

## Sustainable Development Goals and Net Zero Emissions Targets: Bibliometric Study

Amit Kumar Kashyap<sup>\*</sup>, Neeraj Sharma<sup>ID</sup>

Institute of Law, Nirma University, Ahmedabad 382481, India

Corresponding Author Email: [amit1law@gmail.com](mailto:amit1law@gmail.com)



Copyright: ©2024 The authors. This article is published by IIETA and is licensed under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

<https://doi.org/10.18280/ijstdp.191030>

### ABSTRACT

**Received:** 7 May 2024

**Revised:** 5 August 2024

**Accepted:** 18 September 2024

**Available online:** 30 October 2024

#### **Keywords:**

*sustainable development goals, climate change, energy security, net zero emissions, greenhouse gases*

The Sustainable Development Goals (SDG) lay down the expectations of the countries worldwide to make this earth a better place. SDG 13 provides urgent action from nations to address climate change. The Paris Agreement has been instrumental in bringing consensus among the leaders from different states to keep the rise in global average temperature not to exceed 1.5 degrees centigrade concerning the pre-industrial level. To keep an eye on the consequences of the rising global average temperature, there is a need for a coordinated approach at the international level. The ever-increasing greenhouse gases aggravate the problem of global warming. The energy security of the world needs to be ascertained. Simultaneously, the goal of net zero emission (NZE) must be achieved to sustain Mother Earth's existence. To attain the requisite target, the contribution from the research institutions and the availability of quality literature is a must. The present research aims to analyse the literature on different parameters of SDGs and NZE targets in the Scopus database.

## 1. INTRODUCTION

According to the United Nations, climate change is a significant problem worldwide, highlighting the enormous and unprecedented magnitude of its effects. An increase in the average global temperature, sometimes known as climate change or global warming, is one of the world's most significant dangers. Countries worldwide are confronted by the challenge of climate change [1]. The lockdown in the wake of COVID-19 has somewhat reduced the pace of emissions. However, there has not been a complete pause [2]. However, it has been a temporary phase, and the world needs to wake up to the current realities. The average global temperature has already increased by 1.1.

Degree centigrade in comparison to the temperature in the 19th century [3]. The efforts need to be scaled up to reduce the emission by up to 40% by 2030 and to achieve a net zero emission (NZE) by the year 2050 [3]. The Sustainable Development Goals (SDG) are part of the 2030 agenda, adopted by the United Nations in 2015, to ensure that the world moves towards the synergy between environment and development [4, 5]. The target of NZEs should be achieved by 2050 by following progressive climate change policies at the national and regional levels [6]. To achieve the vision of NZEs, there is a need to invest heavily in different renewable energy sectors [7]. The scientific literature on the impact of climate change and the path to achieving NZE should be analysed for a better understanding. The present study offers a distinctive addition by highlighting notable gaps in the current body of knowledge on SDGs, particularly regarding SDG 13, which emphasises climate action. The present analysis accentuates the subject's dynamic and quickly developing character, in

contrast to previous bibliometric studies that primarily classify research under broad sustainability topics. Also, the goal of NZEs is not limited to one stream regarding research studies. The interest in dealing with emissions and achieving SDGs is spread across different streams, including law, management and social sciences, and science and geographical studies. The growing awareness of the manifold adverse consequences of Climate Change due to human intervention is forcing countries to switch to options like hydrogen and renewables to decarbonise the polluting industrial sectors [8]. The present work will provide insights into the history of research developed to control the adverse impact of climate change. The Present research aims to analyse the usage and discussion of essential keywords across different documents appearing in the search results of the Scopus database. The present work aims to track the level of research across different countries and types of workbooks, articles, chapters, conference proceedings, etc. The literature about climate change and sustainable development in the Scopus database has been analysed. Moreover, it highlights the absence of integrated studies across many SDGs, suggesting that the field is still far from sufficiently advanced. Through addressing these research gaps, this study establishes the basis for future enquiries and provides a guide for exploring under-researched SDGs.

