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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

A BIBLIOMETRIC REVIEW ON THE SUSTAINABILITY OF AIRPORT AND AIRLINE BUSINESSES

HAVALİMANI VE HAVAYOLU İŞLETMELERİNİN SÜRDÜRÜLEBİLİRLİĞİ ÜZERİNE BİBLİYOMETRİK BİR İNCELEME

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Abstract

The importance of sustainability in research has been increasing day by day. This article aims to determine the extent to which sustainability is studied in the context of airport and airline operations in terms of economic, environmental and social dimensions, and to identify gaps in the literature to guide future research. To achieve this goal, bibliometric analysis is utilized. Using the Perish or Publish literature search program, studies obtained from the Scopus database are analyzed using the Vosviewer program to examine the dimensions of sustainability in airport and airline operations. Additionally, the most prolific authors, most cited publications, journals with the highest number of articles published, and the most studied sectors related to the topic are analyzed to contribute to the literature.
Keywords: Sustainability, Airport, Airline, Bibliometric Analysis
Jel Classification: M10, M19

Öz

Sürdürülebilirlik kavramının önemi her geçen gün artmaktadır ve aynı oranda bu alanda yapılan çalışmalar da artmaktadır. Bu makale ile havalimanı ve havayolu işletmeleri üzerine yapılan çalışmalarda sürdürülebilirliğin ekonomik, çevresel ve sosyal boyutlarının hangi oranda çalışıldığının tespit edilmesi ve yazındaki boşluklar belirlenerek gelecek çalışmalara yol gösterilmesi amaçlanmaktadır. Bu amacı gerçekleştirmek için bibliometrik analiz yönteminden yararlanılmaktadır. Perish or Publish literatür tarama programı kullanılarak Scopus veri tabanından elde edilen çalışmalar Vosviewer programı yardımıyla analiz edilerek havalimanı ve havayolu işletmelerinde sürdürülebilirliğin boyutları incelenmektedir. Yanı sıra konuyla ilgili en çok yayın yapan yazarlar, en fazla atıf alan yayınlar, en fazla makale yayınlayan dergiler, en çok incelenen sektörler analiz edilerek yazına katkı sağlanması amaçlanmaktadır.
Anahtar Kelimeler: Sürdürülebilirlik, Havalimanı, Havayolu, Bibliometrik Analiz
Jel Sınıflandırması: M10, M19

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1. Introduction

According to Tang et al. (2020), globalization has led the world to undergo various changes or transformations, which can result in a widespread range of effects on industries, sectors, organizations, etc., such as climate change, depletion of natural resources, poverty, population growth, and environmental damages caused by production processes. Essentially, these issues indicate the importance of the concept of sustainability in today's context. Simply put, sustainability entails the idea of leaving enough resources for future generations while consuming the existing ones. It is evident that this concept has increasingly gained popularity over time and is being given higher consideration in various sectors or organizations, including the aviation sector or entities within it.

However, it is noteworthy that the concept of sustainability has undergone many changes over time, with the most influential and significant development believed to be the Brundtland Report prepared by the United Nations World Commission on Environment and Development in 1987, titled "Our Common Future" (Bermejo and Bermejo, 2014). This report emphasizes the importance of sustainability and plays a significant role in increasing awareness about the concept and its explanations or approaches. Consequently, sustainability is now seen as an important principle within the framework of legal regulations, intergovernmental agreements, and national/international policies (Hörisch et al., 2017).

The phenomenon of sustainability, which is addressed in many disciplines and has been brought to an international dimension, brings up the existence of the concept of corporate sustainability when considering the increasing role and impact of businesses in the economy. Moreover, it is believed that the traditional business approach, which has traditionally focused solely on financial gains, has now been replaced by a more value-oriented approach that embraces sustainability principles. In other words, it is now necessary to consider not only financial gains but also environmental impacts, social responsibilities, and corporate governance in measuring a business's success. Therefore, businesses are not only adopting profit-driven practices but also embracing those that are compatible with the environment and society, focusing on the values they create (Frecè and Harder, 2018).

