

## BIBLIOMETRIC ANALYSIS OF THE CONCEPT OF SUSTAINABLE FINANCE: AN APPLICATION IN SCOPUS DATABASE

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### Abstract

This study aims to conduct a bibliometric analysis of the concept of sustainable finance between 1992 and 2023 by examining authors, publications, research topics, institutions, and countries. The analysis, carried out using the VOSviewer software, contributes to the literature by providing a holistic perspective on sustainable finance, a concept that is predominantly addressed within theoretical frameworks in existing studies. The findings indicate that Italy and the United Kingdom are the most active countries in terms of research output on sustainable finance. Moreover, the most frequently used keywords in the analyzed studies include *sustainable finance*, *sustainable development*, *ESG (environmental, social, and corporate governance)*, *sustainability*, *green finance*, *green bonds*, and *sustainable development goals*. An examination of the international collaboration network reveals that the United Kingdom occupies a central position in sustainable finance research and maintains strong research collaborations with countries such as China, Italy, and France.

**Keywords:** Sustainability, Sustainable Finance, ESG, Bibliometric Analysis.

**JEL Classification Codes:** Q56, C80, M14

## SÜRDÜRÜLEBİLİR FİNANS KAVRAMININ BİBLİYOMETRİK ANALİZİ: SCOPUS VERİ TABANINDA BİR UYGULAMA

### Özet

Bu çalışma, 1992-2023 yılları arasında sürdürülebilir finans kavramının yazarlar, çalışmalar, konular, kurumlar ve ülkeler kapsamında bibliyometrik analizini yapmayı amaçlamaktadır. Literatürde genel olarak teorik çerçevede ele alınan sürdürülebilir finans konusuna bütüncül bir bakış açısı kazandırılmasına katkı sağlayan bu çalışma VOSviewer programı ile gerçekleştirilmiştir. Bu çalışmada sürdürülebilir finans konusunda en aktif çalışan ülkelerin İtalya ve Birleşik Krallık olduğu, çalışma kapsamında konuyu ele alan çalışmalarda en sık kullanılan anahtar kelime tekrarlarının sürdürülebilir finans, sürdürülebilir kalkınma, esg (çevresel, sosyal ve kurumsal yönetim), sürdürülebilirlik, yeşil finans, yeşil tahvil, yeşil bono, sürdürülebilir kalkınma hedefleri olduğu, ülkeler arası işbirliği ağı incelendiğinde ise Birleşik Krallık'ın sürdürülebilir finans konusunda yapılan çalışmaların merkezi olduğu ve Çin, İtalya, Fransa gibi ülkelerle araştırma ağı kurarak işbirliği yaptığı tespit edilmiştir.

**Anahtar Kelimeler:** Sürdürülebilirlik, Sürdürülebilir Finans, ESG, Bibliyometrik Analiz.

**JEL Sınıflandırma Kodları:** Q56, C80, M14

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## **1. Introduction**

As the increase in the world population day by day directly affects the environment, society and economy, the construction of large industrial facilities based on this, the desire to produce low-cost production while producing a product, and the desire of people to use the environment by damaging the environment over time have become a threat to the planet and life, which is the common living space of everyone. It is a pity that in the current period of time, everything related to the environment is making progress in direct connection with the economy. The financial part of the concept we call sustainable finance, also known as green economy, is more related to supporting economic growth and development (Allen, 2012: 979). In this regard, green finance plays a significant role in rebuilding financial systems with environmental sensitivity, particularly in terms of environmental degradation, climate change, and sustainable development. Therefore, the environment and its natural resources should serve humanity's development, prosperity, and happiness.

Sustainable finance is defined as finance that aims to bring about things that can be beneficial in economic, social, and environmental terms and to direct financial investments to economic sectors or activities that can strengthen them (Kashi & Shah, 2023). In other words, sustainable finance is the inclusion of environmental, social, and governance (ESG) factors in financial decision-making processes to promote long-term economic development while creating solutions to sustainability issues such as corporate governance, social inequality, and climate change. In this context, this type of finance has become the cornerstone of investment strategies and contemporary finance, emerging as an important concept at the intersection of finance and sustainable development goals (Talukder et al., 2025). Its global development gained momentum with the Paris Climate Agreement signed in 2015. Since the agreement, sustainable finance has become an important factor in combating the threats posed by climate change and environmental degradation (Korkmaz et al., 2023a: 73). When considered from Turkey's perspective, although the development of green finance has not yet reached the desired level, progress has been attempted by taking various steps in this area. In particular, Turkey's ratification of the Paris Agreement and its announcement of a net-zero emissions target for 2053 have been important turning points in terms of promoting green financing instruments. In this direction, public authorities have made improvements in the banking and capital markets sectors; green bonds, sustainable loans, and ESG-based financing instruments

have come to the fore (Birasoğlu & Şahin, 2025). Funds provided using these instruments are allocated to sustainable, green, and environmentally friendly projects. As awareness increases in dealing with many social, managerial, and environmental problems such as climate change, depletion of natural resources, global warming, social inequality, and favoritism, and as policies related to these issues are developed, the importance of sustainable financing tools is expected to increase (Şahin, 2024).

While bibliometrics is defined as the adaptation of mathematical and statistical techniques to communication tools such as articles and books, bibliometric analysis is defined as the quantitative examination of specific characteristics of documents or academic publications, such as the journals in which they are published, information about the authors, and the content or subject of the publication. In other words, bibliometric analysis can also be defined as an attempt to manage a large amount of information through conceptualization by revealing the turning points, trends, and structure of a field in scientific research. The main steps of the analysis include obtaining data from databases, examining, cleaning, and improving it, and processing the data with different bibliometric analyses. This analysis is considered important for revealing common authorship patterns by quantifying various aspects of the literature (such as citation counts), mapping a research field, identifying publications, authors, and journals, and providing insights into the reasons for the emergence of research topics and their development. In this respect, it is often preferred in studies to bring together and examine a large amount of scientific data. (Temelli & Karcıoğlu; Passas, 2024). In addition, conducting a bibliometric analysis of any journal or concept is also valuable in terms of showing the development of that journal or concept. In this regard, studies that include the bibliometric analysis of the journal or concept(s) within the scope of the research assist in making strategic decisions. Monitoring the development of the journal or concept(s) examined in the publication process, identifying their shortcomings, and determining the extent to which the targeted goal has been achieved also ensures that important results are obtained (Erbaşı et al., 2017: 207).

Based on this information, this study aims to examine trends related to sustainable finance, such as authors, publications, and countries, using bibliometric methods. To this end, the term “sustainable finance,” which is most frequently used in the literature, was filtered to include only article titles, and 742 articles in the Scopus database were examined. In this

way, academic studies on the concept of sustainable finance, the authors who wrote these studies, and other related results were sought to be revealed.