## 2. REVIEW OF LITERATURE

The Paris Agreement has brought world leaders to agree to keep the global average temperature to 2 degrees centigrade concerning the pre-industrial level [9]. On the safer side,

efforts are being made to keep the global average temperature below 1.5 degrees centigrade. The Nations have agreed to submit the intended Nationally determined contributions, wherein the action plan of the countries to keep a check on greenhouse gas emissions is mentioned [10]. In order to achieve the goal of maintaining a check on the rising temperature, there is a need to control the emissions [11]. The objectives of the Paris Agreement need to align with the vision of NZEs [12]. To achieve NZEs, countries must reduce gas emissions and develop policies to remove the emitted greenhouse gases through sinks [13]. The objectives of the Paris Agreement are to keep a check on the global average temperature, and the SDGs were laid down in 2015 [14]. SDG 13 mentions taking urgent action to reduce the adverse impact of climate change [15]. Urgent action is required from governments across the globe to save human existence on Mother Earth [16]. Using fiscal measures and switching to non-conventional energy sources can reduce the adverse impact of climate change [17]. It is a matter of fact that the greenhouse gases once emitted into the atmosphere stay for a very long time [18]. There is a need for the extensive plantation drive to act as the sink. The long-believed notion of absorbing hefty tonnes of carbon dioxide by seawater does not hold, as it has limits [19]. Environmental education has a significant role in enabling awareness among the masses regarding environmental degradation [20]. Agenda 21 mentions the promotion of environmental education to promote awareness regarding desertification and the management of droughts [21].

Diplomats and academics are greatly worried about the significant impacts of climate change. The emerging economic instability directly results from the environmental catastrophe, presenting a palpable danger to humans and animals [22]. Scholars and policymakers have thoroughly studied the socio-economic vulnerabilities caused by climate change in the last two decades. This bibliometric analysis specifically examines scholarly papers to identify trends, topics, influences, and prospective areas for future research in the dynamic field of climate change studies.

### 3. METHODOLOGY

The paper analyses the trends of scientific research regarding the issues of climate change and NZEs. Using the Scopus database, the researcher used bibliometric analysis to study the trends in the research.

The Scopus database provides an advantage regarding comprehensiveness and diversity of research. The authors intend to find out the level of research across various streams, and Scopus serves that purpose quite extensively.

The Scopus database is essential to our inquiry for several reasons. Scopus is distinguished primarily by being the most extensive compilation of peer-reviewed scientific articles and, in conjunction with WoS, by being the primary source of scientific citation data. The fact that WoS covers very few publications in the Social Sciences is noteworthy [23]. Furthermore, earlier bibliometric research focused on climate change has extensively used Scopus [24]. The researcher has used the search of the selected keywords within the Titles of the Articles, Abstracts and Keywords stored in the database. The selected keywords include the terms “Net Zero Emissions”, “Sustainable Development Goals”, and “Climate Change”.

In order to determine the bibliographic coupling of the authors, the software VOS viewer has been used. Further, the following methodology has been followed:

1. The data has been downloaded from the Scopus database using the essential keywords.

2. A map based on bibliographic data was used to create the bibliographic coupling through the software.

3. The option of reading the file from a bibliographic database file has been chosen under the option of choosing the data type for analysis.

4. Then, bibliographic coupling is used as the type of analysis, and the unit of analysis as the Author has been chosen. The full counting method has been chosen. The choice of method is based on research conducted by Van Eck and Waltman [25] and Perianes-Rodriguez et al. [26], who strongly support using fractional counting instead of complete counting in co-citation analysis. This method is suggested to reduce the disproportionate impact of publications with vast reference lists on forming co-citation networks.

5. Then, the thresholds are chosen, with the minimum number of the author's documents being reduced from 5 to 2 and the minimum number of citations being increased to 1 from the default figure of zero.

