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A Visualized Bibliometric Analysis of Mapping Research Trends Of Airline Business Models (ABMs) from 1985 to 2021

Gökhan Tanrıverdi[1*], Mehmet Şahin Durak[2]

[1*]Erzincan Binali Yıldırım University, Department of Aviation Management, Ali Cavit Çelebioğlu School of Civil Aviation, 24000, Erzincan, Türkiye. (gtanriverdi@erzincan.edu.tr).
[2]Kırklareli University, Department of Aviation Management, Lüleburgaz Faculty of Aeronautics and Astronautics, 39000, Eskisehir, Türkiye. (msdurakk@gmail.com).

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Corresponding Author: *Gökhan Tanrıverdi*

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Abstract

Deregulation and liberalization acts have contributed to the emergence of various airline business models (ABMs) in the airline industry by putting competition ahead. Influenced by catastrophic crises, increased competition, and changes in customer needs and expectations, airlines have had to innovate their business models or converge them with others over time. Thus, the topic of ABM has attracted tremendous scholarly attention. However, the extant literature lacks a visualized bibliometric study that investigates the evolution of ABM in depth. In this context, this paper employs a comprehensive visualized bibliometric analysis through CiteSpace software to present the evolution of the topic "airline business model" and its possible trends in the post Covid-19 era by benefiting 652 articles on ABMs published during the period from 1985 to 2021. The results reveal that studies on ABMs have increased especially over the past few years, and Journal of Air Transport Management is the leader outlet preferred by authors on this topic. In addition, although studies on low-cost carriers have an obvious dominance over studies on other ABMs, the results provide some evidence that studies on long-haul business models will increasingly continue in the future.

1. Introduction

The airline industry plays an important role in the economic growth and development of countries by facilitating integration into the global economy (The World Bank, 2021). An average of 12.5 million passengers and $18 billion worth of goods transported via 128,000 daily flights in 2019 can be expressed as proof of this situation. In addition, on an annual basis, 1478 commercial airlines carried 4.5 billion passengers via approximately 47 million scheduled flights (ATAG, 2020). Moreover, the fact that the airline industry employs approximately 88 million people worldwide, of which 11.3 million are directly in the aviation industry, clearly demonstrates its place in the global economy (ATAG, 2021).

Although the airline industry is one of the crucial industries that keep the global economy alive, it struggles with high fixed costs. The structure of the airline industry, which is easily affected by the crises, makes this struggle more difficult for the airlines. When looking at aviation history, it is seen that the concept of low cost has increased its impact on business models after the 1978 oil crisis, the 11/09 attack, and the 2008 crises in the airline industry which were dominated by traditional airlines. Thus, airlines head towards strategies that will keep their resilience strong in order to handle the crises successfully and accordingly strive to innovate their business models. On the other hand, recent changes in customer demands and needs, the intensity of competition in the markets served, corporate pressures, and the increasing appetite of airlines for successful business models are other factors that increase the pressure on business models. This causes convergence and hybridization on business models (Jiang, 2013; Corbo, 2017; Klophaus et al., 2012; Adiloğlu-Yalçınkaya and Besler, 2021).

The outbreaks experienced in the last 20 years are also among the above-mentioned crises that airlines have had to deal with. The outbreaks of SARS in 2003, bird flu in 2006, swine flu (H1N1) in 2009, MERS in 2012, and Ebola in 2014 have not seriously threatened the world economy but resulted in reduced demand for the airline industry in certain markets. The main reason is that air transport, which has gained great momentum since the beginning of the 2000s, increases the risk of spread of diseases by facilitating mobility with its characteristic of creating a bridge between travel points in a short time (Pereira and Mello, 2021; Brockmann and Helbing, 2013; Sun et al., 2020). The Covid-19 outbreak, which first appeared in Wuhan, China at the end of 2019, differentiated from previous epidemics and turned into a pandemic, not only affecting public health but also causing unprecedented damage to the global economy (Hou et al., 2021; Zhu et al., 2021). The measures employed to prevent the spread of the disease during the pandemic have considerably restricted mobility. Therefore, with the onset of the pandemic, the travel industry, and

especially air transport, has experienced a very drastic decline (European Commission, 2020; Curley et al., 2020). With the peak of the crisis in April 2020, 90% of airline passenger traffic decreased (Jumar, 2020) and the airline industry experienced approximately 492 billion dollars loss in 2020. This figure accounts for about 60% of the airline industry's 2019 revenues. Moreover, future projections express that the return to 2019 figures will not occur before 2024 (Bouwer et al., 2021).

