A Systematic Literature Review: Determinants of Airport Sustainability

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Abstract. Airport sustainability always needs to be considered because airports are one of the most important transportation infrastructures for a country's economy. Airports are not only the main gateway for air transportation but also play an important role in driving the economy and tourism. Therefore, good airport sustainability can have a positive impact on economic growth and tourism in a country. The complexity of activities that occur at airports causes some negative impacts on several sectors. One concept that can be implemented as a solution to overcome or minimize the impact that occurs due to activities at the airport is airport sustainability. This needs to be supported by analyzing variables that can inhibit and encourage the implementation of airport sustainability. One way to mine these variables is by utilizing current technological developments through Bibliometric and Systematics Literature Review (SLR). The mining of these variables is taken from scientific publications that have proven their accuracy. The result of this research is that several determinants of airport sustainability are environmental, social, and economic. In contrast, China is the country that has done the most research on airport sustainability.

Keywords: airport sustainability, bibliometric, systematic literature review

1. Introduction

Transportation is critical to the development of a region as it provides mobility to places around the world and plays an important role in facilitating trade. The air transportation sector has made many significant contributions both directly and indirectly to the economy and the activities of human civilization. Companies engaged in this field need to implement strategies for the sustainability of the company and achieve predetermined targets. The complexity of activities that occur at the airport has several negative impacts on several aspects, such as the environment, economy, and society. Airport sustainability is one of the important elements in the company's business strategy. By prioritizing sustainability, companies can benefit from improving corporate reputation and operational efficiency, reducing the risk of climate change, and increasing competitiveness. Companies that implement airport sustainability in terms of implementing environmental regulations such as regulating carbon emissions, waste, and other environmental impacts make a better corporate reputation. Sustainable practices also lead to operational efficiency such as energy savings. Companies that care about the environment can help reduce greenhouse gas emissions and contribute to mitigation efforts to reduce the impact of climate change. This shows that the company cares about the environment and society. Therefore, the implementation of airport sustainability will have an impact on the company's image, which is getting better, and this is an important factor in consumer selection.

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In order to implement airport sustainability in an airline company, it is necessary to identify variables that can support and are relevant to the research. This is to discuss variables that may affect the research results. The resulting variables help identify gaps in the existing literature so that they can make a significant contribution to the research topic. The variables sought are both drivers and inhibitors of the strategy. Variable exploration can be mined by utilizing technological sophistication in today's digital era through abundant scientific publications. By utilizing our technological advances, the work runs more effectively and efficiently when compared to searching manually one by one. The utilization of technology in finding these variables can be searched by utilizing Bibliometric and Systematics Literature Review (SLR). The results of mining using Bibliometric and SLR will produce a comprehensive and up-to-date model of variables that can encourage or hinder Airport Sustainability. The results help researchers identify trends, contradictions, or general conclusions in the existing literature that are novel to this research.

2. Literature Review

2.1. Airport Sustainability

Airports have an important role in the community, both in the transportation of people and goods. In addition, airports have a role in the trade industry, both regional, national, and international trade, but besides that, the aircraft industry also presents challenges to the environment. Fuel consumption in the aircraft industry is relatively high, which has an impact on climate change. Therefore, issues related to sustainability have become a focus for practitioners to minimize socio-economic problems. The Sustainable Aviation Guidance Alliance (SAGA) suggests that each airport formulate a definition of sustainability depending on its surroundings and its role in the community it occupies. An airport can adopt a definition of sustainability based on the available definitions and adapt it to its needs [1].

The Federal Aviation Administration (FAA) defines airport sustainability as a practice that is implemented in the planning, design, construction, and operation of airport facilities, where the implementation of these practices must be based on three principles, namely: protecting and preserving nature, increasing economic growth and maintaining its stability, and striving to advance the social environment by considering the needs of all stakeholders [2].

2.2. Systematic Literature Review

Systematic Literature Review (SLR) is a comprehensive method used to identify, evaluate, and interpret all research that is relevant to the topic to be studied, both in the formulation of the problem and the research topic area/subject [3]. In line with that, [4] also defines Systematic Literature Review (SLR) as the process of finding, assessing, and integrating available research information with the aim of facilitating detailed answers to research questions.