As stated by Gupta and Benson (2011), these sustainable practices have become crucial key elements that provide competitive advantages to businesses over time. This is because consumers, investors, and other stakeholders now place significant importance not only on the quality of products or services but also on the environmental and social impacts of businesses. Therefore, businesses focusing on sustainability principles can gain a significant advantage in increasing their market share by reaching a wider customer base. Hence, it is expected that businesses will make more efforts to reduce their environmental and social impacts, fulfill their social responsibilities, and embrace the principle of corporate sustainability.

On the other hand, businesses that approach corporate sustainability as a whole with its environmental, social, and economic dimensions, and integrate this approach into their management strategies, can maintain their market power continuity in addition to being at the forefront in the race of competition (Terra dos Santos et al., 2023). Corporate sustainability requires a societal perspective

and represents a steady process aimed at ensuring the careful use of a society's cultural, social, natural, scientific, and human resources and respecting their use (Jitmaneeroj, 2016). Nowadays, sustainability practices, which continue to gain importance within this framework, have been institutionalized at the organizational level (Wang and Lin, 2007) and are seen among the strategic objectives of organizations in achieving corporate sustainability. In this context, it is important that all dimensions of sustainability are equal important and carefully addressed accordingly.

Today, sustainability or coordinated activities and practices carried out within this scope in many sectors or organizations, including aviation, are important. It is advocated that organizations should take various measures to reduce their environmental and social impacts, use natural resources more efficiently, and consider the needs of future generations (Kocmanová and Dočekalová, 2011). Moreover, the changes brought about by globalization and the problems they have caused not only highlight the importance of the sustainability concept but also reveal the increasing necessity of considering sustainability both economically, socially and environmentally. Economic, social, and environmental elements are seen as important inseparable parts complementing each other in sectors or businesses (Epstein, 2018). At this point, structuring these elements and internalizing actions aimed at them in the relevant sector or organization based on the sustainability understanding in activities to be carried out is necessary. In order to emphasize this necessity, it is aimed to identify academic studies on the economic, social and environmental sustainability of organizations and to determine which dimension of sustainability (economic, social, environmental) these studies focus on more. On the other hand, determining which dimensions of sustainability remain insufficient in studies constitutes the main purpose of the current study.

2. The Concept and Importance of Sustainability

Sustainability, with its conceptual roots tracing back to ancient times, has historically been described as a subject where people contemplate how to utilize natural resources and preserve them for future generations (Basiago, 1995). However, it is observed that the modern understanding of the sustainability concept gained prominence particularly in the latter half of the 20th century and the beginning of the 21st century. As indicated in the literature, sustainability corresponds to various concepts such as continuity, perpetuity, uninterruptedness, and stability, and essentially can also imply supporting, guaranteeing, and demonstrating the preservation of something. At its simplest, sustainability is a phenomenon that entails the transfer of human actions to future generations by maintaining the balance in the ecological life system and preserving natural resources (Halme et al., 2002).

Pioneering approaches to the concept are brought to attention through the interaction of environmental sciences and economic theories. In this context, sustainability was defined in the 1987 report "Our Common Future" by the United Nations Brundtland Commission as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Bermejo and Bermejo, 2014). This definition constitutes the basis for the development of the sustainability concept and is widely accepted internationally. When approached with a modern

perspective, the sustainability concept today is expressed not only in relation to the environment but also as a broader concept encompassing economic, social, and sometimes even cultural dimensions (Frecè and Harder, 2018).