Considering the effects of the 9-11 terrorist attacks and the 2008 global financial crisis on aviation as the two major crises, the decline in passenger demand and its economic consequences due to the Covid-19 pandemic was recorded as the biggest blow to the aviation industry (Jumar, 2020). The pandemic has raised questions relating to how businesses worldwide will survive (Amankwah-Amoah et al., 2021). Consumer buying behavior (Mathurin et al., 2021) and the industry environment (Sheng et al., 2020) have been extensively reshaped during this period. All these developments create the impression that air transport will probably never be the same as before and will differ from the future scenarios presented in the current literature (Bauer et al., 2020). Bpharm (2020) also argues that a completely different world will be encountered post-Covid-19 and conceptualizes this period as the "post-Covid 19 era" or the "new normal". Song and Choi (2020) point out that such changes will lead to different demands and needs of passengers regarding the use of air transport.

Given the unprecedented challenges posed by the Covid-19 pandemic on the airline industry (Tuchen et al., 2020), strategic options for airlines include identifying the optimal structure of their networks and fleets, considering merger and integration opportunities, and restructuring their business models (Hsiu-Ying Kao et al., 2020). In this context, it is expected that the innovation in airline business models (ABMs) will be inevitable. Amankwah-Amoah et al. (2021) also argued that the way to successfully come through crises like Covid-19 depends on the ability of business models to innovate over time.

In the adventure of airline transportation that started with the traditional airlines, many different airlines have emerged that have adopted ABMs that meet different customer expectations and needs, such as full-service network carriers, low-cost carriers, and low-fare airlines. Therefore, possible innovative or revolutionary changes in the dimensions of ABMs (value proposition, customer, structure, value capture) would be seen as a normal expectation for the post-pandemic period. In this context, this study aims to shed light on past and possible trends in ABMs, with a comprehensive bibliometric analysis of the ABM literature by visualizing existing relationships and trends via CiteSpace software. In this context, the study seeks answers to the following research questions:

- What can we learn from the ABM literature for the future of the ABMs?
- What is the distribution of ABM studies by year?
- Which authors/institutions/journals/countries are prolific in terms of the ABM studies?
- Which clusters do the ABM studies gather around?
- Which studies come to the fore with a sudden burst at certain time intervals?
- What are the research trends regarding ABMs?

When the studies on ABMs are examined, it has not been encountered any study in the extension literature that retrospectively and comprehensively analyzes the evolution of the ABM. Current bibliometric studies on the airline industry research efficiency and effectiveness (Yakath Ali et al., 2021; See et al., 2022), airport capacity (Dixit and Jakhar, 2021), service quality (Bakır et al., 2022), air cargo transportation (Yıldız and Taşdemir), the future of air transportation through JATM literature (Tanrıverdi et al., 2020), and the relationship between air transport and ABM (Bergiante et al., 2015). Of these studies, the only one study focusing on ABMs, Bergiante et al. (2015) analyzed the relationship between air transportation and business model only descriptively and superficially by benefiting from the literature published between 1990-2012. In their study, Bergiante et al. (2015), presents limited results such as the distribution of ABM studies by years and productive authors/territories/countries in terms of ABM publications. The approach of this study also includes visual and quantitative analysis unlike Bergiante et al. (2015). In addition, this study focuses on a longer period (1985-2021) and provides clues to the post-crisis period by including the Covid-19 pandemic, which is the most catastrophic crisis experienced by the airline industry. The remaining parts of the study are as follows: Section 2 presents the data collection process based on the PRISMA approach. Section 3 mentions about the research methodology and other studies conducted using the relevant methodology. Section 4 presents publication and citation performance. Section 5 includes the results of graphical mapping analyses and while section 6 discusses the main results of the study. Last, section 7 contains some conclusions as well as limitations and suggestions for future studies.

2. The Bibliometric Data Collection Process

In this section, the data collection process is explained in steps. Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) was performed to increase the validity and reliability of the results in the data collection process of this study (Moher et al., 2009). Fig. 1. shows the PRISMA approach followed in the data collection process.