3. Research Methods

Systematic Literature Review (SLR) is a technique used to explore and identify variables in designing research models related to Airport Sustainability. The software used in the Systematic Literature Review (SLR) is Bibliometric and VOSviewer. Bibliometrics is a tool to analyze the development of disciplines based on intellectual, social, and conceptual structures and identify major trends. Meanwhile, Bibliometric analysis is a quantitative method used to analyze bibliographic data in articles or journals.

VOSviewer is an application that is utilized to review search engine results, data pertaining to scientific publications, and bibliographic databases. The use of VOSviewer allows users to describe and elaborate on the correlation between publications, citations, authors, and research fields. In addition, VOSviewer can also be used to review bibliometric data in a number of aspects, including study area, time period, and nation.

The database used in the research is Scopus. The purpose of using the Scopus electronic database is because Scopus is the largest accredited scientific database that provides various journal articles [5]. The period in this study is limited to the last 5 years, namely 2019 – 2023, with the type of journal articles written in English.

a. The steps taken in this research using Scopus and RStudio are presented as follows:
b. Define the search keywords, in this case, Airport Sustainability.
c. Airport Sustainability keywords are searched based on the article title, abstract, and keywords TITLE-ABS-KEY (Airport AND sustainability) in the Scopus database.
d. To maximize the search results, the filter TITLE-ABS-KEY (Airport AND sustainability) AND (LIMIT-TO (PUBYEAR, 2023) OR LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019)) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) is enabled.
e. Saving the search results in the form of a file using the .bib extension format
f. Organizing data according to the Research Question formed with the help of Rstudio.
g. Downloading and installing the latest version of RStudio and R.
h. Run the RStudio application and enter the script :
i. install.packages("bibliometric")
j. library(bibliometric)
k. biblioshiny()
l. Rstudio will redirect to a new page.
m. The file that has been saved is uploaded to the page.
n. Complete the data analysis.

The following Research Question (RQ) was formed to elaborate on the development of Airport Sustainability research.

RQ 1	:	How do we examine keywords in research papers on the topic of Airport Sustainability?
RQ 2	:	What are the most prominent words in the research on the topic of Airport Sustainability?
RQ 3	:	What other keywords are relevant to the Airport Sustainability study?
RQ 4	:	Which words are the most important and pertinent when researching the topic of airport sustainability?
RQ 5	:	How has the research progressed by theme with research related to Airport Sustainability?
RQ 6	:	How does thematic mapping emerge based on document titles with the topic of Airport Sustainability research?
RQ 7	:	What are the known determinants based on the Airport Sustainability research topic?

To answer questions RQ 4, RQ 5, RQ 6, and RQ 7 can be obtained by integrating Publish or Perish and VOSviewer software. Publish or Perish is utilized in the literature review of the

topic under study [6], in this case, Airport Sustainability. VOSviewer is widely operated and preferred because it has the advantage of working in a relatively large database and the advantage of displaying bibliometric maps. The articles used in this analysis were released within the last five years, specifically between 2019 and 2023. The procedure carried out can be described as follows:

a. Establish the keyword "Airport Sustainability" with the title, abstract, and keyword criteria in the 2019 - 2023 timeframe on Scopus
b. Articles obtained from search results are saved in file format with the .RIS extension
c. Data visualization and trend analysis were obtained by operating VOSviewer software.

VOSviewer and bibliometrics can be utilized in assessing research contributions related to Airport Sustainability. The research contribution information that will be obtained through the use of VOSviewer and bibliometrics:

a. Identify basic conceptions and the relationship between concepts and Airport Sustainability. Through VOSviewer, researchers can analyze the meaning and relationship between basic concepts in the published literature on Airport Sustainability. This can assist researchers in pinpointing areas that still need investigation and in fully grasping the notion of airport sustainability.
b. Identification of research tendencies. Research trends related to Airport Sustainability can be identified through the use of bibliometrics. The aim is to see the evolution of Airport Sustainability research over a period of time.
c. Identification of influential authors and bodies. Researchers can determine the most important writers, organizations, or bodies in the field of airport sustainability research by using bibliometrics. This can help researchers elaborate on findings that could be relevant to study further.
d. Identify the journals that study Airport Sustainability the most. By using bibliometrics, researchers get information about the journals that most include the theme of Airport Sustainability. This can assist researchers in selecting the appropriate journal for publication of their findings.
e. Review relevant research topics, understand the evolution of research, identify research collaborations, and choose the right journal to publish research results.

