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Bibliometric Analysis of Studies Published In The Field of Green Transformation

Yeşil Dönüşüm Alanında Yayımlanan Çalışmaların Bibliyometrik Analizi

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Abstract: Since green transformation is the new sustainable growth and development paradigm of the world, researchers' interest in this field has increased. The aim of this study is to analyze the development course of studies published in the field of green transformation between 1988 and 2024 using bibliometric method. In this analysis, 3793 articles scanned in the Scopus database were analyzed. As a result of the analysis, the details of the subject such as the country with the most publications, the most cited authors, articles, prominent journals and keywords in the field were revealed. The most frequently used keywords in the articles published in the field of green transformation are renewable energy, energy consumption, economic growth, carbon emissions, sustainable development, environmental sustainability, energy efficiency, technological innovation and climate change. As a result of the, content clusters were formed analysis, two. In the first cluster, the concepts of renewable energy, climate change and sustainability, and in the second cluster, the concepts of economic growth, carbon emissions and renewable energy came to the fore.

Keywords: Bibliometric Analysis, Green Transformation, Scopus, R Studio

JEL Classification: C80, O10, Q01

Öz: Yeşil dönüşüm, dünyanın yeni sürdürülebilir büyüme ve kalkınma paradigması olduğundan, araştırmacıların da bu alana ilgisi gittikçe artmıştır. Bu çalışmanın amacı 1988-2024 yılları arasında yeşil dönüşüm alanında yayınlanmış çalışmaların gelişim seyrini bibliyometrik yöntem kullanarak analiz etmektir. Bu analizde Scopus veri tabanında taranan 3793 makale incelenmiştir. Yapılan inceleme sonucunda, en fazla yayın yapan ülke, en çok atıf alan yazarlar, makaleler, öne çıkan dergiler ve alandaki anahtar kelimeler gibi konunun detayları ortaya çıkarılmıştır. Yeşil dönüşüm alanında yayınlanmış makalelerde en sık kullanılan anahtar kelimeler; yenilenebilir enerji, enerji tüketimi, ekonomik büyüme, karbon emisyonu, sürdürülebilir kalkınma, çevresel sürdürülebilirlik, enerji verimliliği, teknolojik yenilikler ve iklim değişimi. İçerik analizi sonucunda iki adet kümelenme oluşmuştur. Birinci kümede yenilebilir enerji, iklim değişikliği ve sürdürülebilirlik kavramları ikinci kümede de ekonomik büyüme, karbon emisyonu ve yenilenebilir enerji kavramları öne çıkmıştır.

Anahtar Kelimeler: Bibliyometrik Analiz, Yeşil Dönüşüm, Scopus, R Studio

JEL Sınıflandırması: C80, O10, Q01

1. Introduction

Countries focus on economic growth processes by ignoring the environment has increased environmental pollution and this process has led to the climate crisis that the whole world is suffering from today. Countries have been searching for a new world order in order to solve the challenges such as climate crisis and inequalities. As a result of these searches, many conferences were organized. First, the United Nations Conference on the Human Environment was organized between June 5-16, 1972 in Stockholm. This conference was the first environmental conference to recognize environmental problems as an international major issue (UN, 1972, p.2). In this conference, environmental problems were discussed for the first

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time and the Stockholm Declaration was published as a result of the Conference. Later, countries gathered in Rio De Janeiro, Brazil, on June 3-4, 1992, to determine how sustainable development goals could be achieved in the interests of all and in the respect of environmental interests, based on the Stockholm Declaration adopted in Stockholm in June 1972 (UN, 1992, p.1). In the Rio 1992 conference, it was stated that environmental problems would be solved with the participation of all citizens (Handl, 2012, p.1). The importance of civic participation in environmental problems was emphasized and it was also stated that civic participation was important in sustainable development and growth.

The Rio Declaration was signed at the Rio Conference. Together with the Rio Declaration, Agenda 21 was published, which describes the issues to be considered in issues related to environment, development and growth (UN, 1992, p.2). Later, the United Nations Conference on Sustainable Development (Rio+20) was held in Rio De Janeiro, Brazil in 2012, 10 years after the Rio+10 conference. At the United Nations Conference on Sustainable Development (Rio+20) on June 20-22, 2012, a green economy policy was presented as a new policy proposal for realizing sustainable development and reducing poverty (UN, 2012, p. 2-10). The concept of “sustainability”, which comes to the fore in green transformation, aims not to jeopardize tomorrow's resources while meeting today's needs. In June 2009, the ministers of 34 OECD countries signed the Green Growth declaration, stating that the concepts of green and growth should be handled together, thus strengthening green growth strategies (OECD, 2015, p.5). The aim of green growth is both to protect the environment and to offer a growth model without ignoring the environment in realizing the economic growth needs of countries. According to the OECD's definition, green growth is defined as a growth model that promotes economic growth and development by protecting natural resources and the environment (OECD, 2011, p.4).

Adopted in 2015 at the United Nations Climate Change Conference (COP 21) in Paris, the Paris Climate Agreement aims to limit the increase in global average temperature to 2°C (3.6°F) above pre-industrial levels, or even 1.5°C if possible. The roadmap for achieving this goal was set out in the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015. Following the Paris Climate Agreement, the European Union (EU) published the European Green Deal, which sets out its roadmap for measures to be taken against climate change in 2019. The European Green Deal includes a very comprehensive and serious green transformation policy for both EU member states and countries that cooperate and trade with EU countries.

The Green Deal aims to transform the EU into an environmentally competitive economy and aims to reduce greenhouse gas emissions by 55% compared to 1990 levels (Fetting, 2020, p. 5). The Green Deal provides a roadmap for countries to realize their sustainable development and green growth goals. Green growth is a subset of sustainable development, helping to realize sustainable progress between the economy and the environment (OECD, 2015, p.5).

The first article containing the phrase 'green transformation' in the context of sustainable development and green growth was published by Luttropp and Karlsson (2001). They began to analyze the green transformation movement in terms of better performing industrial products and business opportunities (Cheba et al., 2022, p.2).

Today, the green transformation process, which started with the emergence of growth and development problems, shapes the constraints and opportunity areas that arise in the ongoing economic order. Green transformation is the process of developing and implementing policies and strategies for the transition to a production model that ensures the continuity of economic growth while at the same time protecting natural capital, using it efficiently and preventing pollution. Green transformation is a concept created to create an environmentally sensitive model and ensure its sustainability. The changes related to the green transformation are a long-term process and strongly linked to the active environmental protection policy.