2.1. Identifying keywords and initial search

In the first stage of the data collection process, keywords related to the ABM were determined. Then, Science Citation Index Expanded (SCI-Expanded), Social Science Citation Index (SSCI), and Emerging Sources Citation Index (ESCI) were selected among the Web of Science (WoS) Core Collection Editions. Afterward, a search was made through the specified keywords (“airline business model” or “traditional airlines” or “full-service airlines” OR “flag carriers” OR “legacy airlines” OR “low-cost airlines” OR “low-fare airlines” OR “no-frills airlines” OR “budget airlines” OR “long-haul low-cost” OR “charter airlines” OR “hybrid airlines”) and 1078 records were identified. Since all keywords were searched together, duplicates were automatically excluded. WoS removes duplicates by searching these keywords together with "or". The data collection was conducted on May 21, 2021. This study does not include studies published after this date.

2.2. Screening the initial search results

In the second stage, the studies that are suitable for the exclusion criteria (“book and book chapters”, “conference proceedings” and “non-English studies”) were removed from the 1078 records by switching to the “analyze results” page

from the WoS result screen. After the application of the criteria, the number of studies decreased from 1078 to 958. 958 studies were recorded by transferring them to a marked list on the WoS web page called the "airline business model" created by the authors for further review.

2.3. Assessment of full bibliometric information for eligibility and inclusion

The "Marked list" section in WoS allows the researchers to review the listed studies at different times and facilitates the assessment for the eligibility process, preventing inappropriate studies from being overlooked. After the screening phase, the remaining 958 studies were carefully examined in terms of compliance with the ABM topic. 307 studies were eliminated in the eligibility assessment stage and 652 studies were suitable for visualized bibliometric analysis. The dataset of 652 studies consists of author name, publication date, publication name, citation number, keywords, and digital object identification (DOI) for each study. Finally, a dataset of 652 studies was imported as plaintext from WoS for analysis via the CiteSpace 5.8.R3 software.

3. Research Methodology

This study aims to present the existing relationships and trends, and also new trends in the ABM topic with a comprehensive and systematic visualized bibliometric analysis. The bibliometric analysis method is expressed as the quantitative analysis of bibliometric data on a field, journal, or subject. Bibliometric analysis outlines large amounts of bibliometric data to present the state of intellectual knowledge structure and new trends in a topic or field of research (Donthu et al., 2021). Fig. 2 shows that the number of bibliometric studies has increased significantly over the past few years. The main reason behind this development is that advances in information technologies and statistics facilitate the data collection process (Cancino et al., 2017).

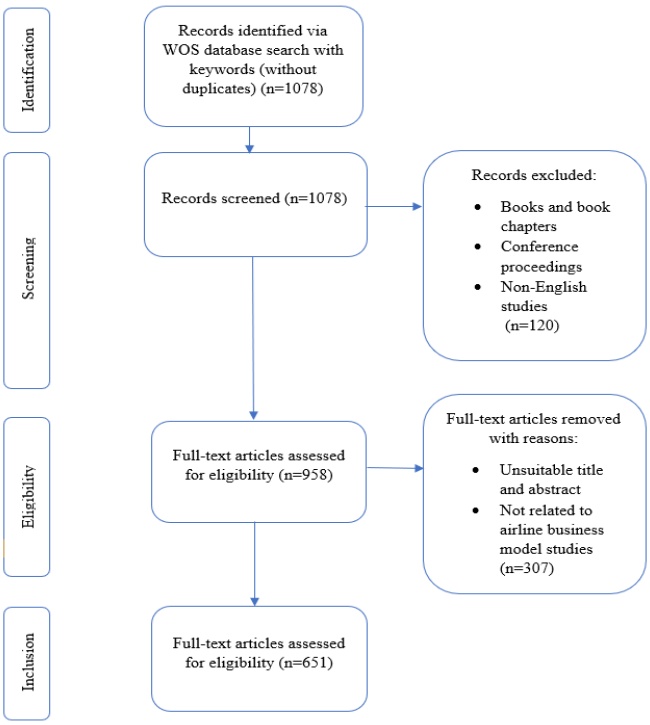

Figure 1. PRISMA approach diagram for data collection process

The extant literature contains numerous studies employing bibliometric analysis in different ways. Some of these studies reveal the development of a particular field of science (Demir et al., 2020; Mulet-Forteza et al., 2019). Some of the other studies may focus on the development of one journal in a particular field (Merigó et al., 2019; Donthu et al., 2021) or more than one journal (Modak et al., 2019; Koc and Boz, 2014). On the other hand, there are some studies on prolific scholars (Kivipelto, 2011), institutional contributors (Jogaratnam et al., 2005), and contributing countries (Chanbour et al., 2021; Ramkumar et al., 2020) in the literature.