4. Data Analysis

The process for searching for articles relevant to "Airport Sustainability" was carried out using keywords on the electronic database. The Scopus database is used as a source of information. The search was conducted on October 24, 2023, and the keywords searched on title, abstract, and abstract keywords.

4.1. Search Result

Search results with keywords in the absence of publication year restrictions resulted in 54 Scopus documents. The purpose of this is to determine the progress of Airport Sustainability-themed research. The finding from search results revealed that the latest Airport Sustainability related article was found in 2023, as shown in Table 1.

Table 1. Research Articles related to Airport Sustainability

Author	Title	Source	Year of publication
Jia, X., Buyle, S., Macário, R. [8]	Developing an airport sustainability evaluation index through a composite indicator approach	Journal of Air Transport Management, 113, 102469	2023
Chourasia, A.S., Dalei, N.N., Jha, K. [9]	Evaluating public-private partnership role on the sustainability of airports in India	Sustainable Development, 31(5), pp. 3595-3608	2023
Raimundo, R.J., Balatazar, M.E., Cruz, S.P. [10]	Sustainability in the Airports Ecosystem: A Literature Review	Sustainability (Switzerland), 15(16), 12325	2023
Jia, X., Macário, R., Buyle, S. [11]	Expanding Horizons: A Review of Sustainability Evaluation Methodologies in the Airport Sector and Beyond	Sustainability (Switzerland), 15(15), 11584	2023
Bahman, N. [12]	Airport sustainability through life cycle assessments: A systematic literature review	Sustainable Development, 31(3), pp. 1268-1277	2023

4.2. Data Compilation

Data compilation utilizes Rstudio software with a "bibliometrix" library, which requires files to be saved in the .bib extension. The Research Question that has been determined will form the order of the data compilation.

4.2.1 How to examine keywords in research papers on the topic of Airport Sustainability

Figure 1 shows the cumulative number of keyword occurrences in Airport Sustainability-themed research each year using the shape of a development curve. Keywords began to appear from 2004 to 2023 with an increasing trend. Keywords related to Airport Sustainability that have a significant boost on research are Air Transportation, Airport, Airports, Climate Change, Economic and Social Effects, Environmental Impact, Environmental Management, Greenhouse Gas, Sustainability, and Sustainable Development. These results show that the keywords that advance the most significantly are airports.

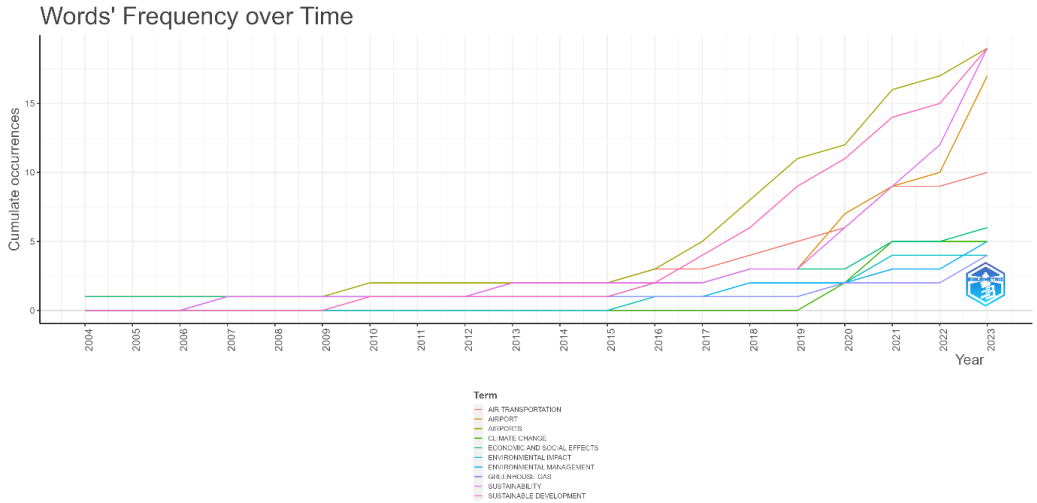

Figure 1. Dynamic Word

4.2.2 What are the most prominent words in the research on the topic of Airport Sustainability?

Figure 2. Word Cloud

The dominant word in Airport Sustainability-themed research is obtained using a word cloud. The word cloud will present words with more frequent occurrences with a larger size and placement of the most dominant word in the center. Findings from the word cloud showed that some words related to Airport Sustainability, ordered from the most dominant, are sustainability, sustainable development, airports, airports, air transportation, economic and social effect, and environmental management. It can be stated that for future research, sustainability, most keywords related to airport sustainability-themed research, will be a determining factor for airport sustainability.

