

Article

A Bibliometric Overview of the International Airports and Airlines 'IAA' Topic in Journals and Scientific Community

Lázaro Florido-Benítez 

Department of Economics and Business Administration, University of Malaga, 29016 Málaga, Spain; lfb@uma.es

Abstract: *Background:* The purpose of this study is to provide an assessment of international airports and airlines, 'IAAs', and to organize and classify the literature on air transport to stage the importance of this topic and encourage future research in the projection of the aviation and tourism sectors. *Methods:* It is a bibliographic study, and this work focuses on IAA documents published in major international journals, conferences, and books from 2000 to 9 June 2021; this topic is scattered across various journals and has secondary data in many disciplines. *Results:* The findings suggest a new paradigm applied to the IAA topic and are classified in four first-order research streams: airports; airlines; connectivity; and competition. This study identifies new challenges and opportunities for researchers, airport and airline operators, and stakeholders to make better future decisions. *Conclusions:* There is no agreement on an explicit definition of the IAA concept that captures the true nature of this topic. For this reason, this article is innovative in the new IAA concept and in how it will possibly change the theoretical frameworks in future scientific research in the aviation and tourism sectors. This study has been needed to better understand the effectiveness, projection, and different business strategies to be adopted by researchers and organizations in the aviation and tourism future.

Keywords: airport; airlines; academics research; universities; disciplines



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1. Introduction

The new paradigm of twenty-first century aviation needs coherent management and long-term sustainability to comprehensively address global crises such as the COVID-19 pandemic and needs to promote the development of clean energies to reduce carbon emissions. It has now become imperative to take stock of the actual situation of air transport. Today's passengers are conscious of their rights to travel safety, comfort, and cheap fares, but they are also aware about the increase in the level of carbon emissions, issues of environmental protection, and global warming. Thelle and la Cour Sonne [1] consider that airports of all sizes are often subject to many competitive constraints. For this reason, airport and airline operators must change their management strategies in the next thirty years. 'International airports are bases or laboratories for the study of mobility of tourist destinations' [2]. Airports and airlines enhance human mobility [3,4]. In the area of logistics management, greater efforts are also needed to promote the importance of international airports and air cargo airlines in logistics and e-commerce industries. Airports and airlines are responsible for the success of e-commerce and logistics companies in the XXI century, particularly in the period of a pandemic crisis.

From a strategic point of view, it is important to negotiate with airlines so that the airport has a good location and intermodal accessibility [5]. The bilateral service agreements between airlines and airports have increased the market power of the airlines vis airports. These agreements protect both parties: airlines can guarantee the price and quality of service provided by airport operators [6]. The COVID-19 pandemic has had a catastrophic impact on the tourism and air sector worldwide [7]. Airport operators must develop marketing strategies to ensure airport operations over the short and long run [8].

The pandemic crisis has modified the travel behaviour of passengers in the aviation sector [9], in order to survive the pandemic at this time. The pandemic and recovery management contexts have helped the air transport sector deal with the current crisis, particularly in the years 2021 and 2022 [10,11]. The relationship between international airports and airlines (IAAs) is becoming popular in scientific theory and practice. In a study carried out by Zhang et al. [12], it was found that airport competition encourages cooperation between an airport and airlines as well as maximizes benefits for both [13].

Reductions in traffic provoked significant decreases in airport revenues and profits, especially for airports with large international traffic volumes [14]. In connection, airlines show a strong performance in airports in terms of routes, network density, code sharing, frequency, punctuality, and airport attractiveness, among others [15]. Airports and airlines have a symbiotic relationship; they need each other to thrive. Nevertheless, airports are aware of their roles as tourism promoters [16] and airlines increase their output levels and flight frequencies. Airports' efficiency improves with the number of airlines using them [17]. The operation of the international airport environment is aimed at the production of flows of planes in the air, as well as on the ground, through taxiing, take-off, and landing [2]. In this context, there is a disconnection between the analyses provided by the transport literature and the actual impact of airline and airport disruptions on the final users [18].

This research project looks to illustrate the performance of the fusion of international airports and airlines, 'IAAs', as a topic. To understand the established benefit between both concepts from a scientific and strategic management perspective will help to make better future decisions in the planning and management of airports and airlines by airport and airline operators, Destination Marketing Organizations (DMOs), and researchers. Airports are the gateway of destinations and part of the tourism service system [19]. The objective of this research is to analyse the IAAs on an air transport framework, to organize and classify the literature on IAAs to stage the importance of this topic, and to conceptualize it for future research. To reach these aims, a comprehensive review of international airport and airline research published in academic publications is made to assess the state of IAA investigation. The new contribution of this study lies in the harmonisation of the relationship between international airports and airlines, which has not been jointly addressed as a topic until now. It is a bibliographic study and the scientific literature on this topic focuses mainly on definitions and characteristics of IAA, but it does not show the successful impact of this subject on airport and airline operators in all parts of the world.

A systematic review of air transport can be used to confirm the relevance of topic criteria and develop future research questions [20]. Furthermore, this study proposes five research questions to tackle the challenges and impacts related to the IAA topic in the aviation industry:

1. The relationship between international airports and airlines, 'IAAs', as a concept.
2. What are the contributions of this study to the literature review?
3. How important are IAAs for passengers and destinations?
4. What are the most prominent countries and universities in terms of the IAA topic?
5. Who are the most prominent authors on the IAA topic?

To answer these five questions, this study tackles the conceptualization of international airports and airlines as an IAA topic in Section 2. The remainder of this manuscript is organized as follows. Section 3 provides the research methodology including previous studies and bibliographic material. In Section 4, the publication and citation structure of the IAA topic, the most cited publications, and the main results of leading authors, institutions, and countries are analysed. Moreover, in this section, the five research questions are answered according to the results obtained. Section 5 summarizes our main findings including the limitations of the study and offers, in addition to our conclusions, some future research avenues.

2. Background and Conceptualization of International Airports and Airlines (IAAs)

The continued internationalisation and globalisation of the world's economy has accelerated aviation development [21]; in fact, airlines and airports have had to respond to changing demands for their services due to the globalisation of the aviation sector. International airports are essentially providers of services [22]. Most airports worldwide are also significant generators of surface access journeys such as trains, buses, taxis, or undergrounds [23]. Air transport and tourism research themes are growing in response to industry issues [24].

The literature review about international airports is limited; some researchers such as Lu et al. [25] analysed the key influences of international airport performance in relation to sustainability, and Yeh and Kuo [26] claimed that the rapid growth of international passenger traffic around the world was because of passenger-oriented management practices by airport operators. The proposal is to map the state-of-art to identify the advances in the field and areas in need of further research [27]. However, there are no studies that have defined the concept of international airports, due to its topic or complexity. This study is a proof of the IAA concept for use in future research and as a generalisable decision-support topic in literature-limited scenarios. Furthermore, methods to identify which are the most efficient airports by region [28] and offer knowledge on transfer passengers and shares at airports to other destinations [29], Cheung et al. [30] noted a high passenger growth at hub airports thanks to the Global Airport Connectivity Index (GACI) and this improved airports' competitive position.

Airports are powerful business magnets and metropolitan-region economic accelerators [31]. From a lexical point of view, Cambridge Dictionary [32] defines the concept of an international airport as an airport used by international airlines, with flights to and from different countries. An international airport is a concept focused on interaction and interdependence between an international airport and international airlines. In the same line, Albers et al. [33] suggest that it is only a first step in the conceptualization of airline–airport relationships, the opportunities to be explored, and the benefits that can be achieved by its re-evaluation. In the end, the airport passenger mix depends on airline and tour operator decisions [34].

It is nevertheless important to make a distinction between an international airport and a hub airport; a hub airport is defined by Cambridge Dictionary [35] as an airport with flights to lots of different places, where people can arrive from one city or country and get flights to other cities or countries. A hub airport is a dynamic concept, which looks at the interrelationship between airport–airlines–passengers–connectivity in the context of its accessibility and aviation network. There is a great difference between hub-and-spoke networks and point-to-point networks; hub airports serve as central transfer points, from which flights come in and go out to other cities [36,37].

International airlines have come to dominate the provision of air travel around the world. Indeed, alliances represent the airlines' way of providing seamless international travel [38]. Commercial airlines provide air connectivity in a geographic scope and at scale terms at tourist destinations [39]. It is vitally important that an airline configures its route network as a hub-and-spoke system, with a view to its traffic growth [40]. The liberal market environment of the airline industry plays an important role in the tourism industry [41]. On the contrary, there is a higher concentration of airlines in the market due to the effects of the pandemic and Russia's invasion of Ukraine that have provoked a high incidence of bankrupt low-cost airlines and an increase in prices in the aviation and tourism industries.

To combine the international airports and airlines' activeness in one keyword or concept is not straightforward. Hence, the current study sought to combine both concepts to establish an evocative definition of IAAs and the staging of these two criteria. In this paper, the IAA concept is defined as that mutual interaction and interdependence between airports and international airlines, with the aim of operating flights to and from different countries or around the world. Airports see airlines as their primary customers because airlines

pay a variety of charges such as landing fees, charges per passenger, and tone of freight handled, amongst many others [42]. Indeed, the airport is the provider of infrastructures and general services, and the airlines are its consumer [43]. Airports and tourist destinations can promote routes with airlines, proposing the development of code-share agreements as a complement to increasing new flights. In this same line, Domínguez-CC et al. [44] suggested that tourist destinations should improve their accessibility thanks to airports' volumes of air traffic, connectivity with other airports, the frequency of flights, and the number of airlines.

3. Methodology

Scope of the Study in an International Airport and Airline Context

From the existing air transport research, we will analyse international airports and airlines' documents posted in major air transport management, transport geography, aviation, tourism, and transportation journals, conferences, and books from 2000 to 9 June 2021. Additionally, the period under study runs from 2000 to 2021; this temporary scope addresses the need to examine the positive evolution of the aviation industry in the last 21 years. The IAA concept is linked to the development of new technologies and the tourism industry, sectors that are subject to continuous changes because international consumer demand is growing fast. The data group of the study is the publications registered and accessible on the Web of Science (WoS), also known as the Social Sciences Citation Index (SSCI) [45–47]. The literature search was based on 'international airports and airlines' keywords and peer-reviewed journals. Systematic reviews also follow a defined search strategy using readily accessible databases from WoS and Scopus to identify the key relevant literature on the topic [20,48], and these are the most frequently used databases in bibliometric analyses [49,50].

