

Bibliometric Analysis of Sustainability in Civil Aviation

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Abstract

As air travel has become a crucial part of modern life, concerns about its environmental impact, economic sustainability, and social responsibility have significantly grown. Sustainability in this context refers to the delicate balance between current needs and future aspirations, taking into consideration environmental, economic, and social factors. The aviation industry is a substantial contributor to worldwide carbon emissions, and its ongoing growth poses a threat to exacerbate climate change. But it also has a crucial role in promoting economic growth and global connectivity. Achieving a balance between these competing interests necessitates a collaborative approach involving governments, industry stakeholders, academia and the general public. The sustainability viewpoint in the aviation sector, as well as the research carried out in this field, is of great significance in advancing the sector. The objective of this research is to identify and analyze publications regarding sustainability in the aviation sector within the SSCI and SCI-Exp databases. Suggestions for future research are proposed. The study includes a bibliometric analysis of 123 scientific articles published between 2001 and 2023. The findings reveal significant trends, influential authors and leading institutions in aviation sustainability research whilst also identifying gaps in the literature. Keyword analysis revealed recurring themes such as energy efficiency, emissions reduction, and life cycle assessment. These findings highlight the aviation industry's increasing dedication to sustainability and the necessity for further research and practical measures to ensure a more environmentally sustainable future for civil aviation.

1. Introduction

The aviation industry is currently facing a considerable challenge as it endeavors to balance progress and economic growth with the planet's finite resources (Kılıç et al., 2019). Because of extended global connectivity, air travel has transformed from being a luxury to acting as a critical facilitator of trade, tourism, and personal mobility (Bieger & Wittmer, 2006). However, the considerable growth of the aviation sector has raised concerns about its impact on the environment, economic sustainability, and social responsibilities. This challenge is vital and pressing. The aviation industry is responsible for a substantial amount of global carbon dioxide emissions, and its expansion trajectory risks exacerbating the effects of climate change (Scheelhaase and Grimme, 2007). At the same time, the industry is a crucial catalyst for economic growth, employment, and connectivity. Therefore, a considered and subtle approach is required to achieve sustainability (Darnhofer et al., 2010). Achieving this balance requires cooperation between governments, industry stakeholders, academia, and the public (Teo, 2002). As per the International Air Transport Association (IATA) (IATA, 2021), aviation was responsible for 2-3% of worldwide CO₂ emissions in 2019. With the continued expansion of air travel, the reduction of these emissions has become imperative.

The economic size of the aviation sector can be determined by assessing its contribution to the global GDP. In 2019, research conducted by Boeing revealed that the aviation industry contributed approximately £2.7 trillion to the global economy, which accounted for around 3.6% of the world's GDP. This contribution includes direct and indirect economic activities associated with the aviation industry, comprising airline operations, aircraft manufacturing, and related services. [Source: Boeing, "Boeing's 2020 Global Environment Report"] In addition, the aviation sector has provided employment to millions of people worldwide (BOEING, 2020).

Sustainability, the fundamental concept of this article, concerns the equilibrium between current demands and future aspirations, guaranteeing the consideration of environmental, financial and social attributes in decision-making procedures (Scoones, 2007). Sustainability has gained worldwide importance due to challenges like energy and water scarcities, as well as the swift increase in global population confronted by communities worldwide (Tristante et al., 2023). Sustainability involves a broader obligation to reduce emissions, alleviate noise pollution, guarantee fair access to air travel, and make beneficial contributions to nearby communities (Santa Boca et al., 2020).

Aviation significantly contributes to greenhouse gas emissions, mainly carbon dioxide (CO₂). Academic studies

and reports have provided insights into the impact of aviation emissions.

