focused on have been briefly explained, followed by Section 5 where we share the main highlights in the discussion and conclusion.

2. Materials and Methods

This research mainly focuses on the bibliometric analysis of scientific publications pertaining to achievement of sustainable development goals using eco-innovation. Bibliometric analysis provides insight into the emerging trends in the articles, collaborations, major contributions, and intellectual structures of any domain, using a large volume of unstructured data [14,15]. Pritchard introduced it in 1969, and it later gained recognition from researchers to understand the study background. It helps analyze research literature statistically and identify shifts in the scope of scientific fields [16]. We used the two most recognized databases, Scopus and Web of Science for conducting bibliometric study [17]. The analysis was performed for the period 2001–2022. The area of eco-innovation research aligned with the attainment of sustainable development was analyzed by using logical

integration of keywords in the title, abstract, and keywords field. For better accuracy, PRISMA guidelines were used to refine our search [18].

The first step was identification of the relevant articles. For this purpose, the search string used was: (“eco-innovation” OR “environmental innovation” OR “green innovation” OR “sustainable innovation”) along with (“sustainable development” OR “sustainable development goal” OR “SDG”). These terms have been used interchangeably and are being used to identify innovation aimed at contributing to a sustainable environment [1,6,19,20]. This resulted in total of 1950 articles in Scopus and 993 in WoS. The next step was screening, during which the articles not belonging to the areas of business, management, economics, decision, and social sciences were excluded. Further, articles were chosen as the document type, and languages other than English were excluded. The inclusion of sustainable innovation ensures that the social dimension also is covered. These four keywords are used by different research communities like scholars working with management and competition, those working with regulatory and policy effects, and environmental designers, which helps in more advanced bibliometric analysis. We included economics and social sciences to ensure that all the aspects of sustainable development were covered, and the study was not restricted to only environmentally benefitting themes. After retrieving these articles, the files were merged using Bibliometrix to remove the duplicates. The first step was to export Scopus and WoS datasets as a .bib file and plain text file, respectively. After that, the Bibliometrix package was loaded in the RStudio console window and then the biblioshiny() command was used. It redirected to the web interface for Bibliometrix. Using the biblioshiny app, the previously exported Scopus and WoS files were imported. The next step was to save them in Excel format and export the Excel files. The last step was to import both the Bibliometrix Excel files to RStudio and then through the mergeDbSources() command, we combined both files and removed the duplicates simultaneously. In the next step, the articles were assessed for eligibility by reading their title and abstract to make sure they adhere to the purpose of the research. This resulted in a total of 723 articles that were included in our study. The documents removed at each step following the PRISMA guidelines are shown in Figure 1.

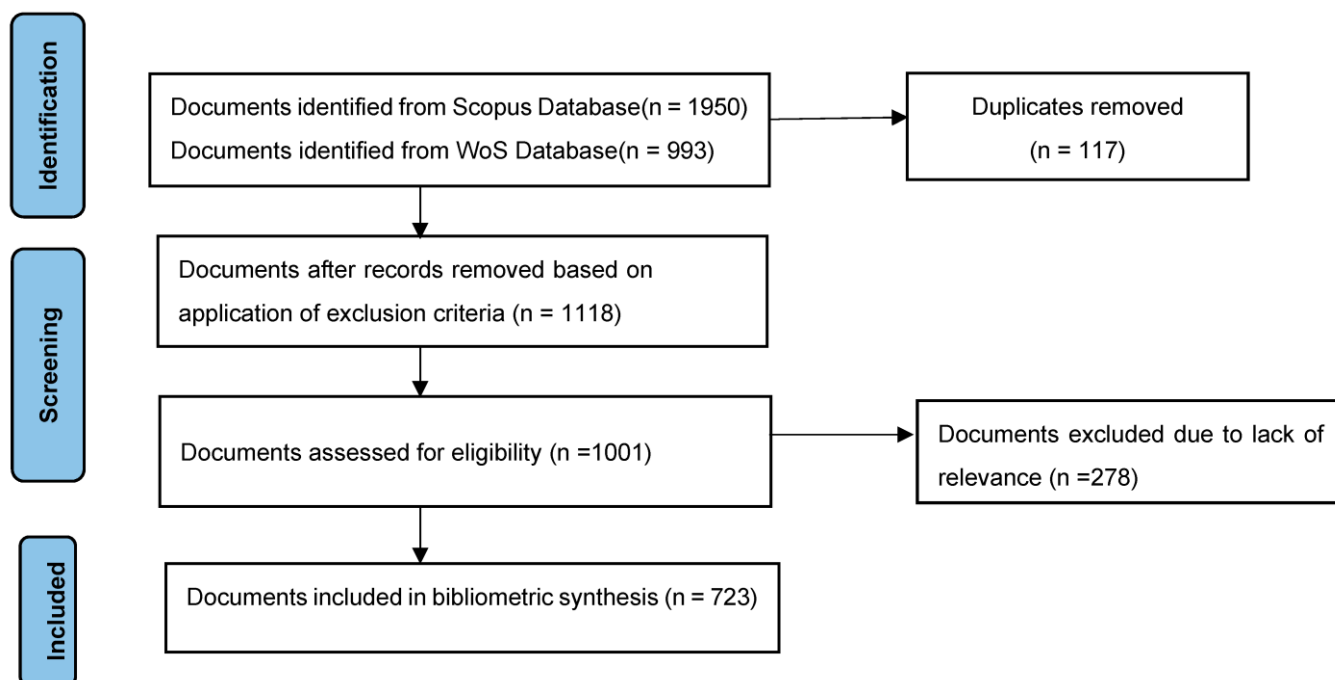


Figure 1. PRISMA flow diagram used for data extraction for bibliometric review.

Then, we used Bibliometrix, which provides comprehensive analysis of research articles by conducting performance analysis, which examines the major contributions of

research elements [21]. In addition, we performed science mapping techniques like citation analysis, co-citation analysis, and bibliographic coupling, which help in examining the relationships between research items. We used VosViewer for this purpose as it enables analysis of a substantial amount of data in an efficient manner and provides comprehensible visual maps [15,22]. The results are elaborated in the next section.

3. Results

The concept of attaining sustainability through eco-innovation has garnered significant attention from researchers worldwide, resulting in a multitude of articles published across different countries, organizations, and academic journals. The reflection of this widespread interest can be seen in the results section. The preliminary information is provided in Table 1. A total of 723 documents from 165 sources have been analyzed.

Table 1. Preliminary information from the analysis.

Description	Results
Timespan	2001–2022
Database	Scopus, WOS
Sources (Journals)	165
Documents	723
Annual Growth Rate %	11.03
Document Average Age	4.64
Average Citations Per Document	53.62
References	49,363
Author's Keywords	2094
Authors	1835
Single-Authored Document	74
Co-Authors Per Document	3.18
International Co-Authorships %	5.118

3.1. Results of Performance Analysis

The results shown in Figure 2 include the articles published in the span of 2001–2022. There is a significant increase in the volume of articles published. A total of 41 articles were published between 2001 and 2010, which is approximately 5.6% of the total volume. After 2011, a gradual increase was noticed. Between 2011 and 2015, 83 articles were published, accounting for 10% of the total articles. In 2016, a sudden increase of 46 articles shows that this field started gaining attention. This can be attributed to the fact that United Nations (UN) adopted the 17 SDGs in September 2015. This shows that earlier eco-innovation was not popular for addressing the attainment of the Millennium Development goals (MDGs), which were adopted in 2000. Between 2016 and 2020, 307 articles were published. The highest jump can be seen from 2021 to 2022, from 88 articles to a total of 180. This shows that eco-innovation is now being seen as a measure to tackle global issues and fulfil the SDGs.

Table 2 shows the top 10 journals that have published the largest no. of articles. It is evident that the *Journal of Cleaner Production* has contributed the highest no. of articles in these fields, around 28.4% of the total research articles. It was followed by *Business Strategy and the Environment* (13%), *Sustainability* (7.74%), *Technological Forecasting and Social Change* (4%), and *Corporate Social Responsibility and Environmental Management* (3.7%).

Figure 3 shows the authors with the maximum no. of publications. Wang J. has published 11 articles followed by Wang Y. and Li Y. Articles by Wang J. concentrated on effect of green learning and boundary-spanning search on green innovation [23–25]. Wang Y. studied the effect of foreign exposure to eco-innovation [26]. Li Y. studied the attitude of the public toward green innovation adoption in the automotive industry [27]. Chen J. studied the effect of licensing on product and process sustainable innovation [28]. Zhao X. explored green building adoption using a successful business model, which helps in diffusion of sustainable innovation [29]. Bocken N. focused his work on incorporating eco-innovation in the production of consumer goods [30–32].

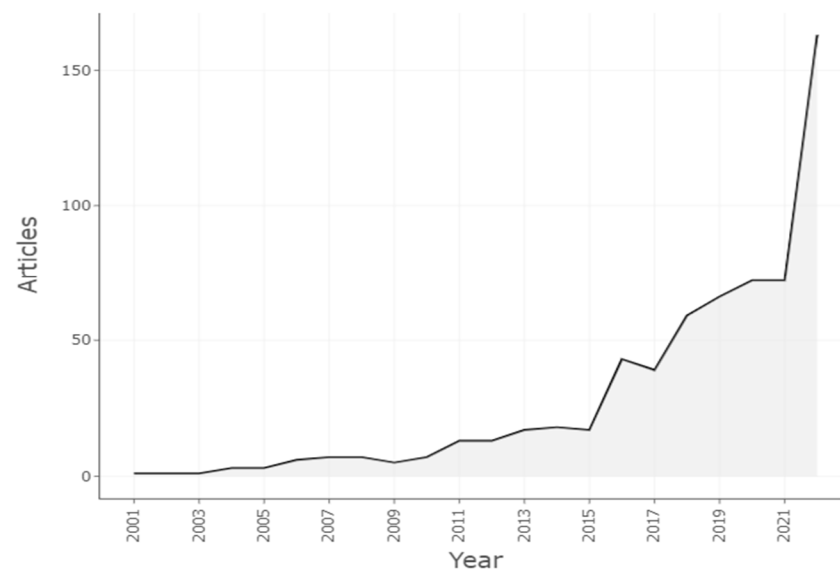


Figure 2. Trend of articles published between 2001 and 2022.

Table 2. Journals with highest production.