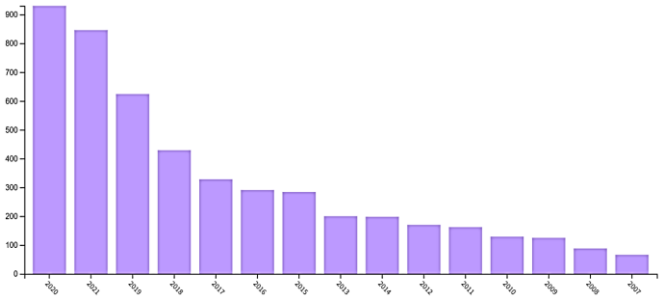

Figure 2. Distribution of ABM studies published between 1985-2021 by years (most to least)

Moreover, the literature also includes many examples of studies on-trend topics in various scientific fields such as machine learning (Su et al., 2021), eco-tourism (Khanra et al., 2021), blockchain (Guo et al., 2021), occupational health (Bautista-Bernal et al., 2021), safety culture (van Nunen et al., 2018), shipping finance (Alexandridis et al., 2018; Jiang et al., 2020), carbon emissions (Tian et al., 2018), social innovation (Foroudi et al., 2021), sustainability in a business (Ferreira et al., 2021), entrepreneurship and crisis (Xu et al., 2021), corporate social responsibility (Ji et al., 2020), high-speed railway (Chen and Liu, 2020).

This study analyzes 652 studies on the ABM published between 1985-2021 comprehensively and bibliometrically in a visual way. Research data were derived from the Core Collection Database of Web of Science (WoS). The WoS database contains the journals with the highest impact factor compared to different databases such as Scholar and Scopus. This reveals that the journals included in WoS are the most influential and therefore the most important. WoS also has a long history and is the most used database by bibliometric studies (Mongeon and Paul-Hus, 2016).

The study carries out publication performance analyses including total publications, citation analysis, and contributing authors/institutions/countries/journals, and graphical science mapping analyses including document co-citation, collaboration networks (authors, institutions, and countries), co-word analysis, and burst detection. Publication performance analysis reveals the distribution of studies on the ABM by years and academic journals, the most cited studies, the most productive authors, institutions, and countries. Document co-citation analysis, which assesses the relevance of documents based on how frequently they are cited together is used since it facilitates the identification of independent clusters and foundational themes (Belussi et al., 2019), while collaboration analysis is used for determining the network relationships of authors, institutions, and countries that contribute to the ABM literature. Finally, the word analysis is used to determine current and future trends in the ABMs

(Donthu et al., 2021), burst detection analysis, on the other hand, is used to reveal keywords, authors, institutions, and countries that stand out by exceeding a certain threshold in a limited time frame (Guzeller and Celiker, 2019).

Bibliometric and visualization studies in the literature use visual analysis software such as CiteSpace, VOSviewer, R Bibliometrix, BibExel, and HistCite, each of which has different prominent features. In this study, CiteSpace (5.8.R3) which is one of the visualization-based bibliometric analysis software is utilized since it offers unique and in-depth analysis possibilities such as burst detection (Li et al., 2017).

4. Publication and citation performance of ABM literature

In this section, the ABM literature is evaluated in terms of publication and citation performance. The figures regarding the number of publications and citations show that the number of publications has been generally increasing over the 20 years, although there are some minor breaks. At this point, Fig. 3 shows that the number of publications exceeded 50 (58) in 2015 for the first time, and then, the same publication number was reached again in 2016 and 2020, respectively. It is noteworthy that the increase in ABM studies immediately after the world economic crisis in 2008, MERS in 2012, Ebola in 2014, and Covid-19 pandemic in 2019, hindered the development of the airline industry and caused the airlines to deal with financial troubles. Here, of course, the strategic responses of airlines to the relevant crises by innovating their business models or converging them with different business models to cope with costs and explore different revenue paths may play a role. The annual total number of citations and the average number of citations per publication are also almost proportional to the course of the annual number of publications. However, this ratio had a decreasing effect on the number of citations per publication in years such as 2011 and 2015, when the number of publications increased more than the number of citations.