According to the International Air Transport Association (IATA), the aviation sector was responsible for around 2-3% of global CO₂ emissions in 2019. This estimate is based on data that considers fuel consumption and aircraft operation emissions (IATA, 2021). Apart from CO₂ emissions, aviation releases pollutants and aerosols at high altitudes. Apart from CO₂ emissions, aviation releases pollutants and aerosols at high altitudes. These substances have a more substantial warming impact than CO₂ alone and are typically measured as radiative forcing. The Intergovernmental Panel on Climate Change (IPCC) estimates that aviation's total radiative forcing, including non-CO₂ effects, can elevate its climate impact by roughly 1.9 to 2.7 times that of CO₂ alone.

These proposals comprise the promotion of technological advancements like aircraft with greater fuel efficiency, air traffic management enhancements, together with the creation and implementation of ecological aviation fuels (IATA, 2021).

This study embarks on a bibliometric analysis, delving into the nuanced landscape of sustainability in civil aviation. By scrutinizing the existing body of literature, this research seeks to contribute significantly to the understanding of sustainable practices in one of the most dynamic and impactful sectors globally.

This study investigates various aspects of sustainability in civil aviation. Through examining environmental issues, analyzing existing regulation, and exploring innovations promoting sustainable practices (Wang et al., 2021), the intention is to provide a comprehensive overview of this dynamic field. The aim of this review is to evaluate the current situation and future potential of the industry. As environmental consciousness, legal obligations and consumer insistence on ethical behavior grows, the aviation sector must move towards sustainable practices to continue being pertinent and sustainable (Bettley et al., 2008). By examining the complexities of this endeavor, we can find ways to work together for long-term alterations that will have a positive effect on upcoming generations.

In addressing the existing gap in the literature, this study fills a crucial void by synthesizing scattered insights into a cohesive framework. The bibliometric analysis allows us to identify key thematic clusters, prominent contributors, and the evolution of research trends. In doing so, we aim to provide scholars, policymakers, and industry stakeholders with a consolidated reference that not only highlights the strides made in sustainability research in civil aviation but also pinpoints avenues for future exploration. This research thus serves as a valuable resource for steering the trajectory of sustainable practices in the aviation industry and enriching the existing discourse with a quantitative perspective.

2. Sustainability

The concept of sustainability entails proactively considering the requirements of future generations (Kucukyilmaz et al., 2009) while also satisfying the current generation's needs (Kazemi et al., 2023). Sustainability has emerged as a crucial global problem, triggering a host of sectors to review their ecological impact (Zia et al., 2021). Given the aviation industry's substantial carbon footprint and resource utilization, it has become a critical topic for attaining sustainability objectives (Becken & Patterson, 2006).

Numerous studies have highlighted the significant environmental impacts of aviation, particularly with regard to greenhouse gas emissions, noise pollution, and air quality degradation (Timmis et al., 2015). Such impacts have

amplified the scrutiny of the aviation industry's contribution to the global environmental challenges. While the sustainability efforts of aviation are commendable, challenges still exist. The adoption of novel technologies and fuels necessitates considerable capital and infrastructure alterations (McManners, 2016). Striking a balance between environmental objectives and economic deliberations presents a convoluted trade-off between airlines and the government (Gössling et al., 2020). Moreover, the Coronavirus disease outbreak has impeded and expedited green initiatives, exposing the frailty and adaptability of the industry (IATA, 2021). The aviation sector is increasingly acknowledging its role in carbon emissions. As per the International Air Transport Association (IATA) (IATA, 2021), aviation was responsible for 2-3% of worldwide CO₂ emissions in 2019. With the continued expansion of air travel, the reduction of these emissions has become an imperative.

The literature underscores the urgency of addressing aviation's environmental impact in the context of global sustainability goals. While challenges persist, the industry's ongoing efforts, innovative technologies, and collaborative approaches demonstrate a commitment to creating a more sustainable future for aviation.