Sources	Articles
<i>Journal of Cleaner Production</i>	206
<i>Business Strategy and the Environment</i>	94
<i>Sustainability (Switzerland)</i>	56
<i>Technological Forecasting and Social Change</i>	29
<i>Corporate Social Responsibility and Environmental Management</i>	27
<i>Economic Research-Ekonomska Istrazivanja</i>	14
<i>Resources, Conservation and Recycling</i>	13
<i>Technology in Society</i>	12
<i>European Journal of Innovation Management</i>	9
<i>International Journal of Innovation and Sustainable Development</i>	9

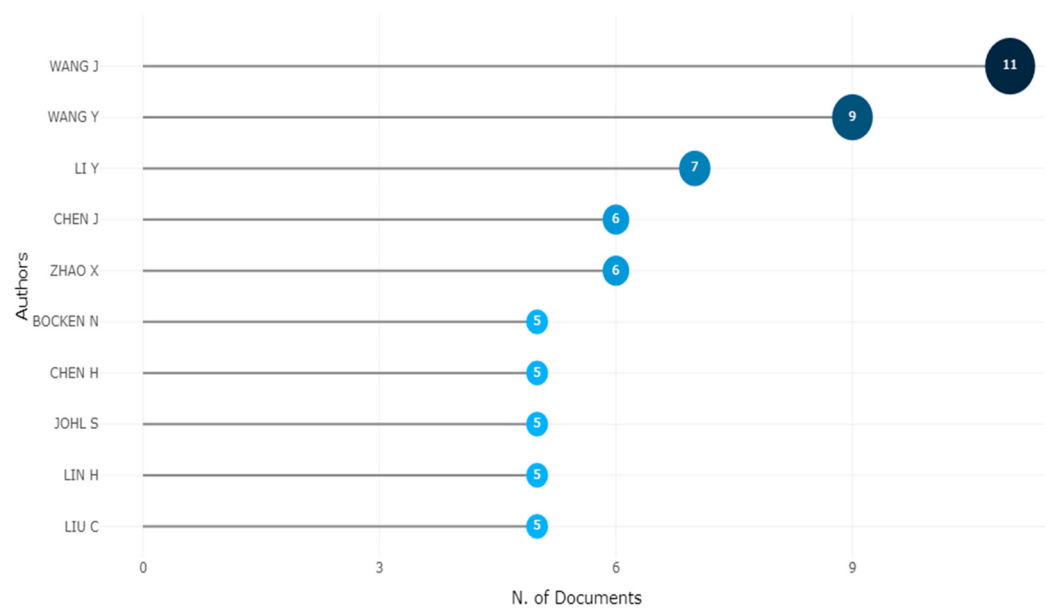


Figure 3. Authors with highest production.

Table 3 contains country-wise scientific production between 2001 and 2022. China has the maximum no. of publications followed by Italy and Spain.

Table 3. Country-wise article production.

Region	Frequency
China	183
Italy	61
Spain	61
UK	52
Netherlands	30
Germany	26
Brazil	25
France	25
USA	24
Australia	23

The three-field plot in Figure 4 shows the interconnectedness between authors, affiliations, and their keywords. The sequence in which they appear can be customized. The plot reveals that three authors with affiliation to Northwestern University have published the most papers on sustainable development. The size of each block is proportional to the frequency of keywords, articles published by authors, and articles published by affiliates. Most of the articles are on sustainable development, green innovation, and eco-innovation. Most of the work has been carried out regarding small manufacturing enterprises (SMEs).

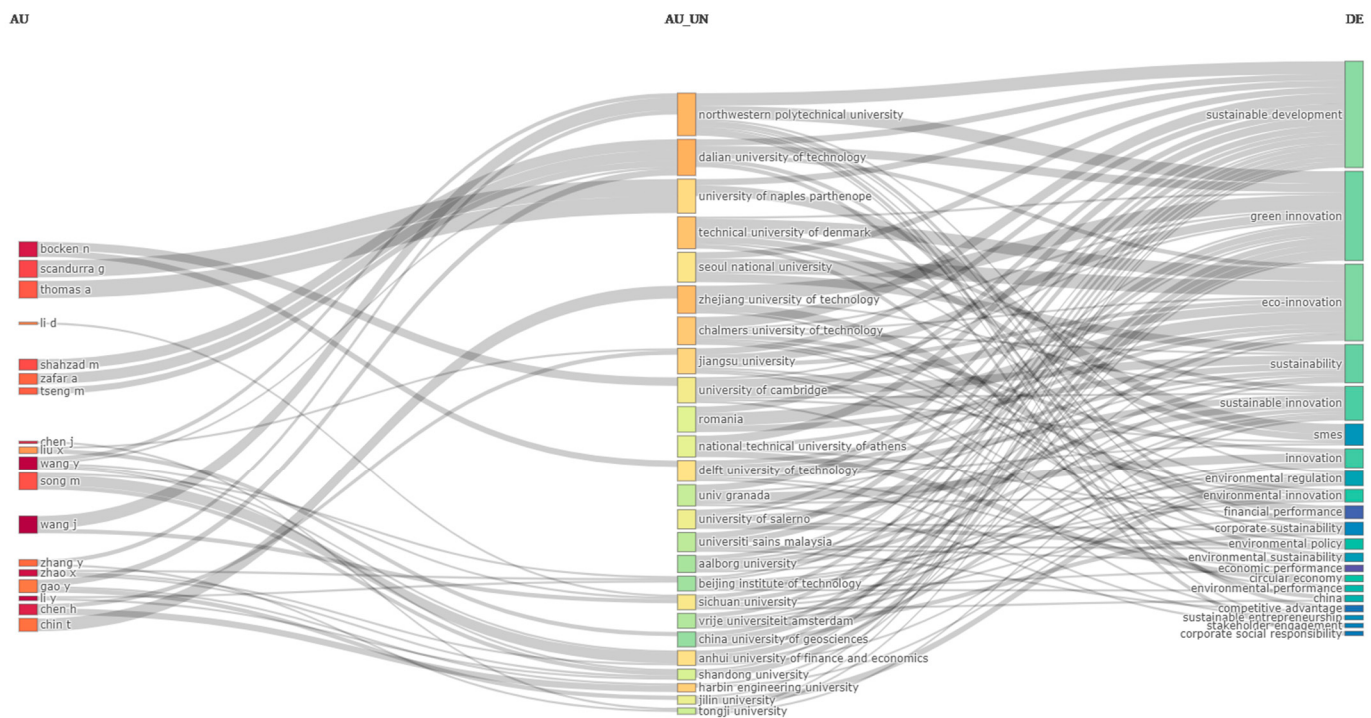
**Figure 4.** Three-field plot of authors, affiliations, and keywords.

Table 4 shows article ranking based on the most global citations, i.e., the highest citations in the database. TC stands for total citation, and AC stands for average citation. Boons and Lüdeke-Freund [33] received the highest number of citations for analyzing business models based on three elements of sustainable innovation, which are technological, organizational, and social innovation. This can help businesses to operate sustainably. Schot et al. [34] concluded that by creating protected spaces for experimenting with technology and user practices, we can aid sustainable innovation. And both internal and external processes are necessary to achieve sustainable development. The study of effect of green innovation on competitive advantage showed that investing in both green products and process innovation is helpful to business [35]. Chiou et al. [36] demonstrated that green-

supply-chain and green-innovation practices positively impact environmental performance. Another article by Boons et al. [37] concentrated on the utility of the business model in sustainable innovation research. Then, the transition from the linear to the circular economy started gaining attention. Interestingly, eco-innovation was found to be a key element in this transition [38,39]. The effect of incorporating sustainability in a supply chain was studied by Gold et al. [40], whose work gained wide attention. Sustainability in supply chain management increases competitiveness of the firms as it helps in generating valuable inter-organizational resources. Another study on SMEs inferred that sustainable innovation targets technological product improvements and increases eco-efficiency [41]. Another aspect of research in this field was added by Truffer et al. [42], who introduced spatial aspects in sustainability transitions.

Table 4. Top 10 most cited documents (global citations).

Authors	Title	Journal	Year	TC	AC
Boons and Lüdeke-Freund [33]	Business models for sustainable innovation: State-of-the-art and steps towards a research agenda	<i>Journal of Cleaner Production</i>	2013	1244	113.09
Schot et al. [34]	Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy	<i>Technology Analysis and Strategic Management</i>	2008	1142	71.38
Chen et al. [35]	The influence of green innovation performance on corporate advantage in Taiwan	<i>Journal of Business Ethics</i>	2006	1120	62.22
Chiou et al. [36]	The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan	<i>Transportation Research Part E: Logistics and Transportation Review</i>	2011	683	52.54
Boons et al. [37]	Sustainable innovation, business models and economic performance: An overview	<i>Journal of Cleaner Production</i>	2013	633	57.55
Kirchherr et al. [38]	Barriers to the Circular Economy: Evidence from the European Union (EU)	<i>Ecological Economics</i>	2018	537	88.83
Gold et al. [40]	Sustainable Supply Chain Management and Inter-Organizational Resources: A Literature Review	<i>Corporate Social Responsibility and Environmental Management</i>	2010	522	37
Prieto-Sandoval et al. [39]	Towards a consensus on the circular economy	<i>Journal of Cleaner Production</i>	2018	478	79.67
Bos-Brouwers H.E.J. [41]	Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice	<i>Business Strategy and the Environment</i>	2010	469	33.5
Truffer et al. [42]	Environmental Innovation and Sustainability Transitions in Regional Studies	<i>Regional Studies</i>	2012	352	28.58

Figure 5 presents the thematic evolution of research in the field of eco-innovation and sustainable development over the last 22 years in different time frames. The time frame is divided into three phases. The first phase is 2001–2013, to see the research keywords during the which Millennium Development Goals were in focus. The next phase is 2014–2018, when MDGs were replaced by SDGs. And then, finally, the last phase is how SDGs have changed this pattern.

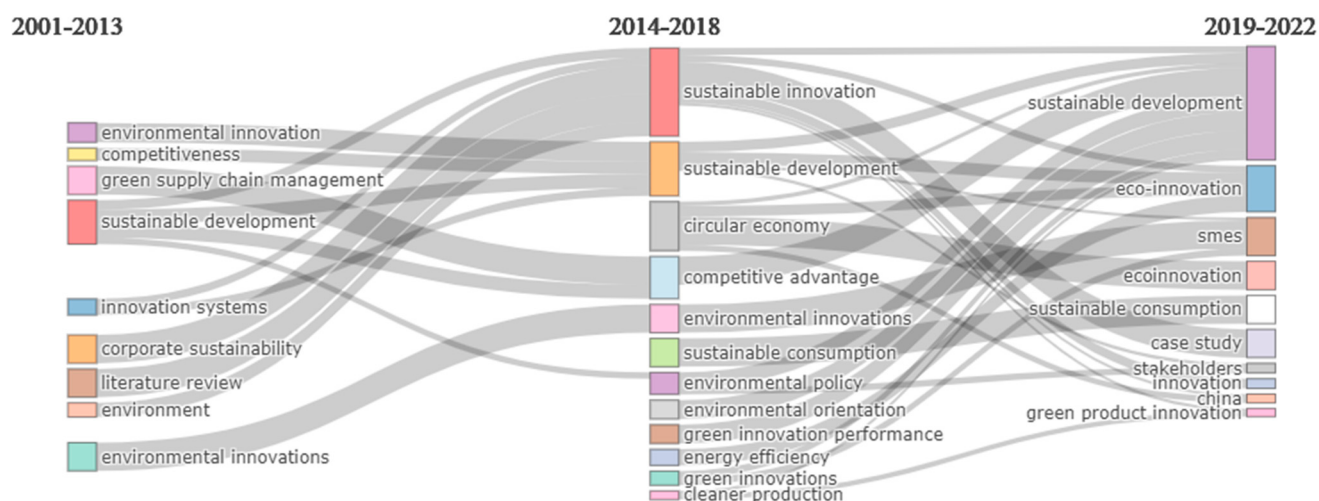


Figure 5. Thematic evolution of the keywords.