However, this manuscript project created maps from bibliometric data thanks to VOSviewer 1.6.16 software [51,52]. VOSviewer is used to discover the relationship between publications from campus authors within engineering fields [53]. This software collects, provides maps, and interprets data from different academic databases [54]. Furthermore, this study examines the co-occurrence of author keywords, universities, and authors that published documents [55] related to the IAA topic. Since 2001, there has been a growing interest by academics in the aviation industry, with the output of articles on airports and airline management increasing [56].

This section presents the results obtained in the IAA topic on exploring its performance, evolution, and trends over the past 21 years. Findings were obtained from bibliometric SSCI. To date, 581 studies were found, and all papers were checked with the aim of removing those that were not related to the IAA topic. A total of 15 documents (9 articles and 6 proceedings papers) did not have a clear linkage to the IAA topic, and for this reason, these 15 documents were removed. For instance, Travel Medicine or Air & Space Law journals did not show the two descriptors in the title or keywords in some papers, and these did not have a relationship with our topic; for this reason, these articles were removed. The reviewing process yielded 566 IAA documents from 255 journals (articles, book chapters, and proceedings papers). This research presents the number of citations by authors and the total number of publications. By using publications, the present study measures the volume of published research while citations focus on popularity and influence [53]. The document types and distribution of publications during 2000–2021 are shown in Figure 1.

In 2000, 2 documents were published, and in 2020 the number of documents increased by more than 2750 percent, achieving 55 publications. From 2008 to 2020, a sustained growth can be observed in the rates with some exceptions, where it decreased in 2004, 2010, 2013, and 2018. Figure 1 reveals the distribution by types of documents: the research articles with 76.8% predominate over proceedings papers (22.1%) and books or book chapters with 1.1%. Conversely, the paper's quality and importance are not determined by the number of citations and publication influence [57].

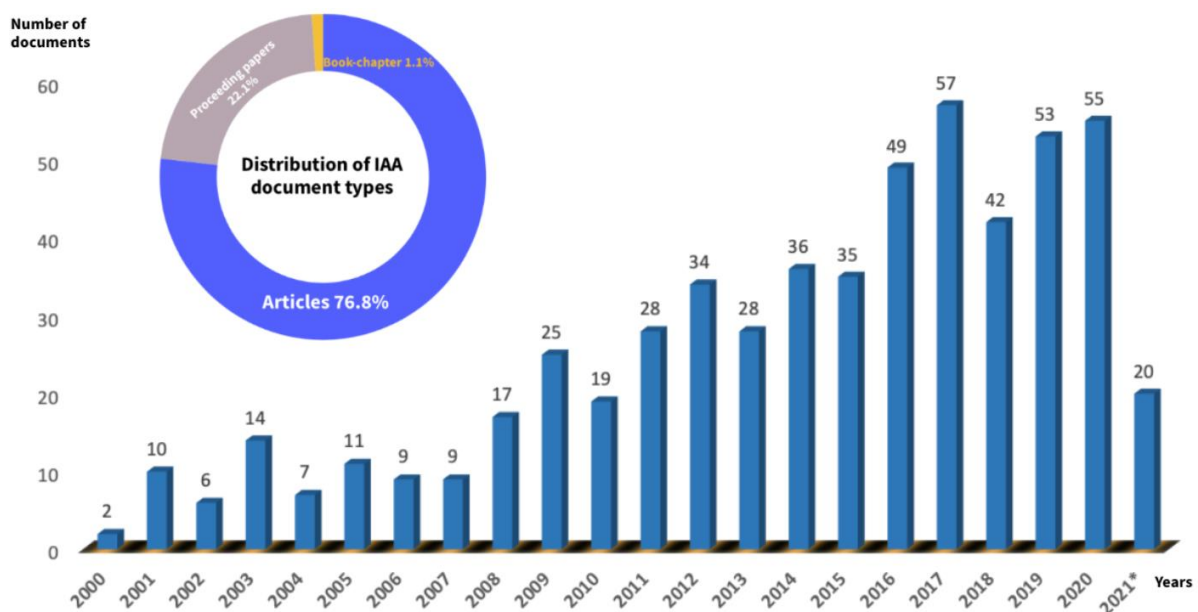


Figure 1. Distribution of document types and number of publications per year in the IAA topic (from 2000 to 9 June 2021 *). Source: own elaboration based on SSCI data.

The main scientific journals that have published documents related to the IAA topic were the Journal of Air Transport Management by 15.37% of publications, followed by the Journal of Transport Geography (4.06%), IEEE AIAA Digital Avionics Systems Conference (3.36%), Transportation research Part A Policy and Practice (3.18%), Transport Policy (2.65%), Transportation Research Record (2.12%), Sustainability (1.41%), Transportation Research Part B Methodological (1.41%), Air Space Law (1.24%), and Transportation Planning and Technology (1.06%), and they represent about 35.87% of the total scientific production related to the IAA topic. A study carried out by Papatheodorou [58] found a high correlation among airline, airport, and tourist destinations due to their intersectoral and transversal relationships.

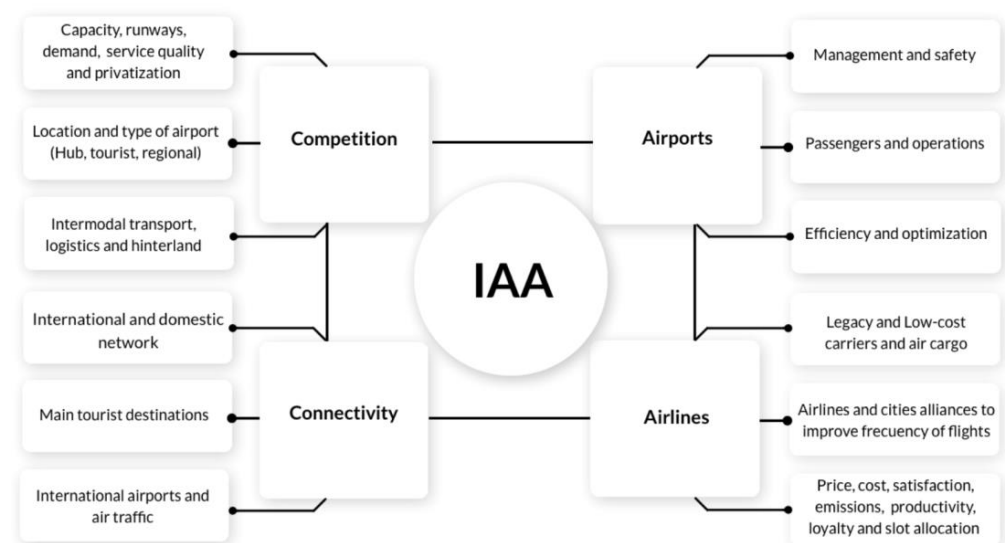
Sometimes, research articles do not always capture the main elements shaping the global aviation industry [59]. Nonetheless, Table 1 shows that the IAA topic has evolved and developed satisfactorily in the last years, in particular in transport and aviation journals. For instance, the Journal of Air Transport Management, 'JATM', published 87 papers in this topic, this journal is focused exclusively on air transportation, and then there is a huge gap compared with the Journal of Transport Geography (23 papers) and an even larger gap with the third-placed conference, IEEE AIAA Digital Avionics Systems Conference (19 documents). The JATM covers all the major sectors of the industry such as airlines, airports, and air traffic management as well as related areas such as tourism management and logistics. In other words, it is the main scholarly air transportation journal globally [11]. Journals of Table 1 state that they only accept rigorous papers based on quantitative as well as qualitative methodologies [60].

These articles were reviewed, analysed, assessed, and classified by the author to implement four first-order research streams. In addition, data and information were examined by the description of the manuscript, keywords, and airline and airport topics. Figure 2 displays four first-order research streams according to the traditional strategy–structure paradigm applied to IAAs [56,61,62]. Documents were classified in these four variables: airports, airlines, connectivity, and competition. 'The management at airports is a complex multi-stakeholder task, with operations, and inherent challenges' [63]. The first stream presents the articles related to management and safety at airports, passengers and operations, and efficiency.

Table 1. Journals and conferences on the topic of IAA published in SSCI (from 2000 to 9 June 2021).

Journals and Conferences	N° Documents Published	% Total
Journal of Air Transport Management	87	15.37%
Journal of Transport Geography	23	4.06%
IEEE AIAA Digital Avionics Systems Conference	19	3.36%
Transportation research Part A Policy and Practice	18	3.18%
Transport Policy	15	2.65%
Transportation Research Record	12	2.12%
Sustainability	8	1.41%
Transportation Research Part B Methodological	8	1.41%
Air Space Law	7	1.24%
Transportation Planning and Technology	6	1.06%
Transportation Research Part C Emerging Technologies	6	1.06%
Transportation Research Part E Logistics and Transportation Review	6	1.06%
Journal of Aircraft	5	0.88%
Transportation Research Part D Transport and Environment	5	0.88%
Transportation Science	5	0.88%
2013 IEEE AIAA 32ND Digital Avionics Systems Conference DASC	4	0.71%
Asian Journal of Shipping and Logistics	4	0.71%
Aviation	4	0.71%
Benchmarking an International Journal	4	0.71%
Economics of Transportation	4	0.71%
Journal of Travel Medicine	4	0.71%
Journal of Travel Tourism Marketing	4	0.71%
Tourism Management	4	0.71%
2011 IEEE AIAA 30TH Digital Avionics Systems Conference DASC	3	0.53%
2012 Inter. Conference on Medical Physics and Biomedical Engineering ICMPE	3	0.53%
Total of Top 25 Journals and Conferences	268	47.35%
Rest of the journals (230) and total of this research	566	52.65%

Source: own elaboration based on WoS data.

**Figure 2.** Multidisciplinary approach of IAAs in the aviation industry. Source: own elaboration based on WoS data.

The second stream deals with airlines (legacy and low-cost carriers) and airlines and cities' alliances to improve the accessibility and frequency at destinations and airports.