4.2.3 What other keywords have relevance to the Airport Sustainability study?

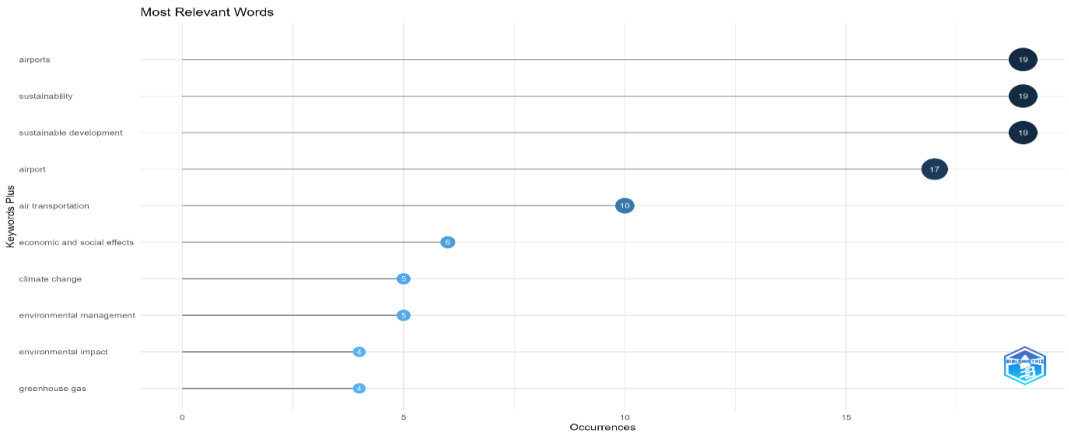

Figure 3. Most Relevant Words

In the collection of research related to Airport Sustainability, some words appear more frequently than others. With occurrences between 0 and 19 times, the ten most relevant words are displayed in the figure above. The words airports, sustainability and sustainable developments are the top most relevant words with 19 occurrences. The second most relevant word with 17 occurrences is airport. The word air transportation is the third most relevant word, with 10 occurrences.

4.2.4 Which words are the most critical and pertinent when researching the topic of airport sustainability?

Figure 4. Word Tree Map

Relevant words can be displayed on a treemap to show the most dominant words. The treemap displays the words in the form of a box, where the area of the box represents the number of occurrences of the word. Figure 4 shows the dominant words, namely airports, sustainability, sustainable development, airport, air transportation, and economic and social effects. Most of the research on sustainability states that sustainability is the focal point in airport sustainability-themed research.

4.3. Data Visualizations

Data visualization was done with the help of the "bibliometrix" library in R software and VOSviewer software. The quantity of word occurrences will be used for visualization in bibliometric analysis. Furthermore, VOSviewer is used to show the relationship between one topic and another using cluster analysis. This research maps bibliometric analysis into 3 visualizations: network, overlay, and density.