3. Sustainability Systems in Aviation

Aviation, a fundamental aspect of global connectivity and economic development, faces mounting pressure to address its negative environmental impact. As apprehensions about climate change heighten, the aviation sector is actively implementing sustainability systems to decrease its environmental footprint while maintaining its crucial international role in transportation and commerce. Numerous undertakings have been established to enhance aviation's sustainability. These factors entail the implementation of greener aviation technologies such as fuel-efficient planes, cutting-edge aerodynamics and propulsion systems, and the accommodation of alternative fuels like biofuels (Ng et al., 2021). Furthermore, airlines and airports are stepping up their game by adopting more efficient operational practices that reduce wastage and energy usage. This involves designing energy-efficient terminals, installing solar power systems, and providing sustainable ground transport options like electric shuttles (Airport Council International (ACI), 2023). Sustainable airport operations aid in reducing the carbon footprint of air travel. Alternative fuels, especially biofuels and sustainable aviation fuels (SAFs), are becoming cleaner alternatives to conventional jet fuels. SAFs have the potential to considerably reduce carbon emissions over the life cycle (IATA, n.d.). For example, such as Turkish Airlines and United Airlines, have started to implement SAFs in their operations.

Advancements in airplane technology have been influential in sustainability endeavors. In an effort to be more fuel-efficient and environmentally friendly, manufacturers are still developing aircrafts. The 787 Dreamliner by Boeing, for instance, employs inventive materials and aerodynamics to lessen fuel consumption and emissions (BOEING, 2020).

Aircraft operations produce substantial noise pollution, which impacts communities situated close to airports. The Federal Aviation Administration (FAA) acknowledges prolonged exposure to aircraft noise can cause harmful health impacts, including stress and sleep disruption. Addressing noise pollution is a social, public health, and environmental responsibility. Furthermore, aircraft emissions lead to the deterioration of air quality. Emissions of nitrogen oxides

(NOx) and particulate matter in the vicinity of airports can intensify air quality challenges in densely populated regions (EPA n.d.). This underscores the necessity for comprehensive sustainability measures to lessen the aviation sector's ecological footprint.

3.1. Sustainability Initiatives

Achieving sustainability in aviation necessitates collaboration among stakeholders, such as governments, airlines, manufacturers, and research institutions (Zieba et al., 2022). Partnerships play a pivotal role in expediting innovation, exchanging best practices, and promoting systemic change.

One of the most pivotal sustainability initiatives in aviation is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) (ICAO 2023). Implemented by the International Civil Aviation Organization (ICAO), CORSA seeks to limit aviation emissions by 2020 with an offsetting scheme. This international accord is a momentous stride towards attaining worldwide carbon neutrality in aviation. Regulatory framework: International organizations such as the International Civil Aviation Organization (ICAO) play a vital role in establishing regulatory frameworks to address the environmental impact of aviation. The technical terms used will be explained when first used. One such mechanism aimed at reducing the sector's carbon emissions is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) (Amaeshi et al., 2006; ICAO, 2023).

International Civil Aviation Organization (ICAO): No changes needed. The ICAO is a major authority in shaping global standards and regulations for aviation sustainability. Its objective is to reduce the net carbon emissions of international aviation, and it is presently developing technical standards for aircraft in order to meet these targets (ICAO, n.d.).

Environmental Protection Agency (EPA): In the United Kingdom, the Environmental Protection Agency (EPA) plays a crucial part in regulating aircraft emissions and noise. The EPA establishes emissions standards and collaborates with the FAA to reduce the aviation industry's environmental impact (EPA, n.d.).

4. Method

4.1. Research Model

In a time when there is a growing concern about environmental impact, social responsibility, and economic stability, the aviation industry has become a crucial intersection of sustainability dimensions (Ranjbari et al., 2021). As demand for air travel continues to rise, it is now essential for the civil aviation sector to scrutinize and implement sustainable practices. This study aims to provide an objective analysis of sustainability in civil aviation by examining the environmental, social, and economic aspects of sustainability within the sector. The objective is to clarify the factors that influence sustainability in civil aviation and their impact on industrial performance. The following research model strives to serve as a well-organized framework to scrutinize these complex associations and furnish noteworthy perspectives for aviation stakeholders, policymakers, and researchers.

