Ecological Footprint Towards Sustainable Development: A Bibliometric Analysis

Nimra Razzaq[1], Mahwish Zafar[2,*] and Amir Ilyas[3]

Abstract

With the consistence global climate change in the world create a lot of threats to the sustainable development. For this, to analysis the effects of ecological footprints we employ R studio for productive methodologies, the first of which is descriptive analysis using authors and documents. Overview is one type; structural analysis is another. All of these processes are carried out using the VOS viewer and the statistical software package R. The results indicate that efficient governance is an important aspect of long-term economic success. Additionally, the study's conclusions have implications for the study of sustainability. The only study that examines key topics on which articles published in ecological and sustainable development are centered and mostly relevant to sustainability practices. This study provides an overview of the development of the literature on sustainability, a list of the most significant authors, as well as information on pertinent countries, organizations, and journal sources. This offers the opportunity for additional research to focus on this topic. Long-term and short-term economic growth are both positively impacted by the ecological footprint. The study concluded that the evidence supporting the immediate effects of governance was of inadequate significance. The study makes policy suggestions for establishing long-term good governance that will promote national economic development.

Keywords: Bibliometric Analysis, Content Analysis, Ecological Footprint, Network Analysis, Sustainable Development

[1] Student, Department of Management Sciences, The Superior University, Lahore, Punjab, Pakistan.

[2] Associate Professor, Department of Management Sciences, The Superior University, Lahore, Punjab, Pakistan.

[3] Lecturer, Department of Management Sciences, The Superior University, Lahore, Punjab, Pakistan.

* Corresponding Author: mahwish.zafar@superior.edu.pk

1. Introduction

The Intergovernmental Panel on climatic Change (IPCC) has been publishing Assessment Reports since 1990, and they show that the progressive increase in global temperature over the past 100 years has been accompanied by sea level rise, polar ice melt, and both common and outstanding weather and climatic events. This has significantly increased pressure on the preservation of the environment and global economic growth (Shen et al., 2023; Shi et al., 2023).

Ecological is recognized as the primary catalyst for economic and industrial growth for a successful nation and its sufficient supply is essential to ensuring human comfort and reducing poverty (Banos et al., 2011; Karekezi et al., 2012; Ershad & Hayat, 2022). The population and economic growth, particularly in developing market nations, which will account for roughly 90% of the increase in energy demand by 2035, are driving a rapid rise in the global energy demand (Green, 2012). Many emerging nations have experienced economic development challenges due to the energy crisis.

Environmental sustainability is always a major issue in social development, and achieving harmony and a positive feedback loop between the economy and the environment is increasingly recognized as desirable expectations and important goals for the general public, lawmakers, and academics. The study of the environmental footprint family (EFF) has consistently generated a lot of interest and is now widely used in practice as a crucial method for assessing sustainability and the environmental impact of various actions.

1.1. Research Questions

This study has some relevant research questions.

1. What are topics covered most frequently in papers on ecological footprint and sustainable development?
2. Which authors, groups of people, and countries have made the most significant contributions to the study of sustainability?
3. What are the papers on ecological footprint and sustainable development that have received the most citations?
4. What references have received the most citations?
5. Which reference journals receive the most citations?
6. Which organizations and periodicals are most productive, and who are the most productive writers?
7. Which funding organizations are crucial for supporting the field of ecological footprint research?

We applied bibliometric analyses to a cartography study using R studio and VOS-viewer to address the problems.

1.2. Research Objective

The goals of this study are to: (1) identify the most productive authors and their papers, organizations, and nations; (2) map and visually represent results in simple presentations; (3) analyses the major contributions of ecological footprint and sustainability development in the field of research; (4) identify the key reference papers

and journals; and (5) offer suggestions for future sustainability research that the journal should take into account.

1.3. Contribution of the Study

This study's goal is to improve and expand the bibliometric analysis of ecological footprints. The global comparison of papers from 2013 to 2022 using the bibliometric method is described in the current paper. The Scopus Science Core Collection database was used to gather the articles for this report's review. We compare ecological footprints papers based on the themes, journals, authors, and institutions of the publications, but we also consider how their conceptual and intellectual structures vary from one another in terms of keywords and citation analysis. To study academic hotspots and research fronts, respectively, author keywords are used in author keyword frequency analysis and author keyword burst analysis. Co-citation analysis and historical citation analysis are based on citation relationship. Furthermore, several ecological footprints have been thoroughly studied in previous research on various subjects under different circumstances. Still, there have been interesting advancements, which are mainly illustrated in (1) Some studies use a limited sample size or rely on subjective screening. (3) The time span of the past study is short or only targeted at a certain time period, resulting in the past study not thoroughly covering related research on this topic. (2) The research object is relatively concentrated on a specific and limited perspective, failing to reflect the current hot spot of ecological footprint research as a whole. In this point view our study main contribution and novelty is that we use R studio and Vos-viewer for all these limitations that previously many researchers used it, but we provide all data in the field of sustainability development and ecological footprint.

2. Literature Review

In this paper, EFF study discusses many footprint indicators that are used to demonstrate the demand and the effects of human activity on environmental systems and natural resources. It is important to note that EFF studies include both standalone environmental footprint indicators as well as integrated environmental footprint and footprint family indicators. The EFF investigations advanced with the initial introduction of the footprint calculation technique in 1996 Smardon (2022) despite the fact that the notion of the indicator ecological footprint had been suggested in 1992 (Bolson et al., 2022). Since then, several footprint indicators have been created, including water footprint (Tuyishimire et al., 2022), carbon footprint (Hata et al., 2022), and others. The footprint family, a flexible framework spanning a collection of footprint indicators, has recently been proposed to track environmental change and evaluate environmental sustainability (Gibin et al., 2022). Theoretical discoveries in the EFF sector have undeniably had a favourable impact on the topic category growth of environmental science and the horizontal enhancement of environmental monitoring. Although there are numerous publications concentrating on the applications and adaptations of indicators, few research focus on the footprint indicators using the bibliometric technique. For example, Zhang et al., (2022) used bibliometric analysis to illustrate the water footprint between 2006 and 2015, Yu et al. (2022) focused on water footprint research in China from 2003 to 2018, Sun et al. (2022) investigated worldwide carbon footprint research trends and hotspots. Campos et al. (2022) employed the bibliometric

and scient metric methods to examine the trend and state of environmental footprint research, particularly in the environmental footprint and life-cycle assessment research areas Liang et al. (2022) analyzed the international and Chinese literature on ecological footprint, focusing on discrepancies in research hotspots and frontiers. More crucially Wu et al. (2022) used a bibliometric study to offer a thorough summary of these top-cited papers in EFF. Although these publications investigated the knowledge base of this topic and its subfields, bibliometric study on the EFF field is still required to provide from a complete and diversified perspective in order to prevent subjectivity and one-sidedness (Tang et al., 2022). As a result, bibliometric analysis must be applied to the subject of EFF, including research on environmental footprints and footprint families, from a unified worldwide view point. Another side Rahman et al. (2022) argue the study's main goal is to investigate the asymmetric relationship between population health and foreign direct investment (FDI). The time period covered by the study is 1980 to 2020. An asymmetric association between foreign direct investment, government spending, trade openness, public debt, and population health is examined using the non-linear autoregressive distributed lag (NARDL) bound testing to co-integration approach. An asymmetric causality test was also employed in the study to look into the relationship between the measured variables and their causes. The results show that the variables influencing the occurrence of asymmetries are co-integrated. The study also discovered that investing in medical services for health care is crucial for improved outcomes in terms of profits from receiving government aid.

Numerous policy recommendations have been made because of the study's findings to increase Pakistani society's average life expectancy. Furthermore, to manage the negative effects of climate change and achieve sustainable development, it is crucial to meet the Sustainable Development Goals (SDGs). Target 13 of the 17 SDGs places a focus on accelerating urgent steps to counteract climate-related disruptions. This goal is also reliant on goal 7, which promotes expanding access to affordable sustainable energy alternatives. It is critical to reduce transportation-related CO2 emissions (TCO2), which grew by around 80% between 1990 and 2019. The Dynamic Ordinary Least Squares (DOLS) test, which mitigates endogeneity and serial correlation, found that Granger-caused TCO2 is mitigated as well as possible by the usage of renewable energy in transportation (Dai et al., 2023). Like Liu et al., (2022) said since renewable energy is more affordable and effective than conventional energy sources, it has gained appeal. Using data for the years 1991 to 2019, the study assesses the asymmetries in the relationship between bioenergy consumption and ecological footprint in the top ten bioenergy-consuming European countries. The results provide a solid foundation for comprehending the overall interdependent structure by analysing how the quantiles of bioenergy consumption affect the quantiles of ecological footprint in an asymmetrical manner. Another study Li et al. (2022) Examining the differing impact of institutional quality and other control variables on environmental sustainability in G7 economies is the study's main goal. The study used a nonlinear ARDL (NARDL) technique to analyses data from 1986 to 2020. The results support the G7 countries' asymmetric link between institutional quality, foreign direct investment, trade openness, economic growth, and

environmental sustainability. Moreover, Fatima et al. (2021) with a data set spanning the years 1995–2018, the study's objective was to evaluate the Environmental Kuznets Curve theory from an ecological footprint perspective. It is commonly known that anthropogenic human activities are the main reason why the environment is degrading. To do this, the current study is fitted in a multivariate framework utilizing autoregressive distributive lag methods on a quarterly frequency for the data set from 1995–2018.