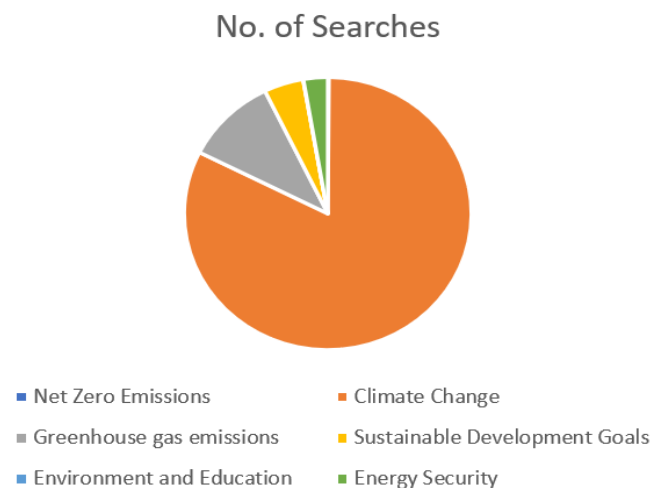
6. The bibliographic coupling is used for the total number of 179 authors to determine the strength of the coupling link of each author with other authors.

### 4. RESULT AND DISCUSSION

The results are prepared for the following different parameters to study the trends in the research:

1. Total Number of search results for the specific keywords
2. Different types of documents that contribute to the literature
3. Subject area of the search results.

Country-wise segregation of the documents relating to the keywords:



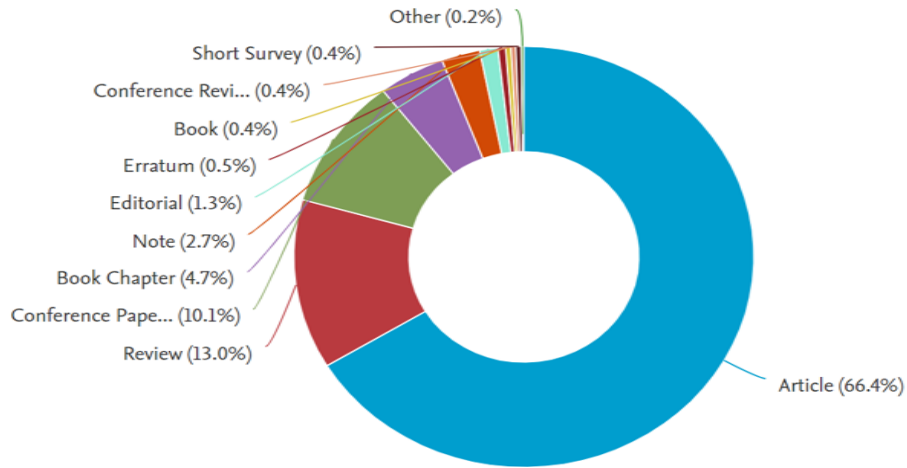
**Figure 1.** Different types of search keywords that contribute to the literature

The chart in Figure 1 shows the distribution of the literature in the form of documents available in the Scopus database for the different but related keywords. In consonance with the SDGs and objectives in the Paris Agreement, keywords like NZEs, Climate Change and SDGs are essential [9]. The Figure

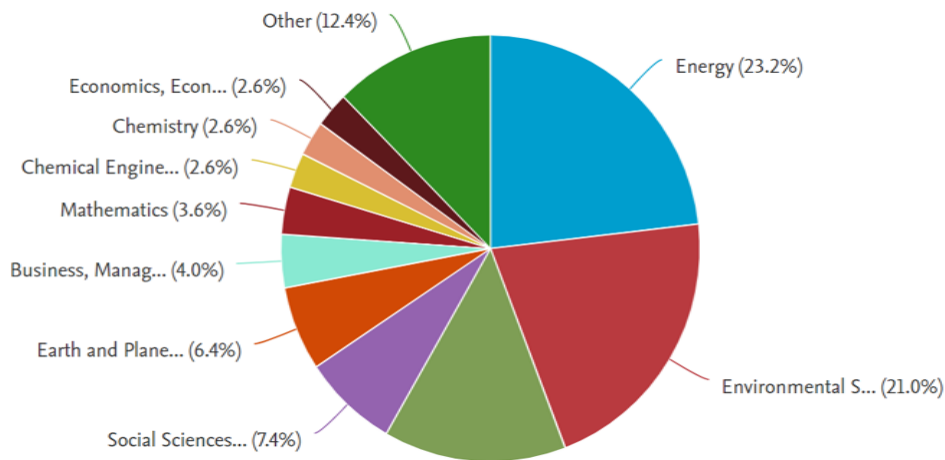
1 shows that most documents are available for the keyword "Climate Change" followed by energy security—the least number of documents available for the conjoint keyword of Environment and Education.

