PressAcademia
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RJBM
ISSN 2148-6689
Research Journal of Business and Management YEAR 2023 VOLUME 10 ISSUE 4

A BIBLIOMETRIC ANALYSIS AND REVIEW OF GREEN TRANSFORMATION

DOI: 10.17261/Pressacademia.2023.1831
RJBM- V.10-ISS.4-2023(1)-p.152-159

Fulya Tasel[1], Ebru Beyza Bayarcelik[2]
[1]Maltepe University, International Trade & Logistics Department, Istanbul, Türkiye.
fulyatasel@maltepe.edu.tr , ORCID: 0000-0001-6959-5776
[2]Maltepe University, International Trade & Logistics Department, Istanbul, Türkiye.
ebrubeyzabayarcelik@maltepe.edu.tr , ORCID: 0000-0003-4886-5719

Date Received: July 29, 2023 **Date Accepted:** November 22, 2023

To cite this document
Tasel, F., Bayarcelik, E.E., (2023). A bibliometric analysis and review of green transformation. Journal of Business and Management (RJBM), 10(4), 152-159.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2023.1831

ABSTRACT

Purpose- The urgent need for environmental sustainability has propelled the world towards a paradigm shift known as the "green transformation". This transformative process aims to reconcile economic development with ecological balance by adopting a holistic approach towards sustainability. At its core, the green transformation revolves around the concept of a "green economy," wherein the production and consumption patterns are aligned with principles of environmental responsibility, resource efficiency, and social equity. Key elements of green transformation examine the various sectors that are undergoing significant changes, such as energy, transportation, agriculture, and urban planning, all driven by the goal of minimizing carbon emissions and ecological footprints. The green transformation seeks to decouple economic growth from environmental degradation by promoting renewable energy sources, implementing circular economy practices, and adopting clean technologies.

Methodology- This study employed a bibliometric analysis to examine the existing literature on the investigation and application of green transformation. A total of 905 publications from Scopus and 645 publications from Web of Science databases is analysed.

Findings- The findings revealed that interest in the concept of green transformation has grown significantly in academia, both in terms of volume and across various disciplines. Moreover, future research in the field of green transformation is expected to build upon current knowledge regarding technology and sustainability while exploring new frontiers, such as the impact of green transformation in digitalized environments.

Conclusion- By employing cutting-edge technologies to delve into current research, this study offers valuable insights to comprehensively grasp recent findings on green transformation**.** It is important to note that the review's inclusiveness and comprehensiveness were constrained by the size of the selected literature.

Keywords: Green transformation, bibliometric analysis, Web of Science, Scopus, VOSviewer
JEL Codes: Q50, Q55, Q56

1. INTRODUCTION

The series of crises, including economic, social and natural, have highlighted immediate and substantive structural changes in global economies. Changes in this crisis include the crucial concept of green transformation, which aims to modernize and increase the competitiveness of national economies while minimizing environmental impact. This transformation encompasses diverse aspects, ranging from the efficient utilization of natural resources to the advancement of environmentally friendly technologies (Cheba, Bak, Szopik-Depczynska, & Ioppolo, 2022).

The emergence of “green transformation” literature can be contextualized as a reflection of the growing recognition and concern for global environmental challenges, notably climate change and the depletion of biodiversity (Amundsen & Hermansen, 2021). The green transformation is a protracted process closely linked to proactive environmental protection policies. These policies not only stimulate the desire for innovative, eco-friendly products, services and technologies but also shape the evolving societal mindset towards sustainability over time.

In the second and third industrialization revolution, economic growth especially relied heavily on the production and consumption of natural resources without thinking limitless of these natural resources. However, this approach has led to a current crisis concerning natural resources, with the looming threat of resource scarcity and continuously rising prices. In

contemporary conditions, countries, institutions and economists are exploring alternative economic models that prioritize environmental preservation while still generating wealth of civilization. This shift reflects the growing recognition of the need for a transition to a green transformation with green economy.