## **2. Literature Review**

### **2.1. Studies Addressing Sustainability**

Recently, there has been a significant increase in the number of studies in this field due to the increasing risks caused by climate change. When we look at the literature, expressions such as green investment, climate finance, sustainable finance, low carbon finance, green finance, environmental finance have been put forward. Sustainable finance, which is one of these concepts, is a concept that has developed within the scope of increasing deterioration in ecosystems, the source of which is human activity Korkmaz et al. (2023b: 72). There are many studies in the literature on sustainability. Some of these studies are as follows in terms of scope;

Demirbulat and Tetik Dinc (2017) aimed to determine the bibliometric properties of master's and doctoral theses on sustainable tourism between 1987 and 2015. As a result of the findings, it was determined that master's theses were mostly prepared at Istanbul University, doctoral theses were mostly prepared at Dokuz Eylül University, master's and doctoral theses were mostly published in the Institute of Social Sciences and prepared in the Department of Tourism Management, and the theses mostly focused on destination sustainability and planning.

Vysochan et al. (2021), aimed to conduct a bibliometric analysis of articles on sustainability accounting in the Scopus Elsevier and Web of Science Core Collection database between 2010 and 2020. As a result of the findings, it was found that there was a significant increase in the number of articles published in the year range within the scope of the research.

Albayrak (2023), aimed to quantitatively examine the publications in the field of green economy to determine its current structure and to identify the areas of study that need to be examined within its scope. The study found that China, the USA and the UK are the countries with the most academic studies; 46% of the 1838 articles included in the study were published in the Science Citations Index Expanded (SCI-EXPANDED); 46% were published in the

Social Sciences Citations Index (SSCI), and sustainability, economics, environmental sciences and research are the leading subject areas examining the green economy.

Kocyigit et al. (2023), aimed to examine the development of articles published on sustainability accounting between 2000 and 2022 and scanned in the Web of Science database by bibliometric analysis method. As a result of the study, it was determined that the most published article year was 2021, the country that published the most articles was the USA, almost all of the published articles were written in English, and the majority of the published studies were published in the journal Sustainability..

Torun (2023), aimed to contribute to the literature by analysing the academic studies in the Web of Science Core Collection database on green economy between the periods 1993-2023. As a result of the study, it was determined that the concerns about green economy and sustainable development increased, 2022 was the most productive year in terms of published articles and citations, the most cited academic study addressed the issues of green economy, the effectiveness of China's green economy, the relationship between green economy and sustainable development, the most frequently used keywords were green growth, sustainability, green economy, climate change and sustainable development, and the most cited countries were China, USA, Russia, UK and South Africa.

Gafoor et al. (2024), aimed to determine the content and development of green finance research and to identify research areas in the field of green finance that are likely to emerge in the future. As a result of the findings, it was determined that there was an increase in publications after 2022, the country with the highest number of publications was China, and the institutions with the highest number of publications were Southwest University of Finance and Economics and Tokai University.

Odabas (2024), aimed to examine the content of academic studies on green innovation with the help of different elements. As a result of the study, it was determined that there was a significant increase in the number of articles published after 2016, the country that published the most articles was China, and the journals with the highest number of publications were Environment, Sustainability and Strategy.

Ozkan (2024), aimed to investigate whether the recently increasing interest in the green bond market supports the studies in the field of green bonds and to contribute to the literature

by analysing the academic studies in this field. As a result of the study, it was determined that China was the country with the highest number of publications, most of the academic studies in the relevant field were published in journals with high impact factor and the most qualified authors were Tahhizadeh-Hesary, F. and Naaem, M.A.

Tao and Chao (2023), aimed to investigate global studies in the field of green finance and energy. As a result of the study, it was found that there was a significant increase in the number of article studies between 2020 and 2022, the author with the most publications and the most citations was Taghizadeh-Hesary, the journal with the most publications was environmental science and pollution research, the country with the most publications was China and the most frequently used keywords were green finance, economic growth, renewable energy, CO2 emissions, impact, China and consumption.

Xu et al (2024), aimed to investigate the fields of energy transition and green finance, which are increasing in importance day by day, and the academic fields that form the basis of these fields. As a result of the study, it was determined that the number of studies on energy transition and green finance has increased over the years, the most cited author is Zhang et al. and the most frequently used keywords are green finance, renewable energy, CO2 emissions.

## **2.2. Bibliometric Studies**

It is known that the first study with bibliometrics in the literature was conducted by Cole and Eales in 1917. In this study, a statistical analysis of publications in the field of comparative anatomy between the periods 1550-1860 was made. In Turkey, it is known that the first study with bibliometrics was carried out by Özinönü in 1970 and the publication was titled 'Growth in Turkish Positive Basic Science'. In his study, Özinönü tried to determine whether the fields of mathematics, physics, earth sciences, mathematics, astrology, chemistry and biology were scientifically productive. There has been a significant increase in the number of studies conducted with bibliometrics, especially in 1990 and after (Hotamışlı & Erem, 2014: 3). There are many studies conducted with bibliometric analysis based on academic studies and journals in the literature. Some of these studies are as follows in terms of method and scope;

Merigo and Yang (2017), aimed to conduct a bibliometric analysis of accounting research with the help of the 'Web of Science' database and found that the most influential journals in the field are 'The Accounting Review and Accounting', 'The Journal of Accounting and Economics', 'Organization and Society', 'Journal of Accounting Research'.

Depren et al (2018), aimed to examine academic studies examining volatility in stock markets with data from the Web of Knowledge database. As a result of the findings, it was determined that the co-authorship network structure is predominantly China and the USA, and the most frequently used keywords are stock returns, volatility, econophysics, financial crisis, stock market and GARCH.

Chiu et al. (2019), aimed to examine accounting information systems journals within the scope of bibliometric analysis and to evaluate their contribution to emerging technologies. As a result of the findings, it was determined that the journals considered within the scope of the study are not gathered around a single topic, and that the articles in ISAFM journal are especially oriented towards emerging technologies.

Orman and Acar (2021) aimed to follow the development processes of the studies written in the field of financial literacy. The study found that there was a continuous increase in the number of articles published in the time interval examined, the author who contributed the most to the literature was Annamaria LUSARDI, the most published journal was Journal of Consumer, the most cited academic study was 'The Economic Importance of Financial Literacy: Theory and Evidence', the most preferred countries in inter-country cooperation were the USA, the Netherlands, China, Germany and Australia, and the country that contributed the most to the literature was mostly the USA.

Haydaroglu (2022) aimed to analyse the postgraduate theses on the financial crisis in Turkey through bibliometric analysis. As a result of the findings, it was found that most of the theses consisted of master's theses, the number of studies published between 1999 and 2021 followed a fluctuating course, the completed theses were mostly in the Institute of Social Sciences and the Department of Economics, the postgraduate theses were mostly published in Marmara University, the titles of the academicians who advised the theses were mostly Prof. Dr., the theses were mostly written in Turkish language and the theses were mostly written in State Universities.