Some researchers, such as [64,65], claim that alliances between airlines or with destinations contribute to streamlining costs. Frequency competition is critical for a full-service airline in gaining market share [64], and this allows airlines to increase ticket prices without losing demand [66]. Furthermore, airport slots represent an important avenue for further research on the airlines [67], on how airlines enhance the practice of price discrimination in the globalised market or 'the high dependence of airlines on efficiency and productivity gains [68], and to reduce carbon emissions by airlines. For instance, airlines can reduce total greenhouse gas emissions through carbon trading under the 'Carbon Neutral Growth from 2020' strategy [69].

The third stream gathers documents dealing with the connectivity of airports, tourist destinations, and airlines. The viability and future of airport–airline co-operation is heavily dependent on airline participation and their network connectivity [70]. In the same line, Warnock-Smith and Christidis [71] consider that analysing the factors that affect network connectivity and competitiveness in the air transport market is very important in terms of the impact of policy. The fourth and last stream presents the papers linked to capacity, number of runways, demand, service quality, privatization, location, and type of airport, among many others. 'Transportation literature is rich of studies concerning the evaluation of public transport service quality' [72]. Access at the vast majority of busy airports is subject to schedule coordination. These airports declare a value of capacity and allocate a corresponding number of slots to the airlines [73]. The airport's priority should be promoting its service quality and environment [74]. Moreover, to detect influenza infection with the intention of preventing entry of the virus into a country is very complicated, especially at airports and for airlines [75]. Tourist destinations and DMOs are highly dependent on the digital and physical accessibility offered by airports [76]. The mutual relationship between air transport and tourism is valuable to improve the literature review of these two areas of knowledge, and to explore in depth the relationship of both sectors [77].

4. Findings from the IAA Topic

4.1. Performance Analysis Findings in the IAA Topic

Table 2 shows the main disciplines related to the IAA topic. In the WoS database, a document can cover various disciplines. Zhou et al. [49] considered that these disciplines help researchers know more about transport-related investigations directly and an area's knowledge domain to present deeper insights. The main disciplines included in the results of the documents were the following: transportation with 224 documents, followed by economics (108), transportation science technology (108), aerospace engineering (42), civil engineering (41), operations research management science (36), geography (35), and management (35), and the rest of the categories have below 27 documents published in the context of IAAs. Engineering, economics, psychology, sociology, and other multidisciplinary areas of knowledge are part of transportation research [78]. Table 2 presents that the IAA topic is highly associated with transportation, economics, and transportation technology activities, and these three disciplines are the operating skeleton of the management and operation of airlines and airports.

Many of the documents in JATM are related to transportation and economics [11]. There is a very high relationship between airport activity and economic development. Airports play an important role for the world and global cities [79,80]. Not only research organizations differ in scientific specialization, but also scientific disciplines are spatially biased regarding their propensity to collaborate [81,82]. On the contrary, [56] found that the three main themes of the academic journal air transport literature were the following: management, airports, and passengers. Air transport systems play a crucial role in human mobility, transportation of goods, economics, and the spread of infectious diseases [27]; to survive and prosper during a new period of crises and beyond, airport and airline operators must re-examine their current strategies and assess what new strategies they should be implementing [83]. Airport operators need to implement a commercial perspective due to the commercial revenue covering part of the financing of airports [84].

Table 2. Main disciplines of IAA research.

Disciplines	N° Documents Published	Total %
Transportation	224	38.55%
Economics	108	18.58%
Transportation Science Technology	108	18.58%
Aerospace Engineering	42	7.22%
Civil Engineering	41	7.05%
Operations Research Management Science	36	6.19%
Geography	35	6.02%
Management	35	6.02%
Electrical and Electronic Engineering	26	4.47%
Environmental Studies	25	4.30%
Business	22	3.78%
Computer Science Artificial Intelligence	22	3.78%
Environmental Sciences	21	3.61%
Hospitality Leisure Sport Tourism	20	3.44%
Public Environmental Occupational Health	18	3.09%
Computer Science Information Systems	15	2.58%
Computer Science Interdisciplinary App.	15	2.58%
Green Sustainable Science Technology	12	2.06%
Industrial Engineering	11	1.89%
Law	11	1.89%
General Internal Medicine	11	1.89%
Meteorology Atmospheric Sciences	10	1.72%
Infectious Diseases	9	1.54%
Telecommunications	9	1.54%
Total of Top 25	886	152.37%

Source: own elaboration based on WoS data.

4.2. Universities and Authors That Have Contributed Substantively to the IAA Topic

The 566 documents were authored by 1328 researchers. This research reviewed the total contributions by each author [62,85]. From 2000 to 9 June 2021, the main contributors to IAA research are shown in Figure 3. Results show that Fu Xiaowen is the author with the most studies posted (9 documents); followed by Wang, Kun; Lei, Zheng; O'connell, John F.; Baker, Michael G.; Jacquillat, Alexandre; Zhang, Anming.; Khan, Kamran; Grimme, Wolfgang; and Tsui, Wai Hong Kan. Identifying the most productive authors is a critical indicator of performance analysis, and this help to better understand the current boundaries of a scientific area [62]. Their H index is 3, indicating that 3 of these documents have been cited at least 10 times.

Nevertheless, Table 3 shows the 28 authors internationally recognised in the air transport sector with a consistent research output and significant academic contributions in the last 21 years. They have contributed significantly to increasing the number of documents in the IAA topic. Baltazar et al. [86] claimed that airports create value in the territory where they are operating and cities grow fastest with economic, tourist, commercial, and city-planning development [87]. In addition, Table 4 presents the most cited authors in the IAA topic: Fu Xiaowen with 9 documents published is the most cited (138); followed by Zhan, Anming (131); Khan, Kamran (105); and John O'connell with 101 citations; these are the most prominent authors in the IAA topic by number of citations. An article should have ten or more citations [88].

Table 3. The main contributors to the IAA topic from 2000 to 2021.

Rank *	Author	N° of Documents That Included the IAA Topic **	Authors' Universities ***	Location of Universities
1	Fu, Xiaowen	9	Hong Kong Polytechnic University	Hong Kong (China)
2	Wang, Kun	8	University of International Business and Economics	China
3	Lei, Zheng	8	Cranfield University	UK
4	O'connell, John F.	6	University of Surrey	UK
5	Baker, Michael G.	5	University of Otago	New Zealand
6	Jacquillat, Alexandre	5	Carnegie Mellon University	US
7	Zhang, Anming	4	University of British Columbia; Shanghai Jiao Tong University	Canada; China
8	Khan, Kamran	4	University of Toronto	Canada
9	Grimme, Wolfgang	4	German Aerospace Centre (DLR)	Germany
10	Tsui, Wai Hong Kan	4	Massey University; Chinese University of Hong Kong	New Zealand; China
11	Chao, Ching-Cheng	4	National Kaohsiung Marine University	Taiwan
12	Takebayashi, Mikio	4	Kobe University	Japan
13	Duncan, Alasdair R.	4	University of Otago	New Zealand
14	Jennings, Lance C.	4	University of Otago	New Zealand
15	Priest, Patricia C.	4	University of Otago	New Zealand
16	Wan, Yulai	3	Hong Kong Polytechnic University	Hong Kong (China)
17	Xia, Wenyi	3	University of British Columbia	Canada
18	Merkert, Rico	3	University of Sydney	Australia
19	Witlox, Frank	3	Ghent University	Belgium
20	Antunes, A. Pais	3	University of Coimbra Pólo II	Portugal
21	Ribeiro, N. Antunes	3	University of Coimbra Pólo II	Portugal
22	Voltes-Dorta, A.	3	University of Las Palmas de Gran Canaria	Spain
23	Budd, Lucy	3	De Montfort University	UK
24	Brunton, Cheryl R.	3	University of Otago	New Zealand
25	Lu, Hua-An	3	National Taiwan Ocean University	Taiwan
26	Bilotkach, V.	3	Newcastle University Business School	UK
27	Fuellhart, Kurt	3	Shippensburg University	US
28	Lohmann, Gui	3	University of Hawai'i at Mānoa	US

Source: own elaboration based on WoS data. * Rank of number of documents in the results of the IAA topic from WoS. ** Minimum of 3 documents published per author and minimum 10 citations per author. *** Some researchers work in two institutions.

Table 4. Most cited authors in the IAA topic.

Rank *	Author	Citations **	Authors' Universities ***	Location of Universities
1	Fu, Xiaowen	138	Hong Kong Polytechnic University	Hong Kong (China)
2	Zhang, Anming	131	University of British Columbia; Shanghai Jiao Tong University	Canada; China
3	Khan, Kamran	105	University of Toronto	Canada
4	O'connell, John F.	101	University of Surrey	UK
5	Wan, Yulai	99	Hong Kong Polytechnic University	Hong Kong (China)
6	Baker, Michael G.	86	University of Otago	New Zealand
7	Grimme, Wolfgang	84	German Aerospace Center (DLR)	Germany
8	Tsui, Wai Hong Kan	61	Massey University; Chinese University of Hong Kong	New Zealand; China
9	Lei, Zheng	59	Cranfield University	UK
10	Xia, Wenyi	57	University of British Columbia	Canada
11	Merkert, Rico	53	University of Sydney	Australia
12	Wang, Kun	46	University of International Business and Economics	China
13	Witlox, Frank	38	Ghent University	Belgium
14	Chao, Ching-Cheng	37	National Kaohsiung Marine University	Taiwan
15	Jacquillat, Alexandre	34	Carnegie Mellon University	US
16	Antunes, Antonio Pais	31	University of Coimbra Pólo II	Portugal
17	Ribeiro, Nuno Antunes	31	University of Coimbra Pólo II	Portugal
18	Takebayashi, Mikio	30	Kobe University	Japan
19	Voltes-Dorta, Augusto	28	University of Las Palmas de Gran Canarias	Spain
20	Budd, Lucy	26	De Montfort University	UK
21	Duncan, Alasdair R.	22	University of Otago	New Zealand
22	Jennings, Lance C.	22	University of Otago	New Zealand
23	Priest, Patricia C.	22	University of Otago	New Zealand
24	Brunton, Cheryl R.	18	University of Otago	New Zealand
25	Lu, Hua-An	17	National Taiwan Ocean University	Taiwan
26	Bilotkach, Volodymyr	16	Newcastle University Business School	UK
27	Fuellhart, Kurt	12	Shippensburg University	USA
28	Lohmann, Gui	12	University of Hawai'i at Mānoa	USA

Source: own elaboration based on WoS data. * Rank of number of citations in the results of IAA topic from WoS. ** Minimum of 3 documents published per author and minimum 10 citations per author. *** Some researchers work in two institutions.