Moreover, various conceptualizations related to sustainability are discussed in many fields, and it is noted that sustainable development, sustainable environment, sustainable energy and sustainable agriculture, among others, are just a few of these sub-concepts. Viederman (1994) provides a sustainability definition developed through the joint participation of stakeholders responsible for the responsible, balanced, and measured use of all existing or potential resources in natural, human, or economic frameworks. Similarly, Gray and Milne (2002) argue that stakeholders can demonstrate sustainability through integrated mutual benefit and decision-making actions. The stakeholders in question include governments, businesses, non-governmental organizations, and individuals from different fields.

Today, it is believed that governments, businesses, non-governmental organizations, and academics have a higher level of awareness about sustainability and have widely grasped the importance of the sustainability concept (Perrini and Tencati, 2006). This is because numerous stakeholder groups in question formulate policies, develop strategies, and conduct various studies in this direction. Consequently, sustainability is now seen as a necessity rather than a voluntary action, and it becomes increasingly difficult to avoid. In this context, sustainability goals are set, and their feasibility is considered both at the local/national and global/international levels by numerous stakeholder groups (Klaas Jagersma, 2009). It is an undeniable fact that the sustainable management of these resources, whether economic, environmental, or social, is crucial for ensuring a healthy transfer to future generations (Martine and Alves, 2015).

3. Examination of Sustainability Dimensions

According to Zeng et al. (2022), sustainability consists of three sub-dimensions within a general framework: economic, environmental, and social. Sustainability, being a multidisciplinary subject, requires different approaches as it is addressed by researchers in various fields, and this greatly contributes to its development. However, ultimately, it should not be overlooked that all activities within the scope of sustainability, like stakeholder groups, are carried out with a common holistic approach for a shared future.

Economic sustainability entails the effective and efficient utilization of all current and potential financial resources of a business and is fundamentally measured through financial indicators such as profitability, earnings per share ratios, etc. (Piedra-Muñoz et al., 2016). One of the two approaches to economic sustainability is to ensure that economic activities do not impose an unreasonable burden on future generations (Foy, 1990), while the other focuses on maximizing benefits and welfare (Harris, 2001). Additionally, there is a significant relationship between economic sustainability and both environmental and social sustainability, necessitating a comprehensive approach or evaluation (Boar et al., 2020).

Environmental sustainability is based on the principle of preventing overconsumption or achieving moderate consumption based on renewable/non-renewable resources. Simply put, it aims to prevent the overconsumption of renewable resources or to procure and consume alternative resources to non-renewable resources in order to create or achieve a healthy system or functioning (Sanchirico and Wilen, 2007). This ensures the sustainability of both economic-based resources, such as atmospheric stability or biodiversity, and non-economic-based resources, such as ecosystem functions (Harris, 2003). The environmental dimension of sustainability enables the attainment of human/nature harmony and ensures and preserves the ability to meet future economic, social, or environmental needs (Nilashi et al., 2019).

Social sustainability, on the other hand, is based on the first six articles of the United Nations Global Compact, which are fundamental pillars of human rights (Moldan et al., 2012). The social dimension of sustainability encompasses the fulfillment of basic human needs, ensuring security, equality, justice, cultural diversity, development of innovative approaches, tolerance, solidarity, and taking subjective needs into account when necessary (Spangerberg and Omann, 2006). In other words, socially sustainable development is a concept that focuses on the relationships with different stakeholder groups, identifies the positive and negative effects it has on individuals, and strives to manage them. At this point, the importance of social sustainability in achieving successful and effective results is evident, as any deficiency in social development inevitably affects the entire process (Ranganathan, 1998).

4. Method

Scientific progress is cumulatively built over time. Researchers often generate new studies by evaluating the results of previous ones. In heavily studied popular topics, sometimes research may become clustered in certain aspects, leaving other facets of the topic unexplored. Identifying where clustering occurs and where gaps exist in the researched topic is crucial for scientific studies. Revealing these gaps is often achieved through bibliometric analyses (Zupic and Čater, 2015). Bibliometric studies involve statistical deductions from various perspectives such as authorship, topic, keywords, and citations of previous studies, enabling conceptual, intellectual, and social evaluations of the research topic (Bozkurt and Çetin, 2016). Bibliometric networks, consisting of visual indicators, are created using complex nodes and connections to transform quantitative data into qualitative results (van Eck and Waltman, 2014).