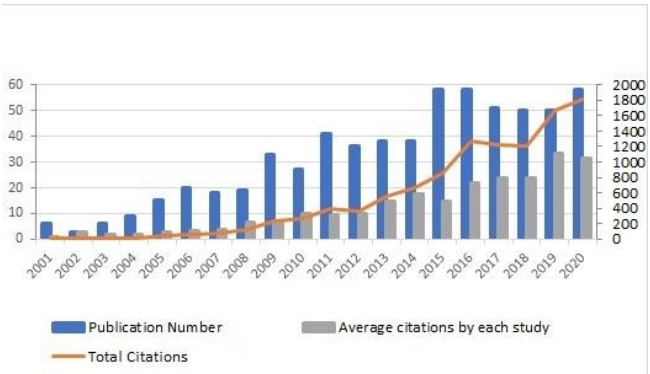

Figure 3. Publication and citation performance of ABM literature by years

After examining the publication and citation performance of the ABM literature, going a little deeper and looking at the publications focus on which ABMs, provides us with a foresight to understand how the interest of researchers and the course of the airline industry has changed during this period. Fig. 4 shows that research on pure Low-cost Carriers (LCCs) has gained significant upward momentum over two decades, albeit with some minor shake-ups. Considering only the year 2020, we can say that the research on LCCs is almost one and a half times the sum of the studies on traditional airlines and Full-service Carriers (FSCs). Undoubtedly, low-cost carriers, which have increased in number since the beginning of the 2000s, after the deregulation and liberalization movements were accepted in America and Europe, have a large share in the formation of this situation.

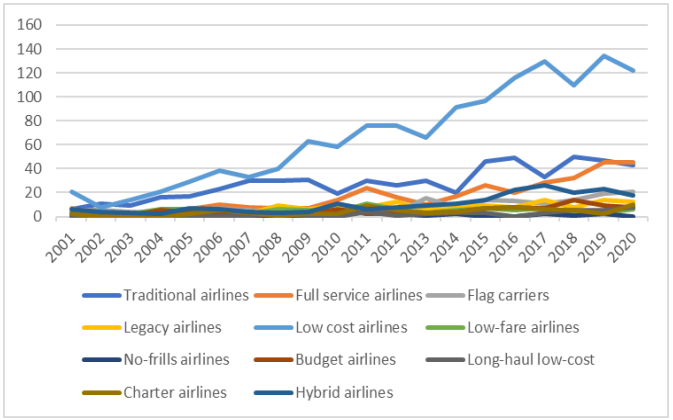

Figure 4. Distribution of the number of publications by years in terms of ABMs

The number of citations is frequently used as an evaluation criterion that shows the impact of the studies in a certain field (Belussia et al., 2019). For example, the most cited articles on the topic of the ABM researched within the scope of this study are important factors that reveals the studies on which the topic is shaped. The number of citations also reveals the impact of research and journals. In this context, Table 1 lists the most influential articles in the ABM literature in terms of the citation number. The most cited study on the ABM is the study of Escobar-Rodriguez et al. (2014) called “Online purchasing tickets for low-cost carriers: An application of the unified theory of acceptance and use of technology (UTAUT) model” (189 citations). According to the total number of citations, the study of O'Connell and Williams called "Passengers' perceptions of low-cost airlines and full-service carriers: A case study involving Ryanair, Aer Lingus, Air Asia, and Malaysia airlines" is the second while the study of Dobruszkes and Frederic called "An analysis of European low-cost airlines and their networks” ranks third. In addition, the figure for the annual average number of citations indicates that six studies were cited 10 or more times. Escobar-Rodriguez et al. (2014) is also the most cited study on average, while Leong et al. (2015) are the second and Akamavi et al. (2015) is the third.

In the adventure of airline transportation that started with traditional airlines, the literature shows that different ABMs meeting different customer expectations and needs such as network carrier business model, low-cost business model, and even ultra-long-haul (ULH) business model were researched. In this context, Table 1 also points out that the most shining ABM is the low-cost business model and its derivatives (16 studies among 20).