The focus of both the MDGs and SDGs was to steer sustainable development. And in the first phase, the literature on both sustainable development and environmental innovation started to gather momentum. The dominance of “sustainable development” and environment-related innovation can be seen in all three phases. The period of 2014–2018 can be seen as a breakthrough phase, as lot of clusters like the addition of literature on “circular economy”, “sustainable consumption”, “energy efficiency”, and “competitive advantage” emerged [43–54]. The third period can be seen as a maturity stage where many clusters can be seen gradually merging into “sustainable development” and “eco-innovation”.

The plot in Figure 6 shows the trending topics based on keyword plus. Keyword plus allows inclusion of general and broader terms as automatic computer algorithms generate them. It can help in detecting the evolution of research themes [55]. This highlights new trends and perspectives gaining attention in this research field. And the most trending topics discussed in the articles are sustainable development goals followed by carbon emission. Various articles have investigated the intrinsic role of eco-innovation in reducing carbon emissions [56–67]. Further, economic and social effects of eco-innovation have also garnered attention [12]. It is seen that gender inclusivity promotes the implementation of eco-innovation. Environmental protection and environmental management have also been addressed by researchers working on sustainable economic development.

3.2. Results of Science Mapping

The techniques of science mapping are citation analysis, bibliographic coupling, citation analysis, co-citation analysis, co-word analysis, and co-authorship analysis. The bibliometric maps have been created using VosViewer.

3.2.1. Co-Authorship Analysis

Co-authorship shows the collaborative patterns among the authors based on their co-authored publications. Figure 7 represents the author clusters where we have used a minimum of five citations as the threshold.

In cluster 1 (red), Huang H. and Wang Y. with three links and Total Link Strength (TLS) score of 4 are the most dominant authors. Yang M. and Zhao X. are most productive in cluster 2 (green) with three links and TLS scores of 4 and 3, respectively. Hirsch R. is the most productive author in cluster 3 (blue) with three links and TLS score of 9.

Figure 8 shows the collaboration among countries. It offers an overlay visualization of collaborating countries where the weight for calculation is based on TLS. The scores are based on the average publication year. It is evident that China has the highest number

of collaborations in the most recent year. It has most recently collaborated with Pakistan, Vietnam, Malaysia, Saudi Arabia, and India.

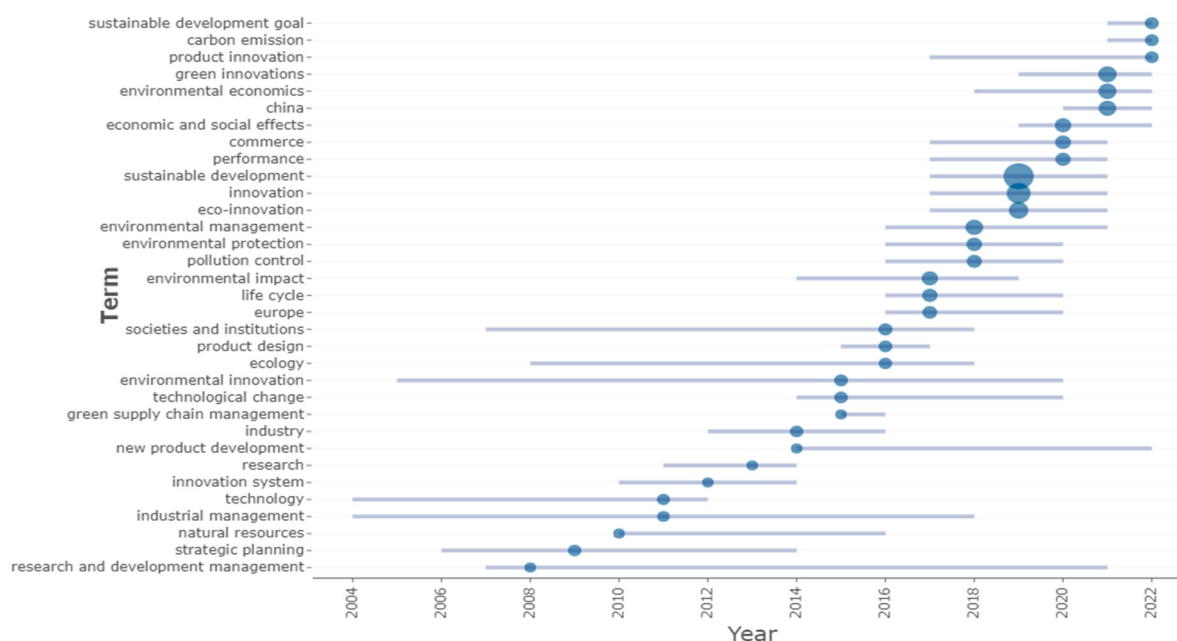


Figure 6. Trending topics.

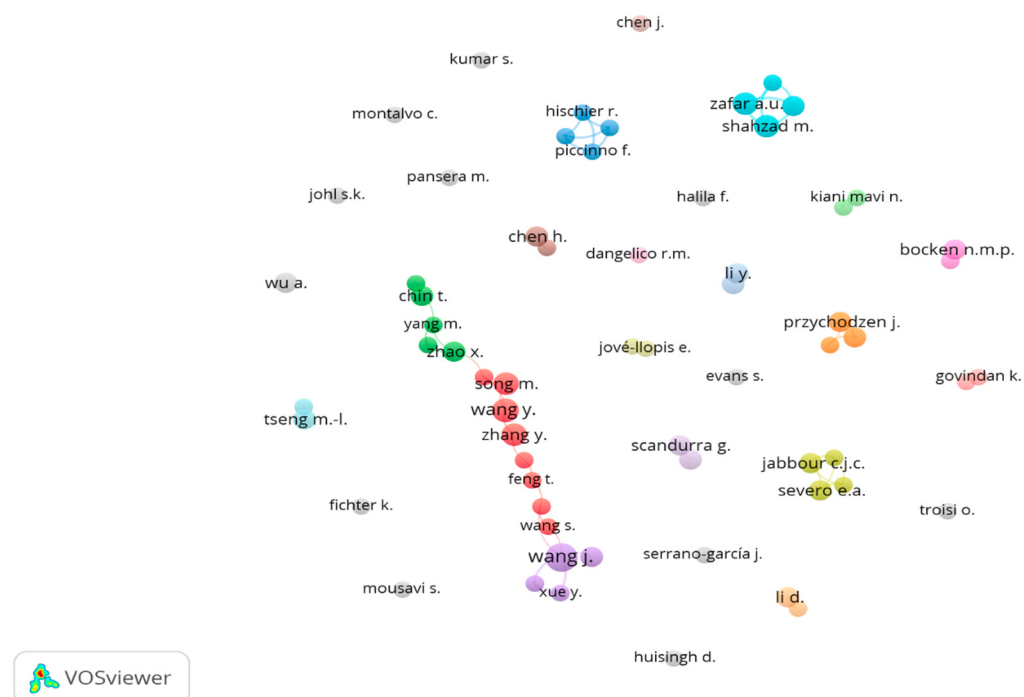


Figure 7. Co-authorship map.

These works include determining the role of eco-innovation in increasing renewable consumption in G-11 countries (Pakistan), examining the effectiveness of eco-innovation and governance in driving SDGs in G-7 countries (Vietnam), and its role in driving municipal solid waste generation in OECD countries (India) [68–70]. Also, collaborative efforts have been undertaken to investigate the role of eco-innovation in ASEAN countries (Malaysia) and encouraging sustainable renewable energy in OECD countries (Saudi Arabia) [71,72].

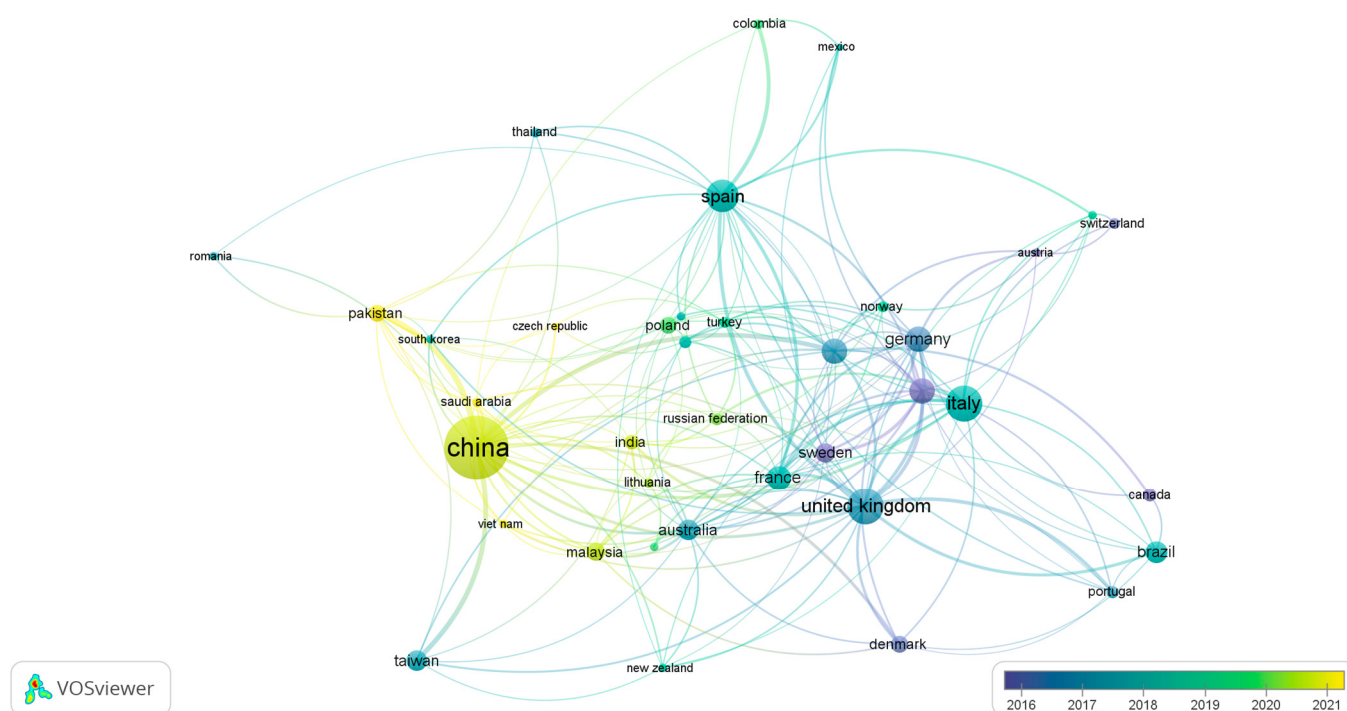


Figure 8. Co-authorship map (countries).