Green transformation includes many legal regulations such as the development of green technologies, energy saving and reduction of greenhouse gas emissions, as well as many activities aimed at directing society towards environmentally friendly technologies and the use of renewable energy sources (Cheba, et al., 2022, p.1).

Since the concept of green transformation is the new sustainability growth and development paradigm, researchers have started to conduct research in this field and studies in this field have increased over the years. From this point of view, the aim of this study is to analyze the development course of studies published in the field of green transformation and to show in detail how this subject has developed in the literature between 1988 and 2024 using bibliometric method. The contribution of this study is that the green transformation literature is analyzed in detail using the bibliometric method and the findings obtained from the analysis guide potential researchers.

In the introduction part of this study, after the agreements made to prevent the environmental problems and climate crisis in the world and the concept of green transformation are explained, a literature summary of the studies on green transformation is given in the first part. In the second part, the bibliometric analysis method is explained. In the

third part, the results of the bibliometric analysis are explained. In the fourth part, the results and evaluations are given.

2. Literature Review

In this part of the study, the concepts related to green transformation are summarized by reviewing some recent literature analyzing the cosncept with the bibliometric method using WoS and Scopus databases.

Morant and Henseler (2017) analyzed 618 academic studies published in the field of green technology between 1971 and 2015 in the Web of Science (WoS) database using Bibexel and Pajek software program with bibliometric method. In this study, they identified the relationships and networks, clustering and prominent authors of the subject, and the most cited studies in this field. They concluded that green technologies are a driving force in development by stating that studies in the field of green technology showed an increase of 70% between the years considered.

Sikandar and Kohar (2022) analyzed 1094 academic publications on green technology published in the Scopus database between 1995 and 2021 with the bibliometric method using the WosWiewer software program. The authors identified the countries with the most publications, the journals with the most publications and the most cited articles in this field. As a result of the network analysis, the most collaborating countries and authors were identified. As a result of the study, they concluded that innovation, sustainable development and competitiveness are the most studied topics in this field.

Chgyrn and Miskiewicz (2022) analyzed 4573 academic studies on competitiveness and green growth published in the Scopus Database between 1991-2021 using the WoS Wiewer software program with the bibliometric method. The authors determined the number of publications in this field by years, the journals and universities with the highest number of publications. As a result of cluster analysis, they found that green economy and competitiveness cluster with issues such as climate change, renewable energy, carbon emissions. They concluded that green competition positively affects green growth.

Albayrak (2022) analyzed the studies in the field of green economy published in the WoS database between 1993-2022 using the WoS Wiever Software software program. The study covered the period between 1993-2022 and analyzed a total of 1839 published studies in the field of green articles. In the study, the number of articles published over the years, keyword analysis of articles, author co-citation network analysis were conducted. The study concluded that green economy studies have increased over the years.

Chou, Ngo and Tran (2023) analyzed the published academic studies on the relationship between renewable energy and sustainable economic growth between 1990 and 2023 in the Web of Science database by bibliometric method. Between these years, 6794 academic studies on this subject were published. As a result of the bibliometric analysis, they determined the number of articles published in this field by years, the journals with the most publications in this field, the authors with the most articles, and the institutions of the authors with the most publications in this field. Network analysis revealed that there is a clustering between renewable energy and green growth. They also concluded that renewable energy is effective on sustainable economic growth in the long run.

Çetiner (2023) conducted a bibliometric analysis of the studies conducted in the field of Green Deal in the WOS database using the Wos Wiever program based on the years 2019-2023. In the study, as a result of the bibliometric analysis method, the number of studies on the European Green Deal by years, the word cloud map of the studies in this field, the countries with the most studies, the authors with the most studies, and the co-authorship map were obtained. As a result of the study, it was concluded that the number of studies in this field has increased considerably in the recent period and is expected to help the EU achieve its goals in 2050.

Mentel, et al. (2023) analyzed the academic publications related to green innovations and renewable energy in the WoS database between 2012 and 2022 with the bibliometric method using the WoSWiever software program. As a result of the bibliometric analysis, they determined that 1144 academic publications were made between these years, the number of publications by years, the number of citations, the journals and countries that publish the most in this field. As a result of the cluster analysis, they concluded which countries cooperate on this issue and that green technologies form a cluster with energy efficiency.

Hutajulu, et al. (2024) analyzed the articles on the impact of green growth and environmental policies on economic development between 1984 and 2024 in databases such as Web of Science, Scopus and Google Scholar by bibliometric method using WoSWiever software program. Between these years, 840 academic publications were published. As a result of the network visualization analysis, they concluded that green technologies and green jobs are related to sustainable economic development.

Erarslan and Erbek (2024) analyzed 1191 studies scanned in English between 1990-2024 from the Scopus database in the field of sustainability and green growth using R program. In the study, they obtained the number of citations of articles by years, journals with the highest number of publications, countries with the highest number of publications, word groups, and

co-occurrence analysis as a result of the analysis. They concluded that studies in this field have increased over the years and that these studies are important for sustainable growth.

Manisha and Singh (2024) analyzed the academic studies published in the field of green growth between 2002 and 2024 in the Web of Science database by bibliometric method. Between these years, 409 academic studies were published in the field of green economy. They concluded that green economies provide sustainable development.

Odabaş (2024) analyzed 414 articles published between 2006 and 2023 on green innovation scanned from the Scopus database using biblioshiny program. In the study, the number of articles written in this field over the years, the distribution of articles according to the countries in which they were published, and the journals in which the articles were published were obtained by using the bibliometric analysis method. As a result of the study, he concluded that green innovation is gaining importance and that governments should increase their investments in this field.

In the literature studies reviewed, Odabaş (2014), Erarslan and Erbek (2024), Hutajulu, et al. (2024), Chgyrn and Miskiewicz (2022), and Sikandar and Kohar (2022) conducted bibliometric analysis using the Scopus database. Authors who conducted bibliometric studies using the WoS database are Manisha and Singh (2024), Mentel, et al. (2023), Çetiner (2023), Chou, Ngo and Tran (2023), Albayrak (2022), and Morant and Henseler (2017).