Figure 2 depicts the documents that captured the keyword "Net Zero Emissions". The Articles comprise more than 65% of the topics' documents, followed by the book reviews. The other documents that have captured the subject area are

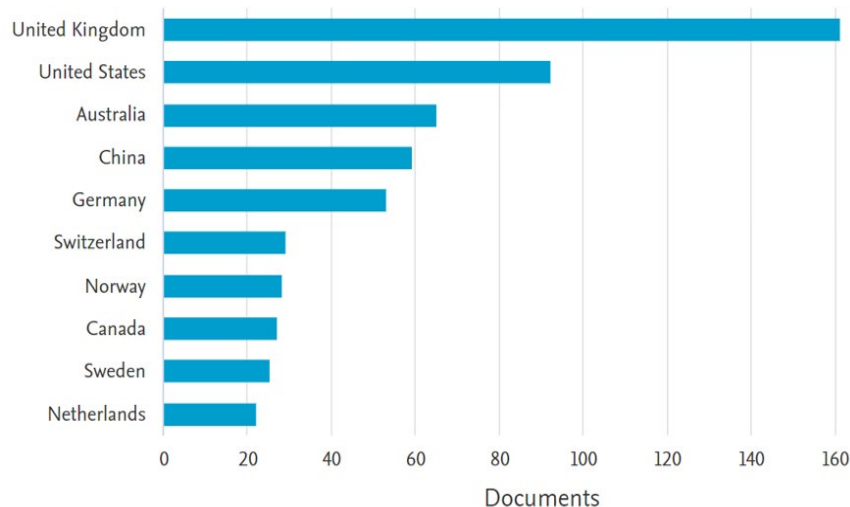
conference papers, book chapters, editorials, and books. The short surveys comprise the least number of documents in the Scopus database that detail the database. The detailed analysis shows that the journals indexed with the Scopus database are observed to accept the research articles rather than other documents. On the other hand, it could be derived from the graph analysis that the researchers contribute in the form of articles on the given keywords.



**Figure 2.** Categorization of the search results for “Net Zero Emissions” based on the documents



**Figure 3.** Comparison of the subject area for the keyword "Net Zero Emission"



**Figure 4.** Comparison of the documents by different countries

Figure 3 shows the pie chart capturing the different subject areas in the Scopus database for the targeted keyword. The documents under the subject area "Energy" comprise more than 23% of all the subject areas. After that, the term was covered under the subject of environmental science. Other subject areas covering the NZEs are social sciences, Earth and Planetary Sciences, Business, Management and Accounting. The fewest documents covering the concerned keyword are under the subject areas of Neuroscience, Psychology, and Veterinary Science.

As shown in Figure 4, the United Kingdom contributes to the documents covering the literature on NZEs. Other significant contributors to the subject area are from the United States of America and Australia. The contribution of any literature does not derive from India. The European countries and the United States have been pioneers in creating awareness regarding the harmful effects of greenhouse gases [26].

Figure 5 depicts the year-wise contribution of the literature on the keywords concerning NZEs. The graph shows that there has been a steady rise in the number of documents on the broad topic of climate change and NZE. The growth in the climate change literature shows the growing awareness of the following topics. After 2015, it can be seen that countries worldwide have entered various agreements to restrict the rise

