# Exploring the Emission Reduction Policy to Achieve Sustainable Economic Growth through Bibliometric Approach

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Many countries are dealing with serious issues related to global warming. Facing the urgency of this climate crisis, many countries are now trying to integrate emission mitigation policies into their economic development strategies. This study aims to understand the evolution of research on emission reduction policies in the context of sustainable economic growth during 2019-2023 through a bibliometric approach. Using data from the Scopus database, this study analyzes the mapping of publication trends, country, author contributions and keyword network visualization using VOSviewer. The results show that there has been a significant increase in the number of publications, which reflects the urgency of this topic. China, Malaysia, and the United States emerged as substantial contributors, while there was a contribution gap between developed and developing countries. The analysis of productive authors reveals the importance of collaboration in increasing the impact of research. Network visualization identified two main research clusters: green and red. The green cluster focuses on emission sources and the factors that cause climate change, while the red cluster focuses on emission reduction solutions and strategies. The study results also show that research in this field is increasingly complex and interdisciplinary, requiring international collaboration. These findings provide valuable insights for researchers and policymakers in developing strategies to achieve sustainable economic growth.

**KEYWORDS:**
emission reduction policy, sustainable economic growth, bibliometric analysis, VOSviewer, publication trends

## I. INTRODUCTION

Climate change has become an increasingly pressing global challenge. Greenhouse gas emissions, especially those derived from human activities, contribute significantly to global warming and the negative impacts it causes (Khastar et al., 2020; Raihan & Tuspekova, 2022; Russell-Smith et al., 2021). To overcome this climate crisis, various countries have adopted emission reduction policies to achieve more sustainable economic growth. However, the effectiveness of such policies and their impact on the economy are still the subject of growing debate and research (Shahbaz et al., 2021).

This study aims to provide a more comprehensive understanding of the evolution of research related to emission reduction policies in the context of sustainable economic growth. This study will use a bibliometric approach to analyze research trends, patterns, and dynamics in this topic. This research will provide new insights into knowledge development, key contributions, and future research directions (Seminario-Córdova & Rojas-Ortega, 2023; Wuri et al., 2024).

Early studies on emissions reduction policies tend to focus on technical aspects and environmental impacts (Chien et al., 2021). Research has recently explored the relationship between emissions reduction policies and economic growth (Gurtu et al., 2022; Wu et al., 2019). Recent research has increasingly emphasized a more holistic approach, considering social, institutional, and governance factors in designing and implementing effective emissions reduction policies. In addition, there is a growing interest in exploring innovative solutions, such as the circular economy and green growth strategies, to drive decarbonization while maintaining economic growth (Gurtu et al., 2022; Seminario-Córdova & Rojas-Ortega, 2023).

This study will use bibliometric methods to analyze relevant literature. Bibliographic data will be collected from leading academic databases, such as Scopus. Bibliometric

analysis will be performed using specialized software, such as VOSviewer, to map and visualize the network of citations, author collaboration, topic trends, and research evolution over time (Chen et al., 2023; Vidiasratri et al., 2024; Wuri et al., 2024). This method allows for a better understanding of the research landscape, identifying important areas and knowledge gaps and highlighting potential future directions. The main objective of this study is to provide a comprehensive review of the evolution of research on emission reduction policies in the context of sustainable economic growth.

## II. METHODOLOGY

A bibliometric approach that focuses on emission reduction policies in the context of sustainable economic growth can provide valuable insights into practical methodological approaches, emerging research trends, patterns of collaboration between researchers in a broader context, and the influence of publications in specific fields (Chen et al., 2023; Gao et al., 2021; Vidiasratri et al., 2024). The number of papers on emission reduction policies is currently increasing rapidly. As a result, organising, synthesising, and assessing the relevant literature is required (Kabil et al., 2021; Martínez-Vázquez et al., 2021).