The concept of green transformation refers to the process of transitioning societies, economies, and systems towards sustainability and environmental control. It involves adopting practices and policies that minimize environmental impact, promote resource efficiency, and address climate change. The goal of green transformation is to shift away from unsustainable practices and transition towards a more environmentally friendly and sustainable future.

This paper conducts a thorough examination of the current literature providing an in-depth analysis of key trends, influential works, and emerging themes in the field. The paper then systematically unfolds the outcomes of the bibliometric study, unveiling a structured flow of information that sheds light on the landscape of green transformation research. The paper concludes by emphasizing the significance of the insights derived from this bibliometric analysis and their implications for future research within the field of green transformation.

2. LITERATURE REVIEW

In today's competitive conditions, recognizing the direct impact of companies' strategies on the environment, it is essential for them to incorporate environmental responsibility into their long-term strategies. Companies face mounting pressure to compete on multiple fronts—not only meeting environmental requirements and complying with regulations but also distinguishing themselves from competitors and attaining sustainable competitive advantage. Companies that prioritize eco and green innovation by aligning their strategies, resources, capabilities, culture, and knowledge with environmental considerations, can effectively meet these requirements while creating barriers to entry for competitors (Šumakaris, Kovaitė, & Korsakiene, 2023). Integrating environmental issues at the strategic level and embracing eco-friendly business strategies are not merely options but imperatives for companies to thrive in a world marked by heightened environmental consciousness (Hojnik, Ruzzier, & Manolova, 2018). In this context, strategic management plays a crucial role in driving and integrating green transformation within organizations. It ensures that sustainability goals are aligned with overall strategic objectives, enables resource allocation for green initiatives, manages environmental risks, and engages stakeholders to create a holistic and effective approach to sustainable business practices.

There are various definitions for green transformation that can be defined a narrower sense, it is associated with the concept of green growth, which entails an economic transformation focused on environmental considerations (Berger, 2011). In a broader sense, the term encompasses the idea of sustainable development, which goes beyond the greening of the economy and also encompasses changes in social and environmental dimensions (Gu, Renwick, & Xue, 2018).

The world is increasingly concerned about environmental changes, and organizations face various obstacles in their efforts to reduce negative environmental impacts. Over the past years, the environment has been severely affected by excessive resource consumption and advanced industrial activities, both of which contribute significantly to the accumulation of environmental pollution (Hanif, Ahmed, & Younas, 2023). For decades, there has been a strong emphasis, both in theory and practice, on the role of governments in increasing the efficient use of natural resources. Throughout the COVID-19 pandemic, the United Nations and various other organizations have called on all nations to adopt eco-friendly and low-carbon economic recovery strategies and promote a more environmentally sustainable global economy (Guo & Yuan, 2022). It is a well-known fact that greenhouse gases (GHGs), a major contributor to global warming, have unfavorable effects on both the environment and the socio-economic landscape. As a result, the idea of a green transformation has gained a lot of attention. Striving for sustainable development goals, the idea of green transformation seeks to promote green economic growth. This involves minimizing greenhouse gas emissions and, ideally, moving away from dependence on carbon (Zhao, Guo, & Feng, 2023). Organizations are consistently prioritizing environmentally friendly innovations to enhance their corporate ecological impact. Their primary objective is to establish a market advantage through a commitment to sustainable environmental practices (Hanif, Ahmed, & Younas, 2023).

"Green economy" is one of the concepts revealed by long-standing studies that deal with economic growth and development together with ecological sustainability. Therefore, much like the sustainable development discourse that preceded it, proponents of the green economy describe it as a "low carbon, resource efficient and socially inclusive" economy (Death, 2015). The economic activities that started with the industrial revolution changed the natural environment of the world much more deeply than in previous periods. Over the years, we see this impact accelerating to a point where global warming and other ecological limits raise concerns about devastating and irreversible changes in global ecosystems and undermine human ability to sustain civilization. The necessity of meticulously reducing environmental pollution and resource consumption is scientifically indisputable. This includes the use of polluting industries and technologies that recognize the value of natural resources and environmental services, and that separates economic growth from resource consumption, gradually removing pollutants such as greenhouse gases or plastic products (Pegels & Altenburg, 2020).