The data was acquired from the Web of Science (WoS) database on 31st August 2023 by searching for the keyword block "sustainability" and "aviation" and undergoing a filtering process. The filtering process only took into account English-language articles indexed in SSCI and SCI-Exp. A

total of 123 academic articles that met these criteria were identified.

4.2. Research Universe

The 123 articles obtained cover the years 2001 to 2023. Over the period between 2022 and 2023, 26 and 14 articles respectively were accepted for publication and included in the research as they are going through the early access process. Because the assignment of the articles to a specific issue after acceptance for publication in indexed journals can take approximately 2-3 years, the articles were published in early visibility to make the authors' work available without delay. These articles appeared in 57 journals. There were 5,708 references to publications in the articles. Table 1 displays basic information on the articles included in the research pool.

Table 1. Article Data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2001:2023
Sources (Journals, Books, etc)	57
Documents	123
Annual Growth Rate %	12.74
Document Average Age	3.92
Average citations per doc	10.62
References	5.708
DOCUMENT CONTENTS	
Keywords Plus (ID)	313
Author's Keywords (DE)	568
AUTHORS	
Authors	339
Authors of single-authored docs	16
AUTHORS COLLABORATION	
Single-authored docs	18
Co-Authors per Doc	3.28
International co-authorships %	18.7
DOCUMENT TYPES	
Article	97
Article; Early access	3
Article; Proceedings paper	4
Editorial material	5
Proceedings paper	4
Review	9
Review; Early access	1

4.3. Analysis of Data

As scientific research increasingly relies on data, the availability and interpretability of this data have become essential components of the scientific process. Importantly, transitioning from raw or retrieved data to usable information presents a significant challenge. As with other fields, bibliometric analysis workflows involve multiple distinct stages, each of which utilizes software tools (Guler et al., 2016).

Bibliometric analyses are easier to conduct and require less effort using web services and software specifically designed for this purpose. Many databases containing citation data are available online. The foremost publishers of such databases, including Clarivate Analytics and Elsevier, advertise their products, such as the Web of Science (WoS) and Scopus, through online and in-person seminars aimed at increasing the number of expert users. It is worth noting that the number of articles dedicated to bibliometric analysis has quadrupled since 2000 (Gureyev et al., 2013).

The R 4.3.1 software package was utilized for data analysis. This open-source program offers researchers a complimentary platform for research and analysis and includes numerous add-

ons for further development. To conduct the bibliometric analysis, we utilized the sub-plugin named bibliometrix within the R program and analyzed data.

5. Findings and Results

Researchers have used different qualitative and quantitative literature review methods to understand and organize previous research. Bibliometric analysis, which depends on statistical measurement of science, scientists, or scientific activity, is one method that has the potential to introduce a precisely defined, transparent, and replicable review process. Compared to other approaches, bibliometrics provides impartial and dependable analyses. The profusion of novel information and conceptual advances, coupled with data, establishes a milieu in which bibliometrics can prove advantageous. It facilitates the methodical appraisal of extensive amounts of data, thereby rendering possible the identification of trends that become discernible over prolonged periods, the detection of shifts in disciplinary divisions, the recognition of influential scholars and institutions, and the presentation of comprehensive research (Aria et al., 2017).

In this context, a comprehensive analysis has been carried out on the yearly rate of article publications, top journals and authors concerning publications, citation counts, keyword usage, and publication status, classified by country. Table 2 displays the yearly distribution of published articles.

Table 2. Distribution of Articles by Year

Year	Articles	Year	Articles
2001	1	2013	2
2002	-	2014	3
2003	-	2015	5
2004	-	2016	7
2005	-	2017	3
2006	-	2018	10
2007	-	2019	10
2008	-	2020	12
2009	1	2021	20
2010	-	2022	26
2011	1	2023	14
2012	8		
Total			123

The first publication regarding sustainability in aviation was issued in 2001. Although the number of publications has fluctuated in subsequent years, there was a significant rise in 2022, with 26 articles published, comprising 21% of the total publications recorded to date. Since the outbreak of the pandemic, increased environmental awareness and a desire for more efficient resource utilization have heightened interest in sustainable aviation.