The search for electronic literature was carried out using the Scopus database in mid-August 2024. Scopus is a web-based database that provides comprehensive research information around the world. A total sampling technique is used, and several search terms are applied to the keyword engine search database. All types of journal publication documents from 2019 to 2023 were taken, excluding conference papers or book chapters, as this study emphasizes reputable journal literature. The first step in collecting data for this study is to search for documents using relevant keywords, including "Emission reduction policy". This search yielded 1,477 documents. Furthermore, the search was narrowed down using a combination of the keywords "Emission reduction," "sustainable," and "economic growth," which resulted in 539 documents.

To sharpen the focus of the research further, the next step was to select documents included in the subject area of Environmental Science, which resulted in 322 papers. After that, a selection was carried out based on the "Publication Year" criterion, namely 2019 to 2023, which resulted in 193 papers.

To be more specific, the next step is to select a document that comes from a journal, which resulted in 172 papers. Finally, selection was carried out based on the type of article, resulting in 165 papers to be used in this study.

In the next step, the data is extracted using Scopus. The following bibliometric variables were extracted: citation information (author, title, year of publication, citation), bibliographic information (affiliation, journal publisher, original document language), abstract, and keywords. Scopus search results are exported and saved to RIS as a VOSviewer database.

The last step is the results of research and data analysis. This step is used to identify general trends in the data, such as the number of publications over time, the contributions of countries and institutions, and the most productive journals and authors (Chen et al., 2023). In addition, citation analysis was conducted to assess the impact and influence of publications in the field. This step involves calculating metrics such as the number of citations.

The VOSviewer software creates a concurrent event map of high-frequency keywords related to emission reduction policies in the context of sustainable economic growth. The app is also used to generate a visualization of keyword co-occurrence analysis, uncovering key themes and topics in the literature, which provides insight into research trends and future directions (Hartanto & Apriani, 2024; Vidiasratri et al., 2024; Wuri et al., 2024).

## III. RESEARCH FINDINGS AND DISCUSSION

### 3.1 Trend Publication of Emission Reduction Policy to Achieve Sustainable Economic Growth

Based on a literature search using a bibliometric approach, 165 relevant papers were found to be analyzed in the research period. Table 2 presents the distribution of documents discussing emission reduction policy to achieve sustainable economic growth, published in reputable international journals and indexed by Scopus. The highest productivity for this topic was achieved in 2023, with 59 papers or 35.76% of total publications.

Figure 1 illustrates the publication trend related to emission reduction policy to achieve sustainable economic growth during 2019-2023. The results of the analysis show that there is a general tendency to increase the number of publications in this field. Figure 1 shows that since 2019, the number of articles discussing the topic of emission reduction policy has continued to increase significantly every year.
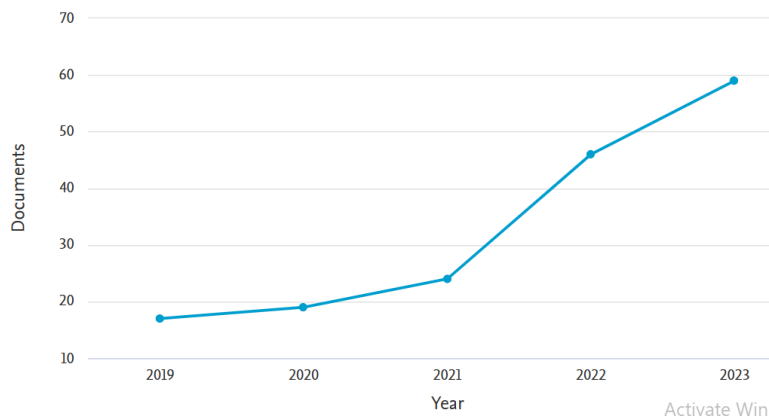
**Figure 1. Evolution in The Number of Publications**

It should be emphasized that articles on emission reduction policy and sustainable economic growth published in 2022 and 2023 have received many citations, which shows a large impact. In addition, the number of papers related to emission reduction policy and sustainable economic growth increased from 17 in 2019 to 59 in 2023. As for the number of citations per paper, there has been a drastic increase from 29 in 2019 to 1,650 in 2023. The consistent increase in the number of papers also reflects the importance of the topic of emission reduction policy to achieve sustainable economic growth among academics (Table 2).