In this research, firstly, publications were scanned in the Scopus database using the "Publish or Perish 8" literature search program, and they included the terms "airline sustainability", "airline sustainability" and "airport sustainability" in their title, abstract or keywords and were published between 1984-2023 (The focus is on studies between the entire Scopus database). This search yielded 820 results. After excluding publications that were not relevant to sustainability studies in the aviation field, 610 publications were deemed suitable for analysis. Subsequently, the data pertaining to these results were transferred to the VOSviewer program for bibliometric analysis. This program allows

for a comprehensive examination of the studies in the literature and enables researchers to visualize developments in any field.

5. Findings

There are numerous studies by various authors in the field of sustainability in aviation. Through the analyses conducted, the ten authors and publication titles receiving the most citations have been identified. Among the studies on sustainability in aviation, it was found that the study by Hall and Page (2014) has the highest number of citations, with 3035 citations.

Tablo 1: The top ten authors and publication titles with the most citations in sustainability in aviation

Author(s)	Publication Title	Year	Citation Count
Hall & Page	The Geography of Tourism and Recreation Environment, Place and Space	2014	3035
Mbaiwa	The socio-economic and environmental impacts of tourism development on the Okavango Delta, north-western Botswana	2003	604
Foo, Chin, Tan & Phuah	The impact of COVID-19 on tourism industry in Malaysia	2021	496
Di Vaio & Varriale	Blockchain technology in supply chain management for sustainable performance: Evidence from the airport industry	2020	406
Capocchi, Vallone, Pierotti & Amaduzzi	Overtourism: A Literature Review to Assess Implications and Future Perspectives	2019	329
Amankwah-Amoah	Stepping up and stepping out of COVID-19: New challenges for environmental sustainability policies in the global airline industry	2020	296
Chuck & Donnelly	The compatibility of potential bioderived fuels with Jet A-1 aviation kerosene	2014	284
Sgouridis, Bonnefoy & Hansman	Air transportation in a carbon constrained world: Long-term dynamics of policies and strategies for mitigating the carbon footprint of commercial aviation	2011	259
Nižetić	Impact of coronavirus (COVID-19) pandemic on air transport mobility, energy, and environment: A case study	2020	251
Upham, Thomas, Gillingwater & Raper	Environmental capacity and airport operations: current issues and future prospects	2003	217

When examining cluster analysis to understand the relationships between other authors, it was observed that a total of 21 clusters were formed. When selecting data points on the visual, documents with citations of 10 or more were chosen, and out of 820 documents, 540 documents were included in the analysis. Among these documents, there are a total of 729 connections between authors receiving citations. Authors such as Graham, Cui, Button, and Zhang, among others, appear larger on the visual, indicating that they received more citations and have the most connections. On the other hand, some clusters formed by certain authors are located more centrally, while others are on the periphery. This could be explained by the fact that studies with higher relationship intensity are more centrally located, while studies with lower relationship levels are on the periphery.