Kucuk and Kaynar (2023) aimed to examine the current status and trends of academic studies in the field of financial technology with the help of data from the Web of Science (Wos) database. The study found that academic studies have increased over the years, the studies are mostly in English, the most publishing institution is the University of Indonesia, the most publishing country is the People's Republic of China, and the most publishing author is Szu-Hao.

Kılınç (2025), aimed to examine the development of Fintech and sustainable finance literature between 2010 and 2024 using bibliometric analysis. According to the results of the analysis conducted using the Web of Science database, it has been observed that topics such as blockchain technology, environmental impact measurement tools, green finance, and digital payment systems are increasingly related to Fintech areas and sustainable finance.

An examination of the relevant topics in the literature reveals a marked increase in bibliometric analysis-based studies in the fields of sustainability, green finance, and sustainable finance, particularly in recent years. However, the vast majority of existing studies focus on China, the US, and European countries; there are no bibliometric studies specifically addressing the concept of sustainable finance in Turkey that directly use the keyword “sustainable finance” in the Scopus database and focus on Turkey. A significant portion of studies in this field in Turkey are conducted through sub-concepts such as green finance, climate finance, ESG investments, and environmental finance, and some of these studies are not included in Scopus. It is noteworthy that a significant portion of existing studies focus on global samples or developed countries, while empirical analyses specific to Turkey are relatively few. Furthermore, it is observed that the majority of studies conducted in the Turkish context address the concepts of environmental sustainability or green finance within a general framework, and that studies examining the effects of sustainable finance on financial markets, investment decisions, and risk indicators in depth are limited. This situation indicates that the Scopus-indexed literature on sustainable finance focused on Turkey has not yet reached a sufficient level and that there is a significant country-based gap in the sustainable finance literature. Based on these observations, this study aims to examine academic developments in the field of sustainable finance, present its conceptual framework, and systematically identify publication trends, prominent authors, and countries. The study chose to focus solely on the concept of “sustainable finance” as a methodological choice to ensure conceptual integrity,

maintain the comparability of bibliometric analysis results, and increase the repeatability of the search strategy. This study is expected to contribute to the understanding of the general structure of sustainable finance research in the international literature and to provide a guiding framework for future empirical and theoretical studies in this field in Turkey. In this respect, the study aims to make a unique contribution to the sustainable finance literature in terms of methodology and geography.

### **3. Methodology**

#### **3.1. Purpose and Scope of the Study**

The aim of this study is to conduct a bibliometric analysis of the concept of sustainable finance within the framework of authors, subjects, institutions and countries with the Vosviewer programme. For this purpose, the data set consisting of 742 articles on the concept of sustainable finance between 1992 and 2023 in the Scopus database was analysed bibliometrically. The questions to be answered for the purpose of the study are as follows;

- What is the distribution of the number of publications and publication year of the articles?
- What is the distribution of the number of citations and publication year of the articles?
- Which are the most cited academic studies in the field of sustainable finance?
- What is the distribution of the leading authors according to the number of publications?
- Which institutions do the articles belong to and how is the number of publications produced by these institutions distributed?
- Which are the most published institutions and how are these countries distributed in terms of how many they publish?
- How are the keyword repetitions and links in the articles?
- How is the cooperation network between countries?

#### **3.2. Data Set**

Scopus, one of the largest bibliometric databases, was preferred as a data source in the research. The reason for choosing this database is that it has all the publications and data of sustainable finance articles published in Turkey. In the study, metadata were analysed and downloaded from Scopus in July 2024. Scopus is an abstract and indexing database produced

by Elsevier that includes full-text links (Burnham, 2006). The content in Scopus includes publications from scientific publishers around the world (Baas et al., 2020). Scopus is one of the largest and most comprehensive abstract and citation databases of peer-reviewed publications, covering books, scientific journals, and conference proceedings regionally and globally, and provides smart tools for tracking, analyzing, and visualizing research with bibliometric tools. The reliability of the Scopus database has ensured its use as a bibliometric data source in many large-scale analyses, such as the evaluation of science policies, research assessments, and university rankings (Ghosh, 2024). The Scopus database contains citation information (author(s), document title, year, source title, volume, issue, pages, number of citations, source and document type), funding details (number, abbreviation, and sponsor), references, other information (trade names and manufacturers, access numbers and chemicals, and conference information), and bibliographic information (links, serial identifiers (e.g., ISSN), DOI, PubMed ID, publisher, editor(s), original document language, correspondence address, and abbreviated source title) for many research bibliography fields (Chung & Tsay, 2015). In this context, studies related to sustainable finance were compiled in the Scopus database. For this purpose, the search term “sustainable finance” was used as the keyword for sustainable finance in the Scopus database, the document type was set to “article,” and the search criteria were selected as 1992-2023, covering all studies conducted from the date of the earliest study related to the topic to the present. This yielded 742 articles. For each article, variables such as “number of citations, publication year and number of publications, institutions, author(s), countries, most cited studies, and keyword links” were used within the scope of bibliometric analysis. The number of citations indicates how many times a publication has been cited within WoS/Scopus. Publication year indicates the year a publication was published, while publication count refers to the total number of studies included in a specific dataset. In bibliometric analyses, this variable is usually calculated in different ways, such as publication count by year, publication count by country, publication count by author, publication count by institution, publication count by journal, and publication count by keyword. Institution information provides details about the institutions to which authors are affiliated and their address information. Author/Authors information provides details about the authors of the publication. Countries represent the country information derived from the institutional addresses of the authors of a publication. In bibliometric studies, the “countries” variable shows which countries contribute more to the literature. The most cited works are ranked

according to the total number of citations received by the works in the dataset. Finally, keyword links represent the link structure based on the frequency of co-occurrence of author keywords (DE) or Keywords Plus (ID) within the same publication. Through these variables, the development of the literature over time, the most productive and influential authors/institutions/countries in the field, and the thematic structure based on the co-occurrence of key concepts have been revealed. Accordingly, the results obtained were processed using VOSviewer software to visualize and test trends in bibliometric form, and articles published between 1992 and 2023 were downloaded in CSV format.

### **3.3. Methodology of the Research**

Within the scope of the study, the studies in the Scopus database in the field of sustainable finance were examined by bibliometric analysis. Bibliometric analysis is a frequently preferred method for researching and analysing a large number of scientific data (Donthu et al., 2021: 285). Its scope is the application of bibliometric data using quantitative methods (Broadus, 1987: 377). Although the history of this analysis dates back to the early 1900s, discussions on bibliometrics began in the 1950s and first gained meaning with Pritchard in 1969. Pritchard defined bibliometrics as the application of mathematical and statistical techniques to the processes of written communication and the rationality and progress of a discipline by subjecting written communication to a good analysis (Lawani, 1981: 302). Pritchard stated that bibliometrics acts as a science of measurement in the process of transferring information, and the purpose of bibliometrics is to analyse and control this measurement process (Sengupta, 1992: 77). Bibliometric analyses are one of the qualitative and quantitative analysis techniques used to identify researchers, research groups, institutions, the impact of journals, and the characteristics of countries in the specified criteria (Ozturk & Kurutkan, 2020: 2). These analyses can be evaluative in line with the determined objectives of the studies, to reveal the characteristics of the articles published in certain year intervals in a descriptive way, and to make analyses to determine the extent to which a published article affects the studies that have entered the literature after it (Aslançı, 2022: 5).