**Table 2. Number of Literature related to Emission Reduction Policy to Achieve Sustainable Economic Growth**

| Year | Number of Publication | Citation |
|---|---|---|
| 2019 | 17 | 29 |
| 2020 | 19 | 164 |
| 2021 | 24 | 319 |
| 2022 | 46 | 1.036 |
| 2023 | 59 | 1.650 |
| Total | 165 | 3.198 |

### 3.2    Exploring Emission Reduction Policy to Achieve Sustainable Economic Growth by Country

Suppose you look at the number of documents by country. In that case, the three main countries that contribute the most to research on emission reduction policies and sustainable economic growth are China, Malaysia, and the United States. China leads with 128 publications, Malaysia with 16 publications, and the United States with nine publications. China's much higher number of publications may reflect its commitment to technological innovation and efforts to tackle climate change, which aligns with its rapid economic growth.

Interestingly, although Indonesia is a developing country with a large population and a growing economy, its contribution to this field of research is relatively limited, only producing two publications. This shows a gap in research focus between developed and developing countries. Significant differences in the number of publications between developed and developing countries can be caused by several factors, such as the availability of research funds, scientific infrastructure, and national policy priorities (Vidiasratri et al., 2024; Wuri et al., 2024).
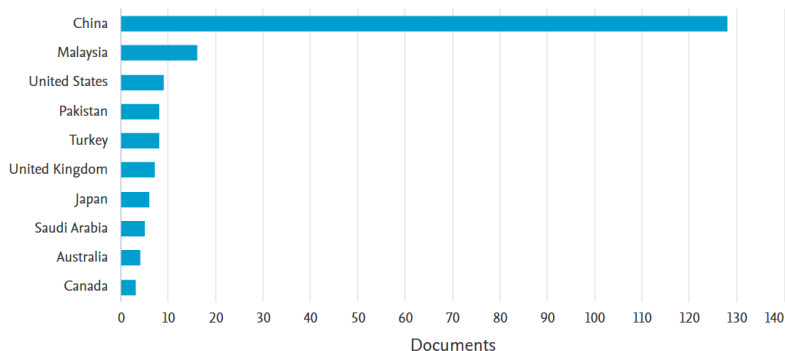
**Figure 2. Number of Documents by Country**

This pattern reflects a general trend in which countries with higher Gross Domestic Product (GDP) per capita tend to generate more research in this area due to more investment in scientific research and technological development. In contrast, regions such as South America, Eastern Europe, and Africa, which generally have lower GDP per capita, have had less research contribution (Vidiasratri et al., 2024; Wuri et al., 2024). This situation opens up opportunities to increase international collaboration in research, especially between developed and developing countries, to address global challenges such as climate change and sustainable development.

### 3.3 Exploring Emission Reduction Policy to Achieve Sustainable Economic Growth by Author

Based on Figure 3, several highly productive researchers have been identified in the field of emission reduction policy. Names such as Raihan, A., Faruk, O., Lin, B., Muhtasim, D.A., and Rahman, M. are significant contributors. An essential characteristic of these researchers is their tendency to engage in extensive collaboration with peers (Hartanto & Apriani, 2024; Martínez-Vázquez et al., 2021; Vidiasratri et al., 2024; Wuri et al., 2024).

These prolific writers strategically leverage their networks and partnerships. They often position themselves as the centre or core of a vast collaborative network involving a variety of other writers. This central position allows them to maximize the impact and reach of their research.
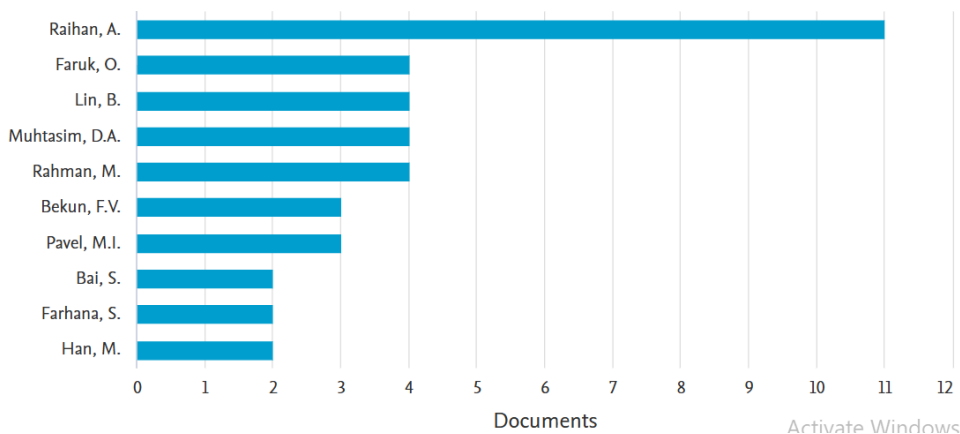