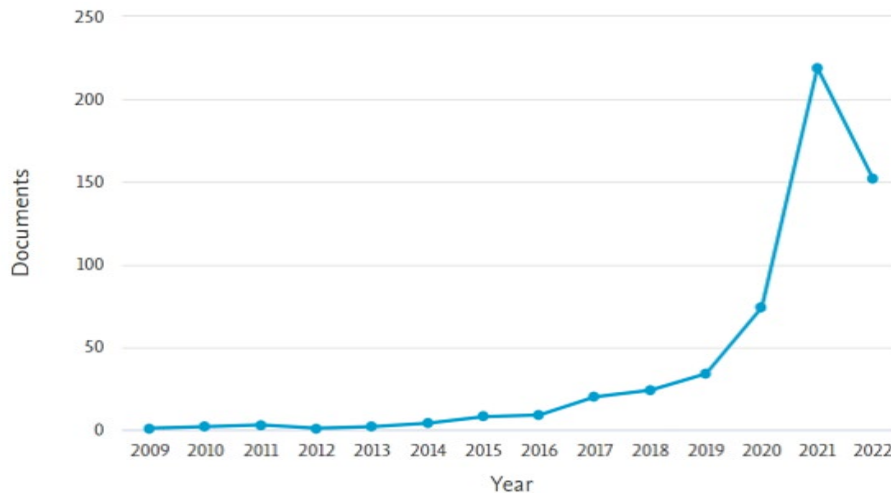


Figure 5. Literature on the keywords concerning NZEs

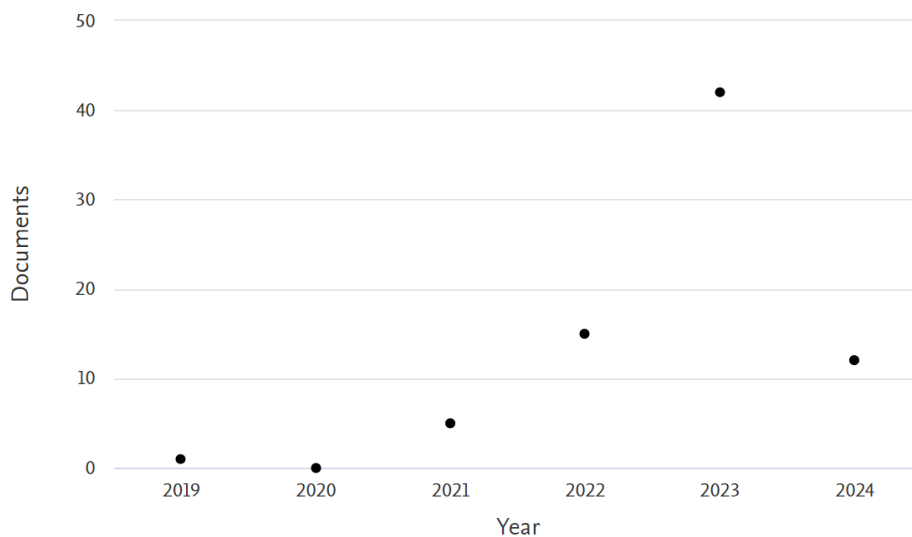


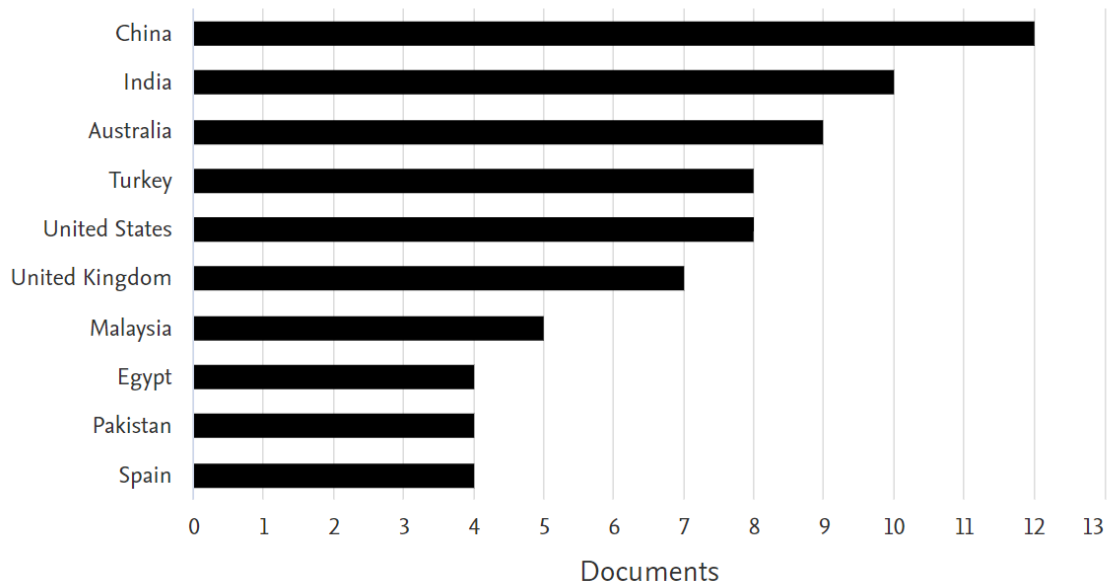
Figure 6. Documents where SDGs and NZEs have been simultaneously discussed

in greenhouse gas emissions. In order to restrict the rise in the global average temperature to 1.5 degrees centigrade, the countries have pledged to attain NZEs [27, 28]. The graph shows the steady rise in the literature on attaining NZE.