### **3.4. Limitations of the Study**

While a detailed research in this field can benefit from multiple sources such as papers, books, journals, magazines and graduate theses, the examination of the study is limited only within the scope of articles and sustainable finance. This constitutes the limitation of the study. Data Analyses VOSviewer is a software tool created by Van Eck and Waltman and developed by the Centre for the Study of Science and Technology (CWTS) at Leiden University in the Netherlands. This software tool helps to create a network based on institutions, publications, keywords and authors, to perform co-citation analysis and to see the links between them. In addition, it is one of the text mining tools used in the analysis of bibliometric data sources obtained from previous studies (reports, conference proceedings, book chapters, theses, documents). Based on files downloaded from RIS, Scopus, Pubmed, WOS and Dimension, it can extract bibliographic networks from bibliographic data. Vosviewer can be used to create maps over these networks and to visualise and examine these maps (Li, et al., 2024: 2-3; Bukar, 2023: 2, Artsin, 2020: 347). In this study, VOSviewer (version 1.6.18) was used as the software visualisation and main metric tool for data analysis. In order to obtain visualisation results, 742 articles written in the field of sustainable finance between 1992 and 2023, downloaded from the Scopus database, were imported into VOSviewer.

## **4. Findings**

According to the results obtained from the Scopus database, a total of 742 academic studies were identified when publications related to sustainable finance from 1992 to 2023 were examined. The distribution of these academic studies by year is shown in Figure 1.

### **4.1. Number of Publications by Years**

In line with the results obtained from the Scopus database, when the publications on sustainable finance from 1992 to 2023 were analysed, it was determined that there were 742 academic studies in total. The distribution of these academic studies by years is shown in Figure 1.

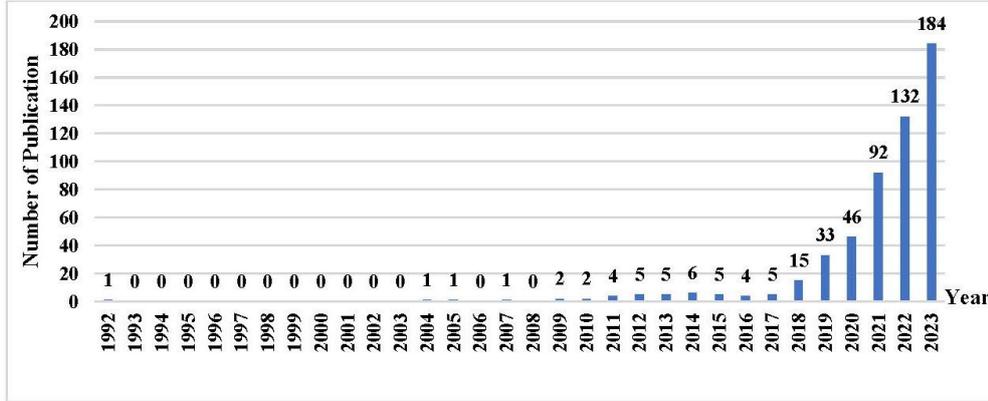
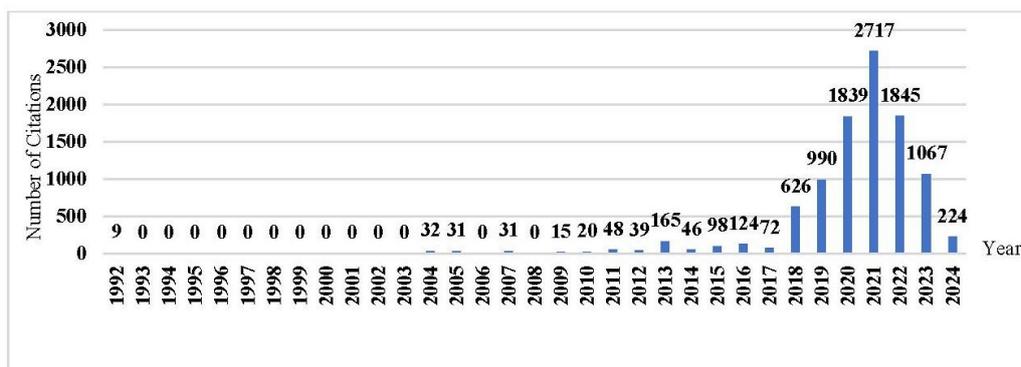
**Figure 1:** Publications on sustainable finance over the years and their numbers

Figure 1 shows the distribution of articles published on sustainable finance between 1992 and 2023. Accordingly, it can be seen that there were no publications on this subject between 1993 and 2003, a small number of publications between 2009 and 2017, a significant increase in the number of publications between 2018 and 2022, and an increase in the number of publications to 184 in 2023. Furthermore, it was determined that 2023 was the most productive year in terms of publications within the analyzed time frame. These findings, obtained from the Scopus database, show that the temporal development of the sustainable finance literature has undergone distinct phases. The absence of any academic publications in this field between 1992 and 2003 indicates that sustainable finance had not yet institutionalized as an independent field of research. The limited number of publications between 2009 and 2017 indicates that the concept was just beginning to find its place in academic literature. In contrast, the rapid increase in the number of publications observed after 2018 reveals that sustainable finance has begun to mainstream in financial literature. In particular, the number of publications reaching 184 in 2023 shows that both academic interest and the importance of environmental and financial sustainability issues on a global scale have increased significantly, revealing that this was the most productive year in terms of publishing during the analyzed period.

## 4.2. Number of Citations by Year

Figure 2 shows the citations to studies related to sustainable finance between 1992 and 2023 and the changes in the number of citations. In line with the results obtained from the Scopus database, when publications related to sustainable finance in the current year range were analyzed, a total of 10,038 citations were identified. The distribution of these citations by year is shown in Graph 2.

**Figure 2:** Citations on sustainable finance over the years and their numbers



When examining the temporal distribution of citations to the sustainable finance literature in the 1992–2023 period shown in Figure 2, it is evident that the field's development process contains distinct turning points. According to findings obtained from the Scopus database, there were no citations to studies related to sustainable finance in 2006 and 2008, and only a small number of citations in 2004, 2005, 2007, 2009, and 2010–2017, and a significant increase in the number of citations after 2018. When all years are analyzed, it is seen that the year with the most citations is 2021, with 2717 citations this year. The absence of citations in 2006 and 2008 indicates that the concept of sustainable finance had not yet become an established field of research in academic literature during this period. The limited number of citations between 2004 and 2017 suggests that sustainability was addressed primarily within the framework of environmental and corporate social responsibility, with the financial dimension taking a backseat. In contrast, the marked increase in citations observed after 2018 indicates that sustainable finance has become an independent and mature field of research. The Paris Climate Agreement, the European Green Deal, the widespread adoption of ESG criteria, and increased awareness of the impact of climate risks on the financial system have

played a significant role in directing academic interest towards this area. Indeed, 2021 stands out as the year with the highest number of citations in the sustainable finance literature, with 2,717 citations; this shows that sustainable finance has become a strategic priority for both policymakers and investors on a global scale.