The overall green transformation in industries includes the improvement of green industrial structure and the transition to environmentally friendly production. Therefore, by the industrial green transformation, the mis-distribution of existing

natural resources can be reduced, while resources are flowed to the most suitable sectors and used rationally. In addition, the relevant regulation, new energy exploration and use of new resources will emerge under industrial green transformation (IGT) (Zhao, Guo, & Feng, 2023).

The primary emphasis of green transformation research lies in renewable energies and intelligent energy systems. According to theories with the firm's resource-based perspective, achieving sustainable competitive advantage involves utilizing unique organizational resources or dynamic capabilities. This enables the identification and exploitation of business opportunities, leading to a transformative impact on the organization. However, other scholars place significant emphasis on the critical role of knowledge (Magyari, Zavarko, & Csedo, 2022).

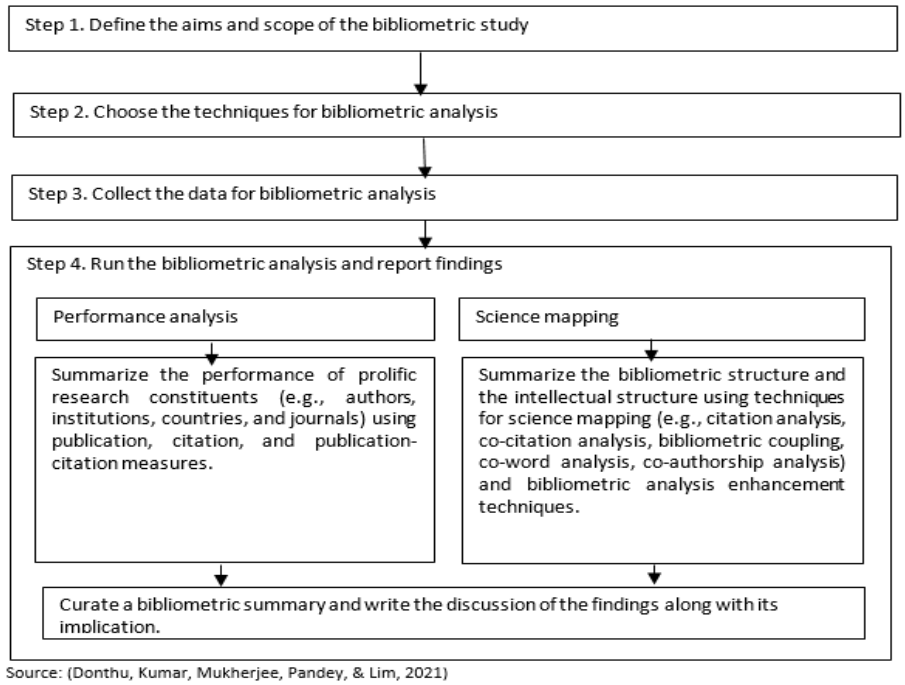
The first papers that introduced the term "green transformation" within the framework of sustainable development and green growth emerged at the start of the 21st century. Luttropp and his colleagues conducted a study examining the concept of green transformation focusing on products with high performance and business opportunities. Their research concluded that the information society had reached a significant level of environmental knowledge and development, presenting new opportunities to utilize environmental guidelines (Luttropp & Karlsson, 2001).

Since from Lutropp and Karlsson studies, the concept of green transformation, encompassing economic and environmental aspects, has become an engaging topic of discussion among scholars worldwide. Over the years, the concept of green transformation has developed and been widely explored and debated by numerous scholars and practitioners worldwide. The volume of scientific publications on this topic has been steadily growing and differentiate by regional perspectives, such as China, (Li, et al., 2021), Indonesia, Ghana, Nigeria (Efobi, 2019), UK (Oyedokun, 2015), Norway (Haugseth, 2019), Taiwan and France. On the other side there are also green transformation studies that analyzing individual published studies related to the industrial point of view, specific fields of science and the general approaches. According to industry perspective, several publications have examined the concept of green transformation within the manufacturing sector, the cement industry, the maritime industry and the fashion industry (Wang, Wang, Meng Wang, 2012).