Table 1: Top 20 most cited studies in the ABM literature

Rank	Publication Title	Author(s)	Year	TC	AC/EY
1	Online purchasing tickets for low-cost carriers: An application of the unified theory of acceptance and use of technology (UTAUT) model	Escobar-Rodriguez, T.; Carvajal-Trujillo, E.	2014	189	23.63
2	Passengers' perceptions of low-cost airlines and full-service carriers: A case study involving Ryanair, Aer Lingus, Air Asia, and Malaysia airlines	O'Connell, JF; Williams, G	2005	184	10.82
3	An analysis of European low-cost airlines and their networks	Dobruszkes, Frederic	2006	167	10.44
4	The impact of low-cost carriers on airport and route competition	Dresner, M; Lin, JSC; Windle, R	1994	154	5.92
5	The impact of strategic management and fleet planning on airline efficiency - A random-effects Tobit model based on DEA efficiency scores	Merkert, Rico; Hensher, David A.	2011	137	12.45
6	Air transport and tourism - Perspectives and challenges for destinations, airlines, and governments	Bieger, T; Wittmer, A	2006	129	8.06
7	Competition between network carriers and low-cost carriers - retreat battle or breakthrough to a new level of efficiency?	Franke, M	2004	126	7
8	Service quality, satisfaction, and behavioral intentions: A study of low-cost airline carriers in Thailand	Saha, Gour C.; Theingi	2009	123	9.46
9	How do the demands for airport services differ between full-service carriers and low-cost carriers?	Barrett, SD	2003	122	6.78
10	Competitive advantage of low-cost carriers: some implications for airports	Gillen, D; Lall, A	2004	122	6.78
11	High-speed rail and air transport competition in Western Europe: A supply-oriented perspective	Dobruszkes, Frederic	2011	107	9.73
12	Airline performance in the new market context: A comparative productivity and efficiency analysis	Barbot, Cristina; Costa, Alvaro; Sochirca, Elena	2008	103	7.36
13	Customer satisfaction using low-cost carriers	Kim, Yu Kyoung; Lee, Hyung Ryong	2011	96	873
14	Where next for low-cost airlines? A spatial and temporal comparative study.	Francis, Graham; Humphreys, Ian; Ison, Stephen; Aicken, Michelle	2006	95	594
15	An SEM-artificial-neural-network analysis of the relationships between SERVPERF, customer satisfaction and loyalty among low-cost and full-service airline	Leong, Lai-Ying; Hew, Teck-Soon; Lee, Voon-Hsien; Ooi, Keng-Boon	2015	94	1343
16	Airport-airline interaction: the impact of low-cost carriers on two European airports	Francis, G; Fidato, A; Humphreys, I	2003	92	484
17	Airports' perspectives on the growth of low-cost airlines and the remodeling of the airport-airline relationship	Francis, G; Humphreys, I; Ison, S	2004	90	5
18	Key determinants of passenger loyalty in the low-cost airline business	Akamavi, Raphael K.; Mohamed, Elsayed; Pellmann, Katharina; Xu, Yue	2015	89	1271
19	Low-cost airlines in Europe: Reconciling liberalization and sustainability	Graham, Brian; Shaw, Jon	2008	89	636
20	The geography of European low-cost airline networks: a contemporary analysis	Dobruszkes, Frederic	2013	86	956

Notes: TC =Total Citations, and AC/EY =Average citations per year.

Considering the institutions and countries contributing to the ABM literature, we can say that 652 studies analyzed within the scope of the study were carried out in 67 countries. Table 2 presents a ranking of the ten most productive (by the total number of publications) countries and institutions that have contributed to the field of the "airline business model". According to the table, the most productive institution is Cranfield University (n=30), while the most productive

country is the USA (n=102). England (n=96), Spain (n=73), Australia (n=50) and Germany (n= 42) follow the USA in terms of country publications while University of Bergamo (n=20), University of British Columbia (n=18) and Loughborough University (n=15) follows Cranfield University (n=30) in terms of institution publications.

Table 2: Top 10 countries and institutions contributing to the ABM literature

Institution	Total Publication	Total Citation	Average Citation	Country	Total Publication	Total Citation	Average Citation
Cranfield University	30	925	31.77	**USA**	102	1667	17.55
University of Bergamo	20	264	14.75	**England**	96	2701	30.43
University of British Columbia	20	625	33.5	**Spain**	73	1104	16.41
Loughborough University	18	582	33.33	**Australia**	50	923	20.18
University of Barcelona	15	230	16.2	**Germany**	42	539	13.74
Massachusetts Institute of Technology MIT	12	300	25.42	**Italy**	42	652	17.1
Embry Riddle Aeronautical University	11	47	4.91	**Peoples R China**	36	548	16.69
Griffith University	11	133	12.64	**Taiwan**	33	425	13.52
Hong Kong Polytechnic University	11	216	20.36	**South Korea**	31	343	11.68
University of Sydney	11	362	34.64	**Canada**	28	918	34.68