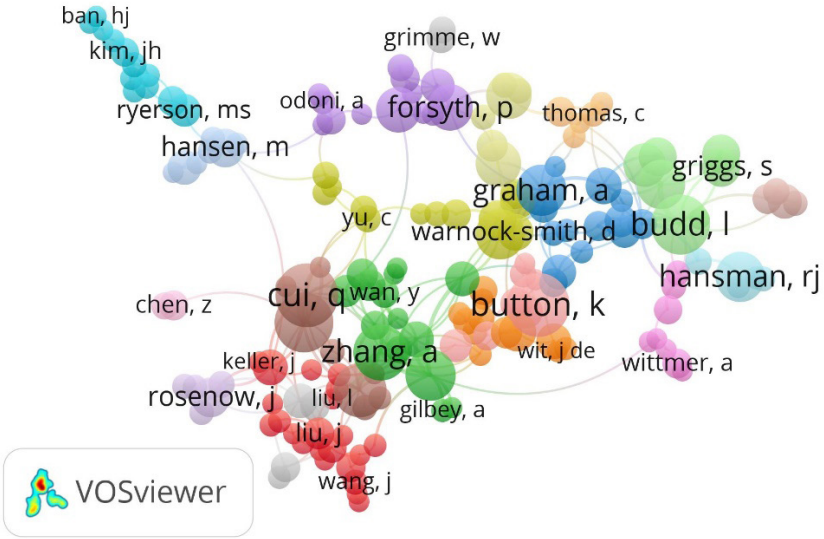

Figure 1: Text data word analysis of all authors

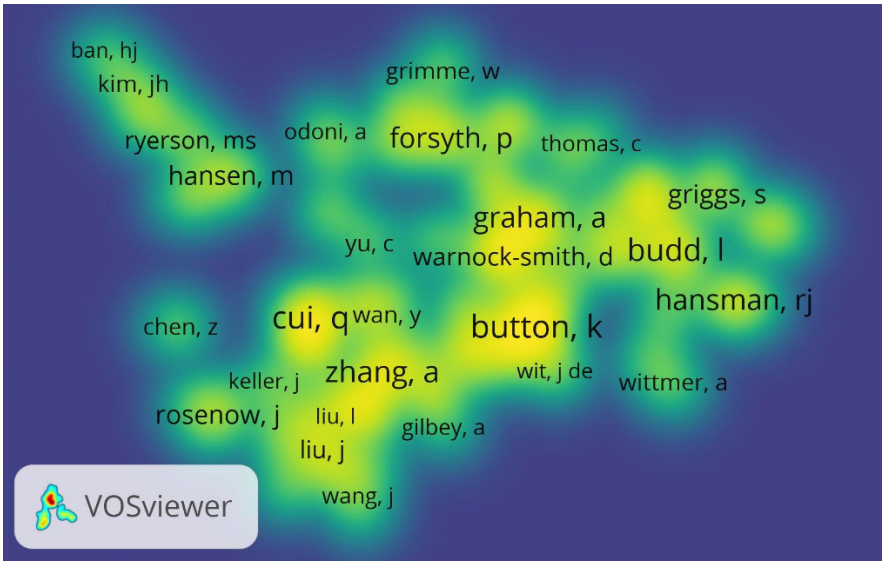

Figure 2: Density map of all authors

The studies on sustainability in aviation are observed to have started in 1984. It can be seen that the number of studies fluctuated and increased from the starting year until 2023. The rise, as depicted more clearly in the graph below, demonstrates the increasing importance given to sustainability in

the aviation sector over the years, and it underscores how authors have been increasingly interested in this topic with each passing day.

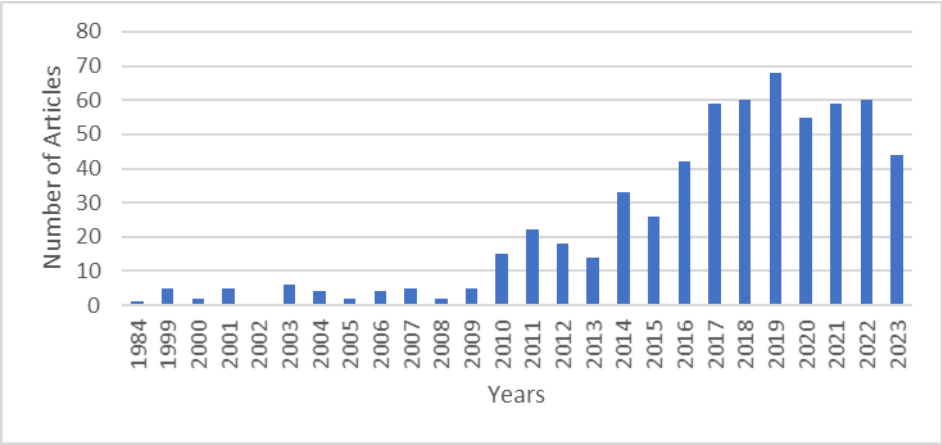

Figure 3: The distribution of studies on sustainability in aviation by year.