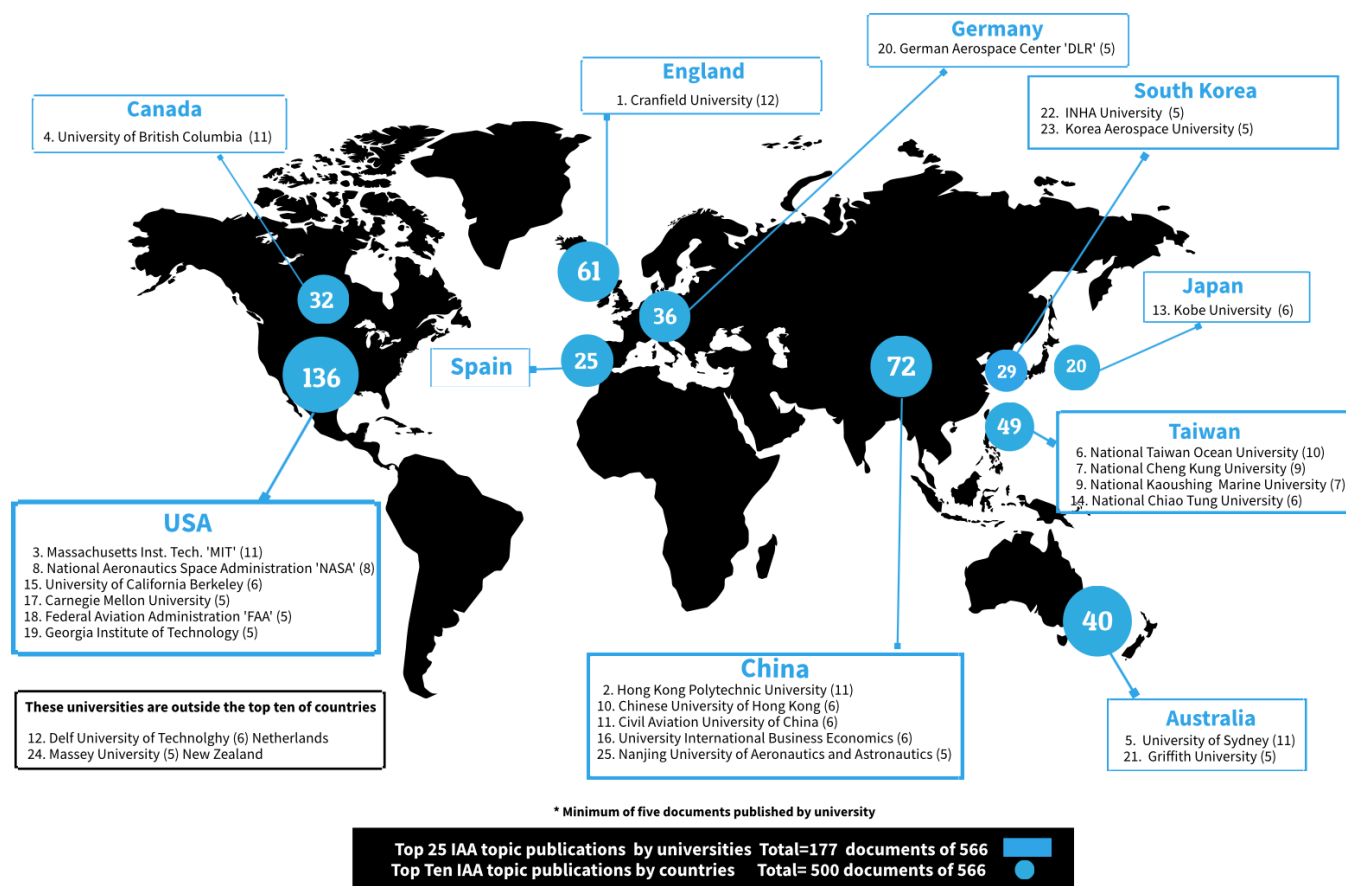


Figure 3. N° of publications of the IAA topic by universities and countries (2000–2021). Source: own elaboration based on WoS data.

Figure 3 illustrates the heterogeneity of universities and countries where work on the IAA topic was posted. This study established a minimum of five documents published by university and only included those published in the English language. The top 25 universities by number of publications provided 177 of 566 documents, published in a wide variety of scientific journals within the established period. Particularly, Cranfield University holds first place with 12 documents; followed by Hong Kong Polytechnic University; Massachusetts Institute of Technology, 'MIT'; University of British Columbia; and the University of Sydney, all of them with 11 documents, and the sixth place is the National Taiwan Ocean University with 10 documents. Cranfield University ranks first in terms of the total number of studies and total citations in air transport and the JATM [11]. Moreover, according to Figure 3, USA universities with 40 documents are the major contributors to IAA research by number of documents published in scientific journals, proceedings papers, and book chapters, followed by China (72) and the UK with 61 documents. These data reveal that there is a great level of interest in researching the IAA topic for universities and researchers around the world. Rana et al. [89,90] noted that collecting international data is really expensive for researchers and that bibliometric studies are very useful to identify the most relevant and distinguishing issues [53,91]. For this reason, systematic reviews provide a bibliometric analysis that can be used to answer the research questions in a more efficient and effective manner [20]. Table A1 more deeply presents the number of publications concerning the IAA topic by universities. Moreover, Table A2 shows the organizations enhanced by number of published documents.

4.3. Most Frequent Keywords in the IAA Topic

Keywords represent the paper's state-of-the-art and the main trends [92], so it is necessary to identify the most frequently written keywords. It is noteworthy that the co-occurrence of authors' keywords in IAA documents are displayed in Figure 4. The size of the nodes is determined by the most relevant keywords, and these were competition; impact; airlines; model; airport; performance; demand; service quality; air transport; aviation; LCC; passengers; market; aircraft; connectivity; travel; management; customer satisfaction; and efficiency. Obviously, competition, impact, airlines, and airport are the most important keywords. We want to highlight that the keyword 'international airport' appeared in the 95th position (6 occurrences 6 and a link strength of 22) among the 116 remaining keywords. Airport, model, and airlines are keywords regularly used in the Journal of Air Transport Management because these are related with the citation counts of papers [11,93,94].

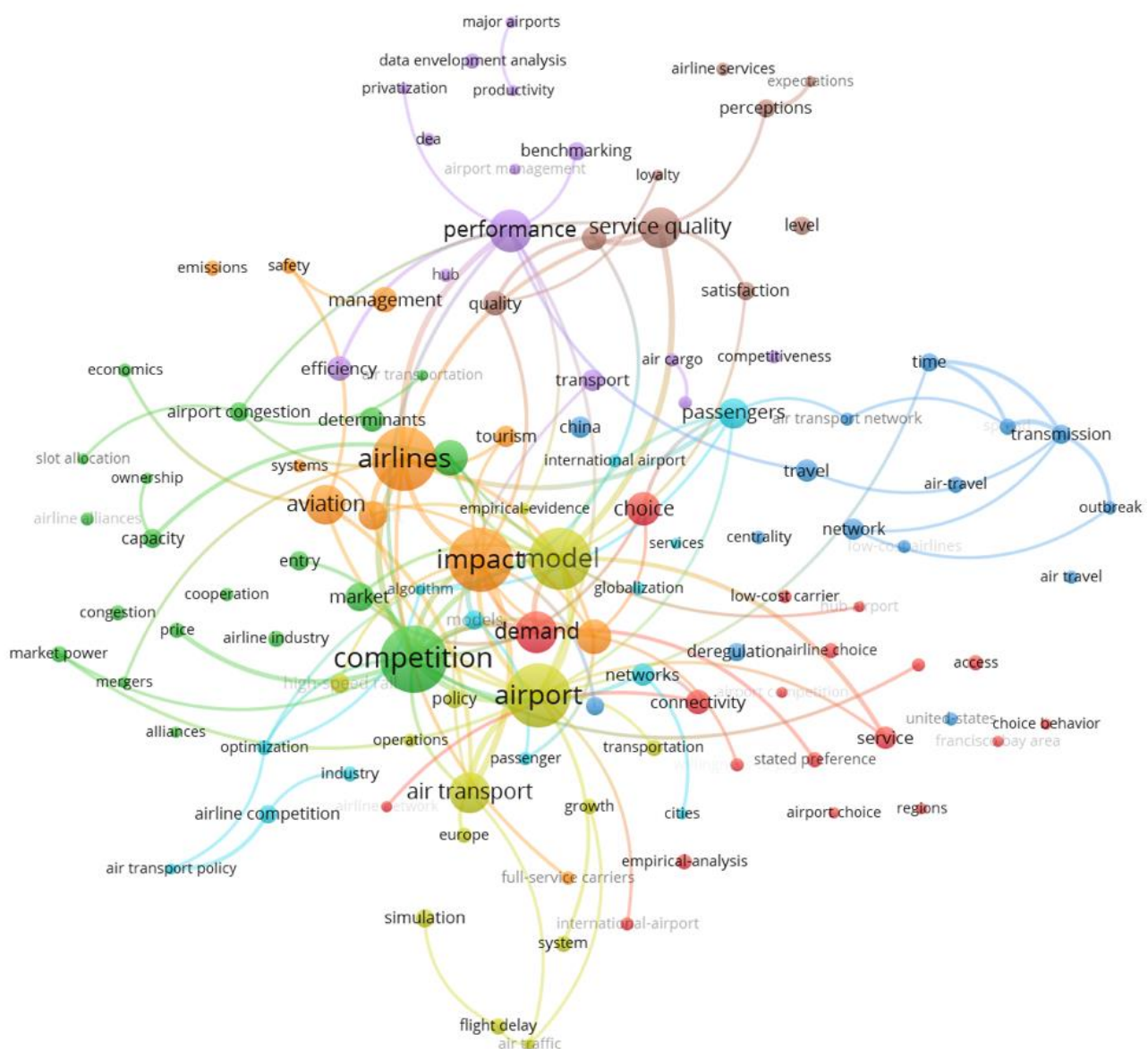


Figure 4. Co-occurrence of authors' keywords of publications on the IAA topic (2000–2021). Source: own elaboration based on WoS data.