3. Research Methodology

Earlier study has already used bibliometric analysis to aggregate prior evidence about research topics in management domains such as excessive industry (Caviggioli and Ughetto, 2019) environmentalism (Caviggioli and Ughetto, 2019; Bhatt et al., 2020). For this, following analyses were carried out: (1) keyword cartography analysis; (2) bibliometric authors' citation analysis; (3) bibliometric papers' co-citation analysis; (2) bibliometric references' co-citation analysis; (3) bibliometric journals' co-citation cartography; and (4) bibliometric references' co-citation analysis. VOS viewer was used for bibliometric analysis, and R Studio was used for content analysis.

Furthermore, using the VOS viewer software tool, the current study performed bibliographic coupling, citation and co-word analysis, and co-authorship analysis. VOS viewer is a dependable piece of software that can analyses bibliometric data and show the findings using advanced choices (Bascur et al., 2022). The current analysis used proportional numbering of bibliometric connections on VOS viewer to adjust for the bias caused by the number of co-authors in publications (Waltman et al., 2020).

3.1. Data Association and Cross-Section

The study of this research has produced the well-known theoretical search database Scopus, which qualifies learner to study about the wide-ranging overview of worldwide research output in a variety of study fields, including organization, Economics, commerce, backing, accounting, and more exactly the social sciences field. The Scopus database was used for this study because, when Scopus and Web of Science were compared, it was discovered that Scopus had more journal coverage than Web of Science (Mongeon & Paul-Hus, 2016). It was decided to use it to provide original data for this study as a result. When searching for publications on Ecological Footprint and Sustainability using Scopus, the term "Ecological Footprint" AND "Sustainability" was included in the title search. The search period spans from the years 2013 to 2022.

3.2. Bibliometric Mapping

The computer application VOS viewer may be used to create, examine, and study bibliometric maps. It clearly presents large bibliometric maps, with an emphasis on the map's graphical depiction. The VOS viewer may be used to investigate numerous linkages in bibliometric network data, such as co-authorship and citation links between academics, institutions, and nations. Bibliometric mapping is employed to look at the sector's structure and dynamics in order to gain important insights about Ecological Footprint.

3.3. Research Design

A statistical historical analysis of publications increasing in the field from 2013 to 2022 is undertaken to control the expansion of the research of ecological footprint and

sustainability. The subject of ecological footprint has been mentioned in business, management, economics, and accounting literature over time. As a consequence, we can identify important environmental trends and appreciate how the debate over ecological footprint evolved over the course of ten years. This is accomplished with the aid of R Studio and the scientific mapping tool VOS viewer. Because this tool allows for the completion of several analyses, clustering and visualization methodologies are combined.

Table 1: Main Information

Description & Result	Results
Timespan	2013:2022
Sources (Journals, Books, etc.)	326
Documents	427
Annual Growth Rate %	7.98%
Document Average Age	8.17
Average citations per doc	13.13
References	18299
DOCUMENT CONTENTS	
Keywords Plus (ID)	597
Author's Keywords (DE)	223
AUTHORS	
Authors	181
Authors of single-authored docs	3
AUTHORS COLLABORATION	
Single-authored docs	7
Co-Authors per Doc	4.78
International co-authorships %	59.7
DOCUMENT TYPES	
Article	61
Conference paper	3
Review 2	2
Short survey	1

In table 1, we utilized the usual full counting approach to generate bibliometric networks. We employ a number of methodologies and five critical processes to examine the references. and this mapping procedure was given a name (Aria, 2017 #76).

3.4. Data analysis with substantial results

### 3.4.1 Authors Co-Citation Study

First of all, look at Table 2 we take most productive authors who has multiple contributions in different field of the economy. For this we show articles and their fractionalization and then citation. Furthermore, we also give ranking according to their articles and citations. In Figure 1 and Table 2, shows top twenty foremost authors in the field of ecological footprint. A detailed assessment presented in Table 2 expose that most productive authors are GALLI A with 17 published articles and its articles

fractionalization is 4.01 with citation of 293 and then it followed by LIN D, WACKERNAGEL M, WITH 10 articles and 91 ,229 citation publication LEE Y-J and WOOD R with 8 published articles with 54, 94 citations respectively. GILJUM S also has an important contribution towards publication with articles followed by 83 citations.

Table 2: Descriptive analyses, topmost Authors Co-citation

Ranking	Authors	Articles	Articles Fractionalized	Citation
1	GALLI A	17	4.01	293
2	LIN D	10	1.56	91
3	WACKERNAGEL M	10	2.20	229
4	LEE Y-J	8	6.17	54
5	WOOD R	8	1.99	94
6	BITTANTE G	7	2.54	48
7	DESTEK MA	7	3.67	24
8	GILJUM S	7	1.73	83
9	IHA K	7	1.07	68
10	SARKODIE SA	7	3.00	39
11	BASTIANNI S	6	1.72	48
12	BORUCKE M	6	1.34	49
13	KITZES J	6	2.53	52
14	LAZARIS C	6	3.22	57
15	CRANSTON G	6	1.26	50
16	TAKKER A	5	1.89	51
17	SHAHBAZ M	5	1.77	48
18	SINHA A	5	3.53	31
19	MOORE D	4	2.88	28
20	HALLE M	4	1.45	26

Table 2 represents the descriptive analysis which shows topmost authors co-citations of top authors.
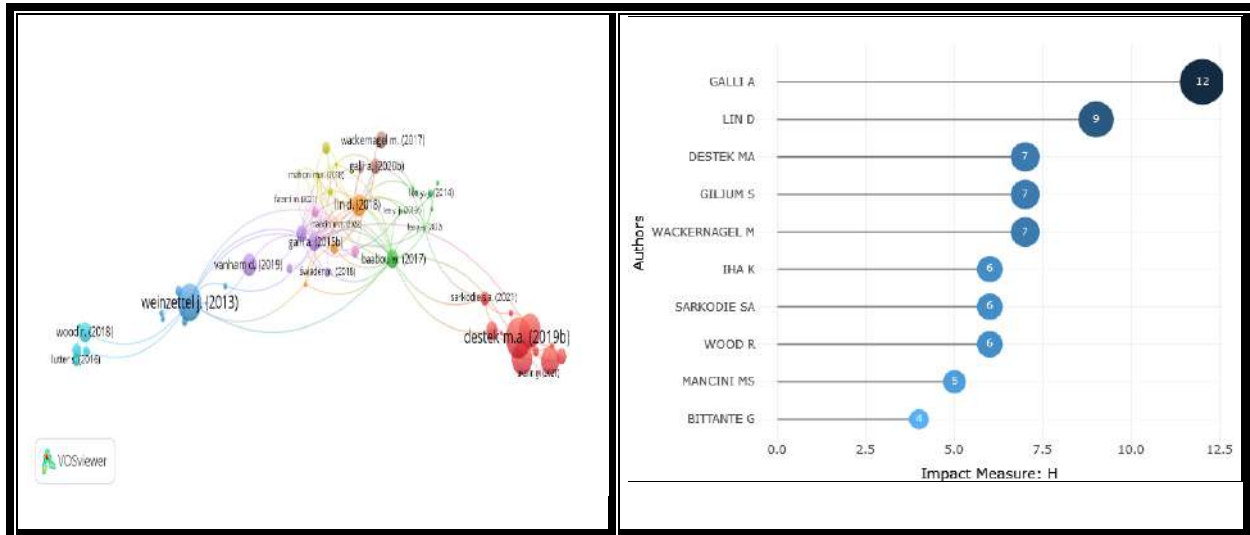

Figure 1: Top Twenty Authors

Figure 1 represents top twenty authors in the field of ecological footprints. It also presents the most dynamic authors in Vos viewer.