Some journals have been observed publishing more articles on sustainability in aviation than others. In this context, the top ten journals that have published the most articles on the subject are listed. Among these journals, "Sustainability" stands out as the journal with the highest number of articles, with 114 articles. The other journals are listed below in the table.

Table 2: The journals publishing the most articles on sustainability in aviation

Journal Name	Number of Articles
Sustainability	114
Journal of Air Transport Management	70
Journal of Cleaner Production	28
Transportation Research	24
Journal of Transport Geography	18
Transport Policy	12
Research in Transportation Economics	12
Journal of the Transportation Research	10

In these journals, while most of the publications have focused solely on aviation, some studies have also explored connections with different sectors or topics. The table below illustrates the sectors in which studies related to the three dimensions of sustainability have been conducted, in addition to the aviation sector. In the first table, studies concerning airports are examined, and sectors and dimensions are presented. Engineering-related studies stand out the most in the context of airports. Following that, studies in urbanization and ecology are seen to contribute to sustainability in aviation. It is observed that areas such as marketing, corporate social responsibility, and econometrics have not been studied in conjunction with airport sustainability. Details regarding other sectors are shown in the table below.

Table 3: Studies on sectors contributing to the sustainability of airports

Sector	Environmental	Economic	Social	Number of Studies (Airports)
Engineering	12	32	2	44
Urbanization	8	4	—	10
Ecology	10	2	—	8
Transportation	2	4	1	7
Tourism	—	6	—	6
Energy	—	2	—	2
Law	2	—	2	2
Management		5	—	5
Accounting	—	2	—	2
Finance	—	2	—	2
Politics	—	—	2	2
Marketing	—	—	—	—
Corporate Social Responsibility (CSR)	—	—	—	—
Econometrics	—	—	—	—

Below is a table showing studies conducted on airlines in conjunction with sectors other than aviation. The findings from these studies indicate that the sustainability of airline operations is primarily studied in conjunction with the ecology sector. Following ecology, finance is the second most studied sector, while no studies have been found on law, urbanization, and politics.

Table 4: Studies on sectors contributing to the sustainability of airline operations

Sector	Environmental	Economic	Social	Number of Studies (Airlines)
Ecology	34	4	—	38
Finance	—	34	—	34
Energy	17	14	—	24
Management	2	19	—	21
Marketing	2	20	4	20
Tourism	10	9	—	19
Engineering	12	14	2	18
CSR	—	18	—	18
Transportation	4	5	—	7
Accounting	—	6	—	6
Econometrics	—	2	—	2
Law	—	—	—	—
Urbanization	—	—	—	—
Politics	—	—	—	—

The relationships between the words frequently mentioned in publications were examined after separating the worked areas according to airports and airlines and analyzing the environmental, economic, and social dimensions. It is observed that the words "Environmental factor" and "transport" stand out. Words crucial for sustainability in aviation, such as "noise," "air pollutant," "green line," "alternative fuel," "profitability," and "sustainability development goal," appear to be

relatively marginal. When the figure is examined, it is observed that the word "socio" has very few relationships and remains outside the clusters. This situation provides a clue that there is less interest in the social dimension of sustainability.

Figure 4: Text data word analysis

The focus of studies on airports and airline companies regarding sustainability dimensions was examined. In addition to studies focusing on only one dimension of environmental, economic, or social aspects, studies that simultaneously focused on two or all three dimensions were also identified. The table below illustrates the focus on sustainability dimensions, categorized by airports and airlines, indicating where each dimension was studied. Accordingly, it is observed that both airports and airlines predominantly emphasize the economic dimension of sustainability. The least studied dimension appears to be the social aspect of sustainability.