Table 5 contains the top five countries whose articles have highest TLS values. This shows the social network among the countries that share authorship. The most dominant countries in terms of co-authorship are China, United Kingdom, Spain, United States, and Italy.

Table 5. Co-authorship metrics of top 5 countries.

Countries	Citation	TLS
China	6570	57
United Kingdom	4682	50
Spain	3174	29
United States	1985	26
Italy	3104	25

3.2.2. Co-Occurrence Analysis

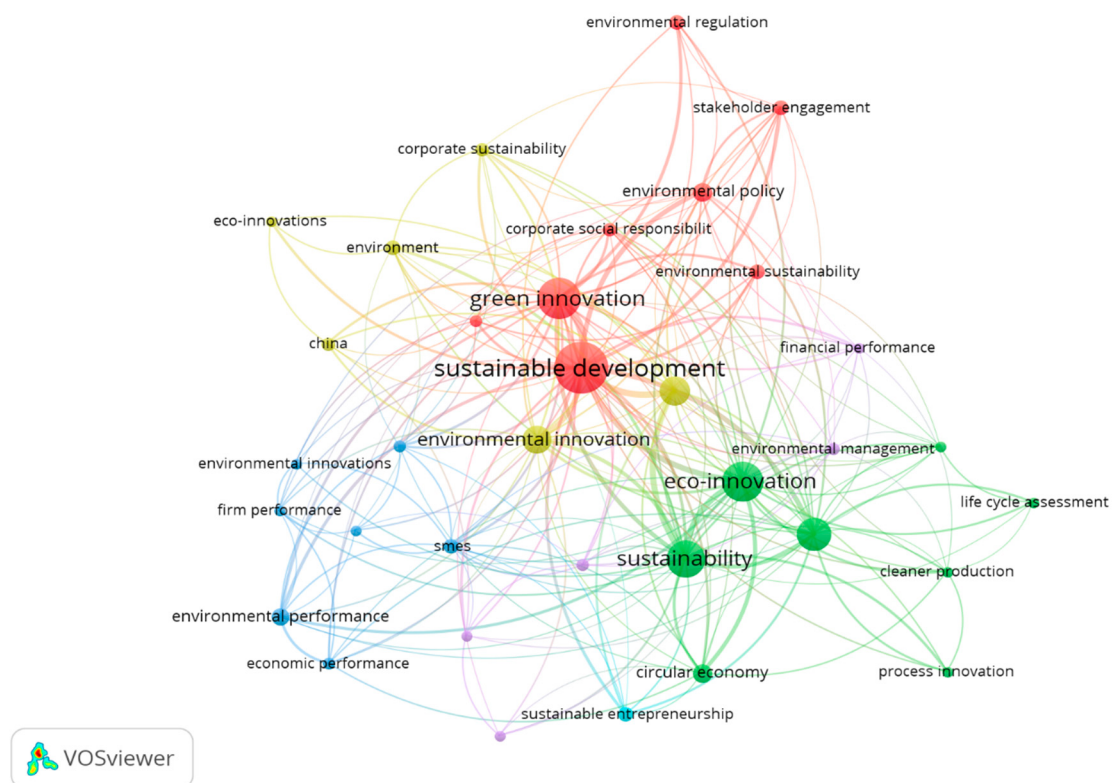
Co-occurrence analysis depicts the patterns of co-occurrence of keywords. This analysis helps in identifying relationships between different terms based on their frequency of co-occurrence. Here, keywords are represented as nodes, and strength of their co-occurrence is represented by proximity between the nodes.

A total of 2094 author keywords and 2778 index keywords were identified. In Table 6, top ten author and index keywords based on TLS values are depicted. In both categories, “sustainable development”, “eco-innovation”, and “green innovation” are the most critical keywords. Figure 9 represents the keyword co-occurrence. This shows that for achieving sustainable development, eco-innovation has a huge potential.

“Environmental policies”, “circular economy”, and “corporate social responsibility” are also seen as prominent terms as they promote eco-innovation. Corporate social responsibility policy has gained popularity by positively affecting willingness to eco-innovate [73].

Table 6. Co-occurrence analysis of top 10 author and index keywords.

Author Keyword	TLS	Index Keyword	TLS
Sustainable development	140	Sustainable development	451
Sustainability	78	Innovation	184
Green innovation	74	Eco-innovation	108
Eco-innovation	63	Green innovation	77
Innovation	49	Environmental economics	61
Sustainable innovation	40	Sustainability	59
Environmental innovation	37	Environmental management	56
Environmental policy	22	Environmental innovation	42
Circular economy	20	Planning	42
Environmental performance	19	Economic and social effects	41

**Figure 9.** Keyword co-occurrence.

3.2.3. Citation Analysis

Citation analysis helps to visualize the citation patterns between publications to identify the key contributors and seminal works. It identifies the highly cited publications, influential authors, prominent journals, countries, and organizations. Table 7 shows the total citations and TLS scores of the top ten authors, countries, and journals based on citations. *Journal of Cleaner Production*, *Business Strategy and Environment*, and *Sustainability* are the top cited journals. Li D. has the highest number of citations, followed by Tseng M.

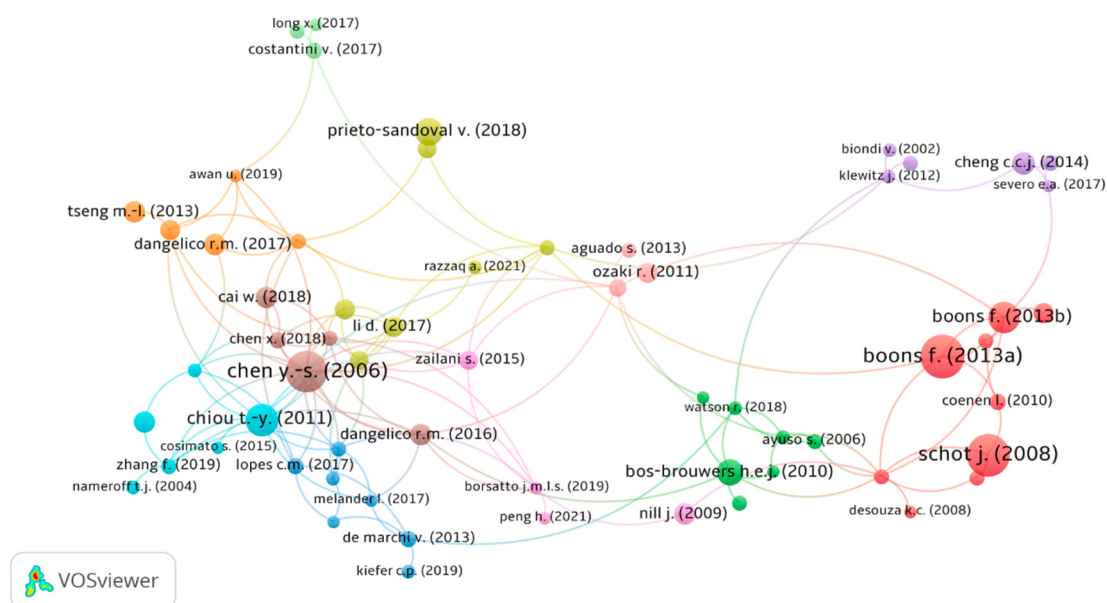
Li D. demonstrated the role of green innovation in achieving sustainable development by combining institutional theory and a resource-based view [74]. The study shows that legitimacy pressure and corporate profitability positively affect corporate green innovation. He also illustrated the positive role of institutional pressure, i.e., normative pressure and coercive pressure on corporate green innovation [75]. Tseng M. explored the key attributes of eco-innovation in industrial symbiosis [76]. Regulation and waste management synergies were the most crucial among identified aspects. In other work, he identified eco-innovation as the critical element in promoting sustainable consumption and production [77]. These works by Li D. and Tseng M. were published in *Journal of Cleaner Production* [74–77].

Table 7. Citation analysis and TLS of the top 10 authors, countries, and journals.

Authors	Citations (TLS)	Countries	Citations (TLS)	Journals	Citations (TLS)
Li. D.	566(15)	China	6570(513)	<i>Journal of Cleaner Production</i>	14,579(229)
Tseng M.	461(2)	Netherlands	5636(280)	<i>Business Strategy and The Environment</i>	4549(172)
Jabbour C, J.C.	434(2)	UK	4682(326)	<i>Sustainability (Switzerland)</i>	1729(2)
Bocken N.M.P.	397(6)	Germany	3668(247)	<i>Corporate Social Responsibility and Environmental Management</i>	1481(59)
Zhang Y.	377(7)	Taiwan	3457(237)	<i>Technological Forecasting and Social Change</i>	1367(35)
Wang Y.	348(9)	Spain	3174(245)	<i>Resources, Conservation and Recycling</i>	752(30)
Shahzad M.	301(20)	United States	1985(202)	<i>Ecological Economics</i>	745(8)
Zafar A.U.	301(20)	Brazil	1951(163)	<i>Research Policy</i>	500(17)
Pzychodzen J.	290(11)	Sweden	1585(116)	<i>Technology In Society</i>	433(35)
Qu Y.	285(18)	France	1321(129)	<i>International Journal of Production Economics</i>	407(20)

Jabbour C, J.C. has provided empirical insights into the green creativity components that positively influence green organizational innovation [78]. Green expertise and creativity skills were found to be the key motivators. Work on sustainable venture capital by Bocken N.M.P. has received high recognition [31]. He pointed out that sustainable venture capitalists provide financial and network support, along with advice to businesses on adopting a triple bottom line framework. Zhang Y. provided empirical evidence on the positive role of organization readiness for eco-innovation [44]. The components of the organization readiness construct are innovation capability and environmental concern. Hence, internal preparation of an enterprise is necessary for sustainable operation.

Figure 10 represents the direct citation relationships between individual documents. A document by Chen Y.S. has the highest number of links (16), followed by one by Asadi S. with 10 links. Here, the size of the node represents the frequency of citation of the document, which is highest for Boons F., who has analyzed business models for sustainable innovation.

**Figure 10.** Citation network for documents.

3.2.4. Bibliographic Coupling

Bibliographic coupling allows researchers to understand the connections among publications based on their shared references. It allows us to identify clusters of related research. Here, each item, i.e., document, author, or source, is represented by a node. And each node in the network is linked to another node if they share one or more references. In Figure 11, bibliographic coupling for journals is shown. The threshold of a minimum of five articles per journal and minimum five citations per article is applied. The *Journal of Cleaner Production* has appeared the most in the references.

