The Issue of "Environmental Policy" during a COVID-19 Pandemic: A Bibliometric Overview

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Abstract. Pandemics have affected all aspects of human life, including environmental issues. This article analyses environmental policy issues during a COVID-19 pandemic using a bibliometric approach method from 173 published articles. Bibliometric data was retrieved from the 2020 Scopus database with "environmental policy" keyword by making use of VOSviewer, using co-occurrence visualization maps to evaluate the conceptual clusters. Further, co-authorship analysis was used to evaluate collaboration between authors and countries' related environmental policy publications. The review result shows, there are seven main clusters of concepts related to environmental policy. The United States is the most productive country on environmental policy literature. Finally, the environmental policy issue revolves around eleven areas. These results inform future research to a more comprehensive understanding of environmental policy.

1 Introduction

In 2020, the most dominant global issue was the COVID-19 pandemic [1]. Human life is greatly affected by the COVID-19 pandemic; the environment is no exception [2, 3]. The pandemic has caused significant changes in the social life of society that were never imagined before [4, 5]. The spread of the pandemic also has negative impacts on the governance of natural resources in the nations. According to Barouki et al. (2021), pandemic and environmental problems are related [6]. There needs to be an integrative global strategy that leads to policies to protect humans and ecosystems both now and in the future.

The current and future global threat to environmental crisis demands international policy cooperation between governments in the world [7]. It seems that environmental issues will receive the spotlight to be resolved through policy mechanisms [8, 9]. The characteristics of environmental problems are caused mainly by the social and behavioral conditions of the community [10]. Policies are expected to shape people's behavior to increase environmental awareness to resolve environmental problems because the essence of the policy is to determine problems to be resolved [10].

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Several instruments are needed to make a policy that is applicable and solutive in a crisis. Two crucial instruments in environmental policy are communication and information. According to de Vries (2019), an example of such communication in the mass media can increase environmental policy compliance. In addition, communication in environmental policy will be effective if communicators pay attention to social and psychological processes [7]. Furthermore, information in the environmental policy is needed to support transparency to all actors. In addition, the dissemination of comprehensive information can determine the success of environmental policies [11].

Environmental policy has been an appealing topic for practitioners and academics in the last decade [12]. Environmental policy research is multidisciplinary, including agenda settings for implementation and evaluation [13]. Environmental policy often contradicts adherents of a country's economic growth, which causes environmental sustainability to be often ruled out. Sajeev & Kaur (2020) explains that the "Size of Government" affects the commitment to environmental sustainability [14]. It implies that adequate government policy is needed to deal with environmental problems.

This article aims to analyze environmental policy issues during a COVID-19 pandemic, using a bibliometric approach from 173 Scopus published articles in 2020. The focus is on the environmental policy research trend of the study areas, the most influential papers, leading authors, and countries and concepts related to environmental policy issues during the pandemic**.**

2 Literature Review

During the pandemic period, the research topic on environmental policy tended to increase in some countries; COVID-19 has potential implications for environmental crises such as air pollution, deforestation, climate change [2, 3, 6, 15]. *Environmental policy*, which can overcome environmental problems [10], is defined as a government response or strategy regulating the environment to deal with future crises and life [10, 16]. Environmental policy, which can be used for governance towards the Sustainable Development Goals [17], also contains strategy and governance [18]. Moreover, Assche et al. (2020) explaining environmental policy covers various knowledge, institutions, issues, actors, and social-ecological linkages [18].

Environmental policy in developing countries is a particular problem compared to developed countries [14] since many of its actors ignore environmental sustainability and pursue economic growth. In developed countries, the environmental policy instruments received more severe government attention. A country that intends to achieve environmental sustainability needs the involvement of civil society institutions and the private sector [19]. This is reinforced by Benson & Jordan, who stated that environmental policy would succeed if it were stretched with the many sectors and other policy fields [20]. Therefore, the nature of the environmental policy is multi-perspective.