3.5. Descriptive Analyses by Years

Table 3: Descriptive Analyses by Years

Year	Number	Mean TC Per Year
2013	2	24.22
2014	3	4.54
2015	3	7.33
2016	1	7.83
2017	6	12.07
2018	14	12.98
2019	8	42.92
2020	13	23.81
2021	12	12.67
2022	3	0

In table 3 represents the descriptive analysis which shows top most years and their mean TC per year. Which is particularly shows for the year from 2013 to 2022.
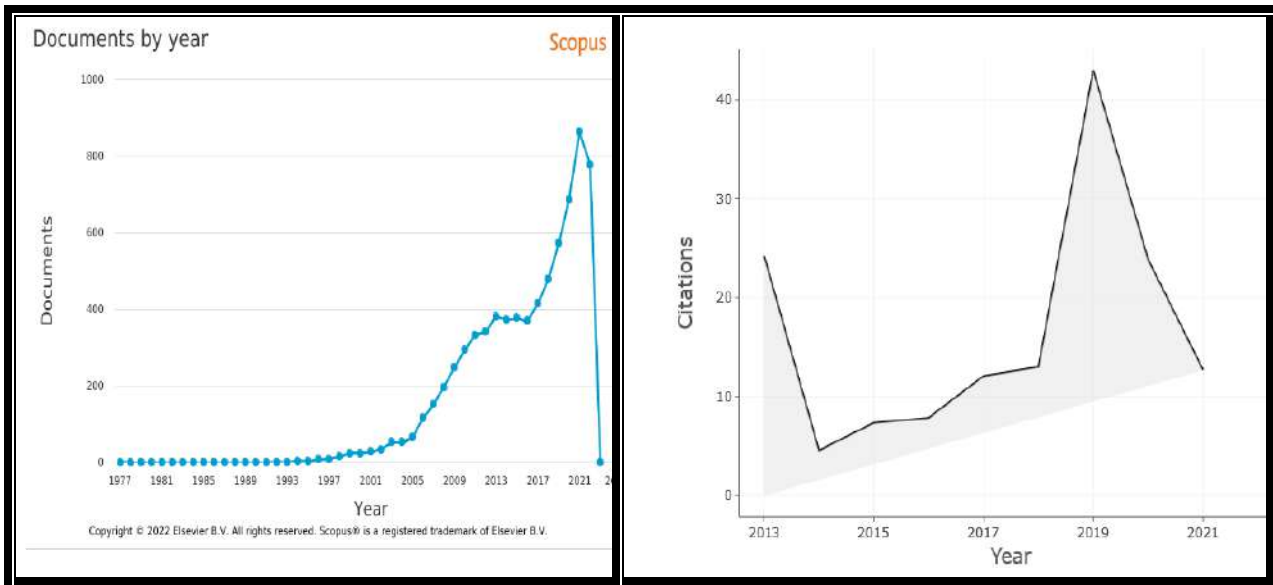
Figure 2: Annual Evolution in Ecological Footprint

Figure 2 shows the ups and downs of the annual evolution in ecological footprint which shows their articles and citations trending and has a significant increase can be seeing after 2018. In late 2000 a very few articles were available because of lack of resources and technology which clearly shows decreasing situation in this era. Figure 2 shows citations which were more flexible and of citation year especially during 2005 to 2021 and then after 2015 whereas it also shows increasing with steady and slow speed because with the passage of time more researchers are engaged in the ecological footprint to investigate that why environment effects with the changes of ecological footprint. Furthermore, in this study we take 10 years' data from 2013 to 2022 to identify the main

reason of ecological footprint. So, its descriptive analysis gives us the variations between the years that when authors published articles and give its citations.

Table 4: Descriptive Analyses Top Most Countries Articles

Country	TC	AAC	Frequency
NORWAY	1034	114.89	30
TURKEY	683	170.75	76
AUSTRALIA	483	162	8
SWITZERLND	360	36	34
ITALY	189	23	52
USA	141	141	48
NETHERLAND	122	40	15
POLAND	74	37	6
AUSTRIA	60	30	19
UNITED KINGDOM	57	19	8

In this Table 4 we have the data of most countries articles and we take data from Scopus data source and after that we run this data on R studio software and it shows that results of different countries have different number of articles on ecological footprint the economy. As we see in the table NORWAY is on top with 1034 citation articles along with AAC 114.89 and its frequency would be 30 after that it followed by TURKEY which have 683 citation articles and ecological footprint its AAC 170.75a well with the frequency of 76. SWITZERLAND also have a significant result in publishing the articles with 360 citation and AAC 36 its frequency shows 0.044. Moreover, we have a lot of countries results but we take only top most countries who's contributing on publishing article were there.
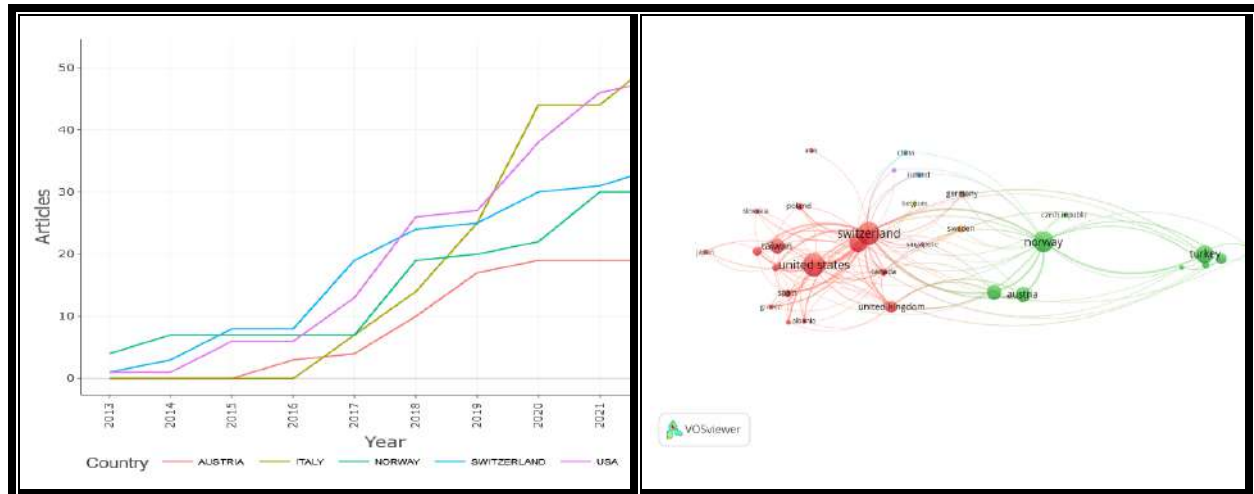
Figure 3: Articles Published Country

The Figure 3 shows the results very efficiently like in figure 4 shows 2 colours sharing with TC & AAC and we take number of documents on X axis and Countries on Y axis. In figure 3 also shows different styles of countries publishing articles as we seen

in this graph it shows multiple waves and its connectivity with different countries and it, we make it on Vos viewer and figure 4 make it on Bibliophagy.

Table 5: Descriptive Analyses topmost Authors Local Citations

Authors	Local Citation
LEE Y-J	33
SARKODIE SA	22
CHAI L	20
WACKERNAGEL M	20
WU P-S	20
AKALIN G	19
ERDOGAN	19
GALLI A	19
LIND D	19
BITTANE G	17

Table 5 shows descriptive analyses on most top authors with local citations before that we study most citation on different country's authors as we see in this table LEE Y-J on top with 33 local citations this author already has many published articles but its citation on ecological footprint were very significant after that SARKODIE SA also have 22 local citations CHAI L 20. And WACKERNAGEL M have combined citations on different articles as well all three have 19 local citations.


Figure 4: Authors Published Country Wise

Table 6 where descriptive analyses on topmost relevant affiliation of articles among the ecological footprint research, the leading organization is the NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY with 13 articles, followed by UNIVERSITY OF PADOVA with 13 articles and CHANG-HUA INSTITUTION FOR ECONOMIC RESEARCH with 12 articles each and VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS (WU) with 11 articles. A further look at the number of citations and authors shows in previous tables where these institutions have significant connectivity with each other.

Table 6: Descriptive analyses topmost Relevant Affiliation of Articles

Affiliation	Articles
Norwegian University of Science and Technology	13
University Of Padova	13
Chang-Hua Institution for Economic Research	12
Vienna University of Economics and Business (Wu)	11
Joint Research Centre (Jrc)	10
Wroclaw University of Environmental and Life Sciences	8
University Of Siena	7
Gaziantep University	6
Nord University Business School (Hhn)	5
University Of Aveiro	5
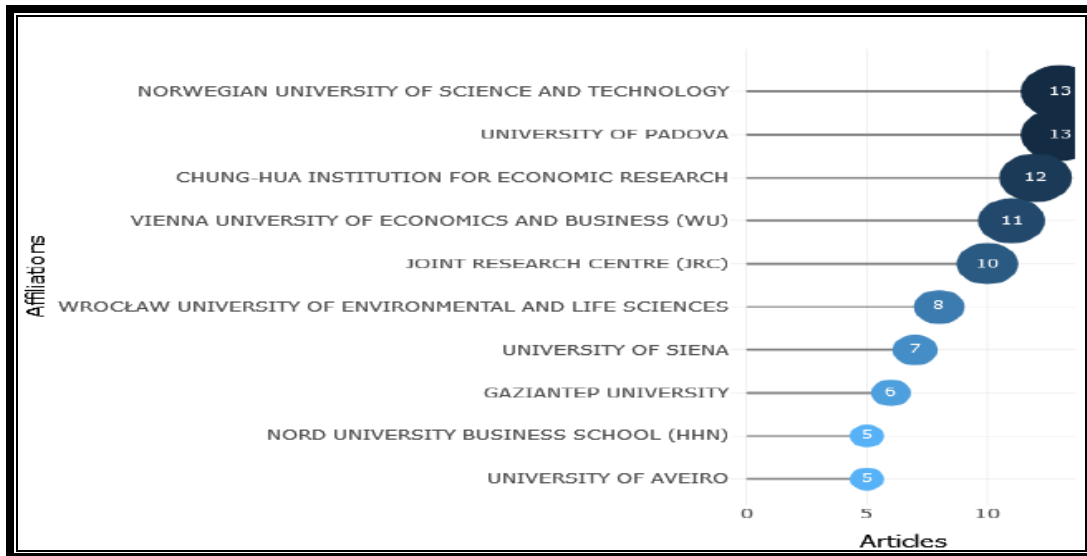
Figure 5: Articles with highest Affiliations

Figure 5 shows that intuitions name on left side and on right side circle shows number of article where NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY is top of the list and UNIVERSITY OF AVEIRO is least with 5 articles.