**Figure 3. The Most Productive Authors**

The productivity and influence of these researchers generally correlate with several key factors. First, access to significant funding, such as research grants, allows for larger, more ambitious projects. Second, affiliation with prestigious academic institutions can increase their work's visibility and credibility. Finally, intense and continuous communication among researchers facilitates the exchange of ideas, cross-disciplinary collaboration, and the acceleration of progress in this field (Chen et al., 2023; Gao et al., 2021).

Emission reduction policy refers to strategies and regulations designed to reduce the release of greenhouse gases and other pollutants into the atmosphere. Collaboration is crucial in emission reduction policies because the issue is complex and cross-sectoral. Expertise in various disciplines, such as environmental science, economics, technology, and public policy, is required. A central position in the research network can improve access to data, resources, and key stakeholders.

*3.4 Exploring Emission Reduction Policy to Achieve Sustainable Economic Growth Based on Most Influential Publications Ranked by Number of Citations*

Table 3 presents the list of the publications that have been cited the most. The articles include case studies from countries such as China, Bangladesh, and Malaysia. This shows that this topic is globally relevant, but with approaches that may vary according to the discipline. The articles were published during the observation period, indicating that this topic has gained more attention recently. This indicates an increase in the urgency and relevance of research on emission reduction policies in the context of sustainable economic growth. There is a strong emphasis on decoupling economic growth from carbon emissions (Wu et al., 2019). This shows a paradigm shift from the traditional model to a more sustainable economic growth model. The articles focus on renewable energy. The role of renewable energy in achieving sustainable economic growth and emission reduction is a recurring theme, demonstrating the evolution of energy policy as a critical component of emission reduction strategies (Guo et al., 2022; Raihan et al., 2022; Raihan & Tuspekova, 2022; Rehman et al., 2021).

**Table 3. Most Cited Articles**

| No | Article | Authors | Source | Year | Citations |
|---|---|---|---|---|---|
| 1 | Decoupling China's economic growth from carbon emissions: Empirical studies from 30 Chinese provinces (2001–2015) | Wu, Ya; Tam, Vivian W.Y.; Shuai, Chenyang, Shen, Liyin; Zhang, Yu; Liao, Shiju. | Science of the Total Environment, 656, pp 576-588 | 2019 | 260 |
| 2 | Effects of smart city construction on energy saving and CO2 emission reduction: Evidence from China | Guo, Qingbin; Wang, Yong; Dong, Xiaobin. | Applied Energy, 313, 118879 | 2022 | 155 |
| 3 | Nexus between carbon emissions, economic growth, renewable energy use, urbanization, industrialization, technological innovation, and forest area towards achieving environmental sustainability in Bangladesh | Raihan, Asif; Muhtasim, Dewan Ahmed; Farhana, Sadia; Pavel, Monirul Islam; Faruk, Omar; Rahman, Mostafizur; Mahmood, Abir. | Energy and Climate Change, 3, 100080 | 2022 | 143 |
| 4 | Toward a sustainable environment: Nexus between economic growth, renewable energy use, forested area, and carbon emissions in Malaysia | Raihan, Asif; Tuspekova, Almagul. | Resources, Conservation and Recycling Advances, 15, 200096 | 2022 | 142 |

*3.5 Mapping Performance of Emission Reduction Policy to Achieve Sustainable Economic Growth based on Network Visualization*