3. METHODOLOGY

While investigating the concept of green transformation, which has gained significant popularity and has emerged as a prominent research area, there remains a lack of comprehensive analysis concerning the interplay between the structure, development, collaboration among existing literature, and the clarification of potential research avenues. Consequently, this paper employs a bibliometric analysis of green transformation to comprehensively comprehend and explore the current landscape of research pertaining to the application of green transformation in economy, as well as sustainability and environmental protection implementations. This study follows the bibliometric analysis procedure based on the study of Donthu et al., (2021) which is given in Figure 1.

Figure 1: Bibliometric Analysis Procedure



Source: (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021)

The outcomes of this investigation aim to assist scientists, researchers, decision makers identifying research focal points and emerging patterns within the field of green transformation, thereby guiding their future research endeavors. The present study seeks to address the following research inquiries using Web of Science and Scopus databases:

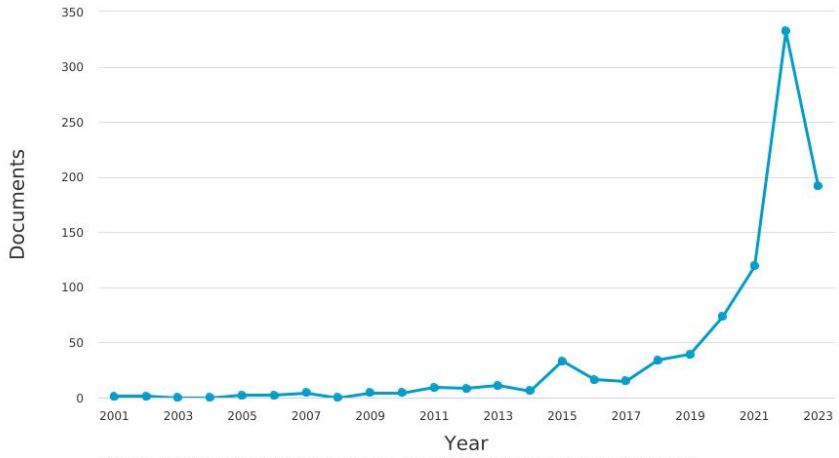
RQ1: In the period of 2001-2023, what trends can be identified in terms of publication quantities, distribution based on topics from green transformation research?

RQ2: Which disciplines and thematic areas stand out as the primary focuses within green transformation research?

4. FINDINGS

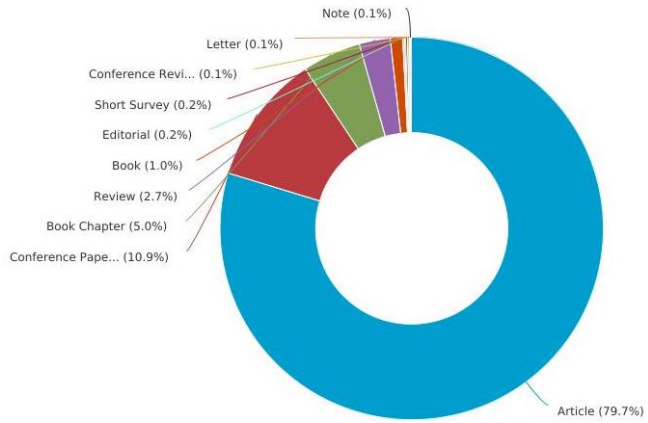
While searching the studies; the time period between 2001-2023 years were taken and titles, keywords and abstracts search tool were used. In both databases "green transformation" used as a focal keyword. This resulted a sample of 905 from Scopus and 645 from Web of Science databases.