3. Bibliometric Method

The bibliometric method provides a general structure and outline of the research area, as well as analyzing the current trends of the literature in a particular field and providing guidance and motivation for future studies (Radha and Arumugam, 2021, p.44). Researchers have recently used bibliometric analysis to discover the current trends of articles, journals, collaboration models and research areas on a particular topic, and to explore the intellectual structure of a particular field in the literature (Donthu, et al., 2021, p.285). The bibliometric analysis method has many other important purposes besides helping to follow the latest developments in the literature. These are;

- Evaluate the performance of articles in a given field
- To uncover and analyze the theme of articles in a particular field and to shed light on future work,
- Finding gaps in the literature and moving the field forward (Sahoo, et al., 2022, p. 17).

In this study, bibliometric method will be used to analyze the studies published on green transformation in the Scopus database between 1988 and 2024. In the bibliometric analysis, the bibliometrix R package (R Studio V.3.4.1 software) and the Biblioshiny open source

software program, which is the interface of the R program, were used. Since this program is opensource software, it is being developed day by day and consists of more than 16000 open source software packages (Derviş, 2019, p.157). This program, created by Massimo Aria and Corrado Cuccurullo, is used to analyze and visualize data from the literature (Zhao and Li, 2023, p.2). In this analysis, articles published in the Scopus database were first collected.

The academic studies published in the field of green transformation to be included in the bibliometric analysis will be examined under the following headings and distributed according to years;

- Total number and types of studies,
- Most cited studies,
- Authors who produce the most academic work,
- The most repeated words and phrases,
- Countries with high academic productivity,
- Conceptual, intellectual and social structures of the studies.

In the bibliometric analysis, literature (literature) filtering was performed first. In the literature filtering, keywords defining green transformation were entered. Together with the bibliometric analysis, answers to the following questions are sought;

- What is the yearly distribution of articles and journals in the field of green transformation indexed in the Scopus Database?
- Who are the authors who have contributed the most to the green transformation literature?
- Who are the most cited authors in the green transformation literature?
- How do the keywords of articles in the green transformation literature change over the years?

4 .Findings

The main purpose of the research is to examine the development process of articles, journals, etc. published in the field of green transformation scanned in the Scopus Database using the bibliometric analysis method. The keywords representing green transformation in the study were determined as; environmentally friendly, ecological, clean, green, sustainable, environmental, green growth, etc. The analysis period started from 1988, when the first study in the relevant field was published, and covers the year 2024. Only studies published in English between 1988-2024 were included in the analysis. The keywords defining green transformation were entered into the analysis and scanned in the Scopus Database and a total

of 3793 published studies were reached. It was determined that 1992 of these studies were articles. Below are the bibliometric analysis results of the studies published in the field of green transformation scanned in the Scopus database between 1988 and 2024. Figure 1 shows the number of articles published in the field of green transformation from 1988 to 2024.

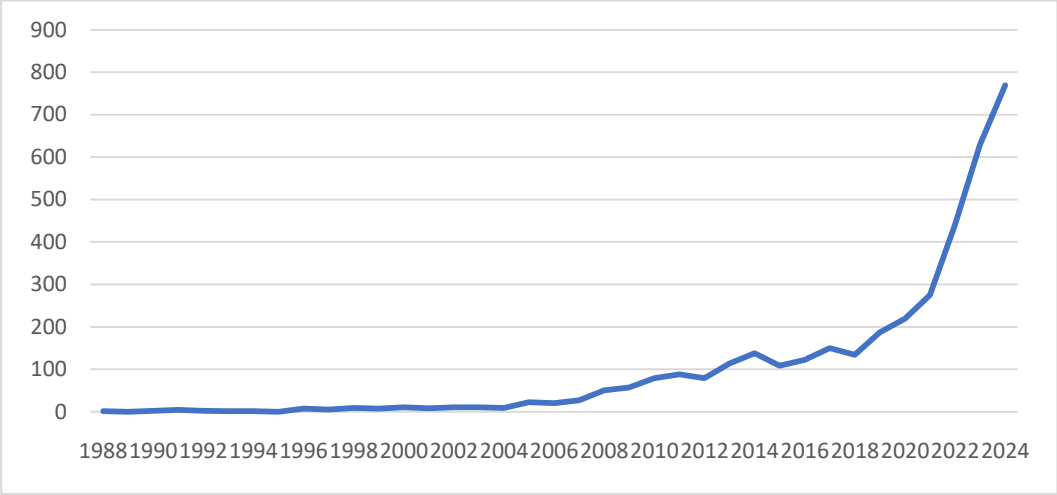

Figure 1. Number of Articles, 1988-2024 Years

Source: Created by the authors

As can be seen from the Figure, when we look at the distribution of articles published in the field of green transformation by years, it is seen that the number of articles published in this field has increased especially after 2012. In 2012, the United Nations Conference on Sustainable Development (RIO+20) held in Rio de Janeiro, Brazil, the adoption of environmentally sensitive green economy policies at the United Nations Conference on Sustainable Development (RIO+20) and the green transformation that started in the world may be thought to have caused researchers to turn to this field and increase the number of published articles. For example, while the number of articles produced in this field was 79 in 2012, this number reached 769 in 2024. To give another example, while the total number of articles published until 2000 was 39, this number was 3744 in 2024 and there was a 960% increase in the number of articles published between the years considered. Table 1 below shows the number of articles and citations in 2024 of the authors who have produced the most articles in the field of green transformation from past to present.

Table 1. Number of Articles and Citations of Authors with the Most Publications in the Field Documentation of Green Transformation, 2024

Author	Year	Frequency	Citation
WANG Y	2024	20	126
ZHANG Y	2024	12	37
WANG X	2024	11	35
LIU Y	2024	11	28
LI X	2024	9	60
LI Y	2024	7	27
ZHANG X	2024	6	44
WANG J	2024	6	3
LI J	2024	5	23

Source: Created by the authors

In 2024, the author with the most published articles was Wang Y with 20 articles and these articles were cited 126 times. The 2nd most published author was Zhang Y with 12 papers and these articles were cited 37 times. The 3rd most published author was Wang X with 11 papers and these articles were cited 35 times. As can be seen from the table, all other authors are of Chinese nationality. At this point, it can be interpreted that especially Chinese academicians publish more in this field and have a say in this field. In addition, knowing the authors who have published the most in this field provides a road map for researchers who want to work in this field.