The 123 scholarly articles used in this study were published in 57 journals. Table 3 displays the magazines with the greatest amount of publications.

Table 3. Journals with the Highest Number of Publications

Journals with the Highest Number of Publications	Articles
International Journal of Sustainable Aviation	14
Sustainability	14
Transportation Research Record	8
Energy	5
Journal of Air Transport Management	5
Energies	4
Journal of Cleaner Production	4
Technology in Society	4
Aerospace	3
Frontiers in Energy Research	3

The International Journal of Sustainable Aviation and Sustainability boasts the largest number of publications (14). IJSA covers a variety of aviation topics with a focus on environmental concerns and sustainability. Sustainability is a cross-disciplinary, peer-reviewed, open-access journal that investigates the environmental, cultural, economic, and social sustainability of humankind. It offers a demanding forum for research on sustainability and sustainable development and is accessible bi-monthly online via MDPI. Of all the papers published, 64 were submitted by the top ten journals, constituting 52% of the overall total. The data was classified and streamlined for research purposes using Bradford's scatter law. The resulting index, categorized by Bradford's scatter law, is outlined in Table 4.

Articles were collected from three distinct regions in accordance with Bradford's Scatter Law. The initial four journals, acknowledged as core sources, accounted for 33% of the cumulative publications. The h-index has been advocated as a simple method to objectively evaluate the scientific accomplishments of researchers and has become a commonly used metric for scientific productivity (Hirsch, 2005). The h-index measures the number of an author's articles (h) that have had at least h citations, in relation to the number of publications and their impacts (Engqvist et al., 2008).

Table 4. Spread Table. According to Bradford Scattering Law

Rank	Journal Name	Freq	cumFreq	Zone
1	International Journal of Sustainable Aviation	14	14	Zone 1
2	Sustainability	14	28	Zone 1
3	Transportation Research Record	8	36	Zone 1
4	Energy	5	41	Zone 1
5	Journal of Air Transport Management	5	46	Zone 2
6	Energies	4	50	Zone 2
7	Journal of Cleaner Production	4	54	Zone 2
8	Technology in Society	4	58	Zone 2
9	Aerospace	3	61	Zone 2
10	Frontiers in Energy Research	3	64	Zone 2

The g-index was developed to address issues with the h-index, specifically when assessing worldwide citation impact. is considered more effective than the h-index for assessing precise scientists, as they typically have a higher g-index/h-

index ratio and rank better in g-index assessments. Current research indicates that these measures are not interchangeable, but instead complement one another (Costas et al., 2008). As the m-index is adjusted for age, it may be beneficial in forecasting future accomplishments, which is pertinent within this context. The m-index may serve as a quantifiable measure of "research excellence," while additionally assessing age-

related factors not captured by the h-index (Von Bohlen et al., 2011). Sustained productivity is a requisite for the m parameter's relevance, as opposed to the h parameter, which measures overall impact and may evolve post-publication (Hirsch, 2005). Table 5 presents data on the h/g/m indices of the journals where the articles were published.

Table 5. h/g/m Indexes of the Journals

Journal	h	g	m	TC	NP	PY
Energy	5	5	0.455	305	5	2013
Sustainability	5	9	0.833	93	14	2018
International Journal of Sustainable Aviation	4	5	0.444	35	14	2015
Journal of Cleaner Production	4	4	0.571	112	4	2017
Technology in Society	4	4	0.8	40	4	2019
Journal of Air Transport Management	3	5	0.3	82	5	2014
Renewable & Sustainable Energy Reviews	3	3	0.3	46	3	2014
Sustainability Accounting Management and Policy Journal	3	3	0.25	76	3	2012
Aviation	2	2	0.222	11	2	2015
Journal of Environmental Management	2	2	0.087	46	2	2001

Energy ranks highest due to its high number of citations. While the second and third ranked journals have published more papers, their citations are relatively low, resulting in their placement below Energy. The remaining journals are ranked by their h-indices. Energy's popularity among authors publishing in *Turkiye* has contributed to its top position. Table 6 displays the author productivity details. Details on author productivity can be found in Table 6.