4.4. Co-Citation Analysis of Authors and Journals in the IAA Topic

In this subsection, we analyse journals and authors' co-citations. Author co-citation analysis underlines the interrelationships among scholars and highlights the significance of the highlighted cited authors within the knowledge domain [95]. In the case of journals, co-citation network analysis recognizes common points and examines the structure of the relationship across subjects within journals [96–98]. Scientific journals that have received at least ten citations between 2000 and 9 June 2021 are shown in Figure 5, and this illustrates the 173 most representative connections. The Journal of Air Transport Management with 1372 citations is the most influential journal in the IAA topic, followed by the Journal of Transport Geography with 464, Transportation Research Part E Logistics, Transportation Review (396), Transportation research Part A Policy and Practice (395), and Tourism Management with 243 citations. These are the top five journals in terms of co-citations in the IAA topic. The JATM has grown substantially and reached record levels in terms of impact factor, number of citations, and average citations per paper at the end of the analysed period in 2019 [11]. Spasojevic et al. [24] suggests the existence of an emerging interdisciplinary research area at the intersection of air transport and tourism.

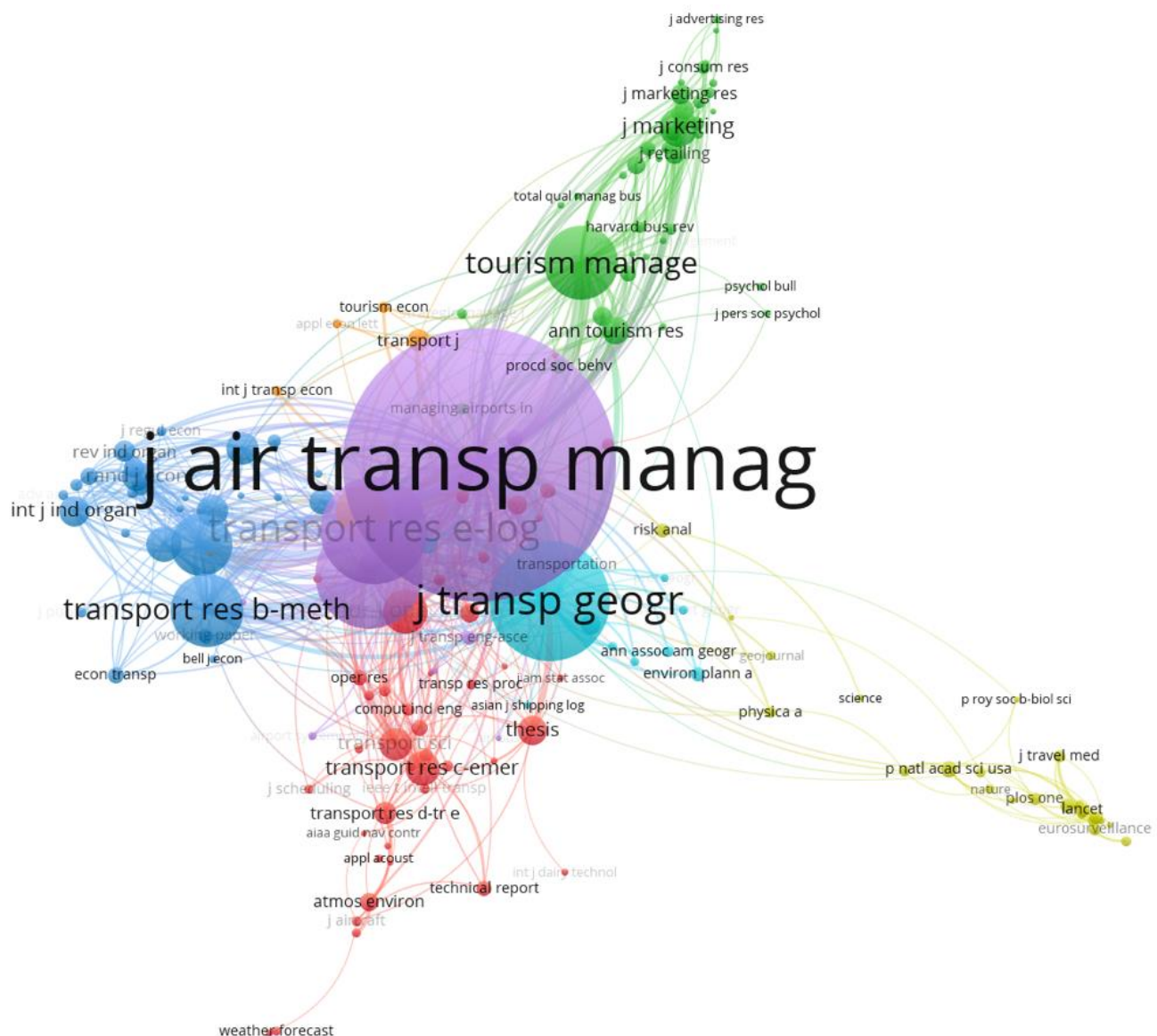


Figure 5. Co-citation of journals in the IAA topic. Source: own elaboration based on WoS data.

Figure 6 displays the authors with the greatest number of co-citations. The size of each node on the co-citation map refers to the relative frequency of author citation in the reference lists [53,98]. According to Figure 6, Jan K. Brueckner from the University of California Irvine is the most influential author; followed by Tae H. Oum (University of British Columbia); Anne Graham (University of Westminster); Eric Pels (University of Amsterdam); Frederic Dobruszkes (Université libre de Bruxelles); and David Gillen (University of British Columbia). The first node (purple one), by nodes Brueckner, K and Oum, T.H, is focused on the study of airport and airline topics. These two topics apply to experts Graham, A. (dark blue) and Pels, E. (navy blue). Suau-Sanchez et al. [99] suggest that airports play a central role in air transport networks and destination connectivity, thanks to airlines. Airports and airlines create benefit spillovers, such as urban economic development and increases in employment and tourism [100]. The proximity of the airport at the collaborating destination is positively related to the expected number of co-authored papers [101]. In addition, expert authors on the IAA topic are also shown in Figure 6, such as Rigas Doganis; Rico Merkert; Pere Suau-Sanchez; Nigel Halpern; Richard Bagozzi; and Florido-Benítez, amongst many others.

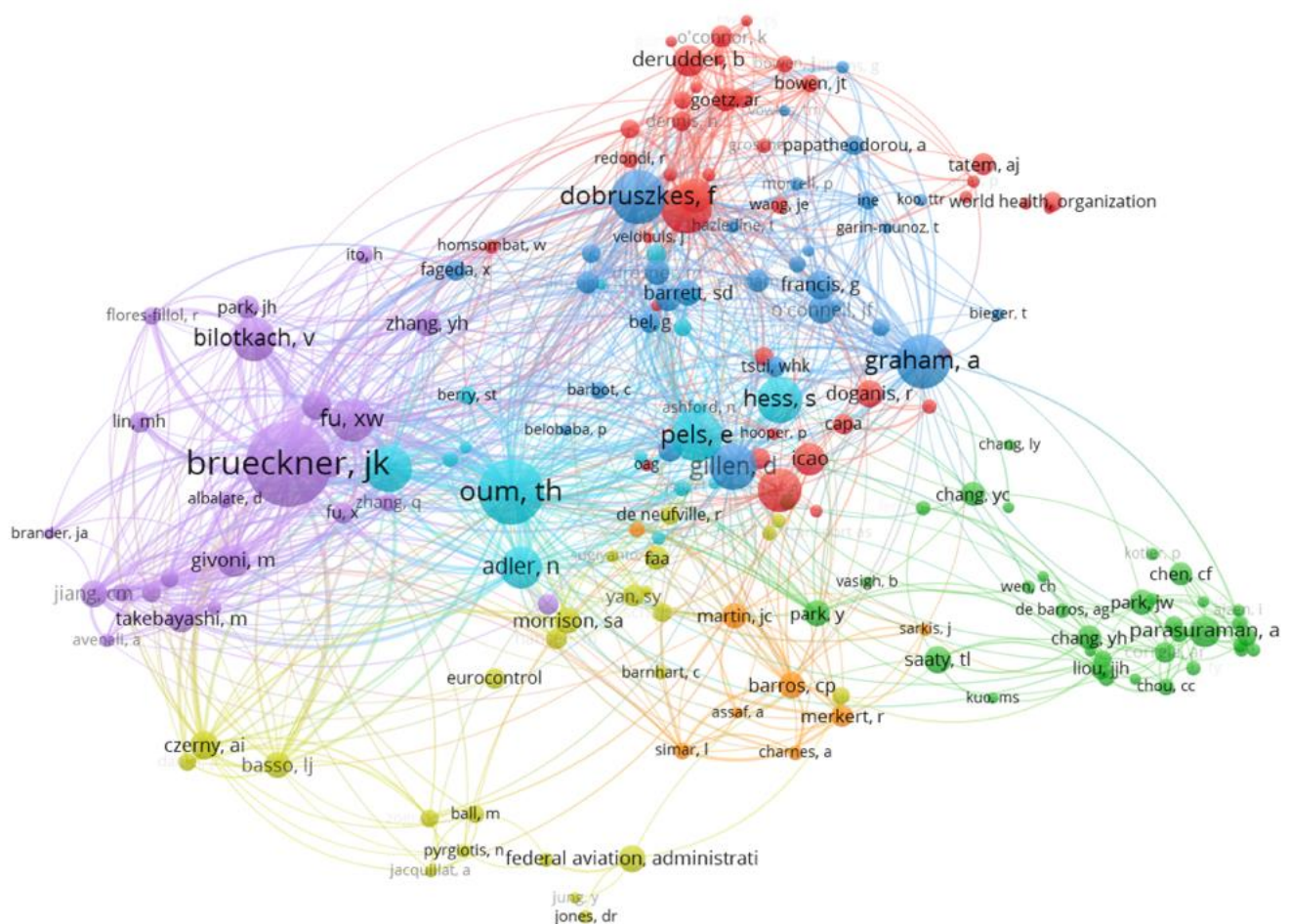


Figure 6. Co-citation by authors on the IAA topic. Source: own elaboration based on WoS data.