Figure 2 below shows the top 10 universities with the highest number of publications in the field of green transformation and the number of articles.

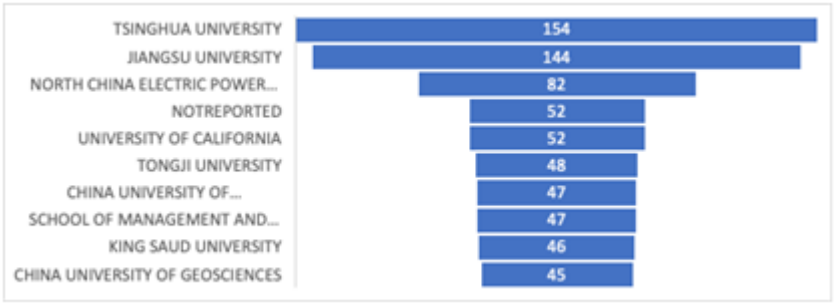

Figure 2. Top 10 Universities with the Most Publications on Green Transformation

Source: Created by the authors

As can be seen from the graph, TSINGHUA University has the highest number of publications in the field of green transformation with 154 articles. As can be seen from the table, when we look at the universities with the highest number of publications in this field,

Tsınghua University ranks in the first three places with 154 publications, Jiangsu University ranks second with 144 publications and North China Electric University ranks in the first three places with 82 publications. These three universities are in China. In addition, as can be seen from the table, when we look at the top 10 universities with the highest number of publications in this field, there are 4 universities from China, which shows the importance China attaches to the field of green transformation.

Figure 3 below shows the top 10 journals with the highest number of publications in the field of green transformation.

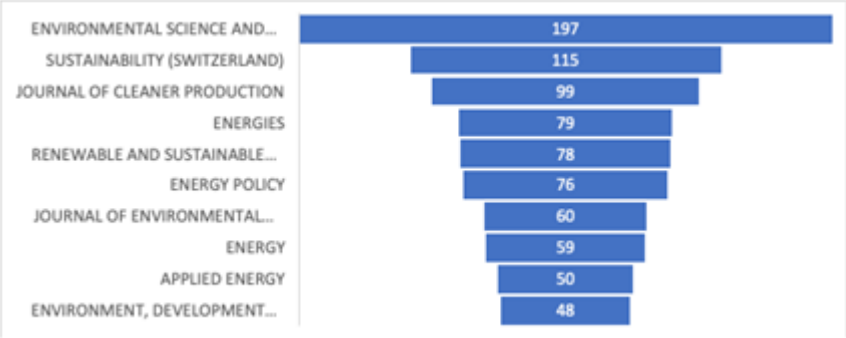

Figure 3. Top 10 Journals with the Most Publications on Green Transformation

Source: Created by the authors

As can be seen from the graph, the journal with the highest number of publications in the field of green transformation is "Environmental Science and Pollution Research" with 197 articles, while "Sustainability" ranks second with 115 articles. 3rd place is Journal of Cleaner Production with 99 publications, 4th place is Energıes with 79 publications and 5th place is Renewable and Sustainable Energy Rewievs with 78 publications. One of the benefits of bibliometric analysis is that it provides us with information about the journals where the most articles are published. For example, it can guide authors who want to work in the field of green transformation and green economy and support publication in this field by creating articles according to the requirements of these journals. In other words, bibliometric analysis allows us to know the authors and institutions that publish the most on the subject that is desired to be researched in a particular field. Thus, it is useful for researchers from different countries to get to know each other and cooperate. Figure 4 below shows the country and the number of articles with the highest number of publications according to the responsible author.

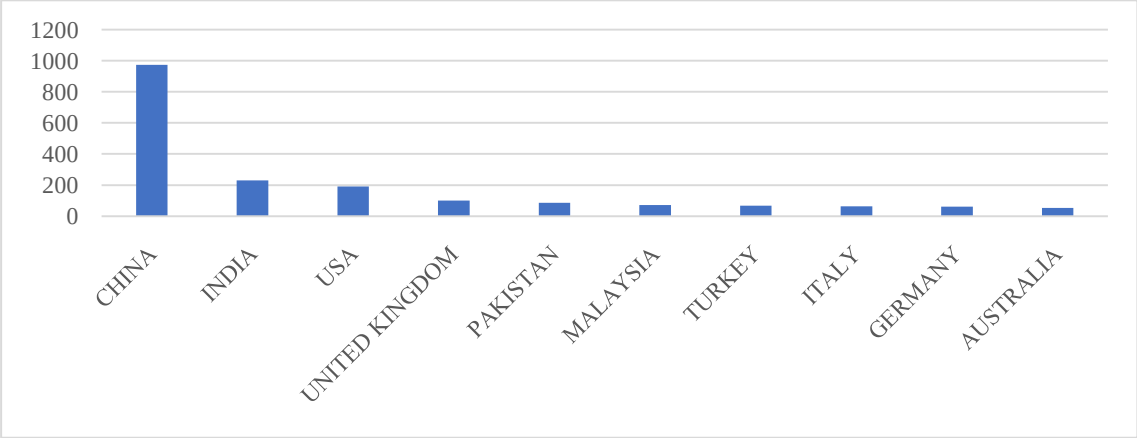

Figure 4. Top Country of Publication and Number of Articles by Country of Corresponding Author

Source: Created by the authors

As can be seen from the figure, China ranks first with 972 articles, India ranks second with 231 articles and the USA ranks third with 192 articles. Turkey ranks 7th with 68 publications. It is very important for Turkey to enter the top 10 in this field in order to be successful in future green transformation policies. When we look at China said that China is the country with the highest number of articles in this field. In addition to the fact that the Chinese economy is among the most developed economies in the world, the fact that they face many negative reasons such as air pollution, environmental degradation, etc. may have encouraged researchers in this country to work in this field.

In this context, the benefit of this bibliometric analysis may be that it provides researchers who want to publish in the field of green transformation with the opportunity to collaborate with these prominent authors in this field, thus contributing to the literature. In addition, since it helps to see the most frequently used words in this field, it enables those who will conduct a study to master the terminology in the field. Figure 5 below shows the most frequently used words in the titles of articles published in this field.