We analyzed the emergence of keywords and trends to identify future research directions related to Emission reduction policy and sustainable economic growth (Chen et al., 2023; Kabil et al., 2021). Keywords are the best introduction to academic articles. By observing the co-occurrence of keywords in a field, academics can quickly understand the research points and future research directions in the educational field. This study created a graph of keyword co-occurrences in VOSviewer, as shown in Figure 4. In the scientific field, analyzing the emergence of keywords establishes a network of topics and their relationships.
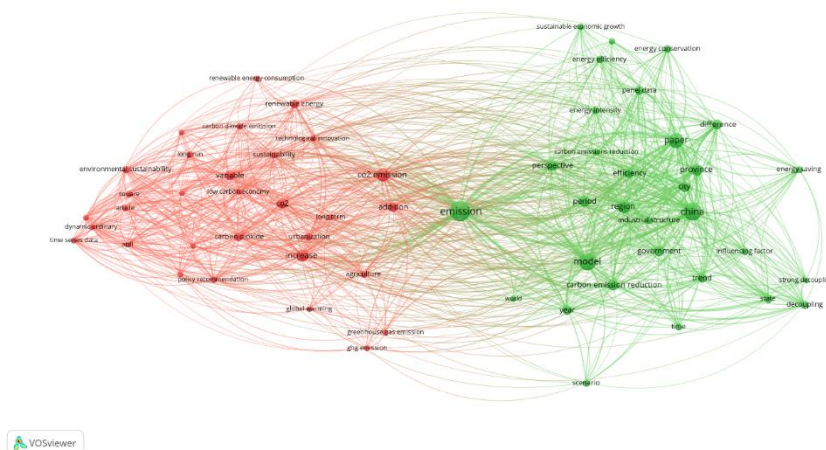
**Figure 4. Network Visualization of Emission Reduction Policy to Achieve Sustainable Economic Growth**

The size of the nodes on this map shows how often keywords appear. The distance between the nodes and the thickness of the connecting line measures the occurrence of keywords. The colour of the nodes indicates a group of keywords, which often consist of terms that appear together and can be considered a broad field of research in the (Gao et al., 2021; Vidiasratri et al., 2024; Wuri et al., 2024). From 2019 to 2023, two general clusters emerged to summarize interesting focus topics in Emission reduction policy and sustainable economic growth.

**Cluster 1:** The topics presented in the red cluster mainly focus on the sources of emissions and the factors contributing to climate change, indicating a more problem-oriented approach. This can be seen from words that often appear together, such as CO2 emissions, carbon dioxide, renewable energy, and global warming. The results of this mapping were also found in previous studies (Jin et al., 2019; Kabil et al., 2021; Martínez-Vázquez et al., 2021).

**Cluster 2:** The topics presented in the green cluster mainly focus on solutions and strategies to address emissions to achieve sustainable economic growth, demonstrating a more solution-oriented approach, as evidenced by words that often appear together, such as sustainable economic growth, model, efficiency, and carbon emission reduction. The results of this mapping were also found in previous studies (Seminario-Córdova & Rojas-Ortega, 2023; Wang & Fujita, 2023).

## IV. CONCLUSION

This study employs a bibliometric approach to explore emission reduction policies for sustainable economic growth from 2019 to 2023. Findings reveal a significant increase in related publications, with notable spikes in 2022-2023. China, Malaysia, and the United States emerge as primary contributors, while Indonesia's input remains minimal. Prolific authors include Raihan, A., Faruk, O., and Lin, B. The most influential publications encompass diverse case

studies emphasizing economic decarbonization and renewable energy's role. Mapping emission reduction policy and sustainable economic growth using network visualization reveals two clusters of hot issues today. The red cluster focuses mainly on the sources of emissions and the factors that cause climate change. The green cluster focuses on solutions and strategies to address emissions while maintaining economic growth. The analysis underscores the need for enhanced international collaboration, particularly between developed and developing nations, to address global challenges related to climate change and sustainable development. This comprehensive overview provides valuable insights into the evolving landscape of emission reduction policies and their intersection with sustainable economic growth.

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