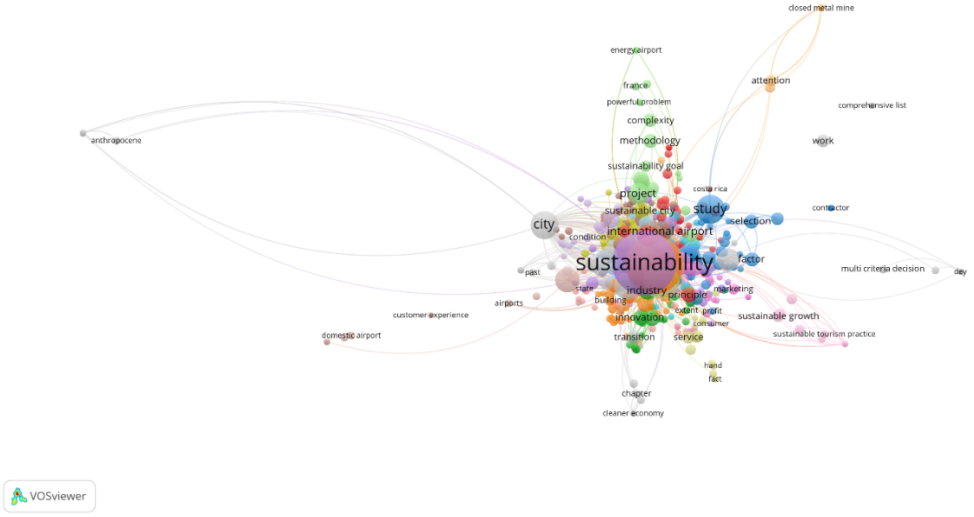

Figure 5. Google Scholar Database Network Visualization Using VOSviewer

In network visualization, the higher the frequency of keyword occurrence, the larger the network circle. Important keywords used in Airport Sustainability research are characterized by the more frequently they appear or the larger the circle.

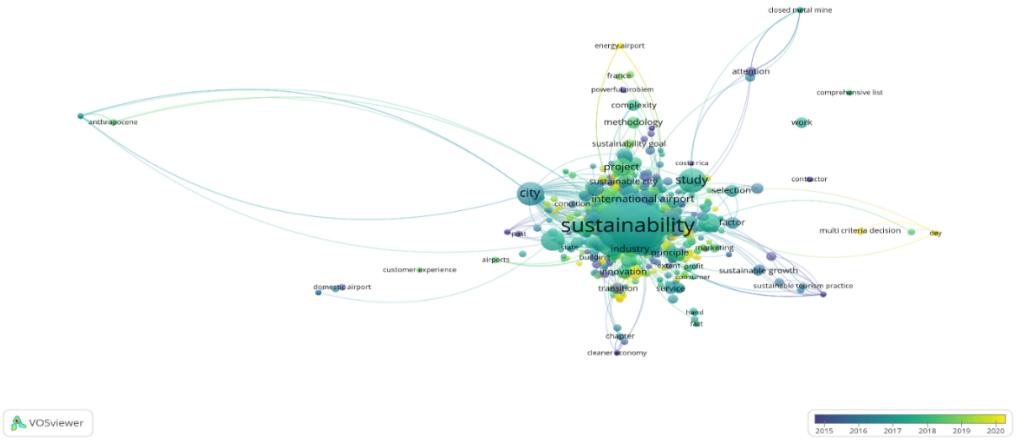

Figure 6. Database Network Visualization

Based on Figure 6, information that can be acquired is the most occurred words, which is sustainability. The occurrence indicated by the area of the circle's word, the larger area means the greater the occurrence, making the word with the keyword sustainability a topic of research.