4.5. Summary of Evaluations in the IAA Topic

This bibliometric study examines the contributions and relevance of authors, countries, and universities in the period established, depending on their publications in major air transport, sustainability, tourism, policy and practice, marketing, and logistics journals and conferences from SSCI data. Findings supply to researchers an overall view of the IAA topic and some theoretical implications to develop new research projects from different academic perspectives, as shown in Figure 7. We are still assessing the effects of the Russia–Ukraine

war and the pandemic crisis on the tourism and air transport sectors. Academics and researchers should have a clear vision of the difficulties which may face these two sectors in the short term to recover the tourism demand at tourist destinations and the number of passengers at airports and airlines. The air transport and tourism sectors are dependent upon each other [77,102].

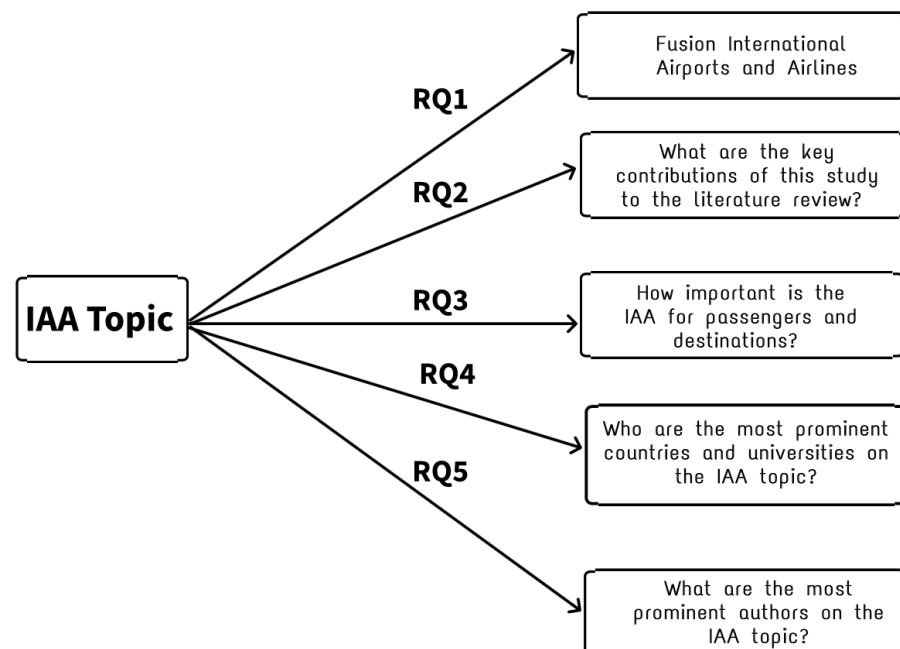


Figure 7. Level of contribution and relevance of the IAA topic to the scientific community and aviation sector. Source: own elaboration.

- 1) Findings have been satisfactory in the fusion of the IAA topic for the scientific community and aviation and tourism industries. IAA topic approval came after extensive review of international airport and airline concepts, consolidating and contributing to the implementation of a new topic in an inclusive way in international aviation, and RQ1 is answered. Possibly, this is the only article that defines the relationships of international airports and airlines as an IAA topic. SITA [103] suggests that the aviation industry needs to tackle new challenges in new technologies, airplane operations, and sustainability. When taking into account documents from diverse areas of knowledge, the interdisciplinary character of IAAs is also well covered. Findings presented in Figure 8 confirm that the JATM is number one by the number of citations, with 792 and 78 documents, followed by the Journal of Transport Geography with 410 citations and 19 documents. The quantum of difference in documents attributed to the JATM is mostly focused on air transport; this is an important source for leading journals in the area of airports, airlines, and the aviation sector [11,104]. Following those are Transportation research Part A Policy and Practice (200 citations and 15 documents), Transport Policy (130 citations and 14 documents), Transportation Research Part B Methodological (134 citations and 8 documents), Tourism Management (129 citations and 4 documents), Transportation Research Part C Emerging Technologies (111 citations and 6 documents), and Transportation Research Part D Transport and Environment (111 citations and 4 documents); the rest of the journals have less than 100 citations, but these have contributed significantly to increasing the number of citations in the fusion of the IAA topic.

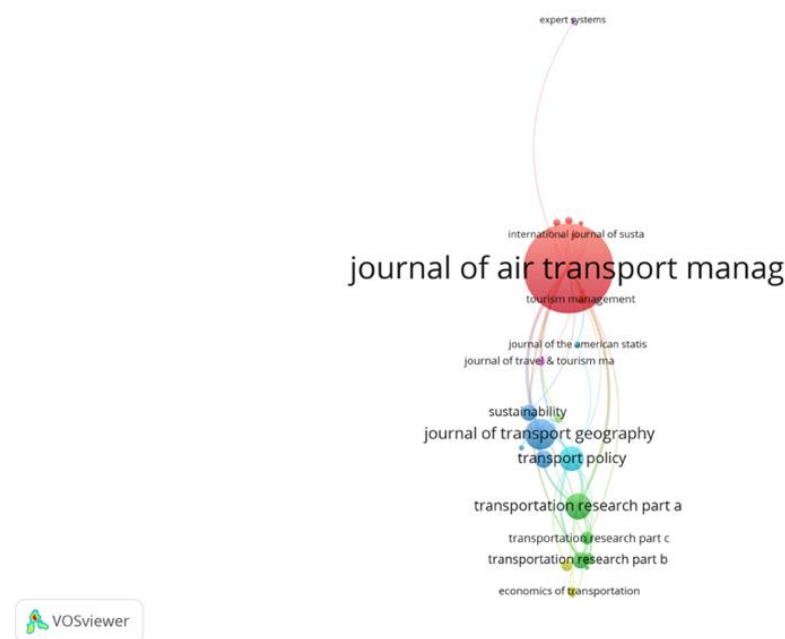


Figure 8. Citation by journals in the IAA topic. Source: own elaboration based on WoS data.

- 2) The level of contribution of this study (RQ2) shows that the IAA topic encompasses a strong interrelation in the international expansion of organizations among airlines, passengers, DMOs, tourist destinations, governments, companies, communication channels, and stakeholders. Airports will only survive by attracting and accommodating enough passengers and supporting airlines [72,105–107]. Airlines with a valuable reference for developing strategies assist governments in understanding the intentions of its airline operators [94]. Commercial aviation enhances understanding of the roles that airports play, and the ways that airlines use them becomes enhanced to maximize their benefits [108,109]. This paper tackles the interaction and interdependence between international airports and international airlines, to improve the air accessibility and connectivity of tourist destinations and passengers' satisfaction and experience. The multidisciplinary framework of IAAs provided four perspectives of research: airports (management, safety, passengers, and operations); airlines (low-cost and legacy carriers, alliances by airlines and cities, and prices and cost management); connectivity (domestic and international routes); and competition (intermodal transport, logistics, airport's hinterland, capacity, runways, and demand, amongst many others). These four dimensions are the indispensable basis of the IAA topic.
- 3) Planning and classification of the literature involved a range of different topics and different disciplines attributed to the IAA topic such as economics, transportation, aerospace engineering, geography, technology, management, and tourism, among others. Technology is very important in the aviation industry, being the engine of the digital revolution in communication, aerospace, airplanes, airports, and control measures. For instance, the dream of travelling through airports and flying around the world without needing to show your passport or boarding pass is now becoming a reality, thanks to the biometric technology [110]. Nevertheless, connectivity, competition, management, accessibility, safety, tourism, technology, and satisfaction factors were identified and considered in this research as important domain areas in the literature review of the IAA topic. These factors suggest that the IAA topic is relevant for tourist destinations and passengers, and RQ3 is answered. Figure 9 presents the 147 terms closely linked to international airports and airlines. Indeed, this research boosts the multidisciplinary of the IAA topic in order to continue investigating topics linked to international airports, airlines, safety, tourism, and cybersecurity, amongst many others. Key terms were 'FAA'; 'gate'; 'taxi'; 'customer satisfaction'; 'high speed

rail'; 'simulation'; 'ICAO'; 'flight frequency'; and 'domestic market'. It is important to point out that a system of transport intramodality in the form of airports, airlines, railways, and taxis is highly analysed and investigated in the air transport literature, as we have seen in the course of this research.