Table 7 displays descriptive analyses of the top keyword co-occurrences in order to categorize the research on the effects of ecological footprint and its front-line research through time. It is essential and crucial that authors assign the key words their frequency of recurrence in publications is evidenced by the co-occurrence of keywords.

Figure 6 provide a generalized overall outlook of keyword co-occurrence analysis. While using the software R studio, Fig.6 denotes a cumulative cooccurrence, and shows Vos viewer connectivity. A visual graph that displays the symmetry of 15 the existence of a specific word is called a document of keyword co-occurrence, also known as a giant wire connection between each other. In the grid, the word with the higher frequency also appears more frequently, and vice versa. The sudden increase in keyword usage reveals new research trends. The time-zone visualization graph in Figures 6 illustrates the time-

zone interpretation of the keyword co-occurrence on the shock to the oil price. Oil price research's key themes are represented by the size of nodes across different time axes.

Table 7: Descriptive Analyses topmost Co-Occurrence with Keywords

| Key Words	Occurrences
ecological footprint	48
sustainable development	25
environmental impact	21
article	17
carbon footprint	14
ecology	14
climate change	11
economic development	11
environmental economics	11
human	11
agriculture	10
biodiversity	10
cheese	10
diet	10
sustainability	10
environmental protection	9
female	9
input-output analysis	9
milk	9
environmental sustainability	8
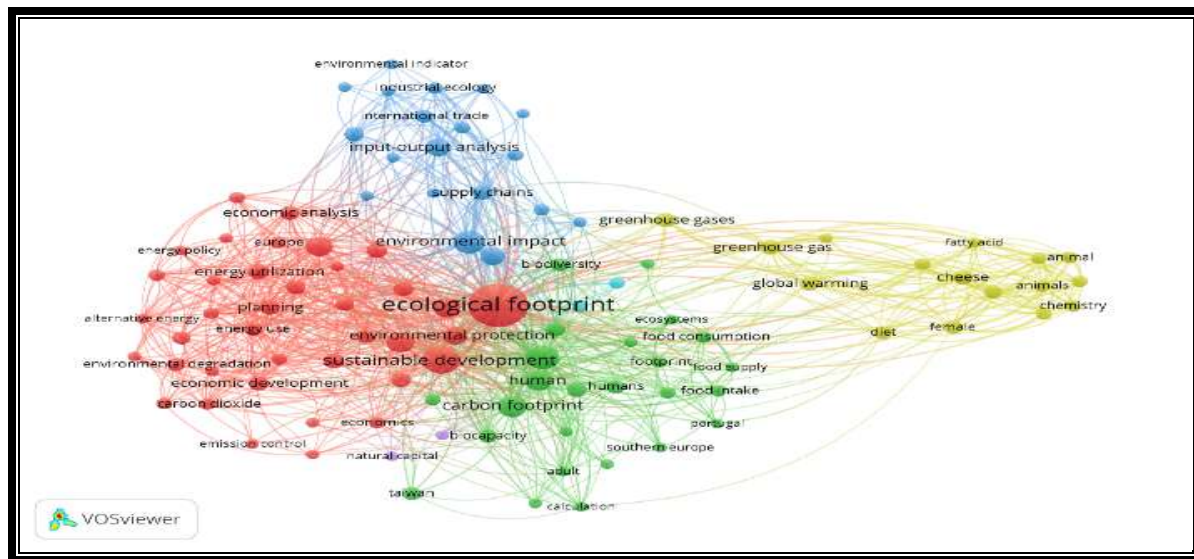
Figure 6: Top Local Cited Authors

Table 8: Descriptive Analyses topmost Impactful Words Trending

Words	Occurrences
Ecological Footprint	48
Sustainable	25
Development	25
Environmental Impact	21
Article	17
Carbon Footprint	14
Climate Change	11
Economic Development	11
Environmental Economics	11
Human	11

Table 8 have analysis of most impactful co words trending which are used in ecological footprint with 48 words on top with along with sustainable word 286 occurrence frequency then development have 25 occurrences.
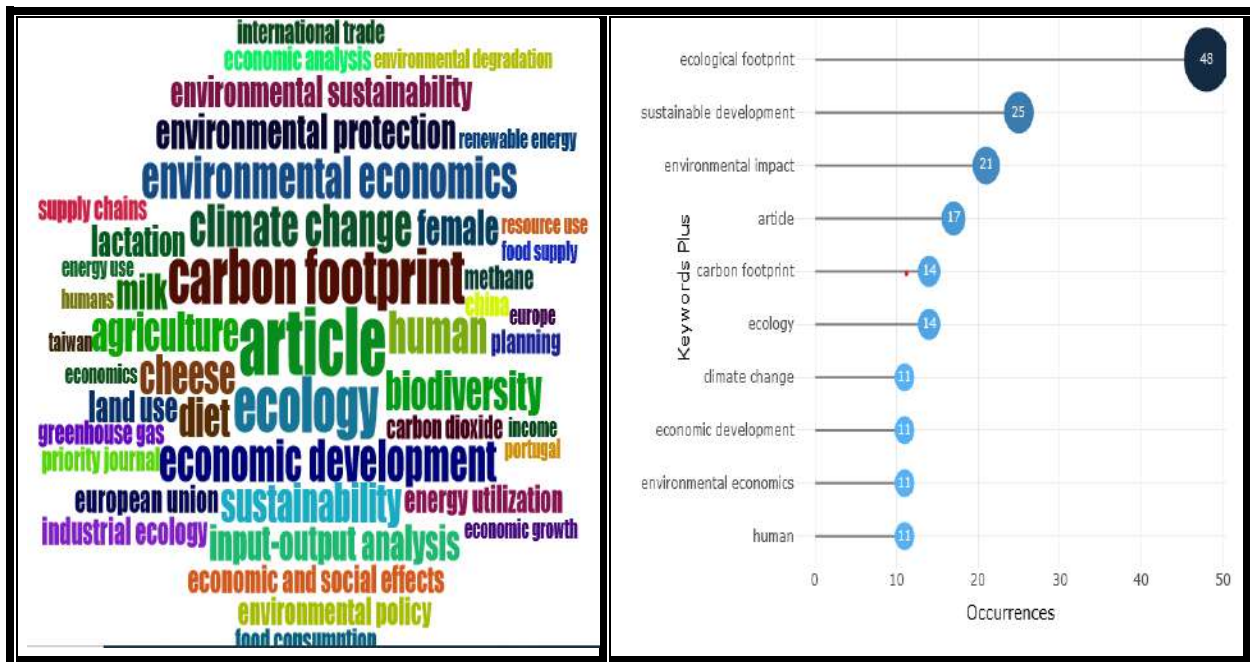

Figure 7: Word Cloud

Countries have a very significant results in this like all these terms have created a word cloud in above mentioned figure 7. The basic objective of the co-word analysis is to create attraction between conceptual structure and co-occurrence network. In figure 7 shows a very strong and colourful picture of the co word analysis in descriptive method it contains different colours word most prominent would be "Carbon footprint" "climate change" and "economic development" etc. while on other side figure 7 show R studio creation of co-occurrence of keyword analysis as well.

