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WHAT ABOUT RELATIONSHIPS GREEN INNOVATION AND SUSTAINABLE DEVELOPMENT? A BIBLIOMETRIK ANALYSIS REVIEW

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Abstract

This research was conducted to visualize the analysis of the relationship between green innovation and sustainable development. The method used in this research is bibliometric. The bibliometric analysis reveals the journals, authors, and provides the past, present, and future potential of this particular topic and serves as an orientation and guide for researchers new to the topic of green innovation and sustainable development. The main aim of the research is to empirically document the intellectual structure, volume and direction of knowledge development. To achieve the goal by using VOS Viewer software and Web of Science (WoS) scientific database. The VOS viewer software is adopted as a bibliometric analysis tool to visualize the network of authors, countries, journals and keywords. The analysis, which was carried out on November 4, 2022, took a total of 2043 documents from 2015 to 2022. The results show that in the last 8 years the number of green innovation and sustainable development publications has grown significantly. Ranked first in China as the most productive country in research in the field of green innovation and sustainable development and ranked second in the USA with the involvement of lead authors and research institutes. Keyword analysis shows that studies on green innovation and sustainable development in the last 8 years have focused on themes related to the environment, economy and technology. The bibliometric analysis presented provides information relevant to the main themes studied about green innovation and sustainable development in development..

Introduction

The Intergovernmental Panel on Climate Change (IPCC) presented part III of its Sixth Assessment Report on 4 April 2022 entitled "Mitigation of Climate Change". The report concludes that human emissions of greenhouse gases must be reduced by 43% by 2030 and achieve carbon neutrality by 2050 in order to limit temperature increases to 1.5 °C, an action approved by nearly 200 countries in the Paris Agreement since 2015.

Environmental degradation and climate change have increased stakeholder anxiety about the prevalence of environmental challenges, resulting in higher rates of global warming. At

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various levels, efforts are being made to strategically address the conflict between environmental concerns and long-term growth (Xue et al., 2022).

Green Innovation is a promising path for increased sustainability, it is fraught with complexity stemming from difficulties and uncertainties around how to align activities both within and across companies to enable Green Innovation (Alerasoul, Afeltra, Hakala, Minelli, & Strozzi, 2022).

Sustainable development is development that aims to improve the quality of life of people around the world, both from present and future generations, without exploiting the use of natural resources that exceed the capacity and carrying capacity of the earth. The goal of Sustainable development (SDGs) is to grab the attention of researchers around the world because of their role in economic growth, employment, environmental security (Finlayson et al., 2019).

The concept of green innovation (GI) makes it easier for companies to create environmentally friendly products and services to achieve sustainable development goals (Fei et al., 2019). The Sustainable Development Goals (SDGs), known as the Global Goals, were adopted by all member states of the United Nations (UN) in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity in 2030 (Lillo & Leyton, 2022).

Therefore, this study aims to analyze and identify literature on green innovation and sustainable development using a bibliometric methodology in the field of green innovation and sustainable development. The impact of publications by researchers or the scientific community on past, current and future research. This research is to add insight and can be used as a reference for future research.

Using a combination of bibliometric analysis, text mining, and visualization, the Objective of the Study is as follows:

RQ1. How is the annual research publication on green innovation and sustainable development for 2005-2022?

RQ2. What is the most productive organizational affiliation in green innovation research and sustainable development?

RQ3. What is the publication of green innovation and sustainable development research in the a country that has contributed the most to conducting research?

RQ4. How to analyze research keywords green innovation and sustainable development using co-occurrence unit analysis author keyword analysis?

RQ5. How to cite green innovation and sustainable development using a Co-citation analysis unit authors?

RQ6. How to analyze the Bibliographic coupling of countries?

A. Green Innovation

Green innovation has recently piqued the attention of the government, business sector and academia. (Zeng et al., 2022). Green innovation creates primary use and knowledge of human and financial energy based on evaluating the protection of energy quantities and natural areas to achieve economic, environmental, and social benefits. This income method is Green innovation (Guzzo et al., 2022).

Green innovation directs innovation in a product design and production method by taking into account environmental factors and energy consumption in the manufacture and use of products to achieve the mission of reducing environmental pollution and increasing the use of energy sources and sustainable development. (Li et al., 2020, 2022a, 2022b; Ling & Long, 2020).

Green corporate culture can be beneficial for companies dealing with environmental issues (Al-Swidi et al., 2021). Green corporate culture can be beneficial for companies dealing with environmental issues (Naqshbandi & Jasimuddin, 2022).

B. Sustainable Development

Sustainable Development is a long-term economic growth model (Chowdhury, et al., 2022). The ideal state is to fulfil current interests without affecting the sustainable development of future generations. This is an idea that people get after knowing the seriousness and then contemplating ecological damage (Jayaratne et al., 2022).