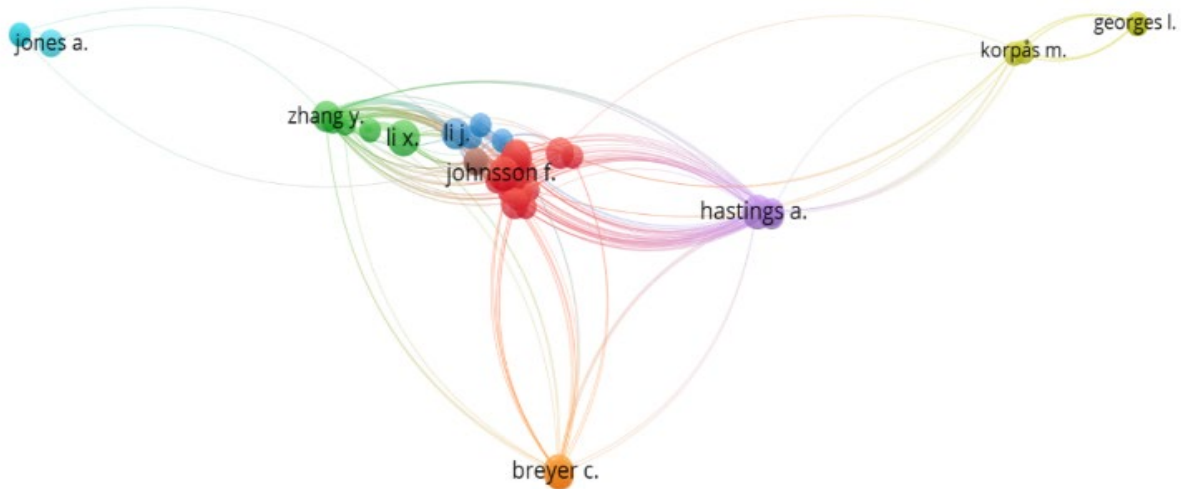
Figure 6 shows that despite the developments in the literature about greenhouse gas emissions and climate change, which have witnessed increasing trends from the last decade of the 20th century, the correlation between SDGs and NZEs has not been researched much. It is only in the year 2023 that more than 40 documents were witnessed in this area.

Figure 7 depicts that the contribution from Asia is at the highest if we look at the documents where the correlation between NZE and SDGs has been studied, with China and India leading in the contribution. However, the numbers are still low. This trend shows that it is still an unexplored area where research can be done. This conclusion can be drawn because SDG 13 states that urgent actions need to be taken to avert the adverse impact of climate change.

In order to determine the bibliographic coupling of the authors, the software VOS viewer has been used. The procedure followed above for the searches with the keyword – “Net Zero Emissions” has generated 156 items. As shown in Figure 8, a total of 17 clusters were created, with 228342,815 links. The total link strength is 31,658.



**Figure 7.** Countries which have contributed to the conjoint research of the NZEs and sustainable development



**Figure 8.** Author bibliographic coupling

## 5. CONCLUSION

The bibliometric analysis of the research trends on keywords about the subject area of climate change shows varied results on different metrics. The analysis of the results in terms of the contributions made from 2009 onwards shows that post-2015, after the Paris Agreement, there has been a steady rise in the research on different aspects of attaining the objective of Net Zero Emission. This proves that deeper academic and research interests have been growing in climate change and threats from climate change. The country-wise contribution depicts how the United Kingdom, Western European Countries and the United States of America have led the research on climate change and NZEs. The irony lies in that historically, the developed nations have been the highest emitter of greenhouse gas emissions, and researchers have led the present research on climate changes from these countries. The analysis shows that the research on NZE has not been restricted to the Environmental Sciences. The research has

been interdisciplinary, and the contours of the scope extend beyond the subject area of Energy Studies and Environmental Sciences. The analysis shows that the related areas constitute research on climate change, SDGs, and energy security. The distribution of the documents shows that among the related areas, the contribution is mainly on the topic of SDGs.