### 4.3. Most Cited Academic Works

In Table 1 below, the most cited studies on sustainable finance are given. The most influential publications were determined according to the number of citations.

**Table 1.** Most cited studies in the field of sustainable finance

Number	Article Name	Number of Citations
1	Corporate Green Bonds, Flammer, C. (2021)	577
2	The Effect of Firm Size on ESG Score: Analysing Corporate Sustainability Ratings, Drempetic, S.; Klein C.; Zwergel, B. (2020)	482
3	Sustainable Business Model Archetypes for the Banking Sector, Yip, A.W.H.; Bocken, N.M.P. (2018)	220
4	European Green Deal - Legal and Financial Challenges of Climate Change, Sikora, A. (2021)	179
5	Past, Present and Future of Sustainable Finance: Insights from Big Data Analytics through Machine Learning of Academic Research by Kumar, S.; Sharma, D.; Rao, S.; Lim, W.M.; Mangla, S.K. (2022)	157
6	Pricing Green Bonds: Are Financial Institutions Special?, by Fatica, S.; Panzica, R.; Rancan, M. (2021)	134
7	Understanding the Role of Green Bonds in Advancing Sustainability, Maltais, A.; Nykvist, B. (2021)	133
8	How Investor Interest Affects the Green Bond Market, Pham, L.; Luu Duc Huynh, T. (2020)	133
9	Are You Blind to Carbon Risk? Analysing Stock Market Reaction to the Paris Agreement, Monasterolo, I.; De, Angelis L. (2020)	127
10	Green Bonds for Financing Renewable Energy and Energy Efficiency in Southeast Asia: A Policy Review, Azhgaliyeva, D.; Kapoor, A.; Liu, Y. (2020)	112
11	Sustainable Finance: A New Paradigm, Fatemi, A.M.; Fooladi I.J. (2013)	109
12	Finance, Climate Change and Radical Uncertainty: Towards a Precautionary Approach to Financial Policy, by Chenet, H.; Ryan-Collins, J.; Van Lerven, F. (2021)	108
13	Challenges for Islamic Finance and Banking in the Post-COVID Era and Fintech's The Role of, Hassan, M.K.; Rabbani, M.R.; Mohd. Ali, M.A. (2020)	105

**Table 1.** Most cited studies in the field of sustainable finance (Continue)

Number	Article Name	Number of Citations
14	Green Finance and Sustainable Development Goals: The Case of China, Lee, J.W. (2020)	103
15	Sustainable Finance and Renewable Energy: Advocates of Carbon Neutrality in the United States, by Qin, M.; Su, C.-W.; Zhong, Y.; Song, Y.; Oana-Ramona, L.O.B.O.N.T. (2022)	101

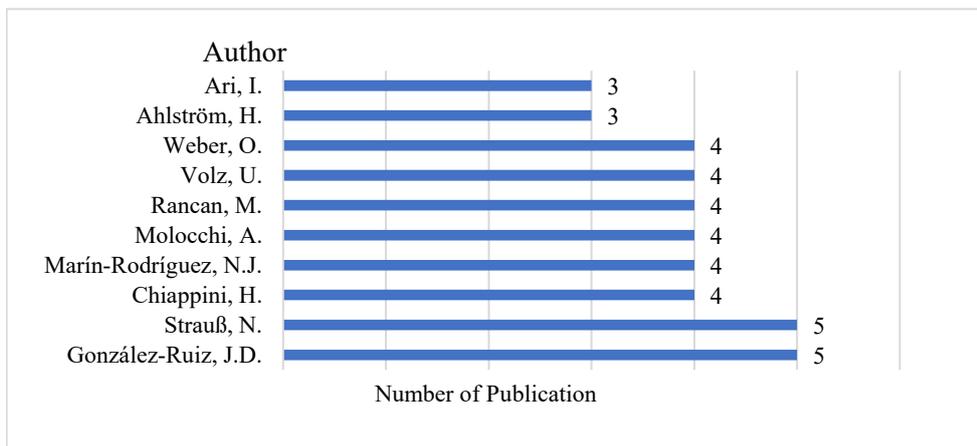
When Table 1 above is analysed, among the articles published on sustainable finance, Flammer's (2021) 'Corporate Green Bonds' has 577 citations, Drempetic et al.'s (2020) 'The Effect of Firm Size on ESG Score: Examining Corporate Sustainability Ratings' with 482 citations, Yip and Bocken (2018) "Sustainable Business Model Archetypes for the Banking Sector" with 220 citations, Sikora (2021) "European Green Deal - Legal and Financial Challenges of Climate Change" with 179 citations, Kumar et al. (2021) 'Past, Present and Future of Sustainable Finance: Insights from Big Data Analytics through Machine Learning of Academic Research' received 157 citations. The fact that these are the most cited articles among these studies can be considered as an important source for studies on sustainable finance. These studies are respectively Fatica et al.'s (2021) 'Pricing Green Bonds: Are Financial Institutions Special?', Maltais and Nykvist (2021) "Understanding the Role of Green Bonds in Advancing Sustainability", Pham and Luu Duc Huynh (2020) 'How Does Investor Interest Affect the Green Bond Market? ', Monasterolo and De Angelis (2020) 'Are You Blind to Carbon Risk? Analysing Stock Market Reaction to the Paris Agreement', Azhgaliyeva et al. (2020) 'Green Bonds for Financing Renewable Energy and Energy Efficiency in Southeast Asia: A Policy Review', Fatemi and Fooladi (2013) 'Sustainable Finance: A New Paradigm', Chenet et al. (2021) 'Finance, Climate Change and Radical Uncertainty: Towards a Precautionary Approach to Financial Policy' by Chenet et al. (2021), "Challenges for Islamic Finance and Banking in the Post-COVID Era and the Role of Fintech" by Hassan et al. (2020), 'Green Finance and Sustainable Development Goals: The Case of China' and Qin et al. (2022) 'Sustainable Finance and Renewable Energy: Advocates of Carbon Neutrality in the United States' by Qin et al. The studies highlighted in the table and notable for their citation counts reveal key research trends in the sustainable finance literature. Flammer's (2021) study, which focuses on corporate green bonds, achieving the highest citation count

demonstrates that sustainable finance has become a tool priced in capital markets and influencing firm behavior. Drempetic et al. (2020) study, which examines the relationship between ESG scores and firm size, has become an important reference point in the literature by raising issues regarding the measurement and comparability of sustainability ratings. Furthermore, other highly cited studies focusing on sustainable business models, climate risks, green bond markets, and policy frameworks demonstrate that sustainable finance has evolved from being merely a normative concept into a multidimensional and interdisciplinary field of research.