When assessing author productivity, the number of co-authors and publications are the primary focus. Although it can be contended that works with only one author have a higher article contribution rate. Notably, Ayse Kucuk Yilmaz from *Turkiye* is at the forefront of author productivity. Institutions with the highest number of publications, based on the affiliations of their authors, are listed in Table 7.

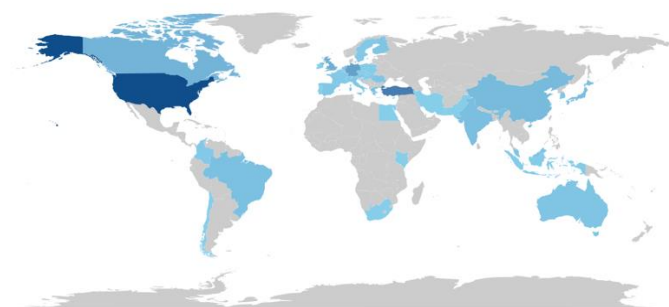


Figure 1. Top Broadcasting Countries

As the blue color in the figure becomes darker, the broadcasting country's effectiveness increases. The grey areas in the map represent no progress. Figure 1 illustrates the distribution of corresponding authors by country.

Table 6. Author Productivity Distribution

Authors	Articles	Articles Fractionalized
Rice S.	9	2.83
Yilmaz A.K.	3	2.50
Sohret Y.	3	2.20
Turan O.	4	1.75
Winter S.R.	5	1.58
Akdeniz H.Y.	2	1.50
Dwivedi P.	5	1.37
Cremer I.	4	1.33
Balli O.	3	1.33
Markatos D.N.	3	1.33

Table 7. Institutions that Publish the Most Articles

Affiliations	Articles
University of Georgia	7
Anadolu University	7
Embry-Riddle Aeronautical University	6
Delft University of Technology	5
University System of Georgia	5
Florida Institute of Technology	4
University of Helsinki	4
Washington State University	4
Florida Institute of Technology	4
Hiroshima University	3

One Turkish university features in the list of the most productive publishing bodies. Turkish scholars face challenges in gaining recognition in academia as their publications often have numerous co-authors and low citation rates. Please refer to Table 7 for a graphic illustration of country-wise publications.

Table 8. Distribution of Articles by Countries of Corresponding Authors

Country	Articles	SCP	MCP	Freq	MCP_Ratio
USA	29	26	3	0.236	0.103
Turkiye	19	17	2	0.154	0.105
Canada	8	7	1	0.065	0.125
United Kingdom	8	7	1	0.065	0.125
Germany	6	6	0	0.049	0
Greece	5	5	0	0.041	0
China	4	3	1	0.033	0.25
Netherlands	4	2	2	0.033	0.5
Australia	3	3	0	0.024	0
France	3	0	3	0.024	1

An examination of the articles reveals that the United States generated the largest number of publications, numbering 29 out of 123. Of these, 26 were authored exclusively by Americans (SCP), whilst 3 were partnerships with foreign authors. Publications solely written by Americans constitute 23.5% of the overall corpus, while the authors from Turkiye's contribution to world literature is estimated to be at 15.4%.



Figure 2. Word Cloud for Keywords

The significance of a country's contribution to world literature is based not only on the quantity of articles, but also on their citation rates. Table 9 displays the number of citations received by each country.

The quantity and quality of an article can be evaluated based on its received citations. A higher number of citations suggests more prestige within the scientific community. In our country, 19 works have been published, and Turkiye has received the most citations. This indicates that we are among the leading countries in this category.