Table 5: Distribution of sustainability dimensions by airport and airline

Dimensions	Airport	Airline
Economic	189	258
Environmental	134	129
Social	33	26
Environmental and Economic	48	34
Environmental and Social	2	6
Social and Economic	4	13
Environmental, Social, and Economic	20	2

As seen in the figure below, the most studied dimension for both airports and airlines is the economic dimension, followed by the environmental dimension in second place, and the social dimension in last place. When focusing on the difference between dimensions, it is observed that in airline operations, the economic dimension is proportionally 50% higher than the environmental dimension. Additionally, it is noted that the social dimension is worked on approximately 91% more than the environmental dimension. A similar trend is observed in airport studies as well. The most studied dimension is worked on approximately 42% more than the closest dimension, which is the environmental dimension. Studies related to the social dimension are only about 15% of those related to the economic dimension. Considering all studies, it is evident that the social dimension accounts for only about 8% of all studies.

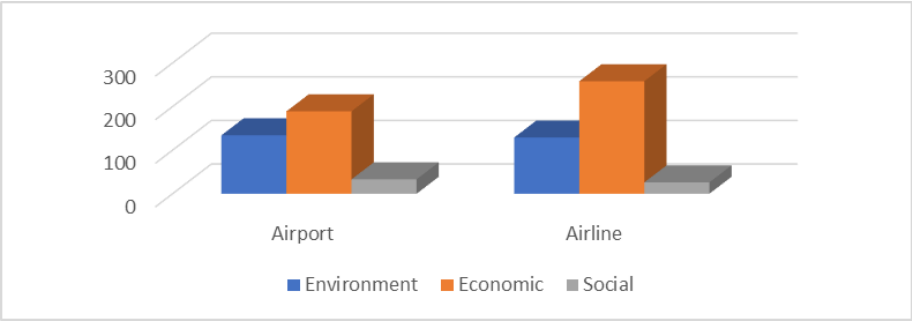

Figure 5: Distribution of sustainability dimensions by airport and airline

On the other hand, when we cluster airports and airlines including countries, we observe that the terms "air pollution" and "British Airways" stand out. The abundance of studies related to these two concepts compared to others and the formation of an intense network of relationships among them indicates that there is intensive research focused on these two concepts. The fact that the concept of "green aviation" remains distant from the clustering suggests that there are few associated studies and that it could be a relatively unexplored area for research.