#### 4.4. Leading Authors by Number of Publications

Figure 3 below provides information on the authors who have published the most on sustainable finance.

**Figure 3:** Most published authors on sustainable finance



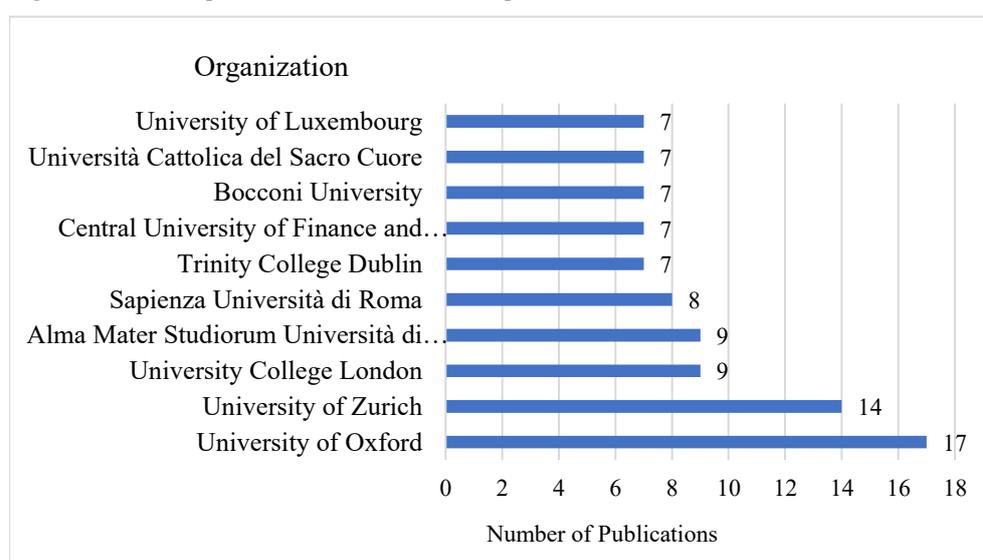
In Figure 3 above, authors with 3 or more publications in the field of sustainable finance are shared. Accordingly, Gonzales-Ruiz and StranB are the authors with the highest number of publications with 5 articles. These authors are followed by Chiappini (4), Marin-Rodriquez (4), Molocchi, Rancan (4), Volz, Weber (4), Ahlström (3) and Ari (3). Based on the results, it can be said that publication intensity in the field of sustainable finance is clustered around certain authors, with Gonzales-Ruiz and StranB, who have the highest number of publications, emerging as the most prolific authors in the literature. Authors in the four- and three-

publication groups can be considered researchers who contribute regularly to the development of the field. These findings show that the sustainable finance literature is shaped by both core and peripheral contributors.

#### 4.5. Institutions and Number of Publications

Figure 4 provides information about the institutions where authors publishing on sustainable finance work and the number of publications by these institutions, and highlights the publication performance of prominent institutions in the sustainable finance literature.

**Figure 4:** The most published institutions and their publications on sustainable finance



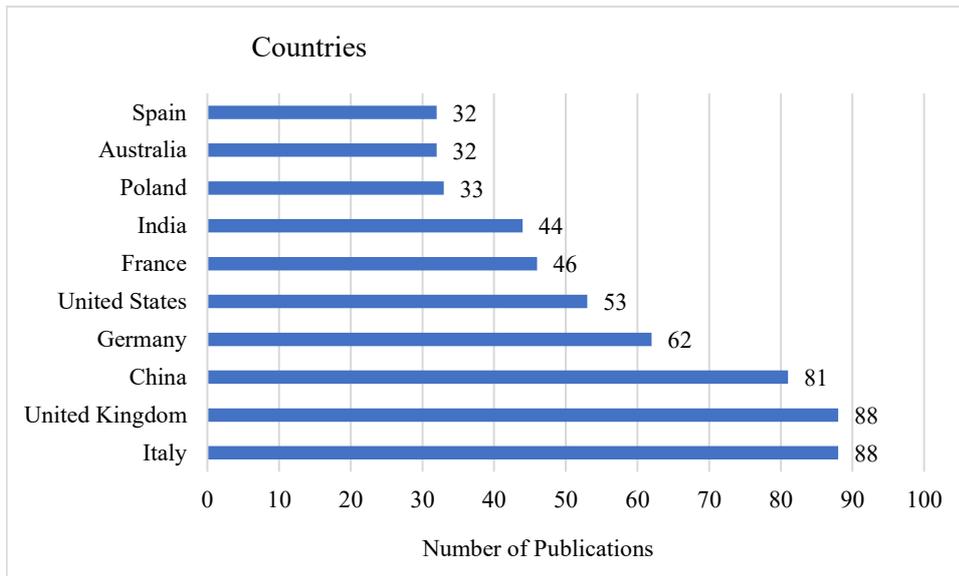
Accordingly, an examination of the findings in Figure 4 reveals that Oxford University is the institution with the most publications on sustainable finance, with 17 publications, and is the clear leader in this field. This situation shows that sustainable finance research is concentrated in certain leading academic centers. In addition, the University of Zurich has 14 publications, University College London and Alma Mater Studiorum Università di Bologna have 9 publications, Sapienza Università di Roma has 8 publications, Trinity College Dublin, Central Faculty of Finance and Economics, Bocconi University, Università Cattolica del Sacro Cuore, and the University of Luxembourg have 7 publications. The total number of publications from all institutions is 92. The fact that these 92 publications were produced by such a

limited number of institutions reveals that academic knowledge in the field of sustainable finance is concentrated around certain universities and that these institutions play a leading role in the development of the field. The dominance of European-based universities, in particular, shows that sustainable finance is strongly addressed in Europe at both the academic and policy-making levels, and this situation is considered to be in line with the European Union's sustainability and green finance policies.

#### 4.6. Countries and Number of Publications

Figure 5 below provides information on the countries to which academics who publish on sustainable finance send their publications.

**Figure 5:** Countries with the highest number of publications on sustainable finance and the number of publications



There are 10 countries contributing to the studies on sustainable finance worldwide. When the countries in question are analysed, it is seen that Italy and the United Kingdom are ahead of other countries with 88 articles. These countries are followed by China with 81 studies, Germany with 62 studies, the United States with 53 studies, France with 46 studies, India with 44 studies, Poland with 33 studies, Australia and Spain with 32 studies. The findings show that academic output in this field is concentrated in certain countries. Italy and the



When the analysis result in Shape 1 is analysed, it is seen that the largest nodes consist of the words sustainable finance, sustainable development, ESG (environmental, social and corporate governance), sustainability, green finance, green bonds, sustainable development goals. These concepts form the theoretical core of the field and demonstrate that sustainable finance has evolved from a normative area of discussion into a measurable, reportable, and regulated financial framework.