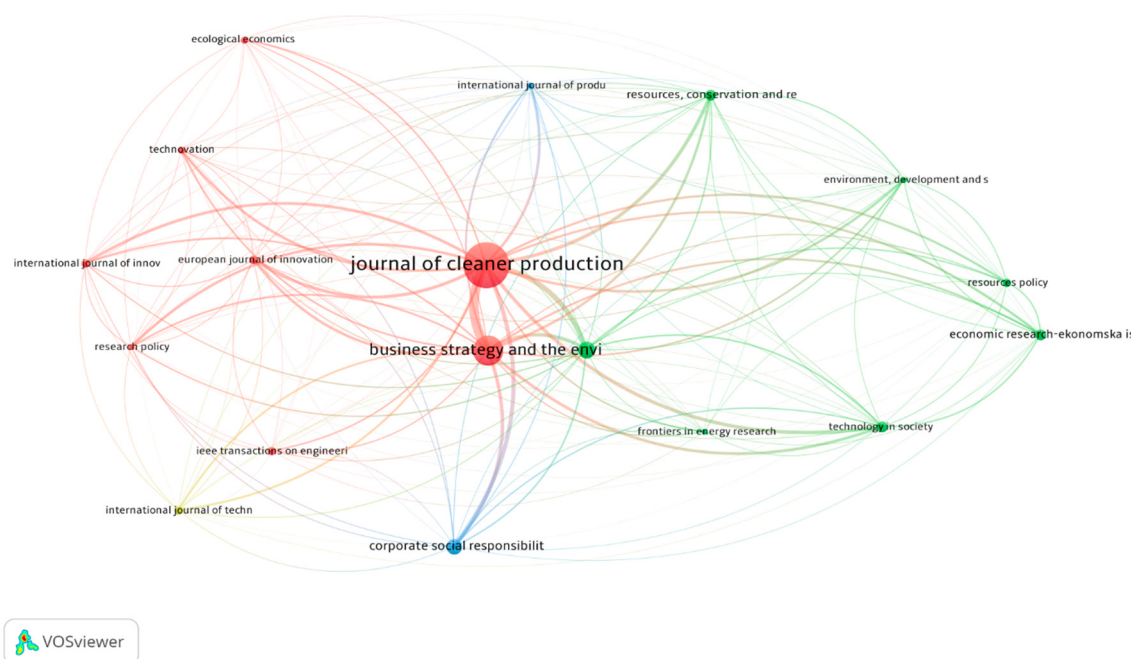


Figure 11. Bibliographic coupling for journals.

Here, the coupling is based on the TLS values. TLS values indicate the cumulative strength of all the links connected to a particular node in a network. Through TLS, we can identify the central nodes that have a significant impact on the flow of information within the network.

In Table 8, five authors with the highest TLS values are shown. These authors have the highest impact, and their contributions to sustainable development based on eco-innovation are the most significant.

Table 8. Bibliographic coupling analysis of top 5 authors.

Authors	TLS
Shahzad M.	388.68
Wang Y.	280.43
Zhang Y.	177.15
Song M.	118.93
Wang J.	58.93

3.2.5. Co-Citation Analysis

Co-citation helps in identifying groups of publications that are frequently cited together with other publications. This indicates a similarity in research focus within a specific field.

Figure 12 depicts the co-citation network of cited authors. There are four major clusters of cited authors. This shows that articles of a particular cluster share a reference list and belong to similar category. Rennings K. has the highest number of co-citations

with a TLS of 343.3, followed by Kemp R. and Horbach J., and they belong to the same cluster (green). Rennings's work focuses on environmental resource management, process innovation, and environment impact assessment. Kemp R. is involved in environmental policy research, circular economy, and strategic niche management. Horbach J. is known for his works on cleaner production, environmental management, and environmental economics. Then, in the yellow cluster, Porter M.E., Wagner M., and Hart S.L. have the highest TLS. Porter's main work deals with competitive advantage, competitive strategy, and economic development. Wagner M. works on corporate sustainability, innovation, and strategic management. Hart S.L. is known for the concept of "sustainable value" and has advocated for the role of businesses in addressing global challenges. The most influential authors in the blue cluster are Sarkis J., Zhu Q., and Dangelico R.M. The authors Sarkis J. and Zhu Q. have co-authored many publications, and their work deals with green supply chain management. Dangelico R.M. has worked on green product innovation and green marketing. Wang Y. has the highest TLS in the red cluster, followed by Zhang Y. and Liu Y. The authors Wang Y. and Zhang Y. have worked in the area of corporate social responsibility and policy making. Liu Y. has authored papers on reducing carbon emissions and making technological progress through green innovation. These authors have significantly contributed to advancing eco-innovation through extensive research.

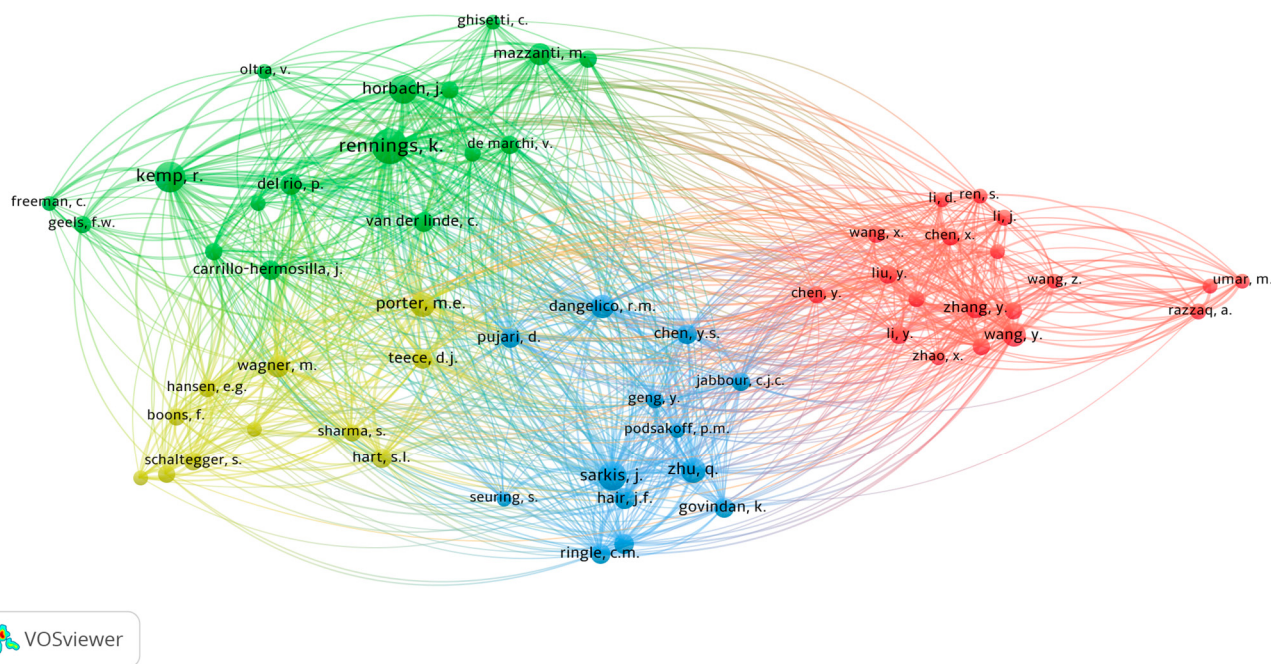


Figure 12. Co-citation network of cited authors.

4. SDGs Focused on During Eco-Innovation Research

The articles were further examined to determine whether eco-innovation has been employed by the authors to target specific SDGs, and it was seen that a limited body of research is available in this area. Lacka et al. [58] employed the dynamic network slack-based model for efficiency evaluation in 27 EU countries, using eco-innovation inputs like labor force, energy consumption, R&D investment, and skilled personnel. They considered availability of water and sanitation and access to clean and affordable energy as output. The model shows how these eco-innovation inputs positively affect the implementation of SDGs 6 and 7. It infers that countries having higher scores in eco-innovation efficiency tend to achieve higher SDG scores, which exhibits their mutual reinforcement.

Saha et al. [79], in their article, investigated the extent to which eco-innovation endeavors have taken gender inclusivity into consideration and how it can slow down environmental degradation. It shows how gender disparity can lead to the loss of the

socio-economic construct of eco-innovation, and restoring gender balance is necessary as its lack dampens the positive impact of the institutional environment on eco-innovation. Similarly, a case study conducted in a higher education institute indicated that preparedness for sustainable innovation action is supported more by female participants [80]. Seifert et al. [81] have addressed the challenges faced by forcibly displaced people living in refugee camps and how eco-innovative solutions can help create sustainable living conditions for them thereby contributing to SDG 11.

Albitar et al. [82] have pointed out that eco-innovation and corporate governance positively impact the SDG 13, i.e., climate action, by conducting a study on a sample of companies listed in the London Stock exchange. Similarly, Jiang et al. [83], Amin et al. [84], and Khurshid et al. [85] studied the effect of green innovation on carbon emissions. They found that an increase in green innovation is inversely linked with carbon emissions, which is important to reach SDG 13. An analysis of BRICS nations yields similar results, by further adding that emission-mitigation effects of green innovation are more pronounced at higher emissions [62]. Another analysis by Choi et al. [86] was carried out to analyze the effect of environmental innovation on air pollution reduction in high-income and low-income countries. The findings indicated that it helps in improving environmental conditions by showing a reduction in CO₂ and SO₂ emissions especially in high income countries. The research by Lasisi et al. [87] examines the role of environment-related innovation for pursuing SDGs 7, 8, and 12 in the economies leading eco-innovation. It suggests that environmental innovation is reducing the reliance on oil consumption and fossil fuels while simultaneously shifting toward cleaner energy. Green innovation strategies significantly reduce carbon emissions and ecological footprint which can help to mitigate climate change and promote sustainable practices [88]. A methodology to calculate carbon footprint of a software-based technology center was developed to aid sustainable innovation in the firm [89]. Socio-economic outcome is the dimension of eco-innovation that is found to be most effective in reducing GHG emissions [90]. Research by Yikun et al. [69] concludes that eco-innovation promotes sustainable patterns in industrial infrastructure and creates employment opportunities. SDG 12 has been targeted by Sinha et al. [70], who investigated the role of eco-innovation on determinants of solid waste generation. It has shown a decrease in generation of solid waste by considering the 10 best and least recycling OECD nations. Further, it has been observed that by embracing eco-innovation techniques, industries can effectively comply with regulations and minimize waste and pollution, thereby preserving the environment [91]. Lower green innovation efficiencies are linked to high polluting industries, which indicates that to combat pollution, these industries need to improve their performance by adopting innovative green technologies [92]. Afeltra et al. [93] deduced that eco-innovation has a positive impact on organizational performance and competitive advantage of firms, which can help in achieving SDGs 8 and 9 by promoting sustainable economic growth and fostering technological and infrastructural enhancement. A case study on a sustainable Indian entrepreneur shows how sustainable innovation can help reduce plastic waste and empower rural women by providing them employment [94]. Zhou et al. [60] ascertained that by embedding green innovation in supply chains, practitioners can address SDGs 8, 9, 12, and 13. Khan et al. [95] examined the role of green innovation reporting in sustainability reporting to contribute to the SDGs. This ensures transparency, accountability, and a transition toward sustainable and innovative business practices.

Park et al. [96] carried out a comprehensive study by linking eco-innovation indicators to specific SDGs. An eco-innovation performance indicator depicting water consumption intensity was related to SDG 6. The activeness of renewable energy utilization and a nation's energy sustainability level indicators can tackle SDG 7. Two eco-innovation capacity indicators, which are a nation's economic competitiveness and general innovation capacity, along with two eco-innovation performance indicators, which are jobs in the green technology industry and green industry market size, are related to SDG 8. Green technology and green industry indicators align with SDG 9. Eventually, green technology, green industry, and green patent indicators can enable sustainable production (SDG 12).