3 Methods

This research used bibliometric analysis to investigate the formal properties of knowledge domains by quantitatively analyzing bibliographic data as derived from previous research publication [21, 22]. A scientific field depicts a comprehensive map of information structure, assessment, and calculation [23]. Bibliographic data was conducted by using the Scopus database (per 30 March 2021). Scopus is chosen as one of the most extensive and detailed research output ranging from many types of documents covering over 77 million items from various fields [24, 25]. For bibliometric mapping, this research uses VOSviewer [26], which

detailed information is in www.vosviewer.com. The articles were evaluated based on the title, written in English, and the final press. The proposed advanced search is as follows:

TITLE ("Environmental Policy") AND (LIMIT-TO (PUBYEAR, 2020)) AND (LIMIT-TO (PUBSTAGE, "final"). The search for articles entitled Environmental Policy initially amounted to 188 articles, but finally after being adjusted based on final articles, only 173 articles were obtained.

The feature "analyze search results" in the Scopus database for a more comprehensive analysis was used. At the next step, the search results were downloaded in the CSV (Comma-Value-Separated) file to visualize using VOSviewer. This is descriptive research. The bibliometric research method in the environmental study has been used in several studies, such as in rural environmental governance [27], SDGs in strategic planning [28], and environmental management and social marketing [29].

4 Results and Discussions

In this section, we describe bibliometric analysis based on Scopus database search results. Of the 173 published articles, we explained it in several parts as follows:

4.1 Subject Areas and Document Type

The environmental policy issue during the 2020 period was published in various types of documents in the Scopus database. The documents consist of articles, conference papers, book chapters, reviews, erratum, notes, and editorials (Table 1). However, most are dominated by articles. It indicates that the interest in the environmental policy study did not decline even though the current focus of scientists was to overcome COVID-19 Pandemic.

Table 1. Documents by type.

Documents by type	Number of documents
Article	140
Conference paper	10
Book Chapter	9
Review	8
Erratum	3
Notes	2
Editorial	1

Source: Scopus database (30 March 2021)

Based on Figure 1, as one of the rusty branches between policy and environmental studies, the discussion of environmental policy is not only dominated by environmental and social sciences. Many other areas focus on researchers, starting from the economic side, engineering, even medicine. In total, there were eleven areas discussed by researchers in discussing the issue of environmental policy.

The data shows that the importance of the discussion of environmental policy is multi-perspective in environmental troubleshooting.
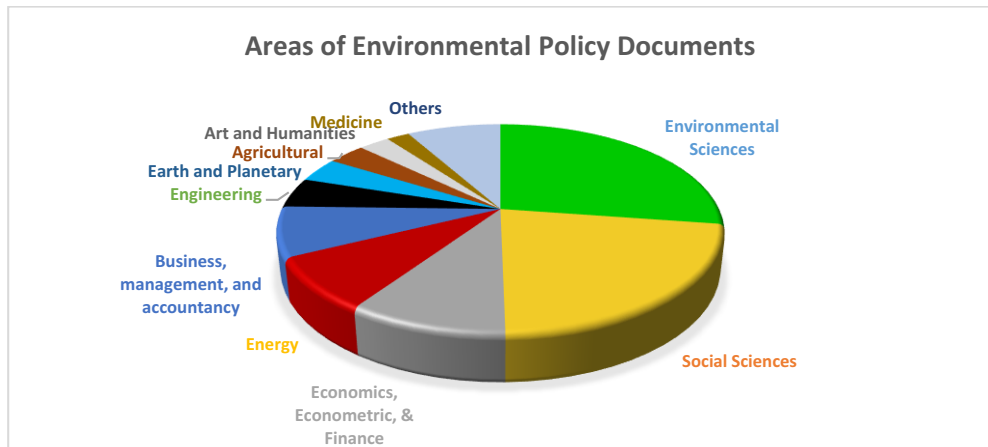
Fig. 1. Areas of Environmental Policy based on Scopus database.