Table 9: Word Tree Map

Words	Occurrences
Ecological Footprint	48
Sustainable	25
Development	25
Environmental Impact	21
Article	17
Carbon Footprint	14
Climate Change	11
Economic Development	11
Environmental Economics	11
Human	11

The word tree map in Table 9. in R studio is displayed. It is a highly distinctive and varied data set that provides a variety of information about our data and displays various frequencies and their percentage contributions.
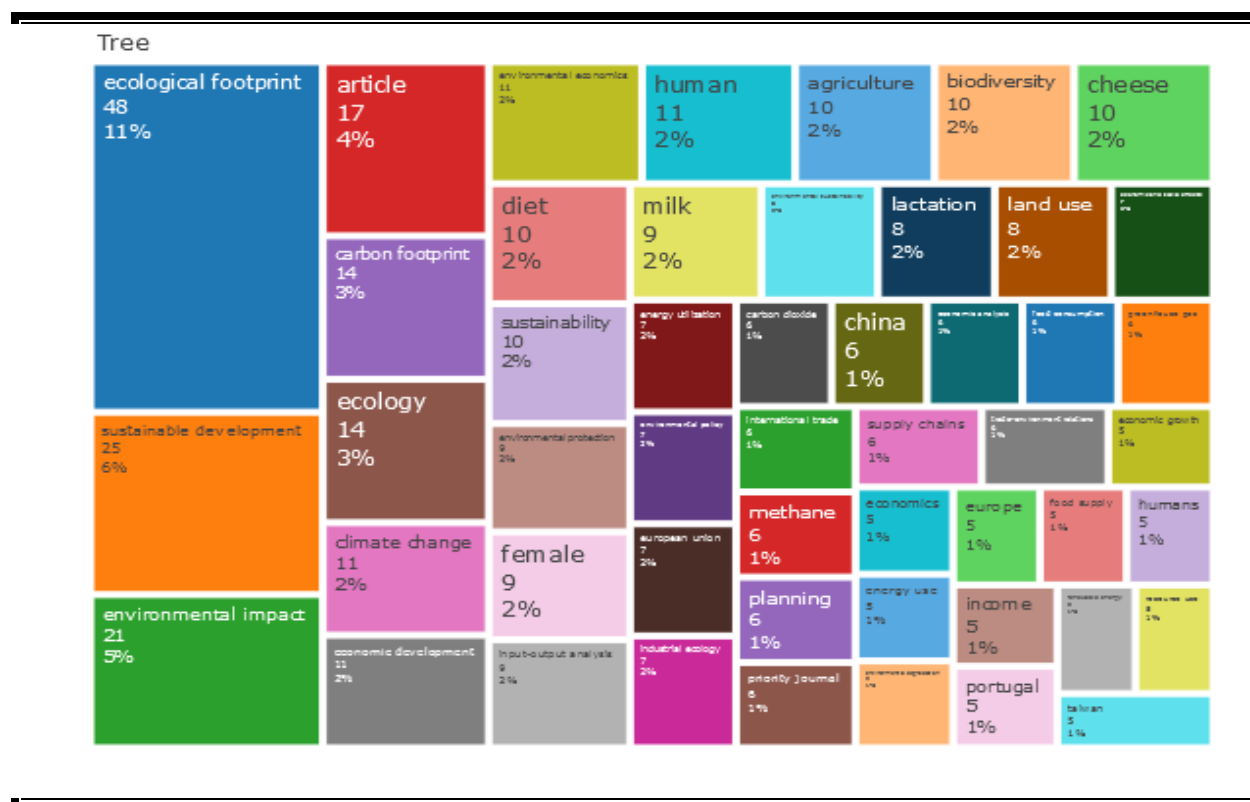
Figure 8: Word Tree Map

The word tree map in R studio is displayed in Figure 8. It is a highly distinctive and varied data set that provides a variety of information about our data and displays various frequencies and their percentage contributions. Tree map analysis is crucial to locating the fascinating study topics and locating gaps in the discussion of ecological

footprint research since researchers frequently enter multiple keywords. The data, which is shown in Figure 8 as layered rectangles using a tree map, reveals the major terms that were used in the articles. An arrangement of data sets from ecological footprint study that include naturally occurring word groupings is shown. The size dimension and colour scheme serve to illustrate relevance and association. The tree map emphasizes the grouping of potential terms that refer to ecological footprint.

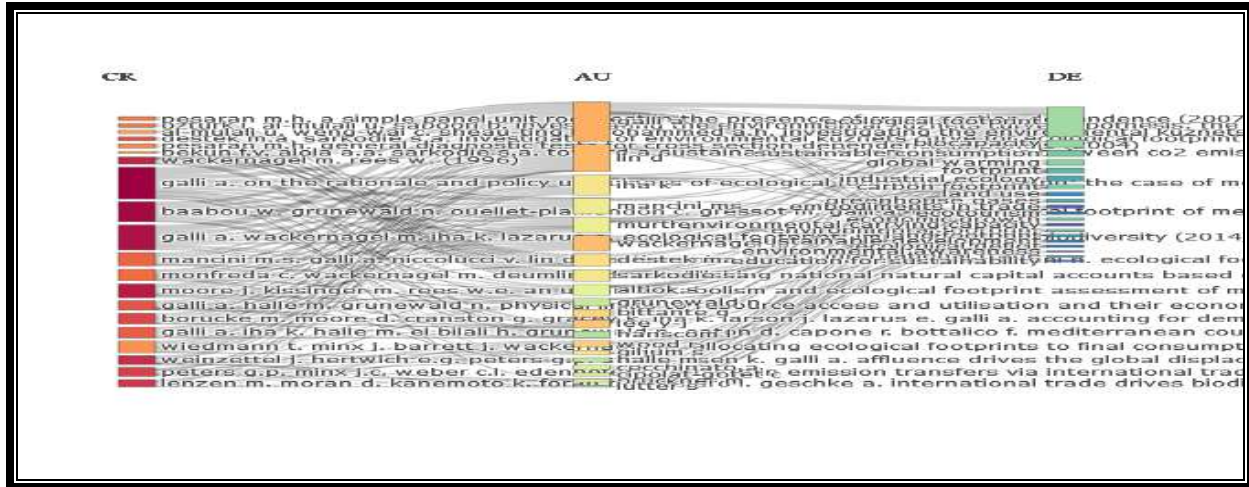**3.6. Three Field Plots**

**Figure 9: Three Field Plots**

In figure 9, we used a three-field plot, also known as the Sankey diagram (middle), to assess the relationship between the source on the (left side), keywords on the (right side), and nations on the (middle). The flow trend between two or more entities is depicted by the three-field graphic. The boxes and arrow widths in a three-field plot are proportionate to the associated quantities and numbers. (Soundararajan, et al. 2014) The three-field layout best illustrates the topic identified using the keyword. The largest indicators that many journals and nations use terms like "ecological footprints," "sustainability," and "economic growth" in their publications are the edge widths leading from these keywords, as seen in Fig 9. Additionally, compared to other journals, sources including the Journal of Corporate Finance, Journal of Financial Economic Policy, Sustainability (Switzerland), World Development, and Rand Journal of Economics have utilized substantially more terms.

We used word co-occurrence to express the conceptual structure of the framework in table 10, which is the most significant part of this essay because conceptual structure is a key feature of the bibliography. Using a conceptual structure map made using a dimensionality reduction method, we conducted a multiple correspondence analysis (MCA) on the keywords (Demiroz & Haase 2019). Different types of mapping can be shaped using the conceptual framework, but in this paper, two basic approaches—the networking method and the factorial approach—were chosen.