An eco-innovation performance measure that indicates CO₂ emission intensity can aid in a swift response to climate change (SDG 13). All these articles have been specified in Table 9.

Table 9. Articles addressing SDGs.

SDG	References
SDG 5: Gender equality	[79,80,94]
SDG 6: Clean water and sanitation	[58,96]
SDG 7: Affordable and clean energy	[58,87,96]
SDG 8: Decent work and economic growth	[60,69,87,93,96]
SDG 9: Industry, innovation, and infrastructure	[60,69,91–93,95]
SDG 11: Sustainable cities and communities	[81]
SDG 12: Responsible consumption and production	[60,70,87,91,94,96]
SDG 13: Climate action	[60,62,79–86,88–90,92,96]

Figure 13 depicts all the SDGs addressed through eco-innovation, and the aim of these goals are mentioned.

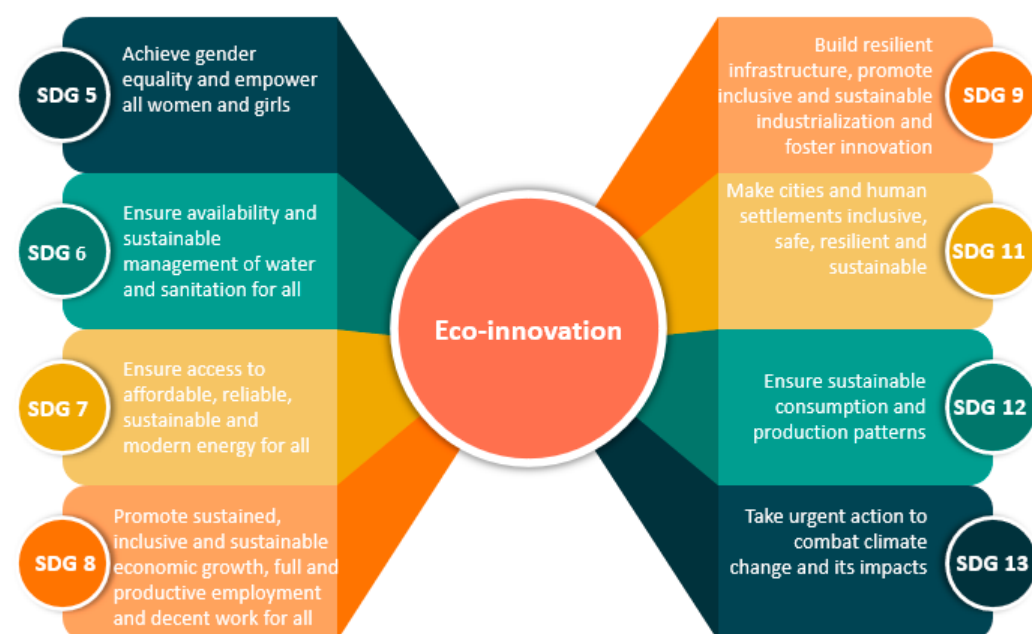


Figure 13. SDGs targeted in the literature.

5. Discussion and Conclusions

This study analyzed the literature in the field of eco-innovation and sustainable development with a focus on SDGs in the WoS and Scopus databases. In this study, performance analysis and science mapping of both the domains were carried out using Bibliometrix and VosViewer. This section concludes the obtained results and future research directions.

5.1. Expansion and Enrichment of Eco-Innovation and Sustainable Development Research

It is quite evident from the trend of publications that the number of articles being published has seen tremendous growth. From 41 articles in the period of 2001–2010, a jump to 180 articles in 2022 alone can be seen. This shows the potential of eco-innovation as a mechanism to achieve sustainable development. Secondly, the top three most productive journals are *Journal of Cleaner Production*, *Business Strategy and the Environment*, and *Sustainability*. They were in the top three regarding the number of articles published and number of citations. The trend plot has shown the rise of sustainable development goals as the most trending topic in 2022. Wang J. has published highest no. of articles, and China is the most productive country in terms of number of publications and collaboration

with other countries. Initially, most articles were focused on effects of eco-innovation on firms for better performance and how they incorporate sustainable practices. In recent years, environmental protection and climate change has become the focus of research. The findings show that eco-innovation has the potential to cater to different SDGs, but it mostly includes carbon and GHG emission limitation.

5.2. Diversity in the Intellectual Structure of Research Field

The co-citation analysis shows that Rennings K. is the most co-cited author, and this can be attributed to his article “Redefining innovation- eco-innovation research and the contribution from ecological economics” [97]. It is an insightful article that used eco-innovation to address changes toward sustainable development. Authors working in the field of ecological economics have made the greatest contribution to this field. The importance of regulation, organizations’ capabilities, and consumers’ involvement has been highlighted in their works. The co-occurrence of keywords shows that the biggest cluster of author keywords focuses on “sustainable development”, “green innovation”, “green product innovation”, “corporate social responsibility”, “environmental policy”, “environmental regulation”, and “stakeholder management”. This shows the research themes that have been studied most frequently together. The foundational research conducted by prominent authors like Rennings K., Kemp R., Porter M.E., and others, who are highly cited in the co-citation network, have paved the way for new researchers to build upon and advance their understanding of this subject. As per the author keywords, “environmental regulation”, “green finance”, and “climate change” are also the most trending topics. But the findings show that there is a lack of international collaboration among the researchers, which is quite vital for the development of less developed economies.

5.3. SDGs in Focus

The detailed review of the articles shows that SDG 8, SDG 9, SDG 12, and SDG 13 are most addressed in these articles. The articles have mostly targeted the issue of climate change caused by emissions. Sustainable production through resource efficiency and waste management has been studied. Eco-innovation through regulation compliance creates sustainable industrial infrastructure. SDGs 5, 6, and 11 can also be achieved, but this area needs more attention. Apart from these, we can investigate the impact of eco-innovation on other SDGs. Studies that involve gender inclusiveness, health, and education should also be undertaken to contribute to the development of society. This shows that the benefits of eco-innovation extend beyond technical concepts and can also encompass economic and social dimensions. Most of these studies have taken non-technological innovations that cover organizations and institutions into consideration. Technological innovations involving product and process change for cleaner production also need to be researched diligently.

5.4. Conclusions and Research Implications

Finally, we can conclude that the fields of eco-innovation and sustainable development have a lot of similarities in terms of their evolution. This area has garnered a lot of attention in the past five years, which shows that by aligning eco-innovation with sustainable development, we can foster innovative solutions for addressing environmental as well as societal challenges. This article will help researchers in identifying the hot spots in these areas and provide direction for future research. The less-targeted SDGs need to be brought to attention. Apart from the environmental aspects of sustainable development, it can also contribute to economic and social aspects. This can serve as a new emerging area of research. This study is expected to make a valuable contribution toward the domain of research linked to achievement of UN SDGs by incorporating eco-innovation in different spheres of sustainable development, particularly in areas of sustainable business, venture capital investment, sustainable consumption, and front end of eco-innovation. This study can help in business and innovation framework development by taking successful eco-innovation

practices into consideration. Information on key trends and unaddressed areas can help in development of policy frameworks aimed at supporting eco-innovation initiatives.

Bibliometric analysis is a valuable tool for mapping research landscapes, identifying influential works, and exploring trends in research articles. Despite this, since its focus is on metadata and citations, which overlook depth, methodology, and novelty of the articles, it may lead to some bias. Another limitation is that even after adopting standard PRISMA guidelines, we might have missed articles that could have provided valuable perspectives. Hence, in the future, results from this study can be complemented with other research methods to provide a more comprehensive understanding of these research domains.

Author Contributions: Conceptualization, N.F. and A.H.; methodology, N.F. and A.H.; software, N.F.; writing—original draft preparation, N.F.; writing—review and editing, N.F. and A.H.; supervision, A.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The datasets used and analyzed during the current study are available from the corresponding authors upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Díaz-García, C.; González-Moreno, A.; Sáez-Martínez, F.J. Eco-innovation: Insights from a literature review. *Innovation* **2015**, *17*, 6–23. [\[CrossRef\]](#)
2. Nylund, P.A.; Agarwal, N.; Probst, C.; Brem, A. Firm engagement in UN Sustainable Development Goals: Introduction of a constraints map from a corporate reports content analysis. *J. Clean. Prod.* **2022**, *371*, 133446. [\[CrossRef\]](#)
3. Horbach, J.; Rammer, C.; Rennings, K. Determinants of eco-innovations by type of environmental impact—The role of regulatory push/pull, technology push and market pull. *Ecol. Econ.* **2012**, *78*, 112–122. [\[CrossRef\]](#)
4. Carrillo-Hermosilla, J.; Del Río, P.; Könnölä, T. Diversity of eco-innovations: Reflections from selected case studies. *J. Clean. Prod.* **2010**, *18*, 1073–1083. [\[CrossRef\]](#)
5. Jo, J.-H.; Roh, T.W.; Kim, S.; Youn, Y.-C.; Park, M.S.; Han, K.J.; Jang, E.K. Eco-Innovation for Sustainability: Evidence from 49 Countries in Asia and Europe. *Sustainability* **2015**, *7*, 16820–16835. [\[CrossRef\]](#)
6. Xavier, A.F.; Naveiro, R.M.; Aoussat, A.; Reyes, T. Systematic literature review of eco-innovation models: Opportunities and recommendations for future research. *J. Clean. Prod.* **2017**, *149*, 1278–1302. [\[CrossRef\]](#)
7. Fernández, S.; Torrecillas, C.; Labra, R.E. Drivers of eco-innovation in developing countries: The case of Chilean firms. *Technol. Forecast. Soc. Chang.* **2021**, *170*, 120902. [\[CrossRef\]](#)
8. Albareda, L.; Hajikhani, A. Innovation for Sustainability: Literature Review and Bibliometric Analysis. In *Innovation for Sustainability*; Springer: Berlin/Heidelberg, Germany, 2019; pp. 35–57. [\[CrossRef\]](#)
9. Ilic, S.; Petrovic, T.; Djukic, G. Eco-innovation and Sustainable Development. *Probl. Ekorožwoju* **2022**, *17*, 197–203. [\[CrossRef\]](#)
10. Šumakaris, P.; Kovaitė, K.; Korsakienė, R. An Integrated Approach to Evaluating Eco-Innovation Strategies from the Perspective of Strategic Green Transformation: A Case of the Lithuanian Furniture Industry. *Sustainability* **2023**, *15*, 8971. [\[CrossRef\]](#)
11. Majid, S.; Zhang, X.; Khaskheli, M.B.; Hong, F.; King, P.J.H.; Shamsi, I.H. Eco-Efficiency, Environmental and Sustainable Innovation in Recycling Energy and Their Effect on Business Performance: Evidence from European SMEs. *Sustainability* **2023**, *15*, 9465. [\[CrossRef\]](#)
12. Galván-Vela, E.; Ruíz-Corrales, M.; Ahumada-Tello, E.; Ravina-Ripoll, R. Eco-Innovation as a Positive and Happy Industry Externality: Evidence from Mexico. *Sustainability* **2023**, *15*, 6417. [\[CrossRef\]](#)
13. Zulkiffli, S.N.A.; Zaidi, N.F.Z.; Padlee, S.F.; Sukri, N.K.A. Eco-Innovation Capabilities and Sustainable Business Performance during the COVID-19 Pandemic. *Sustainability* **2022**, *14*, 7525. [\[CrossRef\]](#)
14. Donthu, N.; Kumar, S.; Mukherjee, D.; Pandey, N.; Lim, W.M. How to conduct a bibliometric analysis: An overview and guidelines. *J. Bus. Res.* **2021**, *133*, 285–296. [\[CrossRef\]](#)
15. Haleem, A.; Khan, M.I.; Khan, S.; Jami, A.R. Research status in Halal: A review and bibliometric analysis. *Mod. Supply Chain. Res. Appl.* **2020**, *2*, 23–41. [\[CrossRef\]](#)
16. Akin, M.; Eydurán, S.P.; Krauter, V. Food packaging related research trends in the academic discipline of food science and technology: A bibliometric analysis. *Clean. Circ. Bioecon.* **2023**, *5*, 100046. [\[CrossRef\]](#)
17. Letchumanan, L.T.; Yusof, N.M.; Gholami, H.; Ngadiman, N.H.A.B. Green Lean Six Sigma: A Review. *J. Adv. Res. Technol. Innov. Manag.* **2021**, *1*, 33–40.

18. Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Int. J. Surg.* **2010**, *8*, 336–341. [\[CrossRef\]](#)
19. Degler, T.; Agarwal, N.; Nylund, P.A.; Brem, A. Sustainable Innovation Types: A Bibliometric Review. *Int. J. Innov. Manag.* **2021**, *25*, 2150096. [\[CrossRef\]](#)
20. Türkeli, S.; Kemp, R. Changing Patterns in Eco-Innovation Research: A Bibliometric Analysis. In *New Developments in Eco-Innovation Research*; Springer: Cham, Switzerland, 2018; pp. 13–54. [\[CrossRef\]](#)
21. Aria, M.; Cuccurullo, C. bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr.* **2017**, *11*, 959–975. [\[CrossRef\]](#)
22. Maier, D.; Maier, A.; Aşchilean, I.; Anastasiu, L.; Gavriş, O. The relationship between innovation and sustainability: A bibliometric review of the literature. *Sustainability* **2020**, *12*, 4083. [\[CrossRef\]](#)
23. Wang, J.; Xue, Y.; Yang, J. Boundary-spanning search and firms' green innovation: The moderating role of resource orchestration capability. *Bus. Strategy Environ.* **2020**, *29*, 361–374. [\[CrossRef\]](#)
24. Wang, J.; Xue, Y.; Sun, X.; Yang, J. Green learning orientation, green knowledge acquisition and ambidextrous green innovation. *J. Clean. Prod.* **2020**, *250*, 119475. [\[CrossRef\]](#)
25. Wang, J.; Xue, Y.; Yang, J. Can proactive boundary-spanning search enhance green innovation? The mediating role of organizational resilience. *Bus. Strat. Environ.* **2023**, *32*, 1981–1995. [\[CrossRef\]](#)
26. Wang, Y.; Qiu, Y.; Luo, Y. CEO foreign experience and corporate sustainable development: Evidence from China. *Bus. Strat. Environ.* **2022**, *31*, 2036–2051. [\[CrossRef\]](#)
27. Li, Y.; Wang, Z. Will Public Environmental Concerns Foster Green Innovation in China's Automotive Industry? An Empirical Study Based on Multi-Sourced Data Streams. *Front. Energy Res.* **2021**, *9*, 623638. [\[CrossRef\]](#)
28. Chen, J.-Y.; Dimitrov, S. Eco-innovation with opportunity of licensing and threat of imitation. *J. Clean. Prod.* **2017**, *147*, 306–318. [\[CrossRef\]](#)
29. Zhao, X.; Pan, W. The characteristics and evolution of business model for green buildings: A bibliometric approach. *Eng. Constr. Archit. Manag.* **2022**, *29*, 4241–4266. [\[CrossRef\]](#)
30. Bocken, N.M.P.; Allwood, J.M.; Willey, A.R.; King, J.M.H. Development of a tool for rapidly assessing the implementation difficulty and emissions benefits of innovations. *Technovation* **2012**, *32*, 19–31. [\[CrossRef\]](#)
31. Bocken, N.M.P. Sustainable venture capital—catalyst for sustainable start-up success? *J. Clean. Prod.* **2015**, *108*, 647–658. [\[CrossRef\]](#)
32. Bocken, N.M.P.; Farracho, M.; Bosworth, R.; Kemp, R. The front-end of eco-innovation for eco-innovative small and medium sized companies. *J. Eng. Technol. Manag.* **2014**, *31*, 43–57. [\[CrossRef\]](#)
33. Boons, F.; Lüdeke-Freund, F. Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *J. Clean. Prod.* **2013**, *45*, 9–19. [\[CrossRef\]](#)
34. Schot, J.; Geels, F. Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technol. Anal. Strat. Manag.* **2008**, *20*, 537–554. [\[CrossRef\]](#)
35. Chen, Y.-S.; Lai, S.-B.; Wen, C.-T. The Influence of Green Innovation Performance on Corporate Advantage in Taiwan. *J. Bus. Ethics* **2006**, *67*, 331–339. [\[CrossRef\]](#)
36. Chiou, T.-Y.; Chan, H.K.; Lettice, F.; Chung, S.H. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transp. Res. E Logist. Transp. Rev.* **2011**, *47*, 822–836. [\[CrossRef\]](#)
37. Boons, F.; Montalvo, C.; Quist, J.; Wagner, M. Sustainable innovation, business models and economic performance: An overview. *J. Clean. Prod.* **2013**, *45*, 1–8. [\[CrossRef\]](#)
38. Prieto-Sandoval, V.; Jaca, C.; Ormazabal, M. Towards a consensus on the circular economy. *J. Clean. Prod.* **2018**, *179*, 605. [\[CrossRef\]](#)
39. Kirchherr, J.; Piscicelli, L.; Bour, R.; Kostense-Smit, E.; Muller, J.; Huibrechtse-Truijens, A.; Hekkert, M. Barriers to the Circular Economy: Evidence from the European Union (EU). *Ecol. Econ.* **2018**, *150*, 264–272. [\[CrossRef\]](#)
40. Gold, S.; Seuring, S.; Beske, P. Sustainable supply chain management and inter-organizational resources: A literature review. *Corp. Soc. Responsib. Environ. Manag.* **2010**, *17*, 230–245. [\[CrossRef\]](#)
41. Bos-Brouwers, H.E.J. Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice. *Bus. Strategy Environ.* **2010**, *19*, 417–435. [\[CrossRef\]](#)
42. Truffer, B.; Coenen, L. Environmental Innovation and Sustainability Transitions in Regional Studies. *Reg. Stud.* **2012**, *46*, 1–21. [\[CrossRef\]](#)
43. Ahmed, R.; Streimikiene, D.; Zheng, X. The Impact of Proactive Environmental Strategy on Competitive and Sustainable Development of Organizations. *J. Compet.* **2021**, *13*, 5–24. [\[CrossRef\]](#)
44. Zhang, Y.; Sun, J.; Yang, Z.; Wang, Y. Critical success factors of green innovation: Technology, organization and environment readiness. *J. Clean. Prod.* **2020**, *264*, 121701. [\[CrossRef\]](#)
45. Waqas, M.; Honggang, X.; Ahmad, N.; Khan, S.A.R.; Iqbal, M. Big data analytics as a roadmap towards green innovation, competitive advantage and environmental performance. *J. Clean. Prod.* **2021**, *323*, 128998. [\[CrossRef\]](#)
46. Qiu, L.; Jie, X.; Wang, Y.; Zhao, M. Green product innovation, green dynamic capability, and competitive advantage: Evidence from Chinese manufacturing enterprises. *Corp. Soc. Responsib. Environ. Manag.* **2020**, *27*, 146–165. [\[CrossRef\]](#)
47. Santamaria, L.; Escobar-Tello, C.; Ross, T. Switch the channel: Using cultural codes for designing and positioning sustainable products and services for mainstream audiences. *J. Clean. Prod.* **2016**, *123*, 16–27. [\[CrossRef\]](#)