Figure 2: Documents by Year (Source: Scopus)



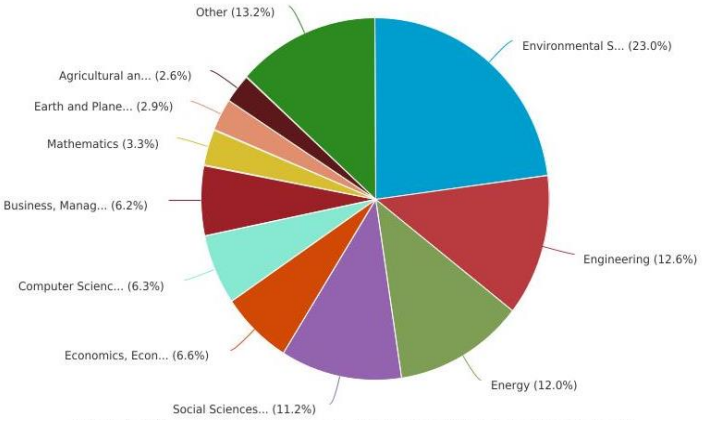
According to the data obtained from the Scopus database, as seen in Figure 2, the publications have been increasing gradually since 2001. Especially in 2020 the number of publications were 73, in 2021 it was 119 and in 2022 it was 332 which shows the increasing interest to the subject of "green transformation".

Figure 2: Documents by document type (Source: Scopus)



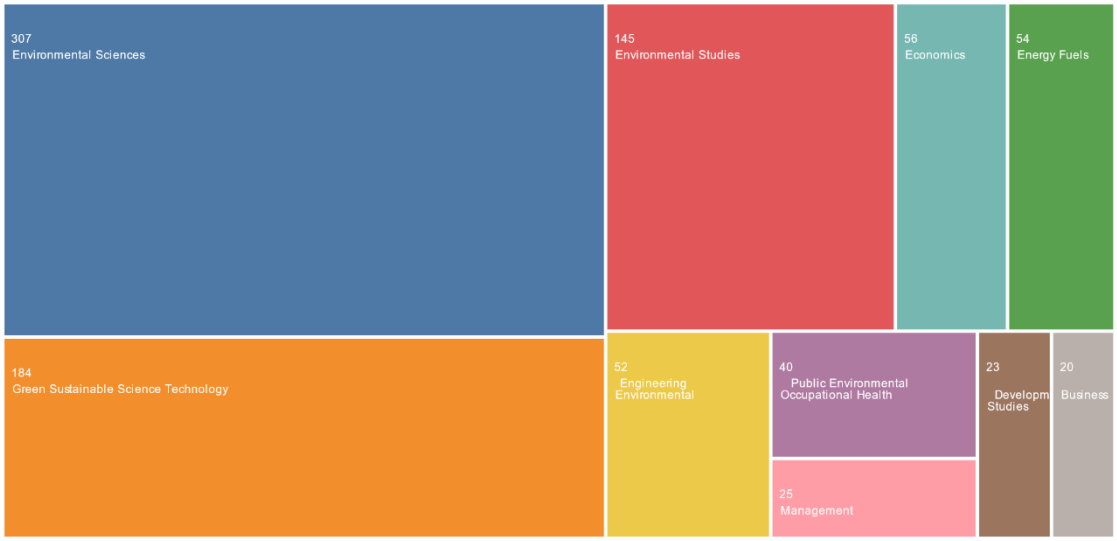
As it is shown in Figure 3 the collected documents included articles, conference papers, book chapters and the others.

Figure 4: Documents by subject area (Source: Scopus)



The Scopus database provides the information about the subject area which gives the mostly studied areas about the topic "Green Transformation". As it is shown in Figure 4 the documents cover mainly 10 different areas and the others. This shows us that although the subject of green transportation seems to be new, several different disciplines are studying and there is a multidisciplinary approach. The most frequent subject areas are "Environmental Studies" (23.0%), "Engineering" (12.6%), "Energy" (12.0%), "Social Sciences" (11.2%) which together account for almost more than half. Figure 5 shows the most studied areas obtained from the Web of Science database; "Environmental Sciences" ranked first with 307 studies, "Green Sustainable Science Technology" ranked second with 184 studies, and "Environmental Studies" ranked third with 145 studies.