Green development refers to economic and social development techniques that aim at efficiency, balance, and sustainability, reflecting the organic unity of green subjects, green economy, and green governance arrangements (Mingwan Wu et al., 2021). Green development can be understood as sustainable development, transformation, low carbon economy, and growth (Wang et al., 2018).

Method

This research adopts the Bibliometric study method. Bibliometric analysis is a research procedure to illustrate the relationship between green innovation and sustainable development.

Most bibliometric analyzes have a shared data source: homson Reuters' Web of Science (WoS) and Elsevier's Scopus (Mongeon & Paul-Hus, 2016). All information bibliographies for analysis, such as authors, citations, journals, countries/regions, and affiliations, that can meet problem-solving needs and help achieve research objectives. In addition, it also follows the bibliometric literature review procedure (Hosseini, Kokabi, & Mousavi, 2018).

This study retrieved data from the database (WOS). The data mining date is November 4, 2022. The concept of this analysis is to use several keywords to find research articles that are published internationally. The keywords used in this analysis are green innovation and sustainable development. The years of publication taken were 2015 to 2022.

In the first stage, the process of collecting data from the Scopus database uses the application of search keywords: TITLE-ABS-KEY "green innovation and sustainable development" which produces 2043 articles. The second stage, Documents in TXT format are exported to VOS viewer software for bibliometric analysis of publications, authors, countries, institutions, journals, organizations and regions (data visualization stage). The third stage, data analysis for identify the main themes discussed in the research developed on "green innovation and sustainable development" (Al-Swidi, Gelaidan, & Saleh, 2021).

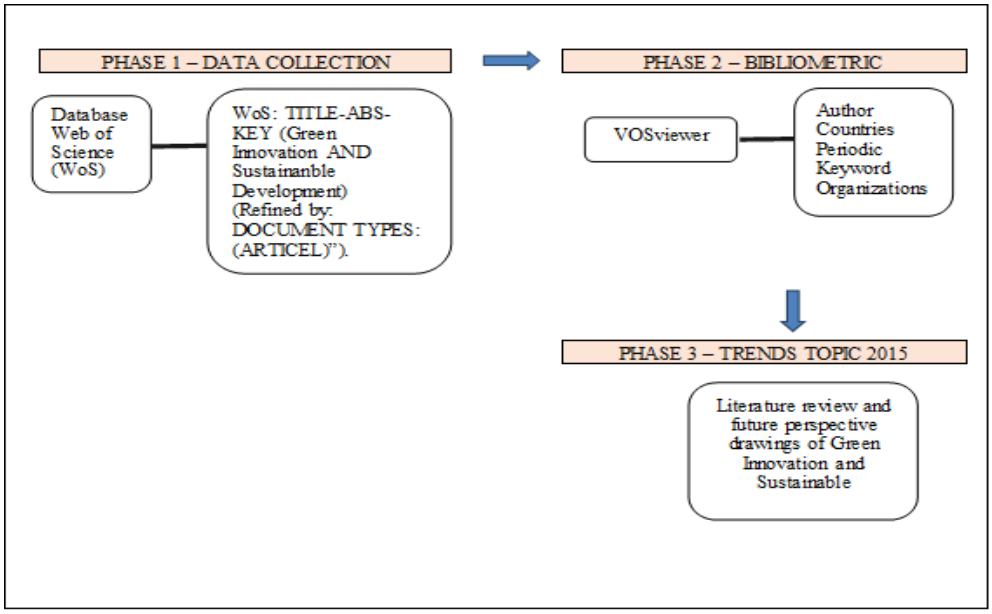

Figure 1.

In the first stage, collecting data from the Scopus database uses the application of search keywords: TITLE-ABS-KEY "green innovation and sustainable development," which produces 2043 articles. In the second stage, Documents in TXT format are exported to VOS viewer software for bibliometric analysis of publications, authors, countries, institutions, journals, organizations, and regions (data visualization stage). The third stage is data analysis to identify the main themes discussed in the research on "green innovation and sustainable development."

Results and Discussion

A. Annual Number of Publications

Figure 2 shows the trend of annual publications related to green innovation and sustainable development studies, starting from 2005 (40 publications) and ending in 2022 with 688 articles that can be accessed online (Cherian, Gaikar, Paul, & Pech, 2021). Enhancement.