Table 10: Conceptual Structure

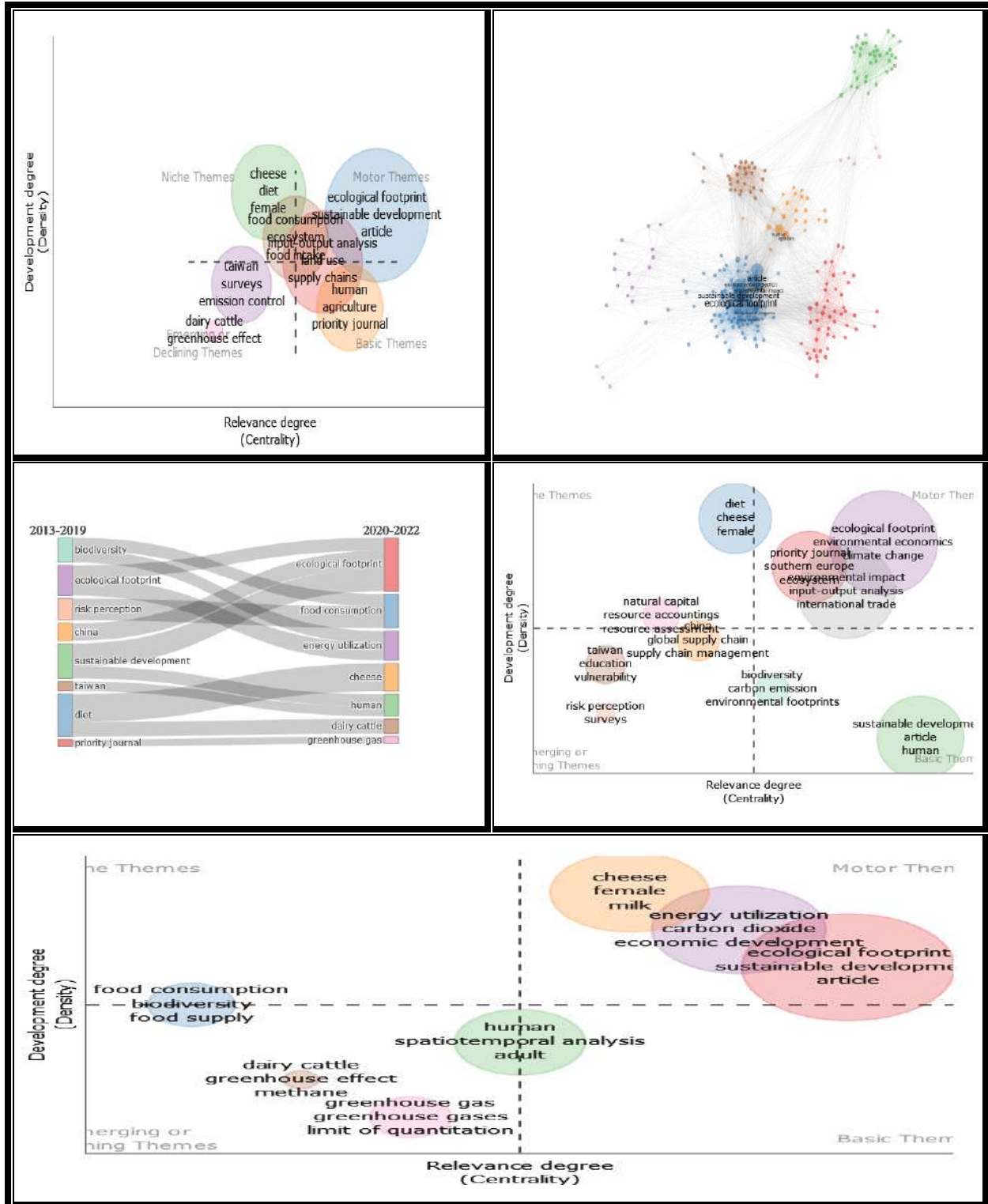| Node	Cluster	Between	Closeness	PageRank
Wood R	1	43.066	0.011	0.034
Giljum S	1	2.85	0.011	0.029
Destek Ma	2	0	0.125	0.018
Sarkodia Sa	2	8	0.2	0.045
Galli A	3	271.314	0.021	0.065
Lin D	3	44.756	0.017	0.052
Bittante G	4	3.623	0.166	0.032
Cecchinato	4	0	0.11	0.014
Lee Y-J	5	0	0.125	0.012
Albrecht G	6	0	0.11	0.012

3.7. Networking Approach
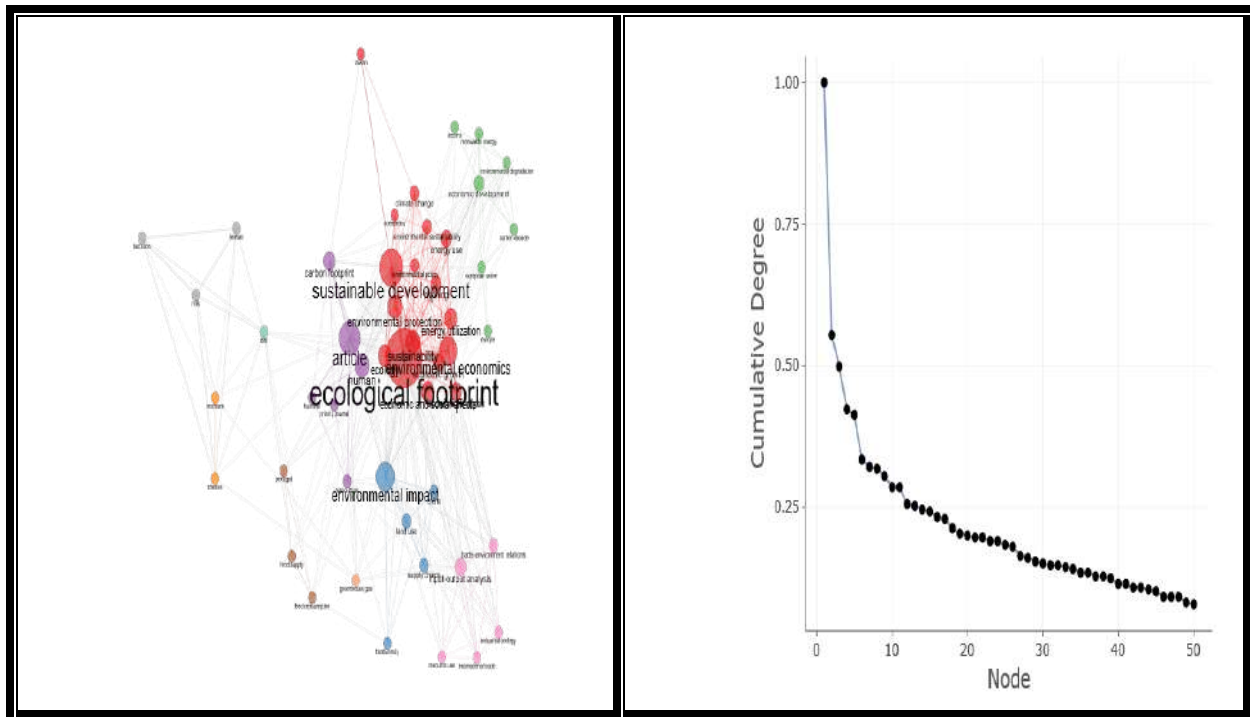
Figure 10: Networking

As shown in Figure 10, we apply Co-occurrence, Thematic Map, and Thematic Evolution in this conceptual structure approach. This type of structure aids in identifying the primary networking of author publications and their citations in above figure, which

displays data from 1990 to 2016 on the left and from 2017 to 2022 on the right, followed by the findings of the mapping network.
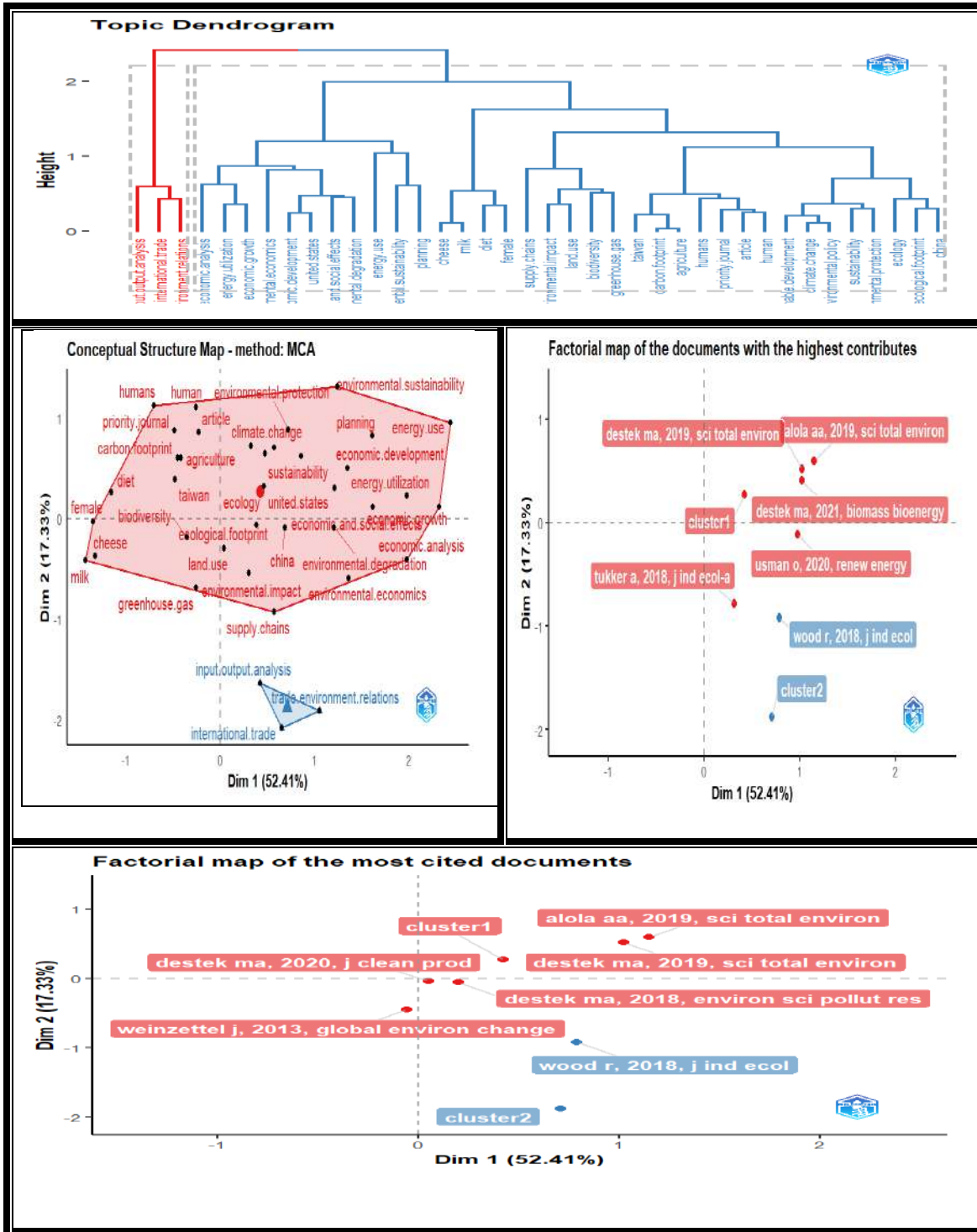
3.8. Factorial Analysis