4.2 Top Cited Articles and Most Productive Authors

Based on the 173 scientific documents analyzed, Table 2 shows the top 10 most cited articles in the established period, for example, the article entitled "Flexible environmental policy technological innovation and sustainable development of China's industry: The moderating effect of environmental regulatory enforcement" by Yuan & Zhang [30]. This article has been cited 31 times. This article gets attention and references other researchers for discussing the importance of policy flexibility in supporting sustainable industrial development.

Table 2. Top ten cited articles.

Authors	Title	Source	Cited
Yuan, B., Zhang, Y.	Flexible environmental policy, technological innovation and sustainable development of China's industry: The moderating effect of environment regulatory enforcement	Journal of Cleaner Production 243,118543	31
Burns, C., Eckersley, P., Tobin, P.	EU environmental policy in times of crisis	Journal of European Public Policy 27(1), pp. 1-19	20
Rahman, M., Aziz, S., Hughes, M.	The product-market performance benefits of environmental policy: Why customer awareness and firm innovativeness matter	Business Strategy and the Environment 29(5), pp. 2001-2018	15
Galeotti, M., Salini, S., Verdolini, E.	Measuring environmental policy stringency: Approaches, validity, and impact on environmental innovation and energy efficiency	Energy Policy 136,111052	15
Guo, M., Kuai, Y., Liu, X.	Stock market response to environmental policies: Evidence from heavily polluting firms in China	Economic Modelling 86, pp. 306-316	12
Alsaifi, K., Elnahass, M., Salama, A.	Carbon disclosure and financial performance: UK environmental policy	Business Strategy and the Environment 29(2), pp. 711-726	12

Sadik-Zada, E.R., Ferrari, M.	Environmental policy stringency, technical progress and pollution haven hypothesis	Sustainability (Switzerland) 12(9),3880	11
Gangi, F., Daniele, L.M., Varrone, N.	How do corporate environmental policy and corporate reputation affect risk-adjusted financial performance?	Business Strategy and the Environment 29(5), pp. 1975-1991	10
Bian, J., Zhao, X.	Tax or subsidy? An analysis of environmental policies in supply chains with retail competition	European Journal of Operational Research 283(3), pp. 901-914	10
Knill, C., Steinebach, Y., Fernández-i-Marín, X.	Hypocrisy as a crisis response? Assessing changes in talk, decisions, and actions of the European Commission in EU environmental policy	Public Administration 98(2), pp. 363-377	10

Source: Data adopted from Scopus database (30 March 2021)

Furthermore, articles written by Burns, Eckersley, and Tobin have been cited 20 times [15], and other articles are listed in Table 2. Of the ten most diarized articles, the article is published in various journals varied, not limited to the area of policy and environment alone.


Fig. 2. The 10 most productive authors.

Figure 2 shows that Burns, C is the most productive writer producing articles that discuss environmental policy. In total, there are three articles where one of the articles has been tangent before. Further, the Top 10 Most Productive Authors is Czyzewski, B also has three articles. One of the articles discusses the potential of local environmental policies at the local level in reducing environmental threats globally [31].

4.3 The Most Contribution Countries

As one of the global issues, research on environmental policy during the pandemic has attracted researchers from many countries. Figure 3 shows the ten most contributing countries based on the number of the article published. The United States leads as the country with the highest number of documents, followed by China, the United Kingdom, Germany, the Russian Federation, Italy, Brazil, Japan, Sweden, and Spain. Among the list of countries dominated by developed countries in the European region, this means that in a publication that researchers in developing countries have not given serious attention to the issue of environmental policy.
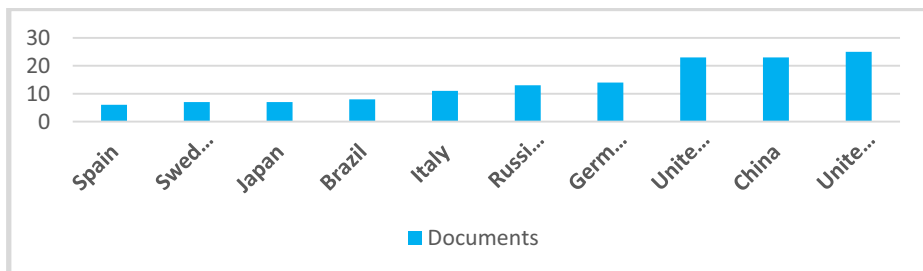
Fig. 3. Documents by country (top 10).