A total of 652 studies on the ABM retrieved from the web of science database were written by 1111 different authors. Table 3 presents the authors who contributed the most (in terms of the number of publications) to the ABM literature. When we look at the publication numbers of the authors in the table. we can easily say that the most contribution was provided by Redondi (n=17). Redondi is followed by Malighetti (n=15). Fu (n=13) and Fageda (n=12). When we look at the table in terms of the number of citations. the author ranking changes. Accordingly. the most prolific author is Dobruszkes with 10 studies and 539 citations. It is followed by Fu with 303 citations and O'Connell with 298 citations. Lastly. Fig. 5 graphically presents the total number of publications and citations of the authors

Table 3: Top 10 authors contributing to the ABM literature

Author	Total Publication	Total Citation	Average Citation
Redondi R	17	245	16.18
Malighetti P	15	235	17.6
Fu Xw	13	303	27.31
Fageda X	12	187	16.67
Castillo-Manzanoji	10	85	9.6
Dobruszkes F	10	539	55.4
O'connell Jf	10	298	29.8
Lopez-Valpuesta L	9	78	9.89
Paleari S	9	190	22
Lei Z	8	207	27

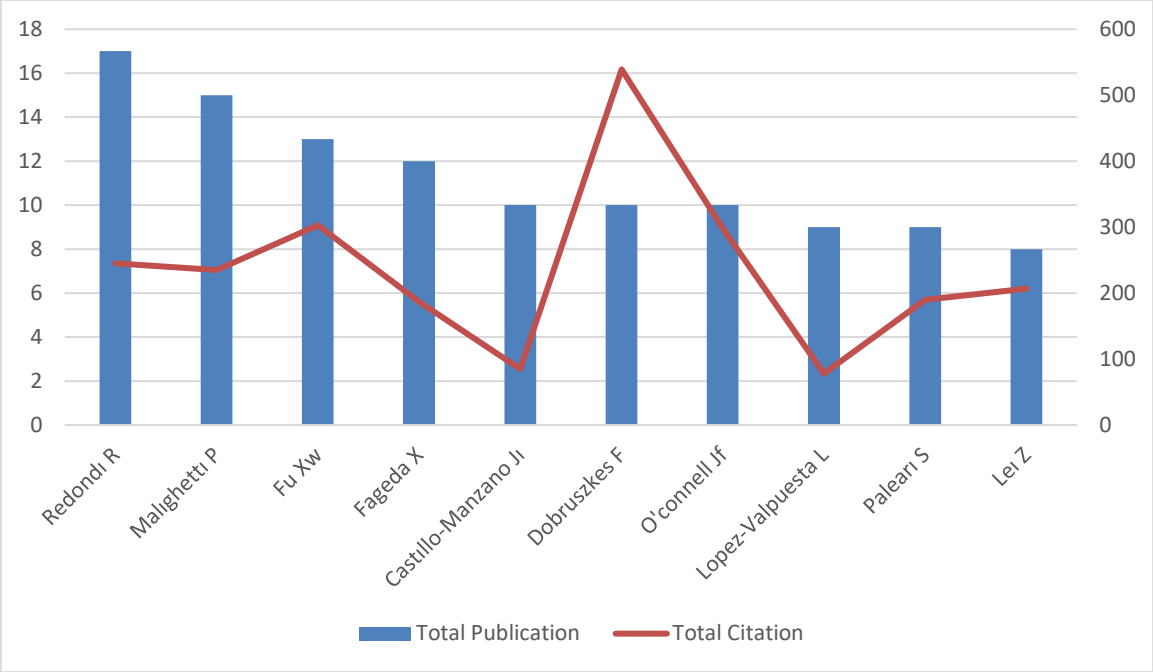

Figure. 5. Top authors contributing to the ABM literature

652 ABM studies included in the analysis were published in 198 different journals. This is due to the multidisciplinary character of the ABM topic. Table 4 shows the top 10 academic journals in which the most studies on ABM were published. These ten journals have more than half of the total number of articles with 353 articles published on the topic. The Journal of Air Transport Management is by far the leading journal on this topic with 191 studies published. Other key journals in the field are the Journal of Transport Geography and Transportation Research Part A Policy and Practice. with 30 and 28 publications. respectively. Additionally. Table 4 provides additional information in terms of the number of citations and the h-index. Journal of Air Transport Management is also the most-cited journal on this topic (total citation=6781) in terms of the total citation number. Tourism Management (total citation=919) and Journal of Transport Geography (total citation=831) are followed.