Figure 11: Factorial Analysis

In figure 11, we use the most significant portion of this conceptual structure study in this factorial technique because it provides us with word mapping, Topic dendrograms, and most contributing papers. A factorial technique is presented in figures 11. The results are evaluated based on the distribution of the facts along the dimensions and their relative placements; the closer the distribution of the words is represented on the map, the more similar it is (Aria & Cuccurullo, 2017).
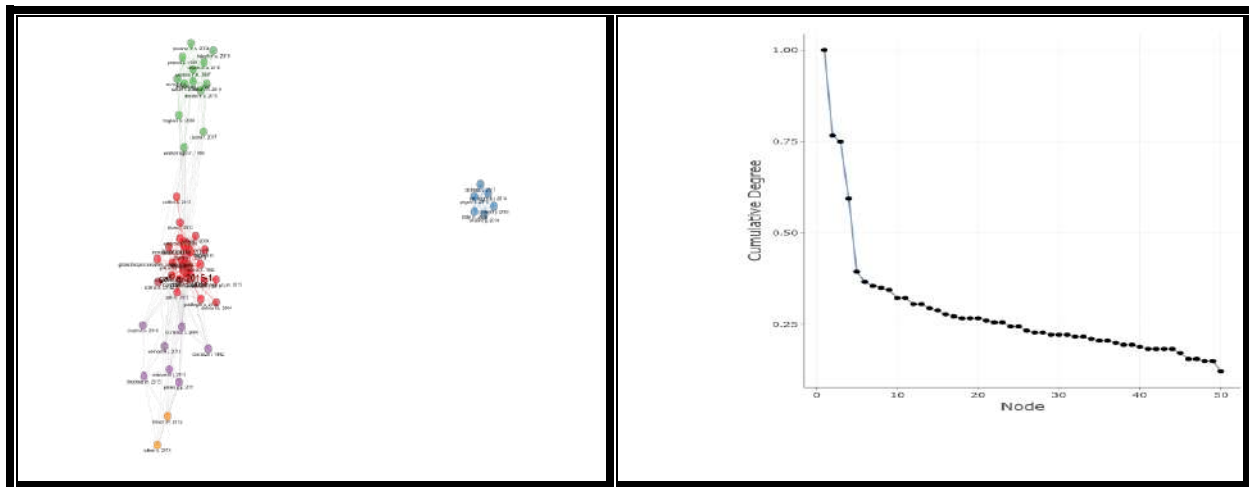
3.9. Intellectual Structure

Table 11 shows different authors in the intellectual structure where cluster, Betweenness, closeness, and page rank shows about the contribution of authors in ecological footprint.

Table 11: Co Citation Network and Hectograph

Node	Cluster	Between	Closeness	PageRank
WOOD R	1	43.066	0.011	0.034
GILJUM S	1	2.85	0.011	0.029
DESTEK MA	2	0	0.125	0.018
SARKODIA SA	2	8	0.2	0.045
GALLI A	3	271.314	0.021	0.065
LIN D	3	44.756	0.017	0.052
BITTANTE G	4	3.623	0.166	0.032
CECCHINATO	4	0	0.11	0.014
LEE Y-J	5	0	0.125	0.012
ALBRECHT G	6	0	0.11	0.012

In figure 12, the intellectual structure also has two kinds one is co-citation and the other one is historiography both we are shown in the figure. It represents degree plot graph of intellectual structure which shows negative slope curve and also shows connectivity mapping where different authors co citation mapping is given.
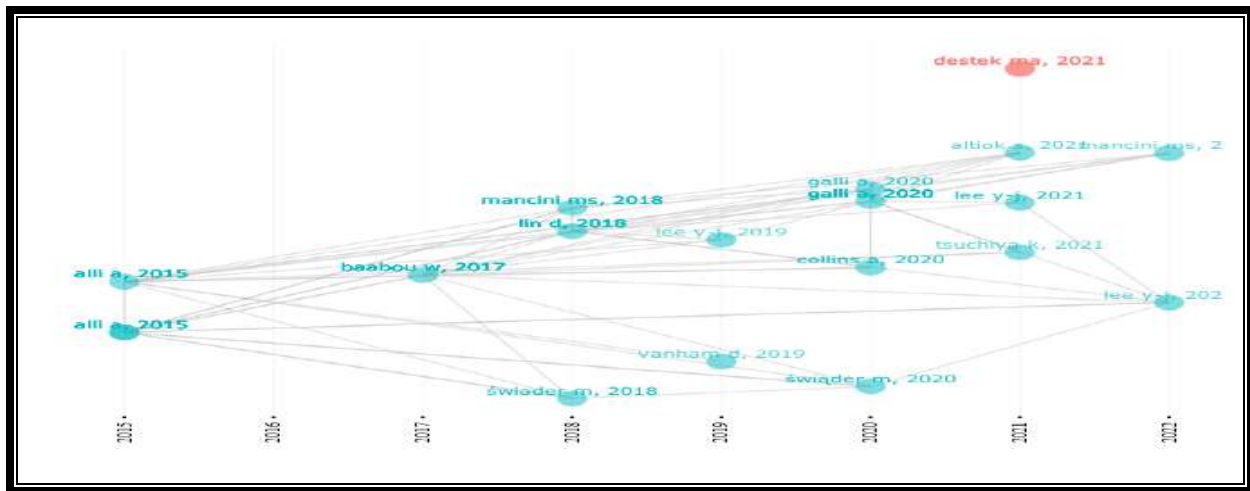
Figure 12: Intellectual Structure

3.10. Social Structure

Table 12: Social Structure Collaboration Network

Node	Cluster	Between	Closeness	PageRank
WOOD R	1	43.066	0.011	0.034
GILJUM S	1	2.85	0.011	0.029
DESTEK MA	2	0	0.125	0.018
SARKODIA SA	2	8	0.2	0.045
GALLI A	3	271.314	0.021	0.065
LIN D	3	44.756	0.017	0.052
BITTANTE G	4	3.623	0.166	0.032
CECCHINATO	4	0	0.11	0.014
LEE Y-J	5	0	0.125	0.012
ALBRECHT G	6	0	0.11	0.012

Table 12 represents social structure mapping in which we take node where WOOD R and GILJUM S were most important author followed by 1 cluster after that Betweenness 43.066 ,2.85 and closeness shows 0.11 respectively. Furthermore, DESTEK MA and SARKODIA SA has significant cluster 2.