Figure 5: Documents by Subject Area (Source: Web of Science)



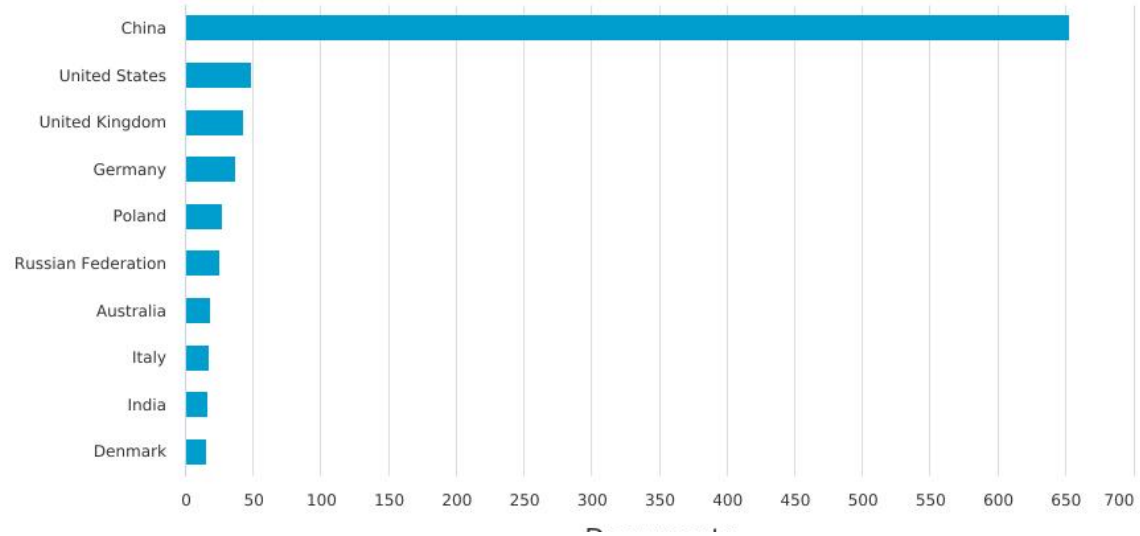
Excluding the conference papers, the books and the book chapters between the time period 2001-2023 728 articles listed in Scopus database and the top fifteen journals are listed in Table 1. The first three journals Sustainability Switzerland (total 89-%12), Environmental Science and Pollution Research (total 50-%7), International Journal of Environmental Research and Public Health (total 43-%6) account for nearly %25 of the relevant papers (a total of 182). As it can be seen from Table 1 the subject of "Green Transformation" is studied in different areas such as Sustainability, Environmental Science, Energy etc.

Table 1: Top 15 Journals Publishing on Green Transformation

Sources	Articles
Sustainability Switzerland	89
Environmental Science and Pollution Research	50
International Journal of Environmental Research and Public Health	43
Journal of Cleaner Production	42
Frontiers in Environmental Science	28
Energies	14
Resources Policy	12
Resources and Environment in the Yangtze Basin	10
Energy	9
Energy Economics	9
Environment Development and Sustainability	8
Science of the Total Environment	7
Technological Forecasting and Social Change	7
Chinese Journal of Eco Agriculture	6
Frontiers in Energy Research	6