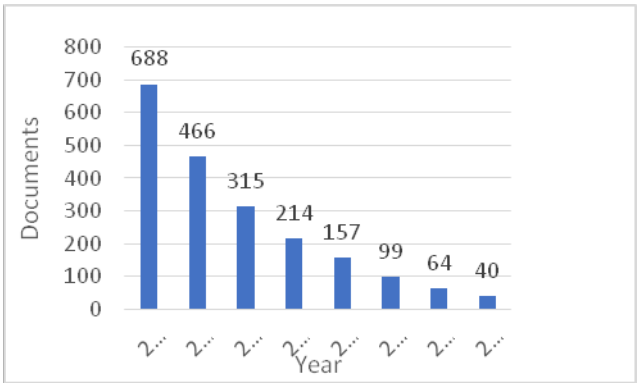

Figure 2. The annual number of publications

B. The Most Productive Organizations

Based on figure 2 there are 2318 organizations that research green innovation and sustainable development. Organization. Top 10 organizations with large number of documentaries published on the topic of green innovation and sustainable development.

Size and color represent separate numeric dimensions of data. The two organizations that published the most were the Chinese Academy of Sciences 28 documents (1.37%), and China University of Mining Technology 26 documents (1.27%). The Chinese state leads the most productive organizations in the study of green innovation and sustainable development (Chowdhury, Budhwar, Dey, Joel-Edgar, & Abadie, 2022).

China is a country that supports the development and research of green innovation and sustainable development.

Figure 2. The Most Productive Organizations

C. The Most Contributing Countries

There are 107 countries that have been identified as researching green innovation and sustainable development. The 10 most productive countries are listed in Figure 2. The top 10 countries include developed and developing countries, which focus on the relationship between green innovation and sustainable development which has become a global problem (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021).

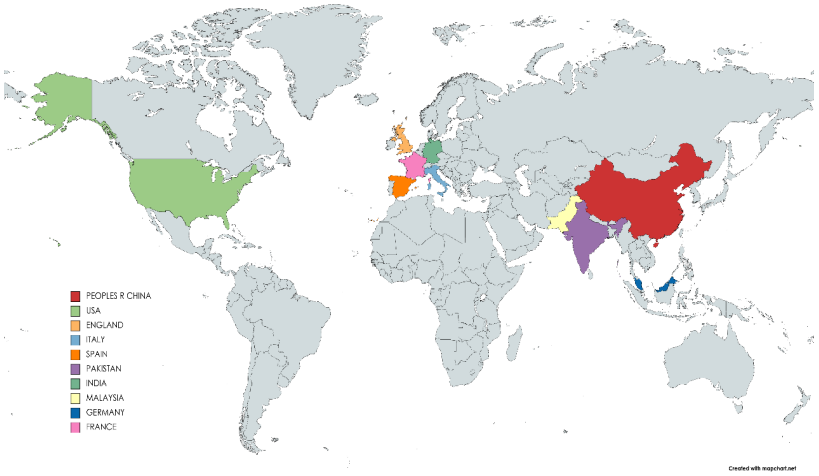

Figure 2. The Most Contributing Countries
Source: This map was created by the authors via mapchart.net

China ranks first with 926 publications. This is because Chinese companies, as important emerging market players, are pursuing a strategy of sustainable development. Companies focus on following intrinsic requirements green economy development and actively taking responsibility for addressing environmental challenges (Duan et al., 2019).

USA is ranked second with 139 publications, England is third with 133 publications, Italy is fourth with 127 publications, Spain is fifth with 109 publications, Pakistan is sixth with 101 publications, India is seventh with 96 publications, Malaysia is eighth with 84 publications, Germany is ninth with 80 publications, and France is ranked tenth with 72 publications (Gaviria-Marin, Merigó, & Baier-Fuentes, 2019).

D. Co-occurrence of Author Keywords

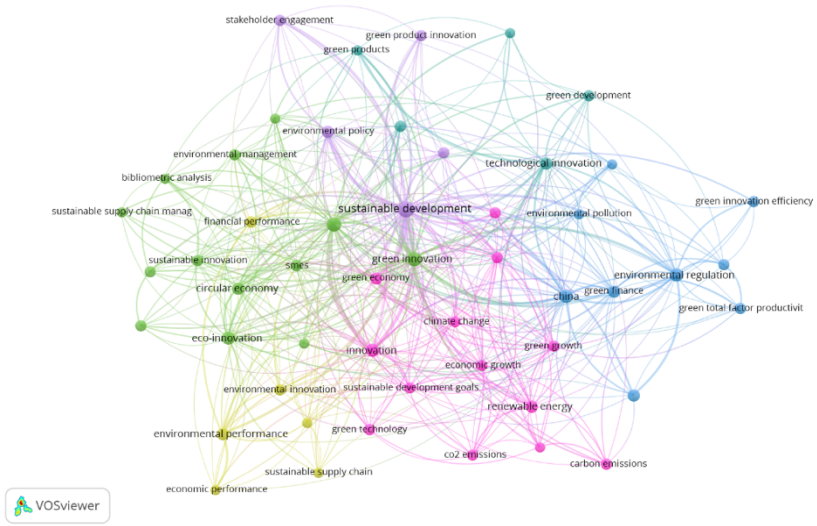

Figure 3. Co-occurrence of Author Keywords

Analysis of the appearance of the author's keywords is given in Figure 5. It was determined that 5677 keywords were used in the publications that were checked with keywords, 15 repetitions of keywords so that out of 5667 keywords that met criterion 51. According to figure 5, the map represented in grouping keywords into six groups (Hristov, Appolloni, Chirico, & Cheng, 2021).