Regarding the research category, the contribution has primarily been in articles. Other categories of research include book reviews and conference papers, which are accepted by the journals indexed in the Scopus database. The research analyses the trends of scientific contributions relating to climate change, SDGs, and NZEs. The findings emphasise the need for further study that connects theoretical discussion and practical application, particularly in sectors directly pursuing NZE goals. This study contributes to the ongoing discussion by highlighting potential topics for future research to address the shortcomings of the current approach.

The study is relevant in the context of the pledges taken by nations worldwide to save human existence on Mother Earth.

The Limitation of the study lies in the fact that the research has been carried out for the data available in the Scopus database.

## REFERENCES

- [1] Myers, T.C. (2014). Understanding climate change as an existential threat: Confronting climate denial as a challenge to climate ethics. *De Ethica*, 1(1): 53-70. <https://doi.org/10.3384/de-ethica.2001-8819.141153>
- [2] Aktar, M.A., Alam, M.M., Al-Amin, A.Q. (2021). Global economic crisis, energy use, CO2 emissions, and policy roadmap amid COVID-19. *Sustainable Production and Consumption*, 26: 770-781. <https://doi.org/10.1016/j.spc.2020.12.029>
- [3] Hughes, L. (2000). Biological consequences of global warming: Is the signal already apparent? *Trends in Ecology & Evolution*, 15(2): 56-61. [https://doi.org/10.1016/S0169-5347\(99\)01764-4](https://doi.org/10.1016/S0169-5347(99)01764-4)
- [4] Tsiropoulos, I., Nijs, W., Tarvydas, D., Ruiz Castello, P. (2020). Towards net-zero emissions in the EU energy system by 2050 – Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal, EUR 29981 EN, Publications Office of the European Union, Luxembourg. <https://doi.org/10.2760/081488>
- [5] Bebbington, J., Unerman, J. (2018). Achieving the united nations sustainable development goals: An enabling role for accounting research. *Accounting, Auditing & Accountability Journal*, 31(1): 2-24. <https://doi.org/10.1108/AAAJ-05-2017-2929>
- [6] While, A. (2008). Climate change and planning: Carbon control and spatial regulation. *The Town Planning Review*, 79(1): ii-xiii. <https://doi.org/10.3828/tpr.79.1.2>
- [7] Chaturvedi, V. (2021). A vision for a net-zero energy system for India. *Energy and Climate Change*, 2: 100056. <https://doi.org/10.1016/j.egycc.2021.100056>
- [8] Espegren, K., Damman, S., Piscicella, P., Graabak, I., Tomasgard, A. (2021). The role of hydrogen in the transition from a petroleum economy to a low-carbon society. *International Journal of Hydrogen Energy*, 46(45): 23125-23138. <https://doi.org/10.1016/j.ijhydene.2021.04.143>
- [9] Sachs, J.D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., Rockström, J. (2019). Six transformations to achieve the sustainable development goals. *Nature Sustainability*, 2(9): 805-814. <https://doi.org/10.1038/s41893-019-0352-9>
- [10] Rogelj, J., Den Elzen, M., Höhne, N., Fransen, T., Fekete, H., Winkler, H., Schaeffer, R., Sha, F., Riahi, K., Meinshausen, M. (2016). Paris Agreement climate proposals need a boost to keep warming well below 2 C. *Nature*, 534(7609): 631-639. <https://doi.org/10.1038/nature18307>
- [11] Arora, N.K., Mishra, I. (2021). COP26: More challenges than achievements. *Environmental Sustainability*, 4: 585-588. <https://doi.org/10.1007/S42398-021-00212-7>
- [12] van Soest, H.L., den Elzen, M.G.J., van Vuuren, D.P. (2021). Net-zero emission targets for major emitting countries consistent with the Paris Agreement. *Nature Communications*, 12(1): 1-9. <https://doi.org/10.1038/s41467-021-22294-x>