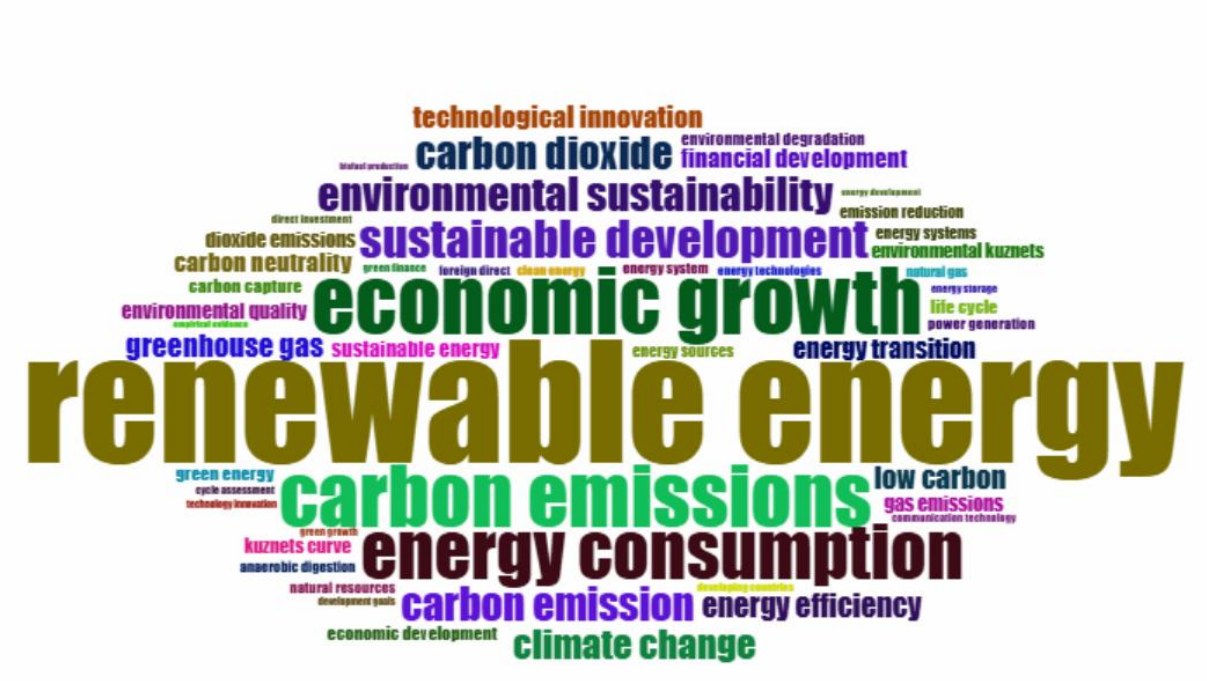

Figure 5. Most Frequently Used Words in the Titles of Articles

Source: Generated by bibliometric analysis software

In the image above, the word groups covering the most fields show the most frequently used words. For example, the most frequently used words in the titles of articles in this field;

- Renewable energy
- Economic growth
- Carbon emissions
- Energy consumption
- Sustainable development
- Climate change
- Technological innovation
- Environmental sustainability

When we look at the most frequently used words in the titles of the articles, we see that words such as green energy, carbon emission, sustainable development, climate change are used most frequently, thus allowing us to comment that environmental awareness is increasing in the literature, clean energy comes to the forefront, pollution is not ignored, and therefore the concept of green transformation comes to the fore. The most frequently used word groups in the keywords of the articles are shown in Figure 6 below.

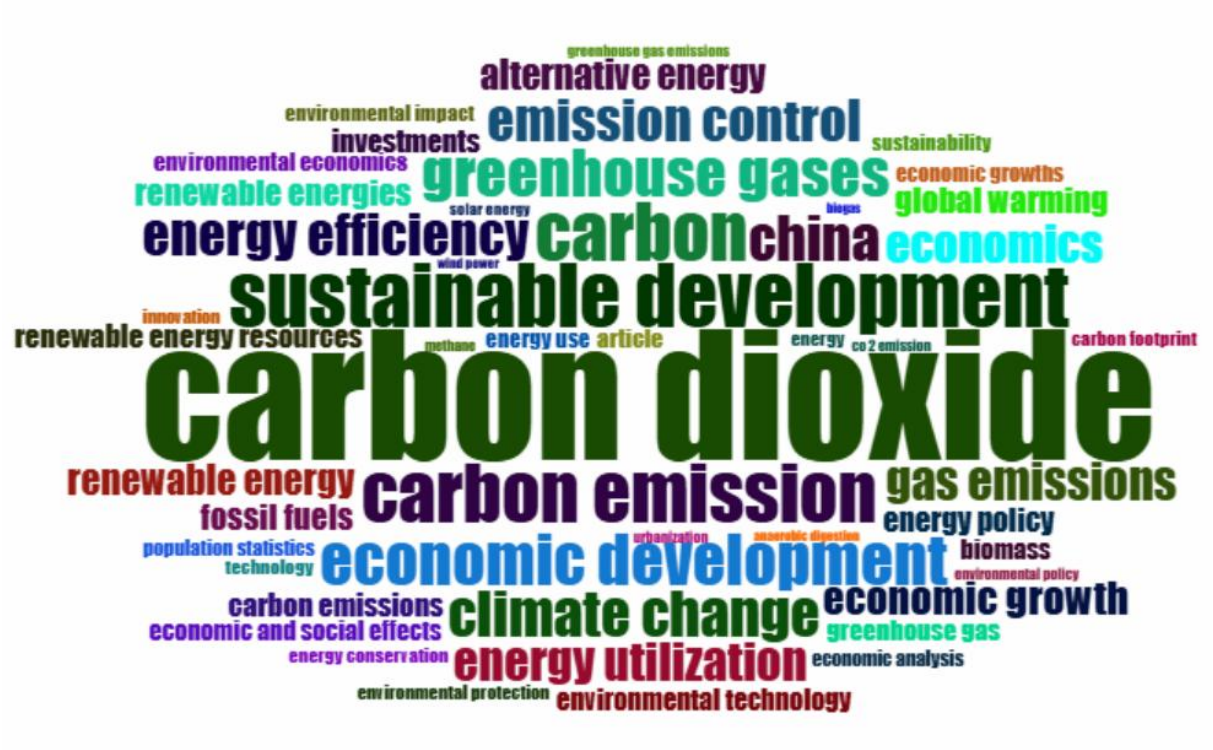

Figure 6. Most Frequently Used Keywords in the Keywords of Articles

Source: Generated by bibliometric analysis software

As can be seen from the figure, the larger the font size of the word groups shows that those word groups are used more than other word groups. The most frequently used words in word groups of articles;

- Carbon dioxide
- Sustainable development
- Greenhouse gases (carbon emissions)
- Fossil fuels
- Economic development
- Carbon emissions
- Energy efficiency
- Word groups such as climate change are used.