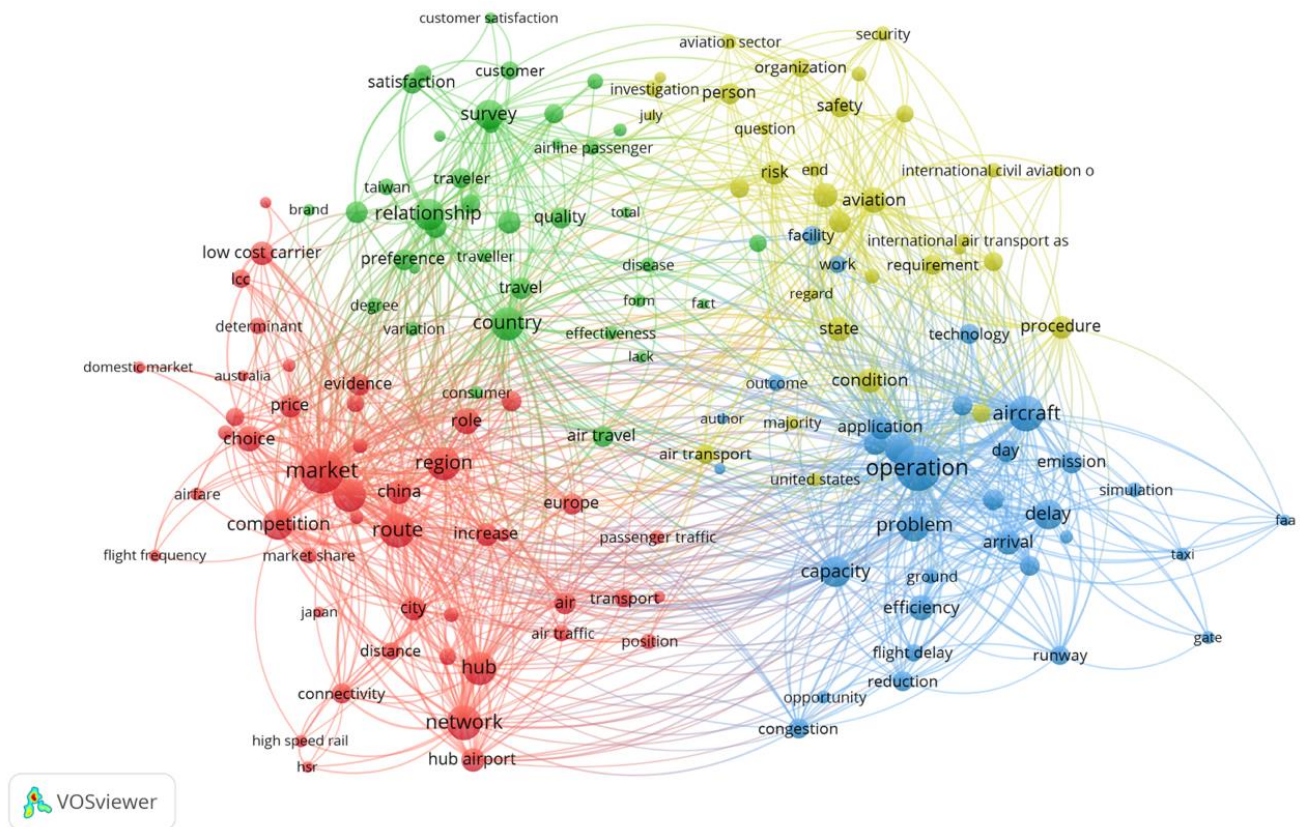


Figure 9. Showing 147 terms in the IAA topic (only title and abstract fields in the IAA topic). Source: own elaboration based on WoS data.

- 4) Additionally, this research tackles the most relevant countries and universities in terms of the IAA topic (RQ4), and findings revealed that IAA research has been conducted by researchers from a large number of institutions in the sample of 566 documents in this paper, principally in the USA, China, the UK, Taiwan, Australia, Germany, Canada, South Korea, Spain, and Japan in productivity and competitiveness terms. Figure 10 presents citations by countries in IAA research. The country cited the most was the USA with 994 citations, followed by the UK (556), China (478), Australia (451), Canada (404), Taiwan (338), South Korea (295), New Zealand (271), Germany (251), France (149), and Spain (147). In addition, Tables A1 and A2 (Appendix A) presents universities by number of published documents, Organizations-Enhanced by number of published documents in the period analysed.

Substantial effort has been made to publish about the IAA topic by universities. Figure 11 illustrates a map of citations by universities in the IAA topic. The University of British Columbia tops the list in the number of citations and total link strength, while Hong Kong Polytechnic University and the University of Sydney rank second and third. The University of British Columbia is represented by the prolific authors Tae H Oum; Anming Zhang [104]; and Xia, Wenyi. Meanwhile, authors such as Fu, Xiaowen and Wan, Yulai represent Hong Kong Polytechnic University, and the University of Sydney is represented by Merkert, Rico. These results demonstrate that universities, researchers, and academics around the world are interested in researching about the topic of international airports and airlines. The aviation industry can be regarded as an engine of global economic prosperity

because it has made an indispensable contribution to worldwide mobility for populations, international trade, tourism, and air transport research [7,101].

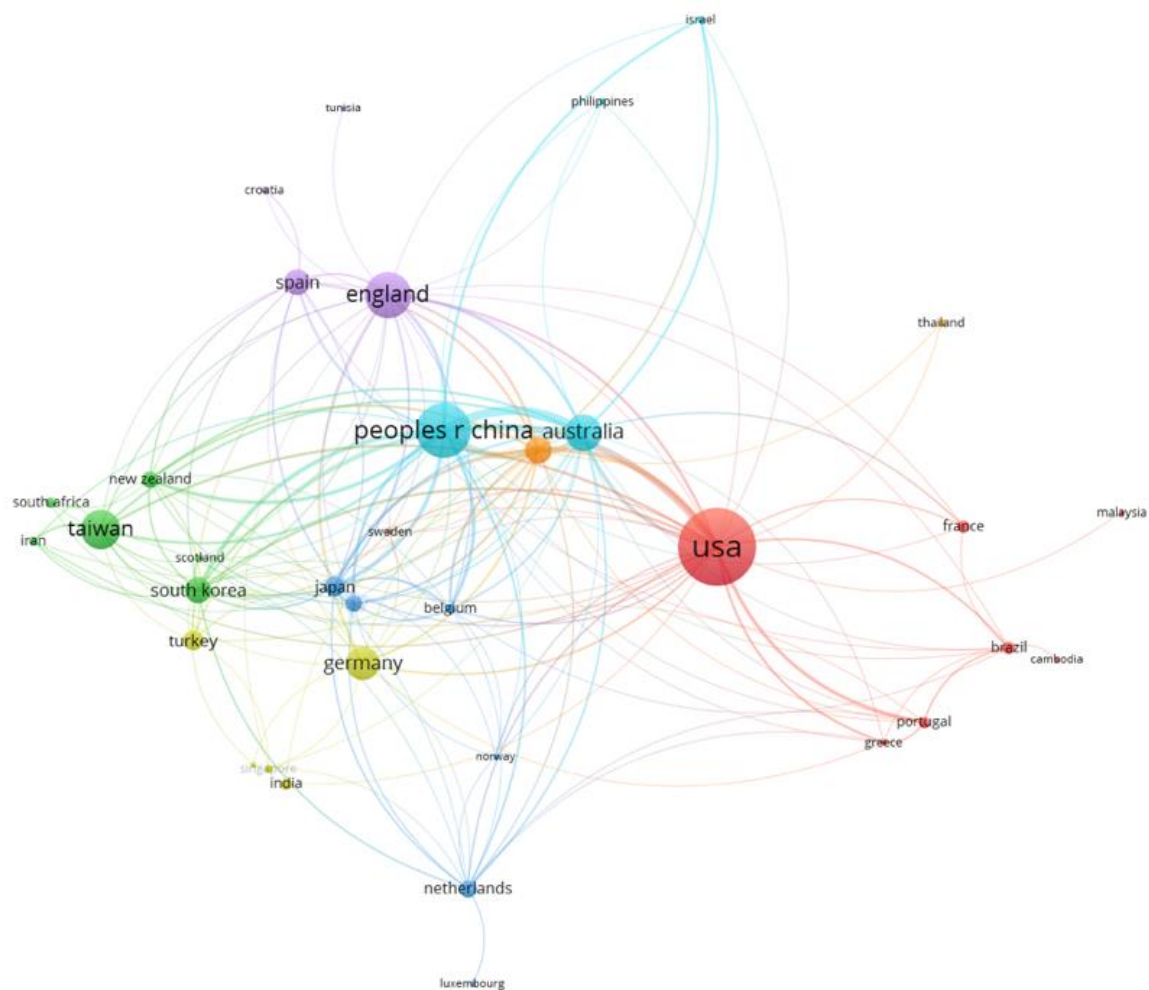


Figure 10. Citations by country in the IAA topic. Source: own elaboration based on WoS data.

- 5) Figure 12 displays the most prominent authors related to the IAA concept by the number of citations. Beaulieu [111] notes that an article should have 10 or more citations. This paper showed the citation structure of authors who have published articles in this domain by setting a threshold of 10 citations, 1 document, and a total link strength. In other words, we consider only those authors whose citations have exceeded 10. Notably, out of 1328 plus authors, only 368 satisfied these criteria. In terms of the number of citations of these selection parameters and the link strength, the following are the most relevant authors: Fu Xiaowen.; followed by Wand, Kun.; Lei, Zheng.; Zhang, Anming.; Xia Wenyi.; Antunes Antonio Pais.; Jaquillat; Alexandre.; Ribeiro Nuno Antunes.; Wan Yulai; and D'alfonso Tiziana. All researchers shown in Figure 12 help to better understand the IAA specificities and complementarities of our work, and RQ5 is answered. We use the citation analysis to identify influential work in the field of study [104], as the number of citations is a strong indicator of scholarly impact in terms of the attention of the research community and these can be considered an emerging trend [112].