E. Bibliographic coupling of countries

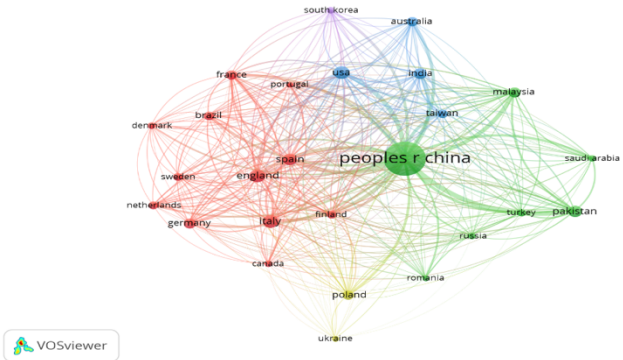

Figure 4. Bibliographic coupling of countries

Bibliographic coupling analysis of countries Figure 6 shows Bibliographic coupling of countries with a threshold of 25 documents. From this analysis, five clusters were obtained with red, green, blue, yellow and purple colors.

Spain, England, Italy, Canada, Germany, Netherlands, Sweden, Denmark, Brazil, France, Finland and Portugal are grouped in red. China, Russia, Romania, Turkey, Pakistan, Saudi Arabia and Malaysia are grouped in green, USA, India, Australia and Taiwan are grouped in blue, Poland and Ukraine are grouped in yellow and South Korea is grouped in purple (Jayaratne, Dasanayaka, Serhan, Alam, & Samara, 2022).

As shown in Figure 6, China has the largest network on the map, and has the largest nodes. That is, it is the most productive country. In addition, England and Italy have an important position. In brief, this study offers a guide for those entering the field of green innovation and sustainable development providing information about the past, present, and future of the field to build compelling empirical models or develop a viable literature review (Li et al., 2022).

Conclusion

Conclusions and limitations of the study First, it was found that bibliometrics is an appropriate technique for inductively approaching the semantic boundaries of the newly created field's conceptual structure demonstrating the multi-dimensional and interdisciplinary character of this field of knowledge in the study of the relationship between green innovation and sustainable development. As in other scientific fields, the application of bibliometrics can enhance our knowledge and help researchers better understand green innovation and sustainable conceptual frameworks. This study aims to investigate the relationship between green innovation and sustainable development and map its development over the last 8 years. To assess field progress, the researchers conducted a thorough bibliometric analysis of 2043 articles published between 2015 and 4 November 2022. To address predetermined research objectives, a bibliometric study including methods of citation analysis, analysis of citations alongside occurrences with author keywords was conducted and classify technical and scientific documents. In conclusion, green innovation and sustainable development is a topic that has recently been developed and currently has great relevance for both academics and practitioners.

Although green innovation and sustainable development are mostly used as the dependent variable and the theoretical background around these concepts is still under construction, there is extensive heterogeneity with regard to the drivers or antecedent variables of green innovation and sustainable development. This may be explained by the diversity of scholars who approach the issue (management, economics, engineering, environment, etc.). The country of China is ranked first as the most productive country in research in the field of green innovation and sustainable development and in second place is the USA with the involvement of the main authors and research institutes. Keyword analysis shows that studies on green innovation and sustainable development in the last 8 years have focused on themes related to the environment, economy and technology. The bibliometric analysis presented provides information relevant to the main themes studied about green innovation and sustainable development in development.

Nevertheless, the interpretation of the results presented and discussed above is subject to some limitations. First, this study is based on a sample of documents published on the Web of Science (WoS). There are more studies on green innovation and sustainable development that are published in non-index journals that are not accessible via the Web of Science (WoS) database. Second, the citation index and number of publications are often used to measure quality and quantity, regardless of the actual quality of the document. Third is the problem of different authors with the same name, which is a common problem in using this method. Fourth, although the results provide an overview of the current situation, this situation may change from

time to time, especially for publications from the last two years which still have to grow significantly in terms of the number of citations. Finally, it should be noted that this research has developed in a specific area: green innovation. Therefore, researchers must be careful in generalizing this conclusion.

For future research studies, scholars may consider conducting a bibliometric analysis using other databases (eg, Google Scholar, Scopus etc.), which will contribute to gathering more information and achieving a better understanding of the topic. Future research can also use structural indicators, which measure the relationship between publications, authors, and fields of knowledge using sociograms academic

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