When examining clusters composed of different colors, the first cluster that stands out in terms of size is the dark green cluster. The largest node in this cluster is the concept of sustainable finance. The prominence of this concept, thanks to its strong alignment with concepts such as climate risk, TCFD, taxonomy, prudential regulation, and risk management, demonstrates that sustainable finance is integrated with macro-level regulatory policies and systemic risk discussions. This situation shows that sustainable finance is increasingly linked to financial stability and public policies.

The focus of academic studies in the green cluster is sustainable finance, and among studies related to sustainable finance are sustainable development, sustainable development goals, climate risk, ESG factor (environmental, social, and governance factor), governance, venture capital, China, conservation finance, renewable energy, taxonomy, prudential regulation, risk management, sustainable, TCFD (Task Force on Climate-related Financial Disclosures).

In the open green cluster, the largest nodes are formed by the words ESG (environmental, social, and corporate governance) and green finance. In this cluster, the terms CSR (corporate social responsibility), green bonds, impact investing, climate finance, environmental sustainability, financial stability, greenwashing, sustainability reporting, green investment, and case study are the most frequently preferred terms in academic studies related to sustainable finance. The prominence of ESG and green finance concepts in the light green cluster indicates that the literature is shifting toward company-level applications, market-based financial instruments, and performance measurement. Concepts within this cluster, such as green bonds, impact investing, sustainability reporting, and greenwashing, indicate an intensifying debate about how sustainable finance is applied in practice and the reliability of these applications.

Sustainable finance studies in the yellow cluster generally use terms such as COVID-19, credit risk, EU taxonomy, banking sector, green banking, sustainable investment, environ-

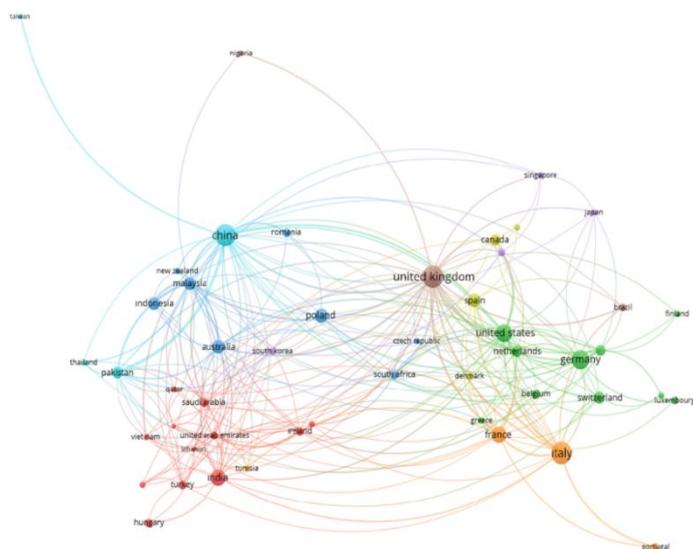
ment, carbon emissions, and environmental performance. The inclusion of concepts such as COVID-19, credit risk, the banking sector, and carbon emissions in the yellow cluster reveals how sustainable finance literature has been shaped in the context of global crises, environmental shocks, and financial risks.

The purple cluster focuses on sustainable finance studies that generally center on concepts such as the Equator Principles, project finance, banks, risk, corporate social responsibility, and financial innovation. The purple cluster represents studies focusing on the financial intermediation mechanisms and risk-sharing dimension of sustainable finance through concepts such as equator principles, project finance, and financial innovation.

Overall, the findings show that the sustainable finance literature has a multi-layered structure and is thematically divided around regulatory frameworks, market-based instruments, crisis dynamics, and financial intermediation mechanisms.

#### **4.8. Co-operation Between Countries**

The country clustering is presented in Shape 2 below. The country clustering shows a bibliometric map of international collaboration between selected countries with at least two publications and two citations using the VOSviewer network visualisation (overlay) mode. By looking at how close the countries are on this map and how thick the line connecting them is, it becomes possible to determine the degree of co-authorship between countries. In addition, the brown, blue, red, orange, orange, green, green, purple and yellow colours used on the map given in Figure 2 provide information about the years in which countries predominantly contributed to each other through publications. On the map shown in Shape 2, as the relations between countries become stronger or weaker, similarly, the networks connecting countries become thicker and thinner.

**Shape 2:** Inter-country co-operation and its change over the years

The country clustering presented in Shape 2 shows that international cooperation in the sustainable finance literature exhibits a hierarchical and center-periphery-based structure. When the distance between countries and the thickness of the links are evaluated together in the network visualization, it is seen that certain countries not only have high publication and citation counts but also play a mediating role in knowledge production and dissemination. An examination of the map reveals that the United Kingdom is central to research on sustainable finance and has established a research network in collaboration with countries such as China, Italy, and France. In this context, the United Kingdom's position at the center of the network highlights its role as a core country with methodological and conceptual leadership in the field of sustainable finance. The UK's strong ties with both developed and emerging research economies such as China, Italy, and France indicate that, according to the literature, intercontinental knowledge flows largely occur through this country. In contrast, the UK's weak relationship with Nigeria shows that the integration of Africa-centered studies into global networks remains limited.

Looking at other countries, the dense networks between the United States and Canada, France and Italy, China and Pakistan, and Ireland and the United Arab Emirates demonstrate the strength of their connections and cooperation.

Looking at the different colored clusters on the map, it can be seen that the United Kingdom, located at the center of the brown cluster, has close relationships with Canada, Spain, Poland, the Czech Republic, the United States, Japan, and Brazil in terms of publications and citations, while its relationship with Nigeria is weak.

China, located at the center of the blue cluster, has close relationships with Romania, New Zealand, Malaysia, Indonesia, Australia, and Poland in terms of publications and citations. In particular, the thick line between China and Pakistan indicates a strong relationship between these two countries, while China's relationship with Taiwan is weak. China's strong co-authorship relationship with Pakistan, particularly within the blue cluster, demonstrates that regional collaborations (Asia-centered networks) are increasingly strengthening in the sustainable finance literature. China's weak connection with Taiwan, however, indicates that scientific collaboration is shaped not only by academic capacity but also by geopolitical and institutional factors.

India, located at the center of the red cluster, is part of a research network and collaboration with countries such as Turkey, Tunisia, Vietnam, Hungary, Lebanon, the United Arab Emirates, Ireland, and Qatar in terms of publications and citations. Spain, at the center of the yellow cluster, has close ties with Denmark and Canada in terms of publications and citations.

When examining the green cluster, Germany is at its center, and Germany has close ties with the Netherlands, the United States, Greece, Belgium, Denmark, and the United Kingdom in terms of publications and citations.

When examining the green cluster, it can be seen that Germany is at the center of this cluster and that Germany has a research network and cooperation with countries such as the Netherlands, the United States, Greece, Belgium, Denmark, and Switzerland in terms of publications and citations. In this context, it can be said that academic integration within Europe is strong and that a multi-centered European core has been established in sustainable finance research.