## 4. 4 Bibliometric Network Analysis

To understand structures in-depth regarding the relationship between authors and cluster of the concept of the Environmental Policy literature. We use VOSviewer to Generate the Graphical Maps based on the co-authorship and co-occurrence of keywords. Figure 6 shows co-authorship Analysed by VOSviewer [26]. The threshold minimum number of articles for an Author was set at two. To obtain an interpretation of Figure 6. Based on co-authorship by country, several countries have links, including Spain, Brazil, Greece, Germany, France, Netherlands, United Kingdom, United States, Japan, China, Turkey, Canada. Some of these countries are joined in 5 clusters. While based on co-authorship by Author, three interrelated authors were found, Chen, Y; Siddiqui, A.S; Tanaka, M. Examples of articles written by three authors are "Environmental Policies in the Power Sector"[32].
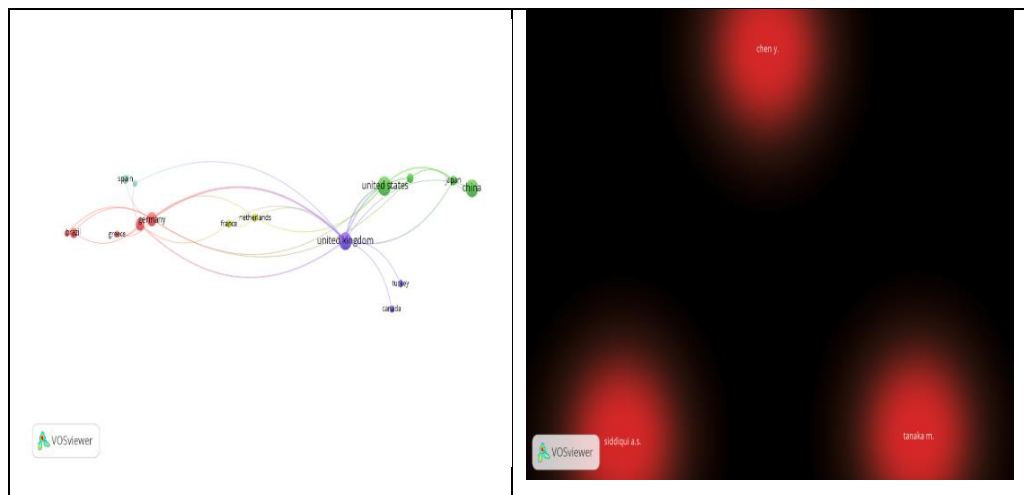
Fig. 4. Co-authorship based on country and author.

For clustering concepts about the issue of environmental policy, we use the feature of co-occurrence relationship by keywords on VOSviewer [23, 33]. From the Scopus database, it indicates 1213 keywords with the minimum number of occurrences of three keywords. The results of 1213 keywords dan 90 meet the threshold. From the, we constructed a concept map (Figure 5). The concept items that often co-occurrence in the same publications are located close to each other in a concepts map, and less strongly related terms (low co-occurrence) are located further away. The more often the concept is used by researchers, the size of one