48. Severo, E.A.; de Guimarães, J.C.F.; Dorion, E.C.H. Cleaner production, social responsibility and eco-innovation: Generations' perception for a sustainable future. *J. Clean. Prod.* **2018**, *186*, 91–103. [\[CrossRef\]](#)
49. Jansson, J.; Nordlund, A.; Westin, K. Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden. *J. Clean. Prod.* **2017**, *154*, 176–187. [\[CrossRef\]](#)
50. Motta, W.H.; Issberner, L.-R.; Prado, P. Life cycle assessment and eco-innovations: What kind of convergence is possible? *J. Clean. Prod.* **2018**, *187*, 1103–1114. [\[CrossRef\]](#)
51. Khan, K.; Nasir, A.; Rashid, T. Green Practices: A Solution for Environmental Deregulation and the Future of Energy Efficiency in the Post-COVID-19 Era. *Front. Energy Res.* **2022**, *10*, 878670. [\[CrossRef\]](#)
52. Jin, M.; Tang, R.; Ji, Y.; Liu, F.; Gao, L.; Huisingh, D. Impact of advanced manufacturing on sustainability: An overview of the special volume on advanced manufacturing for sustainability and low fossil carbon emissions. *J. Clean. Prod.* **2017**, *161*, 69–74. [\[CrossRef\]](#)
53. Gerstlberger, W.; Knudsen, M.P.; Stampe, I. Sustainable Development Strategies for Product Innovation and Energy Efficiency. *Bus. Strategy Environ.* **2014**, *23*, 131–144. [\[CrossRef\]](#)
54. Aldieri, L.; Kotsemir, M.; Vinci, C.P. The role of environmental innovation through the technological proximity in the implementation of the sustainable development. *Bus. Strategy Environ.* **2020**, *29*, 493–502. [\[CrossRef\]](#)
55. Wang, F. The present and future of the digital transformation of real estate: A systematic review of smart real estate. *J. Bus. Inform.* **2023**, *17*, 85–97. [\[CrossRef\]](#)
56. Ferlito, R.; Faraci, R. Business model innovation for sustainability: A new framework. *Innov. Manag. Rev.* **2022**, *19*, 222–236. [\[CrossRef\]](#)
57. Gangi, F.; Daniele, L.M.; D'Angelo, E.; Varrone, N.; Coscia, M. The impact of board gender diversity on banks' environmental policy: The moderating role of gender inequality in national culture. *Corp. Soc. Responsib. Environ. Manag.* **2023**, *30*, 1273–1291. [\[CrossRef\]](#)
58. Łacka, I.; Brzezicki, Ł. Joint Analysis of National Eco-Efficiency, Eco-Innovation and SDGs in Europe: DEA Approach. *Technol. Econ. Dev. Econ.* **2022**, *28*, 1739–1767. [\[CrossRef\]](#)
59. van der Waal, J.W.H.; Thijssens, T.; Maas, K. The innovative contribution of multinational enterprises to the Sustainable Development Goals. *J. Clean. Prod.* **2021**, *285*, 125319. [\[CrossRef\]](#)
60. Zhou, M.; Govindan, K.; Xie, X. How fairness perceptions, embeddedness, and knowledge sharing drive green innovation in sustainable supply chains: An equity theory and network perspective to achieve sustainable development goals. *J. Clean. Prod.* **2020**, *260*, 120950. [\[CrossRef\]](#)
61. Waseem, D.-S.; Lin, L.; Chang, H. A nexus between the rule of law, green innovation, growth and sustainable environment in top Asian countries: Fresh insights from heterogeneous panel estimation. *Ekon. Istraživanja Econ. Res.* **2022**, *35*, 5434–5452. [\[CrossRef\]](#)
62. Razzaq, A.; Wang, Y.; Chupradit, S.; Suksatan, W.; Shahzad, F. Asymmetric inter-linkages between green technology innovation and consumption-based carbon emissions in BRICS countries using quantile-on-quantile framework. *Technol. Soc.* **2021**, *66*, 101656. [\[CrossRef\]](#)
63. Shi, C.; Guo, N.; Gao, X.; Wu, F. How carbon emission reduction is going to affect urban resilience. *J. Clean. Prod.* **2022**, *372*, 133737. [\[CrossRef\]](#)
64. Su, Y.; Xu, G. Low-carbon transformation of natural resource industry in China: Determinants and policy implications to achieve COP26 targets. *Resour. Policy* **2022**, *79*, 103082. [\[CrossRef\]](#)
65. Xie, P.; Jamaani, F. Does green innovation, energy productivity and environmental taxes limit carbon emissions in developed economies: Implications for sustainable development. *Struct. Chang. Econ. Dyn.* **2022**, *63*, 66–78. [\[CrossRef\]](#)
66. Chen, L.; Liu, Y.; Gao, Y.; Wang, J. Carbon Emission Trading Policy and Carbon Emission Efficiency: An Empirical Analysis of China's Prefecture-Level Cities. *Front. Energy Res.* **2021**, *9*, 793601. [\[CrossRef\]](#)
67. Lin, H.; Zeng, S.; Ma, H.; Zeng, R.; Tam, V.W.Y. An indicator system for evaluating megaproject social responsibility. *Int. J. Proj. Manag.* **2017**, *35*, 1415–1426. [\[CrossRef\]](#)
68. Zhao, H.; Li, Y.; Mehmood, U. How human capital and energy prices play their role to enhance renewable energy: Defining the role of innovations and trade openness in G-11 countries. *Environ. Sci. Pollut. Res.* **2023**, *30*, 71284–71295. [\[CrossRef\]](#)
69. Yikun, Z.; Leong, L.W.; Cong, P.T.; Abu-Rumman, A.; Al Shraah, A.; Hishan, S.S. Green growth, governance, and green technology innovation. How effective towards SDGs in G7 countries? *Econ. Res. Ekon. Istraz.* **2023**, *36*, 2145984. [\[CrossRef\]](#)
70. Sinha, A.; Schneider, N.; Song, M.; Shahzad, U. The determinants of solid waste generation in the OECD: Evidence from cross-elasticity changes in a common correlated effects framework. *Resour. Conserv. Recycl.* **2022**, *182*, 106322. [\[CrossRef\]](#)
71. Sadiq, M.; Le-Dinh, T.; Tran, T.K.; Chien, F.; Phan, T.T.H.; Huy, P.Q. The role of green finance, eco-innovation, and creativity in the sustainable development goals of ASEAN countries. *Econ. Res. Ekon. Istraz.* **2023**, *36*, 2175010. [\[CrossRef\]](#)
72. Ma, Q.; Li, S.; Aslam, M.; Ali, N.; Alamri, A.M. Extraction of natural resources and sustainable renewable energy: COP26 target in the context of financial inclusion. *Resour. Policy* **2023**, *82*, 103466. [\[CrossRef\]](#)
73. Villegas, L.E.; Acuña-Duarte, A.A.; Salazar, C.A. Corporate Social Responsibility and the Willingness to Eco-Innovate among Chilean Firms. *Sustainability* **2023**, *15*, 9832. [\[CrossRef\]](#)
74. Li, D.; Zheng, M.; Cao, C.; Chen, X.; Ren, S.; Huang, M. The impact of legitimacy pressure and corporate profitability on green innovation: Evidence from China top 100. *J. Clean Prod.* **2017**, *141*, 41–49. [\[CrossRef\]](#)

75. Chen, X.; Yi, N.; Zhang, L.; Li, D. Does institutional pressure foster corporate green innovation? Evidence from China's top 100 companies. *J. Clean Prod.* **2018**, *188*, 304–311. [\[CrossRef\]](#)
76. Tseng, M.-L.; Bui, T.-D. Identifying eco-innovation in industrial symbiosis under linguistic preferences: A novel hierarchical approach. *J. Clean. Prod.* **2017**, *140*, 1376–1389. [\[CrossRef\]](#)
77. Tseng, M.-L.; Chiu, S.F.; Tan, R.R.; Siriban-Manalang, A.B. Sustainable consumption and production for Asia: Sustainability through green design and practice. *J. Clean. Prod.* **2013**, *40*, 1–5. [\[CrossRef\]](#)
78. Ogbeyibu, S.; Jabbour, C.J.C.; Gaskin, J.; Senadjki, A.; Hughes, M. Leveraging STARA competencies and green creativity to boost green organisational innovative evidence: A praxis for sustainable development. *Bus. Strategy Environ.* **2021**, *30*, 2421–2440. [\[CrossRef\]](#)
79. Saha, T.; Sinha, A.; Abbas, S. Green financing of eco-innovations: Is the gender inclusivity taken care of? *Econ. Res. Ekon. Istraz.* **2022**, *35*, 5514–5535. [\[CrossRef\]](#)
80. Ferreras-Garcia, R.; Sales-Zaguirre, J.; Serradell-López, E. Sustainable innovation in higher education: The impact of gender on innovation competences. *Sustainability* **2021**, *13*, 5004. [\[CrossRef\]](#)
81. Seifert, L.; Kunz, N.; Gold, S. Sustainable innovations for humanitarian operations in refugee camps. *Int. J. Oper. Prod. Manag.* **2023**; ahead of print. [\[CrossRef\]](#)
82. Albitar, K.; Al-Shaer, H.; Liu, Y.S. Corporate commitment to climate change: The effect of eco-innovation and climate governance. *Res. Policy* **2023**, *52*, 104697. [\[CrossRef\]](#)
83. Jiang, Y.Y.; Hossain, M.R.; Khan, Z.; Chen, J.Y.; Badeeb, R.A. Revisiting Research and Development Expenditures and Trade Adjusted Emissions: Green Innovation and Renewable Energy R&D Role for Developed Countries. *J. Knowl. Econ.* **2023**. [\[CrossRef\]](#)
84. Amin, N.; Shabbir, M.S.; Song, H.M.; Farrukh, M.U.; Iqbal, S.; Abbass, K. A step towards environmental mitigation: Do green technological innovation and institutional quality make a difference? *Technol. Forecast. Soc. Chang.* **2023**, *190*, 122413. [\[CrossRef\]](#)
85. Khurshid, A.; Rauf, A.; Qayyum, S.; Calin, A.C.; Duan, W.Q. Green innovation and carbon emissions: The role of carbon pricing and environmental policies in attaining sustainable development targets of carbon mitigation—Evidence from Central-Eastern Europe. *Environ. Dev. Sustain.* **2023**, *25*, 8777–8798. [\[CrossRef\]](#)
86. Choi, J.Y.; Han, D.B. The links between environmental innovation and environmental performance: Evidence for high- and middle-income countries. *Sustainability* **2018**, *10*, 2157. [\[CrossRef\]](#)
87. Lasisi, T.T.; Alola, A.A.; Muoneke, O.B.; Eluwole, K.K. The moderating role of environmental-related innovation and technologies in growth-energy utilization nexus in highest-performing eco-innovation economies. *Technol. Forecast. Soc. Chang.* **2022**, *183*, 121953. [\[CrossRef\]](#)
88. Ramzan, M.; Abbasi, K.R.; Salman, A.; Dagar, V.; Alvarado, R.; Kagzi, M. Towards the dream of go green: An empirical importance of green innovation and financial depth for environmental neutrality in world's top 10 greenest economies. *Technol. Forecast. Soc. Chang.* **2023**, *189*, 122370. [\[CrossRef\]](#)
89. Loyarte-López, E.; Barral, M.; Morla, J.C. Methodology for carbon footprint calculation towards sustainable innovation in intangible assets. *Sustainability* **2020**, *12*, 1629. [\[CrossRef\]](#)
90. Khan, A.; Idrees, A.S. Environmental impact of multidimensional eco-innovation adoption: An empirical evidence from European Union. *J. Environ. Econ. Policy* **2023**. [\[CrossRef\]](#)
91. Khan, P.A.; Johl, S.K.; Akhtar, S. Vinculum of Sustainable Development Goal Practices and Firms' Financial Performance: A Moderation Role of Green Innovation. *J. Risk Financ. Manag.* **2022**, *15*, 96. [\[CrossRef\]](#)
92. Fang, Z.; Bai, H.; Bilan, Y. Evaluation research of green innovation efficiency in China's heavy polluting industries. *Sustainability* **2020**, *12*, 146. [\[CrossRef\]](#)
93. Afeltra, G.; Alerasoul, S.A.; Minelli, E.; Vecchio, Y.; Montalvo, C. Assessing the Integrated Impact of Sustainable Innovation on Organisational Performance: An Empirical Evidence from Manufacturing Firms. *J. Small Bus. Strategy* **2022**, *32*, 143–166. [\[CrossRef\]](#)
94. Vig, S. Sustainable development through sustainable entrepreneurship and innovation: A single-case approach. *Soc. Responsib. J.* **2022**, *19*, 1196–1217. [\[CrossRef\]](#)
95. Khan, P.A.; Johl, S.K.; Johl, S.K. Does adoption of ISO 56002-2019 and green innovation reporting enhance the firm sustainable development goal performance? An emerging paradigm. *Bus. Strategy Environ.* **2021**, *30*, 2922–2936. [\[CrossRef\]](#)
96. Park, M.S.; Bleischwitz, R.; Han, K.J.; Jang, E.K.; Joo, J.H. Eco-innovation indices as tools for measuring eco-innovation. *Sustainability* **2017**, *9*, 2206. [\[CrossRef\]](#)
97. Rennings, K. Redefining Innovation-Eco-Innovation Research and the Contribution from Ecological Economics. 2000. Available online: <https://www.elsevier.com/locate/ecolecon> (accessed on 30 June 2023).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.