When we look at the most frequently used words in the keywords of the articles, it is seen that words such as energy efficiency and environmental pollution come to the fore. In order to realize the green transformation, these word groups have been used in most studies in order to find solutions to such problems when it is necessary to prevent environmental pollution and then to reduce the use of fossil fuels. Figure 7 below shows the content analysis of the studies conducted in the field of green transformation in the bibliometric analysis.

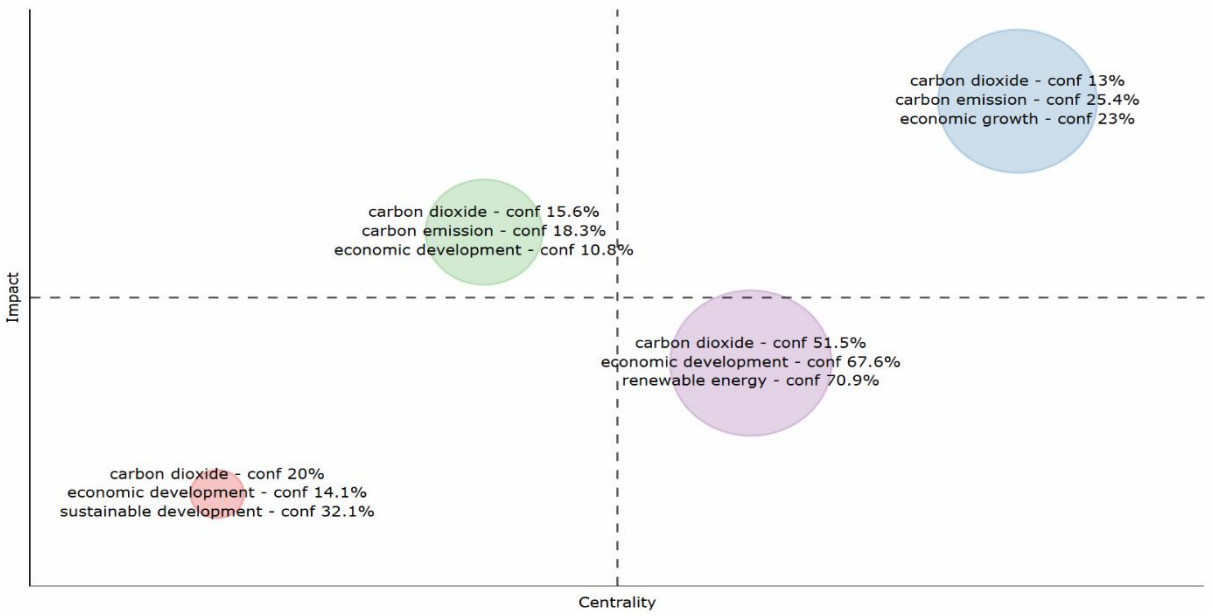

Figure 7. Clustering of Keywords of Studies on Green Transformation

Source: Generated by bibliometric analysis software

As seen in the picture, 4 clusters are formed. Starting from the top left, cluster 1 is green, cluster 2 is blue, cluster 3 is pink and cluster 4 is purple. Cluster 1, the green cluster, includes carbon emissions, carbon dioxide and economic development. Cluster 2, blue, includes carbon emissions, carbon dioxide and economic growth. Cluster 3, pink, includes carbon dioxide, economic growth and sustainable development. Cluster 4, purple, includes carbon dioxide, economic development and renewable energy. As can be seen from the clusters, it can be interpreted that climate change and sustainability are now intertwined with economic growth, and therefore, environmentally sensitive, i.e. green growth models should be used more than economic growth. The threshold frequency used in clustering is 0.3 units. Also the number of units is 250 clusters.

Figure 8 below shows the four clusters, pink, green, blue and purple formed as a result of content analysis.