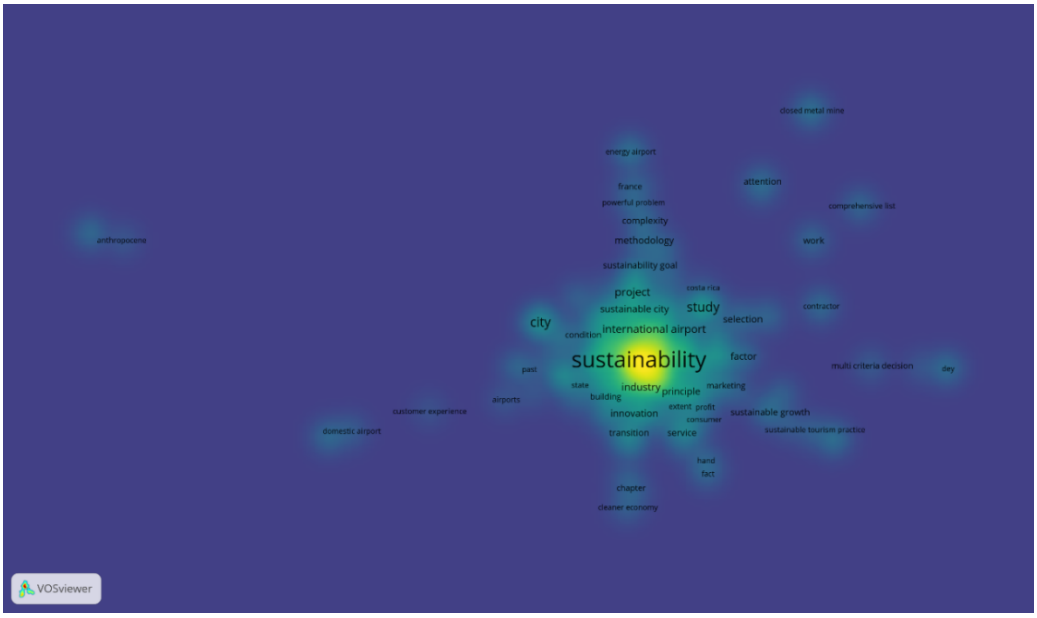

Figure 7. Visualization of Database Networks

4.4.1 How has the research progressed by theme with research related to Airport Sustainability?

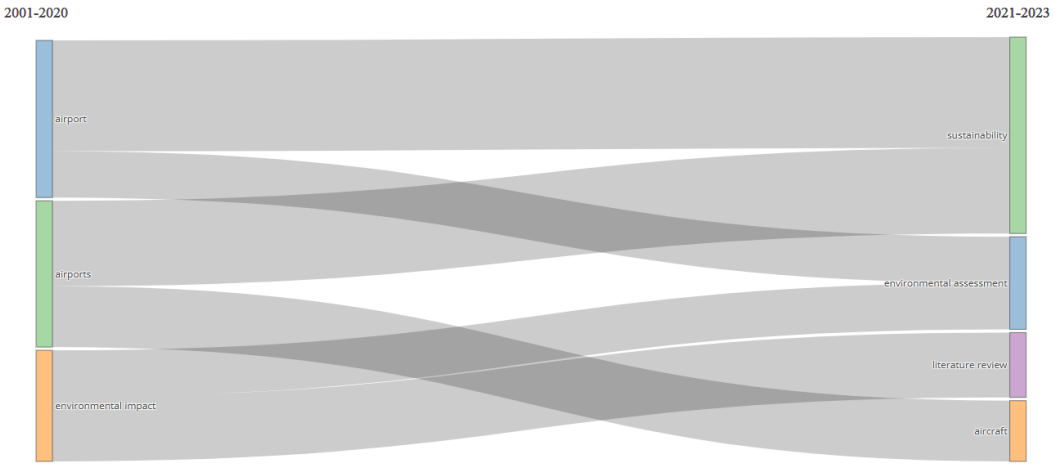

Figure 8. Thematic Evolution

The theme of the research object used in the article must have changed. Figure 8 shows the evolution or change analyzed based on the research theme related to Airport Sustainability. Frequently used themes are marked with rectangles of larger size. The figure is divided into two parts; the left side displays themes used from 2001 to 2020, while the right side is from 2020 to 2023. There are 3 themes on the left side, sorted by largest size, which are airports, airports, and environmental impact. On the right side, there are 4 themes, namely sustainability, environmental assessment, literature review, and aircraft.

4.4.2 How does thematic mapping emerge based on document titles with the topic of Airport Sustainability research?

This research also analyzed thematic maps that divided the Airport Sustainability research theme into 4 quadrants based on document titles. The thematic map was formed with the help of a semi-automated algorithm to review the titles of the research objects.

a. The center-left quadrant is a theme that is highly developed. Despite its high development, this theme is very specific and rarely researched. This is indicated by low centrality but by high density. Themes in this quadrant include airport services and environmental aspects. They are also located between the top left and bottom left quadrants.
b. The lower left quadrant is a declined theme that displays themes with a declining trend, some of which haven't been used in a long time. This is indicated by low centrality and density. The themes included in this quadrant are economic development, environmental aspects, aircraft, economic impacts, numerical models, and energy efficiency.
c. The upper right quadrant, characterized by a high indication of both density and centrality, is the driving theme or motor theme. This theme is important to be studied in future research and thus needs to be developed. The themes that appear in this quadrant are green buildings, climate change, environmental policy, sustainability, carbon emissions, airports,

sustainable development, air transportation, economics, business development, gross domestic product, and transportation infrastructure.