- [13] Gunter, W.D., Wong, S., Cheel, D.B., Sjostrom, G. (1998). Large CO2 sinks: Their role in the mitigation of greenhouse gases from an international, national (Canadian) and provincial (Alberta) perspective. *Applied Energy*, 61(4): 209-227. [https://doi.org/10.1016/S0306-2619\(98\)00042-7](https://doi.org/10.1016/S0306-2619(98)00042-7)
- [14] McCollum, D.L., Zhou, W., Bertram, C., De Boer, H.S., Bosetti, V., Busch, S., Riahi, K. (2018). Energy investment needs for fulfilling the Paris agreement and achieving the sustainable development goals. *Nature Energy*, 3(7): 589-599. <https://doi.org/10.1038/s41560-018-0179-z>
- [15] Kelman, I. (2015). Climate change and the Sendai framework for disaster risk reduction. *International Journal of Disaster Risk Science*, 6(2): 117-127. <https://doi.org/10.1007/S13753-015-0046-5>
- [16] Hamblin, J.D. (2013). *Arming Mother Nature: The Birth of Catastrophic Environmentalism*. Oxford University Press.
- [17] Ricart, S., Villar-Navascués, R.A., Hernández-Hernández, M., Rico-Amorós, A.M., Olcina-Cantos, J., Moltó-Mantero, E. (2021). Extending natural limits to address water scarcity? The role of non-conventional water fluxes in climate change adaptation capacity: A review. *Sustainability*, 13(5): 2473. <https://doi.org/10.3390/su13052473>
- [18] Meinshausen, M., Smith, S.J., Calvin, K., Daniel, J.S., Kainuma, M.L., Lamarque, J.F., Van Vuuren, D.P.P. (2011). The RCP greenhouse gas concentrations and their extensions from 1765 to 2300. *Climatic Change*, 109(1): 213-241. <https://doi.org/10.1007/s10584-011-0156-z>
- [19] Plass, G.N. (1956). Carbon dioxide and the climate. *American Scientist*, 44(3): 302-316.
- [20] Palmer, J. (2002). *Environmental Education in the 21st Century: Theory, Practice, Progress and Promise*. Routledge.
- [21] Hopkins, C., McKeown, R. (2002). Education for sustainable development: An international perspective. *Education and Sustainability: Responding to the Global Challenge*, 13: 13-24.
- [22] Geden, O., Scott, V., Palmer, J. (2018). Integrating carbon dioxide removal into EU climate policy: Prospects for a paradigm shift. *Wiley Interdisciplinary Reviews: Climate Change*, 9(4): e521. <https://doi.org/10.1002/wcc.521>
- [23] Mongeon, P., Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: A comparative analysis. *Scientometrics*, 106(1): 213-228. <https://doi.org/10.1007/s11192-015-1765-5>
- [24] Di Matteo, N., Diaconu, D., Grimaldo, F. (2018). Understanding climate change through an interdisciplinary perspective: Bibliometric analysis and research overview. *Frontiers in Environmental Science*, 6: 10.
- [25] Van Eck, N.J., Waltman, L. (2014). CitNetExplorer: A new software tool for analyzing and visualizing citation networks. *Journal of Informetrics*, 8(4): 802-823. <https://doi.org/10.1016/j.joi.2014.07.006>
- [26] Perianes-Rodriguez, A., Waltman, L., Van Eck, N.J. (2016). Constructing bibliometric networks: A comparison between full and fractional counting. *Journal of Informetrics*, 10(4): 1178-1195. <https://doi.org/10.1016/j.joi.2016.10.006>
- [27] Schmidt, C.W. (2006). Putting the earth in play: Environmental awareness and sports. *Environmental*

Health Perspectives, 114(5): A286-A295  
<https://doi.org/10.1289/ehp.114-a286>

[28] Tong, D., Zhang, Q., Zheng, Y., Caldeira, K., Shearer, C., Hong, C., Qin, Y., Davis, S.J. (2019). Committed

emissions from existing energy infrastructure jeopardize  
1.5 C climate target. *Nature*, 572(7769): 373-377.  
<https://doi.org/10.1038/s41586-019-1364-3>