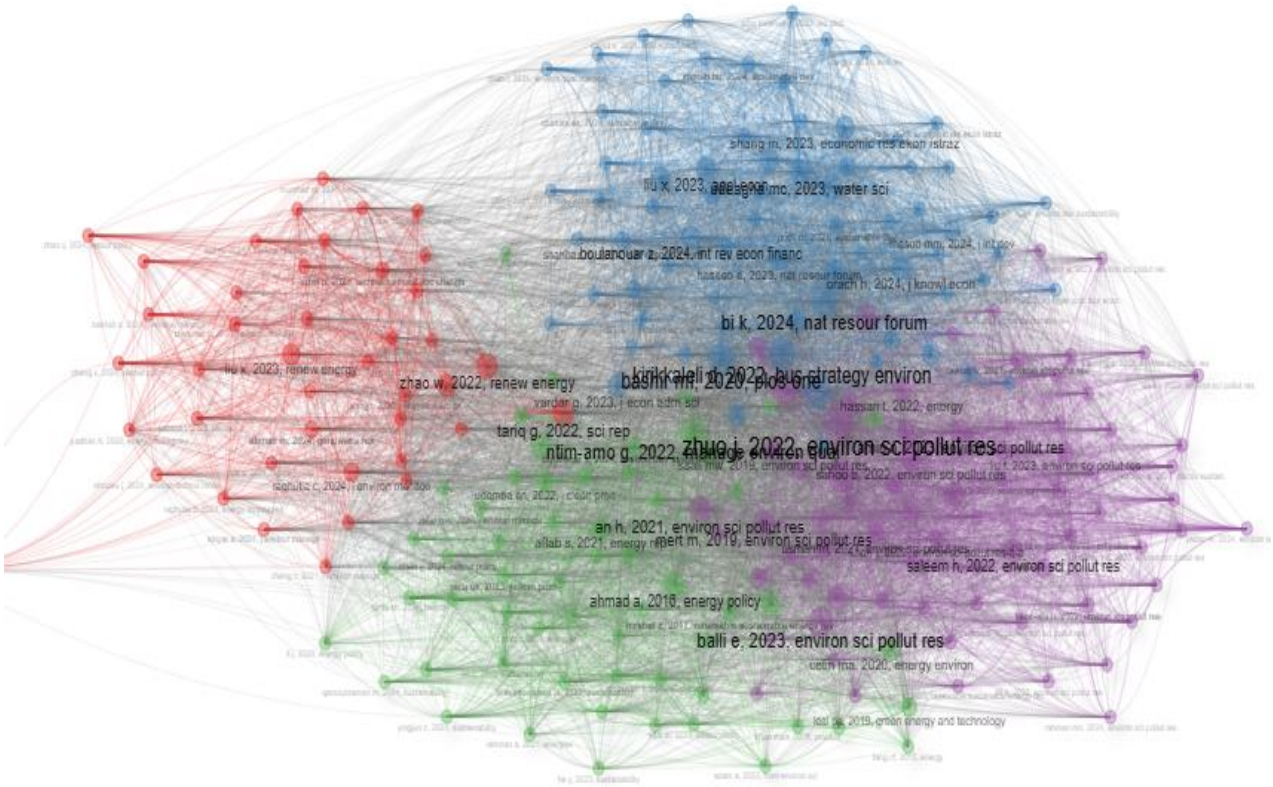

Figure 9. Clustering of Keywords of Studies on Green Transformation

Source: Generated by bibliometric analysis software

As can be seen from the picture above, there are four clusters, pink, green, blue and purple. formed as a result of the content analysis; therefore, concepts such as sustainability, renewable energy, economic growth and carbon emissions are used together in the studies conducted in the field of green transformation. According to the clustering results, it can be interpreted that the focus is no longer only on economic growth, but there is a transition to environmentally friendly growth in economic growth processes.

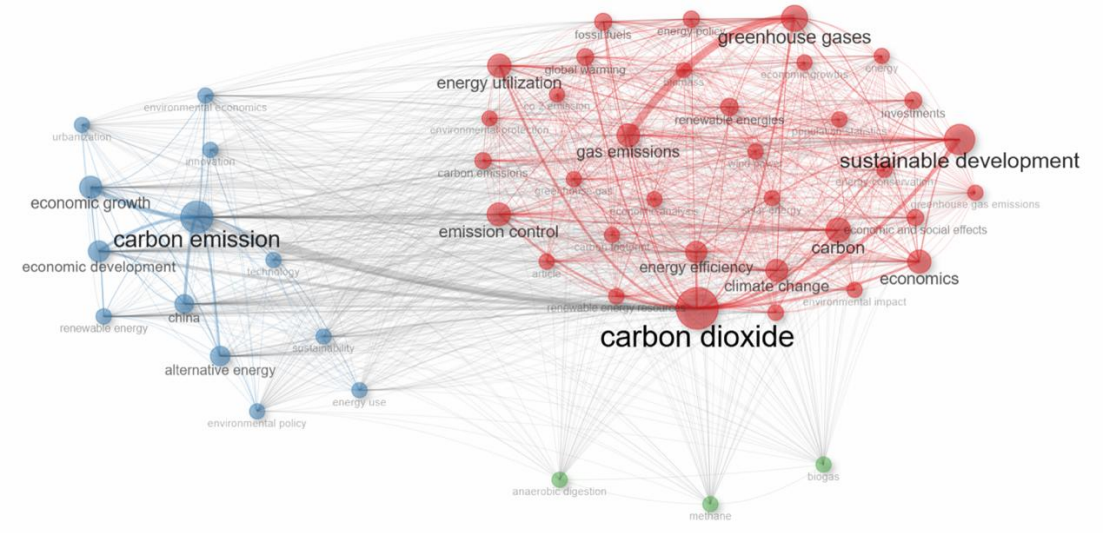

Figure 10. Co Occurrence of Keywords

Source: Generated by bibliometric analysis software

As seen in the figure, the analysis of the co-occurence used in the keywords of the articles is shown. As seen in the figure, the closer the distances between the words, the stronger the relationship between those two words. Carbon emission is in the middle of the figure and it is concluded that there is a strong relationship between carbon emission and words such as sustainable development and renewable energy.

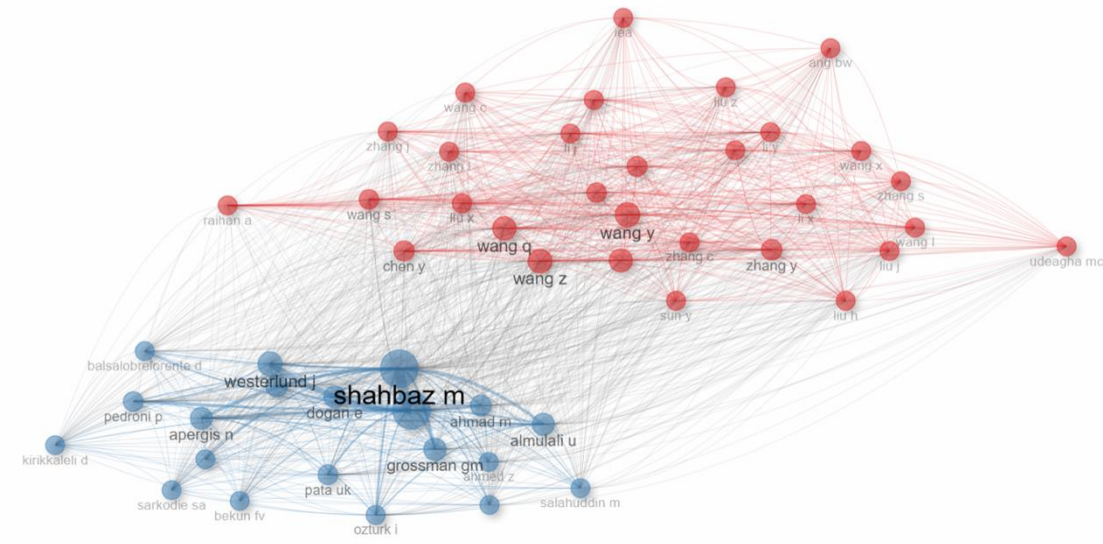

Figure 11. Co Occurrence of Author

Source: Generated by bibliometric analysis software

As seen in the figure, it shows the co-author network. The figure shows which authors collaborate with each other. The greater the intensity between the lines, the greater the relationship between the authors and the greater the number of collaborations on the topic

under consideration. It can be interpreted that the most collaboration is between Shahbaz and Grossman in the blue cluster.