Table 9. Total Number of Citations by Countries

Country	TC	Average Article Citations
Turkiye	289	15.20
USA	242	8.30
United Kingdom	125	15.60
France	108	36.00
Croatia	97	97.00
Greece	92	18.40
Canada	74	9.20
China	46	11.50
Germany	42	7.00
Brazil	35	17.50

Analyses based on keywords are a crucial indicator for identifying prominent themes in research. This approach enables identification of missing areas in the literature and connections between variables. Any frequently used keywords are included in Table 10 for reference.

Table 10. Most Repeated Keywords

Words	Occurrences
Energy	15
Aircraft	12
Emissions	11
Life-Cycle Assessment	10
Efficiency	9
Impact	9
Performance	8
Sustainability	8
Design	7
Corporate Social-Responsibility	6

Out of a total of 313 terms, 15 were categorized as "energy," 12 as "aircraft," and 11 as "emission." Technical vocabulary is generated by creating a word cloud in literature, particularly to capture the reader's attention. It can be argued that the word cloud is more beneficial due to its impact on visual representation and facilitating comprehension for the reader. The word cloud created is displayed in Figure 2.

The graph showing the change in expressions in the Word cloud over the years is shown in Figure 3.

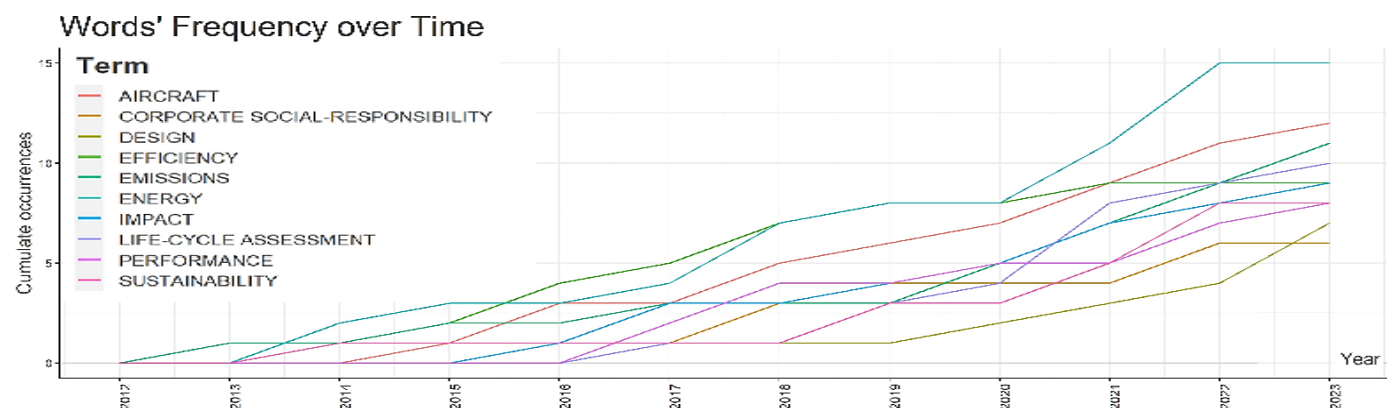


Figure 3. Cumulative Change of Keywords by Years (X axis: Year, Y axis: Cumulative Occurrences)

As can be seen from the graph created the need for sustainability in energy has increased rapidly in recent years.

6. Conclusion

The aviation industry is in a critical phase where sustainability considerations intersect with environmental impact, social responsibility, and economic stability. This analytical study aims to provide a comprehensive view of sustainability in civil aviation, encompassing its multifaceted dimensions: environmental, social, and economic sustainability. The research model created for this objective serves as a structural framework to comprehend the intricate relationships and implications for industry performance, providing significant perspectives for aviation stakeholders, policymakers, and researchers.