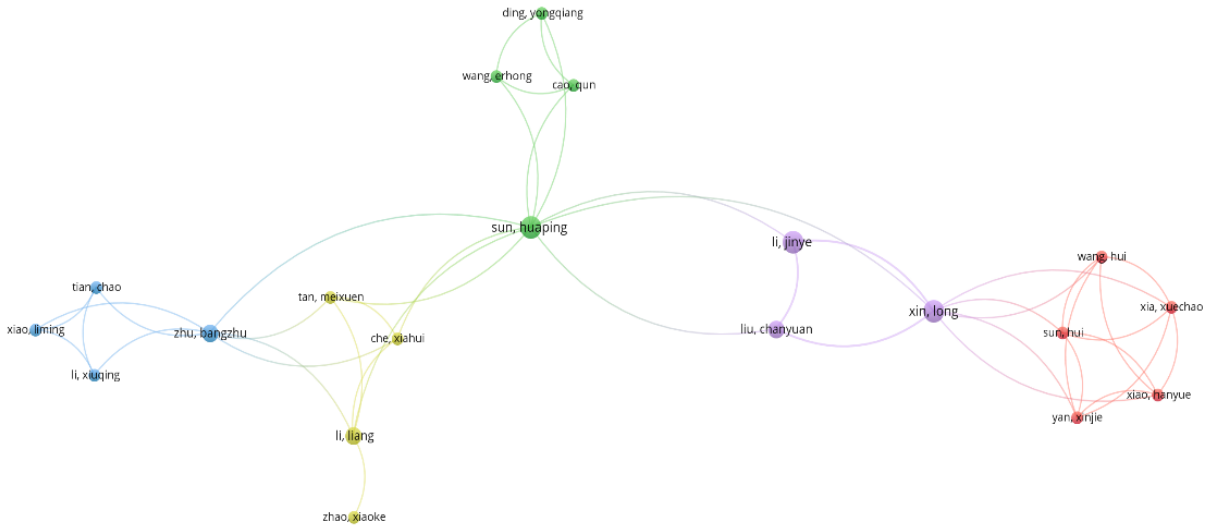
When the geography of publications is analyzed there are many different studies from geographically different regions ranging from Europe to Asia. As it is seen in Figure 6 the most frequently studied countries are China, United States, United Kingdom and Germany.

Figure 6: Documents by Country or Territory (Source: Scopus)



Using VOSviewer software it is possible to see the co-authorship analysis. Co-authorship analysis investigates the interactions among scholars within a specific research domain. The findings of this analyses can justify and catalyze new research initiatives among scholars (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). Figure 7 shows the co-authorship analysis which indicates the interaction between authors highlighting the collaboration of academic studies and the contribution from various countries and institutions using the data taken from Web of Science.

Figure 7: Co-authorsip Analysis (Source: VOSviewer)



5. CONCLUSION AND IMPLICATIONS

The concept of green transformation is relatively new and timely subject which is discussed in the literature to face sustainability challenges. It represents a fundamental shift in our approach towards sustainable development, aiming to reconcile economic growth with environmental control. Through the adoption of cleaner technologies, renewable energy sources, and more efficient resource management, the green transformation holds the promise of creating a greener, healthier, and more resilient future for our planet and future generations. Moreover, the green transformation offers significant opportunities for new technologies, environmental policies and job creation. By investing in clean technologies, sustainable infrastructure, and green industries, nations can foster a new era of green jobs, promoting both economic prosperity and environmental well-being. This transition presents an opportunity to reshape industries, reimagine urban spaces, and promote sustainable consumption and production patterns (Cheba et al., 2022).

Examining the above dimensions provides a comprehensive picture of green transformation, while also outlining the expected trajectory and key green transformation trends for regions and various businesses in the coming years. Starting from 2001 the number of publications in yearly basis are increasing gradually which also shows the increasing level of interest to the subject of “Green Transportation”. Among the mostly studied subject areas Environmental Studies and Environmental Sciences takes the highest places.

The main limitation of the study is that the concept of green transformation has only been explored in the literature since 2001, making it a relatively new concept. Besides, for the future studies, green transformation can be further investigated by narrowing down to specific industries, regions, countries and subjects to delve deeper.

In conclusion, the green transformation is not just a desirable option; it is a necessity. It represents our best chance to mitigate climate change, protect biodiversity, and ensure the well-being of present and future generations. By embracing this transformative journey, we can create a world that is not only environmentally sustainable but also socially inclusive and economically prosperous. It is up to us to make the green transformation a reality, and in doing so, secure a brighter future for ourselves and the planet we call home.

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