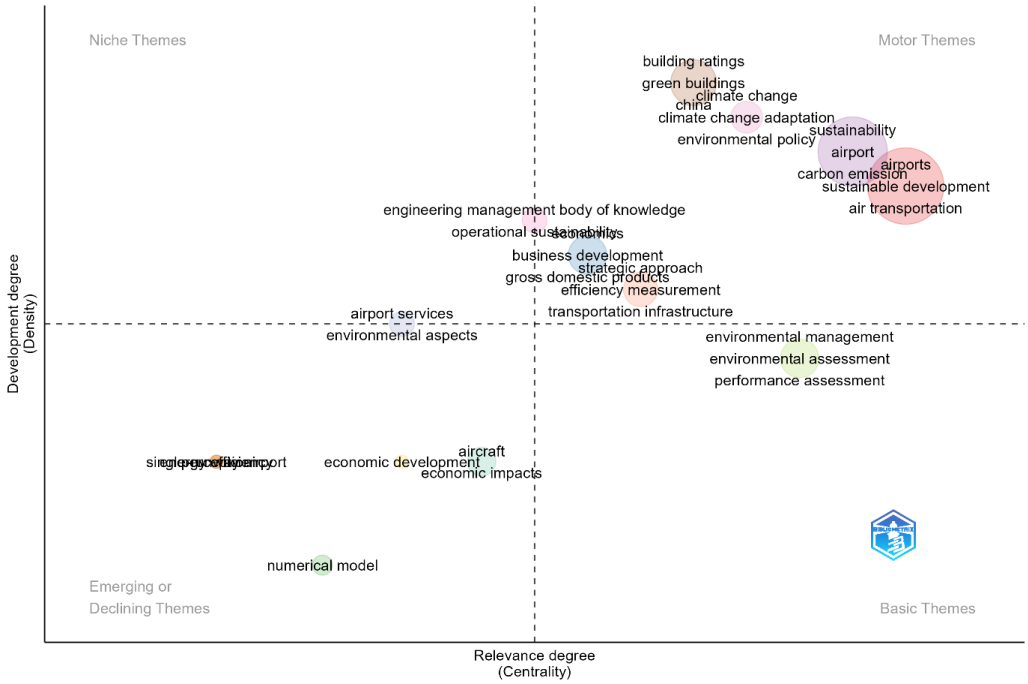

Figure 9. Thematic Map

5. Discussion

Based on bibliometric data analysis, the following factors are the most important ones to consider when assessing airport sustainability.

Potential topics in airport sustainability require deeper research in the future. The visualization results displayed in the aforementioned figures (5, 6, 7, 8, 9, and 10) offer a chance to pinpoint potential subjects for future research in the area of airport sustainability. The determinants of Airport Sustainability obtained from the analysis are shown in Figure 10, namely Environmental, Social, and Economic.

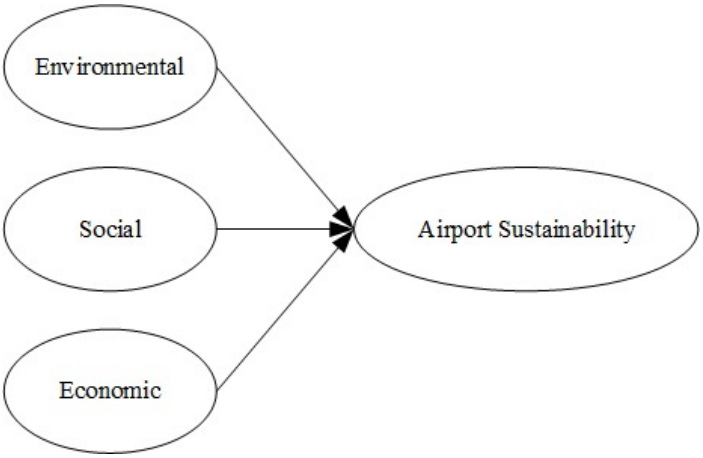

Figure 10. Airport Sustainability Determinants

6. Conclusion

Based on the analysis conducted, some important information was obtained, among others: Bibliometrics is particularly useful in the field of airport sustainability in incorporating the utilization of Scopus electronic databases.

a. Research on airport sustainability is conducted in various countries, both developed and developing countries. The regions that generally conduct research on airport sustainability are Asia and Europe, with a total of 4 articles, while the country that conducts the most research on airport sustainability is China, with a total of 2 articles.
b. Various fields of study have conducted research on airport sustainability, including Accounting, Business, Management, Social Sciences, Environmental Sciences, Computer Science, Economics, Agriculture, Mathematics, etc.
c. some of the most widely used themes in thematic evolution over the span of 2020 to 2023 include 4 themes: sustainability, environmental assessment, literature review, and aircraft. The "bibliometrix" library in Rstudio and VOSviewer software successfully performed quantitative data visualization obtained from Scopus and bibliometric analysis. It was found that the determinants of airport sustainability are environmental, social, and economic.

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