This research model aims to serve as a framework for analyzing sustainability in civil aviation. Technical term abbreviations are explained upon first use. The focus is on identifying underlying factors that shape sustainability practices in the sector and evaluating their impact on the industry. The complex relationships that underpin sustainability are investigated in a clear and concise manner. The language is objective and formal, avoiding filler words and ornamental language. The structure is logical and balanced, with causal connections between statements. The text is free from grammatical, spelling, and punctuation errors. The ultimate objective was to offer valuable insights that can guide not only aviation industry stakeholders but also policymakers and researchers who have a shared interest in the sustainable growth of air travel.

Data analysis was carried out utilizing a bibliometric technique and a dataset of 123 academic articles collected from the Web of Science database. The dataset spanned the period from 2001 to 2023, with a noteworthy spike in publications noted in 2022. This surge indicates an amplified focus on sustainability issues in the aftermath of the pandemic. These publications were distributed across 57 different journals, with the *International Journal of Sustainable Aviation and Sustainability* being the highest contributor.

The evaluation of h-index, g-index and m-index for the journals showed varying degrees of impact and selectivity, providing a nuanced perspective on their research excellence and output. Moreover, the study identified notable authors and institutions, emphasizing their relevance in the discourse on sustainability in civil aviation, and highlighted their productivity. Ayşe Kucuk Yılmaz from *Turkiye* was identified as a noteworthy contributor to the discourse, highlighting the influence of individual researchers in shaping the field. Moreover, publishing powerhouses such as the University of Georgia and Anadolu University demonstrated their commitment to sustainable aviation research. A country-specific analysis unveiled the crucial role played by the United States. It produced the greatest quantity of publications, including a noteworthy amount of solitary author articles.

In the interim, *Turkiye* distinguished itself through its notable average citation rate of articles, showcasing the excellence and influence of its contributions to the global dialogue on aviation sustainability. Through analyzing keywords, the crucial themes addressed in the literature were identified, specifically "energy," "aircraft," "emissions," and "life-cycle assessment." These terms emphasize the industry's concentration on energy efficiency, emission reduction, and sustainable design. To conclude, this research underlines the increasing importance of sustainability in civil aviation. This

is demonstrated by the expanding research in this field and establishes a foundation for further investigations. It will assist stakeholders in recognizing trends, influential actors, and important areas for exploration. The findings of the study improve the understanding of sustainability challenges and opportunities within the aviation industry, promoting policies and practices for greater environmental sustainability in this significant sector.

In conclusion, this bibliometric analysis has revealed the complex nature of sustainability in civil aviation, while confirming the importance of our research goals and policies. Our study was initiated with a dedication to creating a well-structured comprehension of sustainability in the aviation industry, utilizing the distinct perspective of bibliometric analysis.

Our pursuit of identifying thematic clusters, influential contributors, and evolving research trends aligns with a broader policy framework. This exercise was not merely academic. The primary goal was to inform stakeholders in the civil aviation industry, policymakers, and researchers about the current state of sustainability discourse and to provide strategic insights for the future.

Upon revisiting the core tenets of this study, it is apparent that the meticulous bibliometric methodology has been a sturdy underpinning for accomplishing our objectives. Our addition of a quantitative viewpoint to complement extant qualitative inferences has significantly expanded the scope of research on sustainability in civil aviation.

Nevertheless, it is imperative to emphasize that our policies go beyond the boundaries of academia. The integration of fragmented information into a coherent structure is not a goal but a tool to spur significant measures. Hence, the research's final statement must exhort prompt action-urging concerned parties to harness the identified developments, take advantage of the nascent research areas, and collaboratively direct the course of environmentally sound practices in the aviation sector.

Essentially, our research transcends the constraints of this paper and invites collaborative efforts, informed decision-making, and an unwavering dedication to sustainability principles. As we conclude this bibliometric expedition, let it serve as a driving force for unceasing exploration, innovation, and deliberate policymaking in the ever-changing realm of civil aviation sustainability.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare no potential conflict of interest concerning the publication of this paper.

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