As a result, according to the findings obtained from the bibliometric analysis, when the literature in the field of green transformation from 1988 to the present is examined, it is seen that the most frequently used words in the first published studies were only in terms of environmental pollution such as carbon emissions and greenhouse gases. However, in the following years, many variables that are indicators of environmentally sensitive growth models such as sustainable development, energy efficiency, renewable energy, green technology have been used in the studies.

Bibliometric analysis is very important in terms of showing the change in the literature from past to present. The researcher who analyzes the results of bibliometric analysis well can dominate the changes in the field of research and contribute to the literature by examining the deficiencies in this field.

5. Conclusion

The fact that countries focus only on economic growth processes by ignoring the environment has increased environmental pollution and as a result of this process, it has become one of the causes of the climate crisis that the whole world suffers from today. In order to solve these problems, an innovative paradigm, the concept of green transformation, which is an environmentally sensitive sustainable growth and development model, has emerged. Since the green transformation concept is the new sustainable growth and development paradigm of the world, researchers' interest in this issue has increased and studies in this field have also increased. In this study, a bibliometric analysis of the studies published in the field of green transformation between 1988 and 2024 was conducted. Scopus database was used to ensure that the literature used in this analysis is as comprehensive and high quality as possible.

Firstly, the articles published between 1988-2024 were analyzed. A total of *3793* articles were published in this field between 1988-2024. As a result of the analysis, it was concluded that the number of articles in this field has increased. To give another example while the total number of articles published until 2000 was 39, this number was 3744 in 2024 and there was a 960% increase in the number of articles published between the years considered. As a result of the bibliometric analysis, the authors with the highest number of publications in this field were found. In 2024, the author with the most published articles was Wang Y with 20 articles and these articles were cited 126 times. The second most cited author was LI X with 60 citations. Zhang X ranks third with 44 citations and Zhang Y ranks 4th with 37 citations. As can be seen from the table, all other authors are of Chinese nationality. At this point, it can be

interpreted that especially Chinese academicians publish more in this field and have a say in this field. In addition, knowing the authors who have published the most in this field provides a road map for researchers who want to work in this field. As a result of the bibliometric analysis, the 10 universities with the highest number of publications in this field were found. TSINGHUA University has the highest number of publications in the field of green transformation with 154 articles. As can be seen from the table, when we look at the universities with the highest number of publications in this field, Tsınghua University ranks in the first three places with 154 publications, Jiangsu University ranks second with 144 publications and North Chına Electric University ranks in the first three places with 82 publications. These three universities are in China.

As a result of the bibliometric analysis, the 10 journals with the highest number of publications were found. The journal with the highest number of publications in the field of green transformation is "Environmental Science and Pollution Research" with 197 articles, while "Sustainability" ranks second with 115 articles. 3rd place is Journal of Cleaner Production with 99 publications, 4th place is Energıes with 79 publications and 5th place is Renewable and Sustainable Energy Rewievs with 78 publications. One of the benefits of bibliometric analysis is that it provides us with information about the journals where the most articles are published. For example, it can guide authors who want to work in the field of green transformation and green economy and support publication in this field by creating articles according to the requirements of these journals. In other words, bibliometric analysis allows us to know the authors and institutions that publish the most on the subject that is desired to be researched in a particular field.

Thus, it is useful for researchers from different countries to get to know each other and cooperate. As a result of the bibliometric analysis, the Most Published Country and Number of Articles according to the Country of the Corresponding Author were found. China ranks first with 972 articles, India ranks second with 231 articles and the USA ranks third with 192 articles. Turkey ranks 7th with 68 publications. It is very important for Turkey to enter the top 10 in this field in order to be successful in future green transformation policies. When we look at China said that China is the country with the highest number of articles in this field. In addition to the fact that the Chinese economy is among the most developed economies in the world, the fact that they face many negative reasons such as air pollution, environmental degradation, etc. may have encouraged researchers in this country to work in this field.

The study also analyzed the co occurrence keyword analysis of the articles. The most important purpose of this analysis is to show the most commonly used keywords in common

studies. In the figure the closer the distances between the words, the stronger the relationship between those two words. Carbon emission is in the middle of the figure and it is concluded that there is a strong relationship between carbon emission and words such as sustainable development and renewable energy.

The study also analyzed the co-author network of the articles. The most important purpose of this analysis is to show the authors who have collaborated the most in this field. Therefore, it is an important indicator for researchers who want to work in this field. The greater the intensity between the lines, the greater the relationship between the authors and the greater the number of collaborations on the topic under consideration. It can be interpreted that the most collaboration is between Shahbaz and Grossman in the blue cluster.

As a result of bibliometric analysis, the most frequently used words in the titles of the articles were found. Most frequently used words in the keywords of the articles, it is seen that words such as energy efficiency and environmental pollution come to the fore. In order to realize the green transformation, these word groups have been used in most studies in order to find solutions to such problems when it is necessary to prevent environmental pollution and then to reduce the use of fossil fuels. As a result of the content analysis, four clusters were formed. Blue cluster consists of carbon dioxide, carbon emission and economic growth, purple cluster consist of carbon emission, economic development and renawable energy, green cluster consist of carbon dioxide, carbon emission and economic development concepts, the pink cluster consists of economic development, carbon emissions and sustainable development.

As a result of the bibliometric analysis, renewable energy, sustainable development, environmental sustainability, energy efficiency, green energy, carbon emission were the most frequently used keywords in the articles on green transformation. As can be understood from this result, the concept of environment, which countries have ignored for years, has become increasingly important over the years and it has been seen how effective the environmental dimension is on green transformation.

According to the results obtained from the study, issues such as renewable energy, carbon emissions, sustainable development and energy efficiency have come to the fore in the studies carried out in the field of green transformation. One of the most important goals of the European Union Green Deal is to achieve carbon neutrality by 2050. For this purpose, it is also important to invest in renewable energy (green energy) and green technology, reduce carbon emissions, and ensure green growth and sustainable development. In this context, it is important for Turkey to implement the goals of the action plan (Green Deal Action Plan

2021) that emerged as a result of the studies carried out to achieve and comply with the EU Green Deal goals, to invest in renewable energy and green technology, and to make regulations in all sectors in terms of reducing environmental degradation and carbon emissions. (T.C.Ticaret Bakanlığı, 2021:8):

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