When examining the orange cluster, it can be seen that Italy is the central country and that Italy is part of a research network with France and Portugal, with particularly strong ties to France due to the dense network between them.

On the other hand, the emergence of new countries such as Denmark, Canada, and Spain on the map compared to larger countries through overlay visualization (network representation method) can be seen as an indicator of the expansion of the sustainable finance field. The emergence of countries such as Denmark, Canada, and Spain in overlay visualization in recent years indicates that the sustainable finance literature has moved from a maturation phase to a dissemination phase, with new actors beginning to make meaningful contributions to the literature. This situation reveals that the field is not dominated by only certain countries, but rather forms a dynamic and expanding research ecosystem.

## **5. Conclusions And Recommendations**

In this study, it is aimed to make a bibliometric analysis of the concept of sustainable finance, which is examined on the financing of investments aimed at preventing climate change and minimising environmental damages, which has been the subject of studies in recent years, within the framework of authors, subjects, institutions and countries with the Vosviewer program. The data were obtained from the Scopus database in July 2024 with the keyword ‘sustainable finance’ for the years 1992-2023. There are a total of 742 articles on sustainable finance in the Scopus database. VOSviewer software programme was used for bibliometric analysis. When the literature on sustainable finance is examined, it is thought that there is no publication from Turkey in the Scopus database only on sustainable finance and therefore this study will contribute to the literature on sustainable finance both in Turkey and in universities abroad.

This study examines the bibliometric analysis of the concept of sustainable finance, which has been the subject of research in recent years and aims to prevent climate change and minimize environmental damage, using the Vosviewer program in the context of authors, topics, institutions, and countries. Data for the years 1992-2023 were obtained from the Scopus database in July 2024 using the keyword “sustainable finance.” There are a total of 742 articles related to sustainable finance in the Scopus database. The VOSviewer software program was used for bibliometric analysis. Upon reviewing the literature on sustainable finance, it is believed that there are no publications from Turkey related to sustainable finance in the Scopus database. Therefore, this study will contribute to the literature on sustainable finance both in Turkey and at universities abroad.

The analysis conducted in this study revealed that publications in the relevant literature began in 1992, increased from 2018 onwards, and reached their highest level in 2023, particularly in studies on sustainable finance. Furthermore, when examining the citations to studies on this topic, it was observed that the studies conducted in 2021 received the most citations over the years. Considering studies related to sustainable finance, it can be said that the most cited academic study is Flammer's 2021 study titled "Corporate Green Bonds," and this result is also parallel to the fact that 2021 was the most cited year (Flammer, 2021).

When examining the authors who published the most on this topic, it was found that Gonzales-Ruiz, J.D. and Straub, N. were more productive than other authors. When examining the institutions with the most publications, it was found that Oxford University had more sustainable finance studies than other institutions.

When examining the countries most active in research on sustainable finance, Italy and the United Kingdom lead with 88 publications, followed by China. Kashi & Shah (2023) stated that the United Kingdom and China are among the most productive countries in this field, defining China as one of the countries following the United Kingdom in terms of the number of publications. Wang et al. (2025) also supported the relevant findings by stating that China is the most productive country in the field of green finance and that the United Kingdom is one of the leading countries.

When examining the most frequently used keywords in studies on sustainable finance, it is seen that the focus of the studies is on sustainable finance and that concepts such as sustainable development, ESG (environmental, social, and corporate governance), sustainability, green finance, green bonds, and sustainable development goals are used more frequently. In this context, Krastev & Krasteva-Hristova (2024), Wang et al. 2025, Türk & Aksoy, 2025, who analyzed the sustainable finance literature using bibliometric methods, found that the most frequently used keywords were "green bonds," "green finance," "ESG," "climate change," "sustainable finance," "green finance," and "sustainable development."

Finally, when examining the cooperation network between countries, it was found that the United Kingdom is the center of studies on sustainable finance and that this country has established a research network and cooperates with countries such as China, Italy, and France. Kılıç (2025), emphasizing the cooperative relationships between countries such as

China, the United Kingdom, and the United States, supports this finding by stating that there are also connections between China, the United Kingdom, and other countries. Similarly, Peng et al. (2025) support the relevant finding by stating that the United Kingdom has academic connections with countries such as China, France, and Italy in the field of sustainable finance (e.g., ESG/green finance).

Within the framework of the findings, the significant place of green bonds in the literature necessitates financial institutions to increase product diversity for sustainable borrowing instruments and to support corporate firms' green bond issuance processes. In terms of increasing the capacity of the financial sector in the field of sustainable finance, it is important to develop joint education programs, certification processes, and knowledge-sharing platforms with universities.

In terms of regulations, the creation of a national sustainable finance taxonomy is necessary for the effective implementation of sustainable finance. This taxonomy will increase market confidence by determining which activities will be considered green or sustainable, which criteria will be used, and how sustainable financing instruments will be structured according to which standards. Furthermore, gradually making ESG reporting and sustainability disclosures mandatory for listed companies and financial institutions will increase transparency and reduce the risk of greenwashing. Developing incentive mechanisms, tax advantages, or publicly supported guarantee models that reduce issuance costs for the development of the green bond market will also contribute to the deepening of sustainable finance markets. However, for sustainable finance to develop in line with international standards in developing countries such as Turkey, it is recommended to increase alignment with European Union sustainable finance regulations and global reporting standards.

From an academic perspective, the lack of publications originating from Turkey creates a significant research gap in the field of sustainable finance. Therefore, it is recommended that the relationships between sustainable finance, ESG performance, green bonds, climate risk, and financial markets in Turkey be examined using empirical methods. Furthermore, considering the prominence of the United Kingdom as a central country in the literature and the expansion of inter-country cooperation networks, studies explaining the reasons for the formation of inter-country academic networks in the field of sustainable finance, their determinants, and their results will contribute to the literature. In future studies, supporting

bibliometric analyses with methods such as text mining, content analysis, or topic modeling, rather than limiting them to network maps, will contribute to a deeper understanding of the thematic structure of the sustainable finance literature. Finally, since sustainable finance should be evaluated not only in terms of financial markets but also in terms of improving environmental outcomes, it is important to increase studies that measure the real environmental impact of green finance instruments.

For future studies, a more comprehensive map of the field can be drawn by expanding the variables used in this study, such as publication year, number of citations, and keywords, to include different databases such as Web of Science, Google Scholar, and Dimensions. It is also recommended that bibliometric analysis be performed using different databases. In addition, conducting topic modeling analyses based on abstracts, alongside author–institution–country collaboration networks, will contribute to a more detailed presentation of thematic shifts in the literature. This will also contribute to a better understanding of sustainable finance. Furthermore, in studies to be conducted in the field of finance to prevent climate change and increase environmental awareness, it is recommended that sustainable finance instruments such as green bonds, green banks, and green loans be examined by topic through bibliometric analysis.

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