Figure 13 shows connectivity of different authors with their published documents. Table 13 depicts a second type of social structure collaboration world map in which we take data from Biblioshiny where we have a lot of countries data and their frequencies, but we take the most important collaboration between countries first we take USA & SWITZERLAND followed by frequency of 9 both countries have many collaborations world mapping network then AUSTRIA & NETHERLAND or ITALY and SWITZERLAND also have strong frequency with 5. NORWAY and NETHERLAND have 4 frequencies. Furthermore, the United States and the United Kingdom have 3 frequencies. NETHERLAND OR POLAND have 2 frequencies. Furthermore, in Figure 14, we use graphs from R studio and VOS viewer to highlight the extent of connectedness between nations.
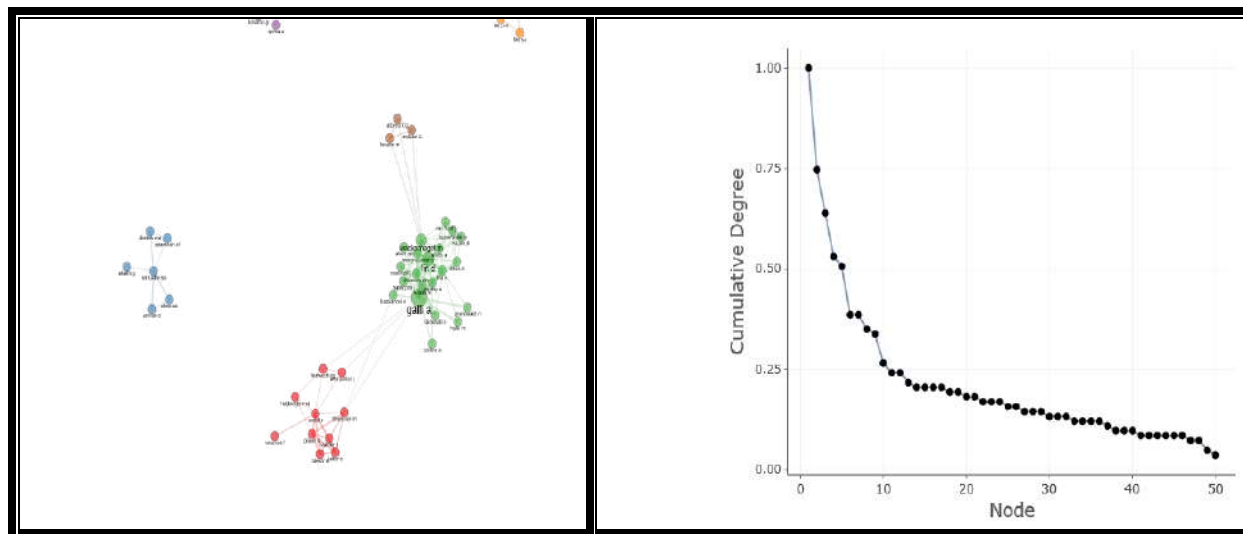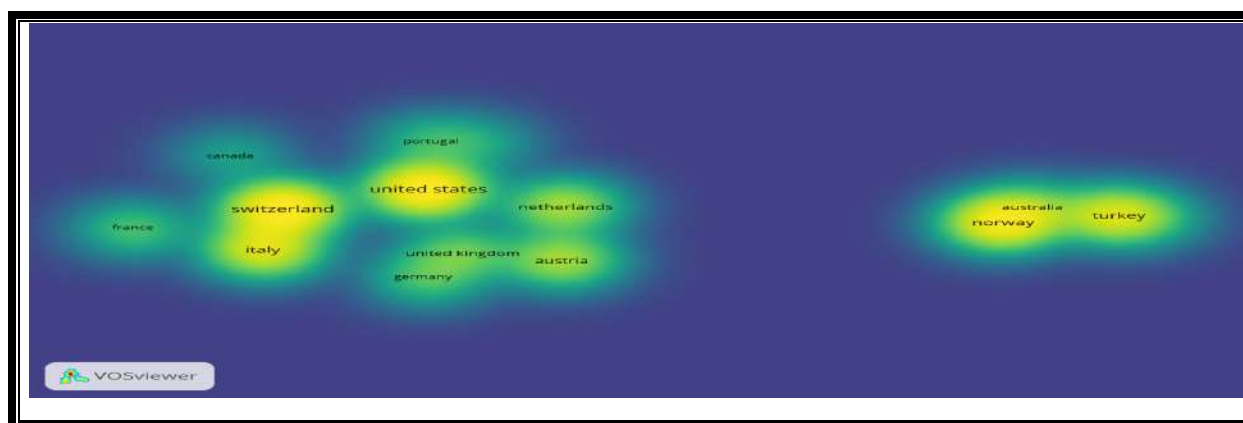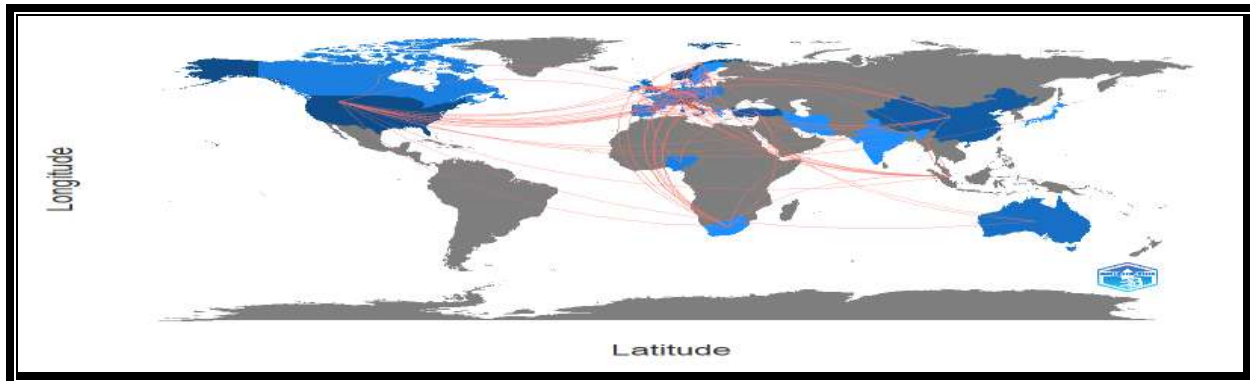
Figure 13: Social Structural

Table 13. Social Structural: Collaboration World Map

From	To	Frequency
USA	Switzerland	9
Austria	Netherland	5
Italy	Switzerland	5
Norway	Netherland	4
Usa	Uk	3
Austria	Uk	2
Nether	Poland	2
Italy	Usa	2
China	Ireland	1
Albania	Croatia	1

Figure 14: World Map

4. Suggestions and Policy Implications

The ecological footprint is currently a hot topic in a variety of social and scientific domains and industries. It has aroused the interest and consideration of international organizations, academics, practitioners, and world governments. This study examined the advancement and trends in global ecological footprint studies between 2013 and 2022. Sixty-five publications that were collected from the Scopus database underwent bibliometric analysis. We identified and addressed the patterns in publication, regional distribution, journals, organizations, funding sources, authors, highly cited papers, and major research areas. The fact that more articles were released each year during this time, especially after 2018, shows that ecological security research is gaining ground. This outcome highlights how crucial international governmental policy is to the ecological environment. In order to help academics, business professionals, and politicians better choose study topics and find appropriate research partners, this article offers critical insights and potential research directions for ecological security research.

5. Conclusion

To establish the journal's contributions to the literature on sustainability, to identify the fundamental thoughts and concepts relevant to this area, and to offer suggestions for future research, this study examined previously published publications in ecological footprints and Sustainability development. The most productive authors, along with their respective organizations and nations, were selected by using a number of bibliometric and content studies. The report also suggested four main areas for further research: (1) environmental sustainability, (2) urban sustainability, (3) environment, and (4) climate change. In addition, both theoretical and practical implications flow from this research. The most relevant topics are listed together with an outline of the development of the literature on sustainability in journals. Furthermore, it aids scholars in understanding the most current issues, as well as the most widely used sources on sustainability. Third, the results of this study can be used by sustainability experts to identify the areas where they should concentrate their future research efforts. For instance, they can examine multiple sustainability-related concerns to guarantee sustainable development. Additionally, the majority of earlier studies in the field of ecological footprints and sustainability development focused only on how environmental and social sustainability affected financial performance, whereas the economic climate is

constantly changing. It is crucial that researchers continue to advance their research to better understand the crucial role that ecological footprints and sustainability development and social practices play in enhancing economic performance. This study examines a bibliometric analysis to adjust the present knowledge from 761 publications related to ecological footprint from this period, covering 33 countries, 31 source, 150 institutions, 585 funding agencies, and 172 authors between 2013 and 2022. This research evaluated citation restraints and co-Authorship networks to acknowledge contributions from select authors, organizations, and countries. Next, a co-citation breakdown of the prior literature identified four major thematic areas: ecological footprint, sustainability, climate change, the carbon footprint, and development'. For this, this study uses R studio productive techniques which include two types of methods first descriptive analysis like documents, and authors. Overview while another type contains structural analysis. The statistical software tool R package and VOS viewer are used to do all of these operations. The findings show that ecological footprint is a key tool for long-term environment development. This Study offers policy recommendations for creating long-term good governance that will assist national economic development.

6. Limitations

There are still limitations despite the large number of data sources included in this study, which can be used to summarize the research characteristics and trends of ecological footprint. First off, a clearer theme structure can be formed using the theme-based search strategy, which can gather a lot of data. However, this study did not entail a thorough interpretation of each cluster or research path in the analytic process due to the macroscopic perspective of the analysis. This study's knowledge map and bibliometric-based analysis can be utilized as one of the techniques for literature reviews for ecological footprint investigations, serving as a guide for next research. Another is that this study comprises a balanced interpretation of different views because the current research on ecological footprint has established a more systematic, diverse, and interdisciplinary research trend. Although this way of interpretation is not exhaustive, it can offer a fresh viewpoint. Moreover, this study has utilized only Scopus based research articles, in future researchers can extend their study by adding web of science data base. This study has seen the relationship of ecological footprint and sustainability only which can be extend by adding more phenomenon There are still gaps that need to be filled in by additional research.

7. Future Directions

This subject will be extremely relevant for future research due to national internal policies that support sustainable development goals and reduce ecological footprints, pollution, and social inequities. More databases could be used in future studies to study trends in the sustainability industry. This analysis only included publications that discussed ecological footprints and sustainable development. Despite these shortcomings, this study provides a useful overview of the most recent sustainability literature.

Ethical Consideration

The authors declare that this submission follows the policies of AJSS as outlined in the Guide for Authors and in the Ethical Statement. Full consent was obtained from the participants prior to the study and all procedures were carried out in accordance with approved ethical standards.

Informed Consent

A fully informed, considered, and freely given decision about whether or not to participate in the study, without the exercise of any pressure or coercion was taken from the respondents.

Declaration of Interest Statement

The authors declare that we have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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