concept item is getting bigger. The 1213 keywords were successfully identified into 7 clusters (Table 3) distinguished from color as in Figure 5.
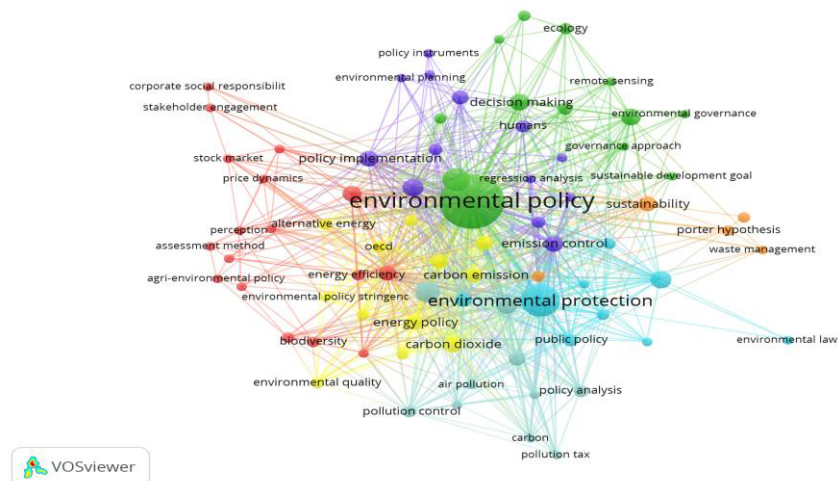
Fig. 5. Cluster of concepts in the environmental policy research.

Mapping the research concept shows that the issue of environmental policy includes various concepts and is still developing. Each cluster indicates closely related and frequently used keywords, representing the following concepts:

Table 3. Concept Clustering of Environmental Policy.

Clusters	Items of Concept	Number of items (Colour)
Cluster 1	Agri-environmental policy; assessment method; biodiversity; common agricultural policy; corporate social responsibility; ecosystem services; empirical analysis; energy efficiency; environmental impact; environmental performance; future prospect; innovation; numerical model; perception; price dynamics; stakeholder engagement; stock market	17 items (red)
Cluster 2	Decision making, ecology, environmental governance; environmental management; environmental policy; governance approach; information, planning; politics; remote sensing; sustainable development	11 items (green)
Cluster 3	Commerce; emission control; environment; environment planning, environment technology, government, humans, local participation, policy implementation, policy instruments, policy making, regression analysis, taxes	13 items (purple)
Cluster 4	Alternative energy, carbon dioxide, carbon emission, economic development, economic growth, energy policy; environmental policy stringency; environmental quality; panel data; renewable energy	11 items (yellow)
Cluster 5	Abatement cost, air pollution, atmospheric pollution; carbon; climate change; environmental economic; policy analysis; pollution control; pollution tax; taxation	10 items (blue)
Cluster 6	Economic and social efficiency; economics; environmental law; environmental protection; environmental regulation; pollution; public policy; regulatory approach	8 items (tosca)
Cluster 7	Efficiency; environmental policies; porter hypothesis; sustainability; waste management	5 items (orange)

The mapping concept above serves to help other researchers in seeing the research position conducted with previous research. So the process of selecting related concepts can be appropriate and have a clear scientific track record.

5 Conclusion

Although global policy focuses on handling COVID-19 Pandemic, the issue of environmental policy cannot rule out. The crisis that occurred due to COVID-19 could trigger environmental threats in the future, so the environmental policy remains a particular concern for researchers throughout the world. This bibliometric study found that environmental policy research during the Pandemic (2020) period was discussed multi-perspective and spread in various international journals. A total of 173 articles were published in this period. Of the number of articles, it was successfully identified by seven cluster concepts related to Environmental Policy. In a scientific structure, most of the introduction to environmental policy research is Burns, C, and Czyzewski. The most influential article was written by Yuan & Zhang [30], which was cited 31 times. The United States was the most productive country on environmental policy Research during the pandemic.

This analysis has some limitations: researchers only use one index database (Scopus), not considering other relevant databases like dimensions, Web of Sciences, Microsoft Academics, etc. The coverage of the time used by researchers is also only one year. On the other hand, this study only accommodates the final documents (have number and page); article in the press is not included—only articles in English. However, the study provides a systematic method and is classified as still limited to seeing certain areas in environmental policy. Research and clustering trends concepts are expected to research in the future in starting their studies related to environmental policy. This study's findings are also expected to provide a stimulus for researchers, institutions, and developing countries in attention to environmental policy.

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