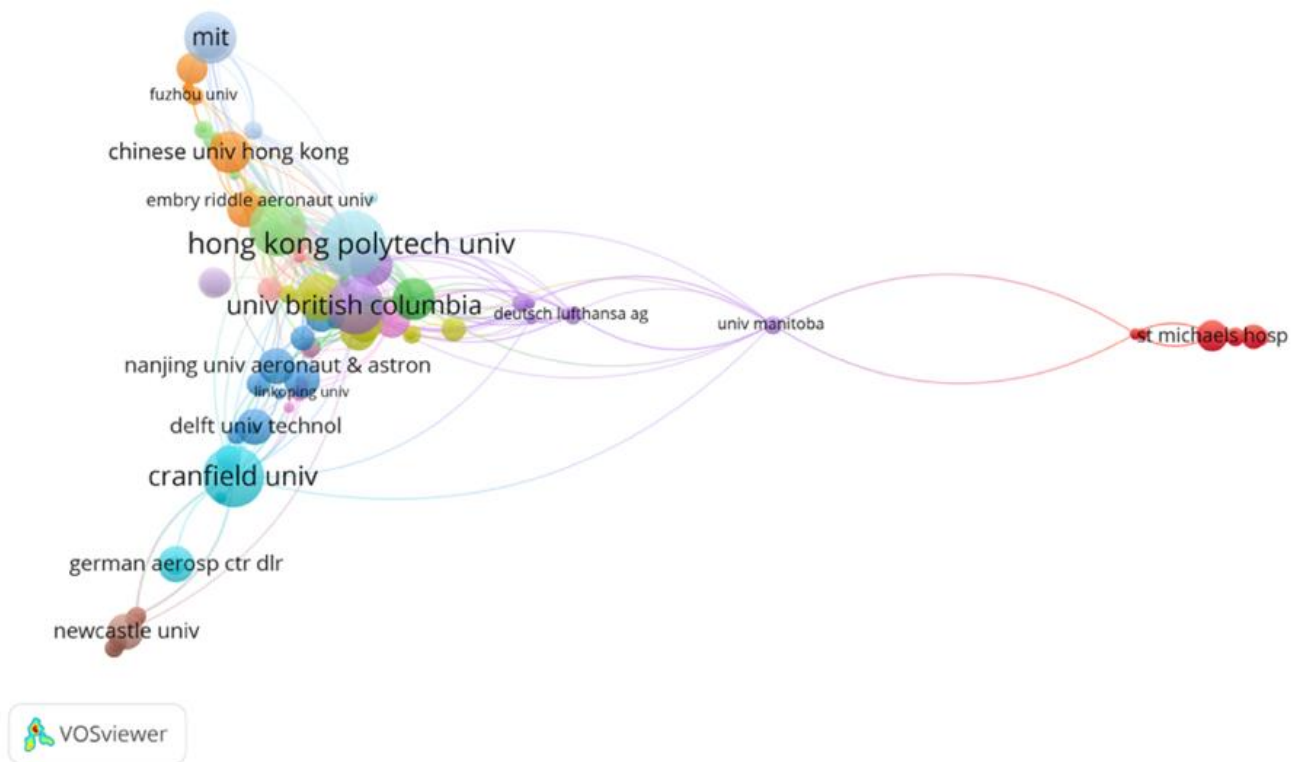


Figure 11. Citations by university in the IAA topic. Source: own elaboration based on WoS data.

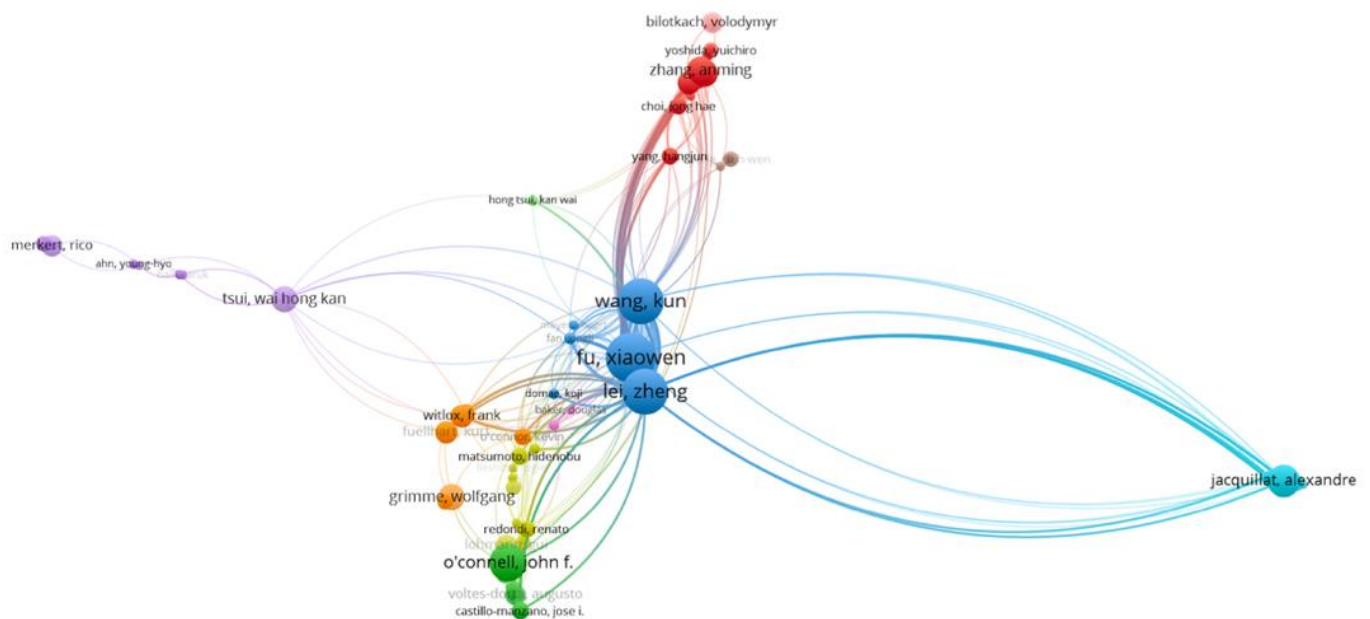


Figure 12. Author's citation analysis in the IAA topic (from 2000 to 9 June 2021). Source: own elaboration based on WoS data.

5. Conclusions

The current research has helped to understand the importance of the IAA topic in the aviation industry. Findings suggest more efforts are required to enhance the context of airports and airlines by universities and researchers to increase the number of investigations in the context of IAAs. In fact, the number of documents has continued to grow in the period analysed, and we have identified new opportunities and challenges for airport and airline operators, academics, and researchers to make better future decisions in times of uncertainty. Moreover, findings of the current study prove that there exists a strong relationship between international airports and airlines. For this reason, results of this study are innovative in the context of IAAs because there is not an actual definition of IAAs that captures the true nature of this topic, and, possibly, this manuscript will improve the theoretical frameworks in future scientific research in the aviation and tourism sectors. Commercial and aeronautic activities of airports have a positive impact on cities' economic development and infrastructures [113]. This study has been needed to better stage the effectiveness, projection, and different business strategies to be adopted by researchers and organizations in the aviation and tourism future.

This research tackles theoretical implications for the IAA topic. This article contributes to the continuous research on international airports and airlines as a topic and expands the literature on IAA and favours new models in future research. Furthermore, findings suggest that in a globalised market, the multidisciplinary approach of IAAs is highly dependent on technology, tourism, safety, quality, and communication activities. This paper would be helpful for researchers, airport operators, and the aviation sector players at large. This research is possibly one of the first and unique studies that has conducted an in-depth bibliometric analysis of the international airport and airline literature. We have undertaken an integrative review of the IAA topic, using citation and co-citation analyses of the literature [104].

The main limitation of this study is the fact that data were collected from SSCI. It is recommended for future research to include another database such as Scopus or Google Scholar. Moreover, it would be interesting to include international journals written in other languages such as Chinese, Italian, Russian, Spanish, and French, amongst many others. The majority of articles are written in the English language [114]. Future studies can add other languages and they will have a more complete vision of the IAA topic in all its dimensions, and it will open new collaboration opportunities for joint research with universities and researchers. Finally, we recommend that future bibliometric studies be carried out in relation to the research areas developed by the IAA topic, such as economic, management, business, safety, cybersecurity, connectivity, travel, customer satisfaction, efficiency, and logistics studies. For instance, future research could tackle bibliometric studies related to logistic activities, airports, and airlines to gain a better overall perspective of processes among these sectors. Even today, there is a need for further work that can elaborate on airport operators and the implementation of new cybersecurity systems to ensure the safety of passengers, air freight, and commercial airline operations.

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Appendix A

Table A1. Universities by number of published documents (from 2000 to 9 June 2021).

Organizations	Number of Published Documents	Total %
Cranfield University	12	2.12%
Hong Kong Polytechnic University	11	1.94%
Massachusetts Institute of Technology ‘MIT’	11	1.94%
University of British Columbia	11	1.94%
University of Sydney	11	1.94%
National Taiwan Ocean University	10	1.77%
National Cheng Kung University	9	1.59%
National Aeronautics Space Administration ‘NASA’	8	1.41%
National Kaoushing Marine University	7	1.24%
Chinese University of Hong Kong	6	1.06%
Civil Aviation University of China	6	1.06%
Delf University of Technology	6	1.06%
Kobe University	6	1.06%
National Chiao Tung University	6	1.06%
University of California Berkeley	6	1.06%
University International Business Economics	6	1.06%
Carnegie Mellon University	5	0.88%
Federal Aviation Administration ‘FAA’	5	0.88%
Georgia Institute of Technology	5	0.88%
German Aerospace Centre ‘DLF’	5	0.88%
Griffith University	5	0.88%
INHA University	5	0.88%
Korea Aerospace University	5	0.88%
Massey University	5	0.88%
Nanjing University of Aeronautics and Astronautics	5	0.88%
Total of Top 25 Journals	177	31.27%
Total of this research (2000–2021)	566	68.73%

Source: own elaboration based on WoS data.

Table A2. Organizations enhanced by number of published documents (from 2000 to 9 June 2021).

Organizations Enhanced	Number of Published Documents	Total %
Cranfield University	12	2.12%
Hong Kong Polytechnic University	11	1.94%
Massachusetts Institute of Technology ‘MIT’	11	1.94%
University of British Columbia	11	1.94%
University of Sydney	11	1.94%
National Kaoushing University of Science Tech.	10	1.77%
National Taiwan Ocean University	10	1.77%
Helmoltz Association	9	1.59%
National Aeronautics Space Administration ‘NASA’	9	1.59%
National Cheng Kung University	9	1.59%
University of California System	9	1.59%
German Aerospace Centre ‘DLF’	8	1.41%
Kobe University	7	1.24%
Nanjing University of Aeronautics and Astronautics	7	1.24%
Chinese University of Hong Kong	6	1.06%
Civil Aviation University of China	6	1.06%
Delf University of Technology	6	1.06%
Loughborough University	6	1.06%
National Yang Ming Chiao Tung University	6	1.06%
University of California Berkeley	6	1.06%
University International Business Economics	6	1.06%
University System of Georgia	6	1.06%
Carnegie Mellon University	5	0.88%
Federal Aviation Administration ‘FAA’	5	0.88%
Georgia Institute of Technology	5	0.88%
Total of Top 25 Journals	197	34.81%
Total of this research (2000–2021)	566	65.19%

Source: own elaboration based on WoS data.

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