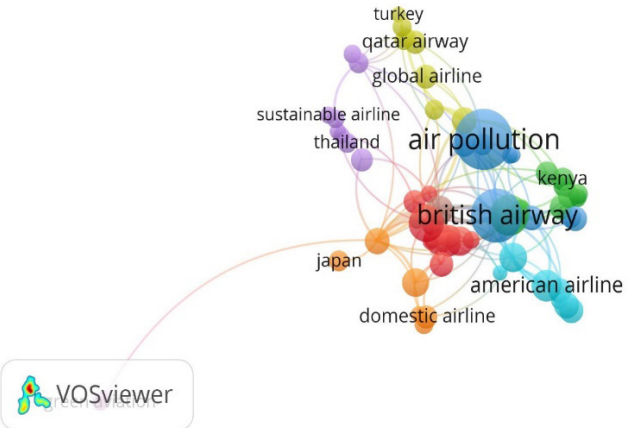

Figure 6: Sustainability topics focused on airports and countries

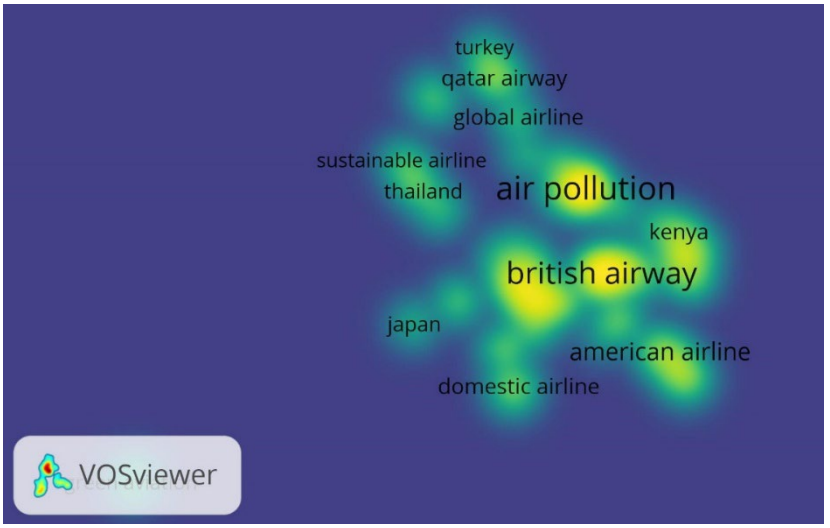

Figure 7: Density map of sustainability topics focused on airports and countries

6. Conclusion

It is believed that the success of today's businesses is shaped not only by financial gains but also by environmental impacts, social responsibilities, and corporate governance (Frecè & Harder, 2018). Therefore, businesses adopt practices that are not only profit-oriented but also environmentally and socially compatible, focusing on the long-term benefits of these values. The responsibility to create and sustain these practices lies among the ultimate goals of organizations. Organizations are implementing sustainable practices in environmental, economic, and social issues, and the importance of these three dimensions of sustainability is increasing day by day. The present study aimed to determine the extent to which these three dimensions are studied by academics in airports and airline companies and to identify possible gaps in the literature to guide future research. Despite fluctuations, research on sustainability in the aviation sector is seen to be increasing day by day. This increase particularly focuses on economic sustainability. While studies on economic sustainability are predominantly conducted in the engineering field at airports, they are predominantly conducted in the finance field at airline companies. The environmental dimension, which is nearly half as much as the economic dimension, is seen to be the most studied in the engineering field at airports, while it is studied in the field of ecology at airline companies. The social dimension of sustainability is poorly studied both at airports and airline companies. Consequently, it is observed that the prominent keywords in the network visualizations are generally related to the economic and environmental dimensions, with no prominent keywords related to the social dimension. Given that the social dimension is considered as crucial as the economic and environmental dimensions for sustainability, academics' lack of attention to this dimension may pose a danger to the future of sustainability.

When examining the studies related to corporate social responsibility (CSR) in sectors related to airports and airlines, it is observed that only the economic dimension is examined in the articles reached. However, CSR is an area that is concerned not only with the economic dimension but also with the environmental and social dimensions as much as the economic dimension. Therefore, in future studies, focusing on the environmental and social sustainability dimensions of corporate social responsibility in airports and airlines will contribute significantly to the literature. A surprising result regarding corporate social responsibility is that no studies have been conducted at airports. Similarly, studies conducted in the fields of marketing and econometrics have only been conducted on airline companies, with no studies found in these areas at airports. Therefore, in future research, it is important for academics working in the fields of marketing, corporate social responsibility, and econometrics to focus on the sustainability of airports. Similarly, while studies on law, urbanization, and politics are focused on airports, no studies related to the sustainability of airline companies have been found. Although urbanization is thought to be mainly related to airports, designing studies in the fields of law and politics including airline companies, would contribute to the literature. On the other hand, when analyzing airports and countries, it is seen that the prominent keywords are "British Airways" and "air pollution." Considering that there are numerous airline companies and airports worldwide, the concentration of studies on a single airline may hinder the sustainable development of the aviation sector. Therefore, in addition to focusing on different airline companies and airports in future studies, it is important to focus on topics other than air pollution to fill the gaps in the literature.

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