Table 4. Top journals contributing to the literature ABM

Journal	Total Publication	Total Citation	Average Citation	h-index
Journal of Air Transport Management	191	6.781	25.32	52
Journal of Transport Geography	30	831	30.1	17
Transportation Research Part A: Policy and Practice	28	577	21.14	11
Transportation Research Part E: Logistics and Transportation Review	21	577	28.19	14
Tourism Management	18	919	52.72	14
Transport Policy	16	294	18.94	8
Aviation Week Space Technology	15	5	0.36	1
Journal Of Transport Economics and Policy	12	379	32.25	9
Research In Transportation Business and Management	11	85	7.91	6
Transportation Research Record	11	30	2.82	3

5. Graphical mapping analyses

In this section. the intellectual knowledge of the ABM is presented by visual maps in order to deepen the descriptive bibliometric results given in the previous section. In this direction. document co-citation analysis. co-authorship analysis on authors and author affiliations (institutions. countries). and co-word analysis are carried out respectively.

5.1. Document co-citation

In this section. firstly. a co-citation analysis of 652 studies was carried out to reveal the main research topics and the clusters around these research topics in the ABM literature. Fig.7 presents the intellectual structure of the extant ABM literature. which includes 15 co-citation clusters from different topics. The most co-cited studies that form the background of the ABM literature are respectively "The evolving low-cost business model: Network implications of fare bundling and connecting flights in Europe" by Fageda et al. (2015) with 32 citations. "Low-cost carriers going hybrid: Evidence from Europe" by Klophaus et al. (2012) with 28 citations and "The geography of European low-cost airline networks: a contemporary analysis" by Dobruszkes (2013) with 27 citations.

Each color in Fig. 6 represents a cluster and a key topic in the ABM literature. Studies gathered around the same color are

studies that contribute to the development of the same topic. This also shows us that the ABM literature is shaped by different topics. These clusters are labeled with the index terms of the studies that cite the studies they contain. Table 5 shows the 6 largest topic clusters in the ABM literature. Here. the largest cluster (#0) is labeled "airport traffic" and has 117 members. The average year of publication of the studies in this cluster is determined as 2003. The mean silhouette value of the #0 cluster is calculated as 0.886. This shows that the studies in the cluster are very compatible with each other and represent the cluster well. The mean silhouette value is a measurement that shows how similar and compatible an object is to its cluster compared to other clusters. As this value gets closer to +1. we can say that the studies in that cluster match well with the cluster and the fit is good. and as it gets closer to -1. there is a problem in matching and coherence (Rousseeuw. 1987). The log-likelihood ratio (LLR) value in this table also evaluates the goodness of fit of each cluster by comparing the probability that the same keyword is found in different clusters. while TF-IDF is often employed to measure the importance of a term in a document (Zhao et al.. 2020; Chen and Xiao. 2016).

Cluster #1 emerged as the second-largest cluster and is labeled as a "long-haul low-cost network". There are 75 members of this cluster. and the average publication date of the documents included here is 2016. The mean silhouette value of the #1 cluster was determined as 0.851. Cluster #2. in the third row. with 73 members. is labeled as "pricing strategies". The average publication date of the 73 documents covered by #2 was determined as 2011. The mean silhouette value of this cluster is 0.865. Cluster #3. labeled as the "Entry pattern". is the fourth largest cluster with its' 70 members. The cluster. whose average publication date is 2014. has a mean silhouette value of 0.764. "UK airport" (#4) is ranked fifth out of 6 clusters. While the average publication years of the studies in the cluster with 67 members were 2009. the mean silhouette value was calculated as 0.932. "Construal level theory" takes the last place among the 6 largest clusters offered by CiteSpace software.

The study also performs burst analysis. which revealed the studies that were cited many times in a certain period. Table 6 indicates the 10 studies with the highest burst rating out of 25 citation bursts found by the CiteSpace software. Accordingly. the most effective study is Doganis (2001). which is in cluster #0 with a value of 9.86. Doganis (2001) received this value due to the citations he received in the three years between 2003 and 2006. The second most effective burst is de Wit (2012) in cluster #4 with a value of 9.40. De Witt (2012) has this value with the citations it received between 2015 and 2017. three years after it was published. The study. which ranks third in terms of burst value. is Fu (2015). which stood out with the citations it received between 2017-2021 with a value of 8.88 and was included in cluster #3.

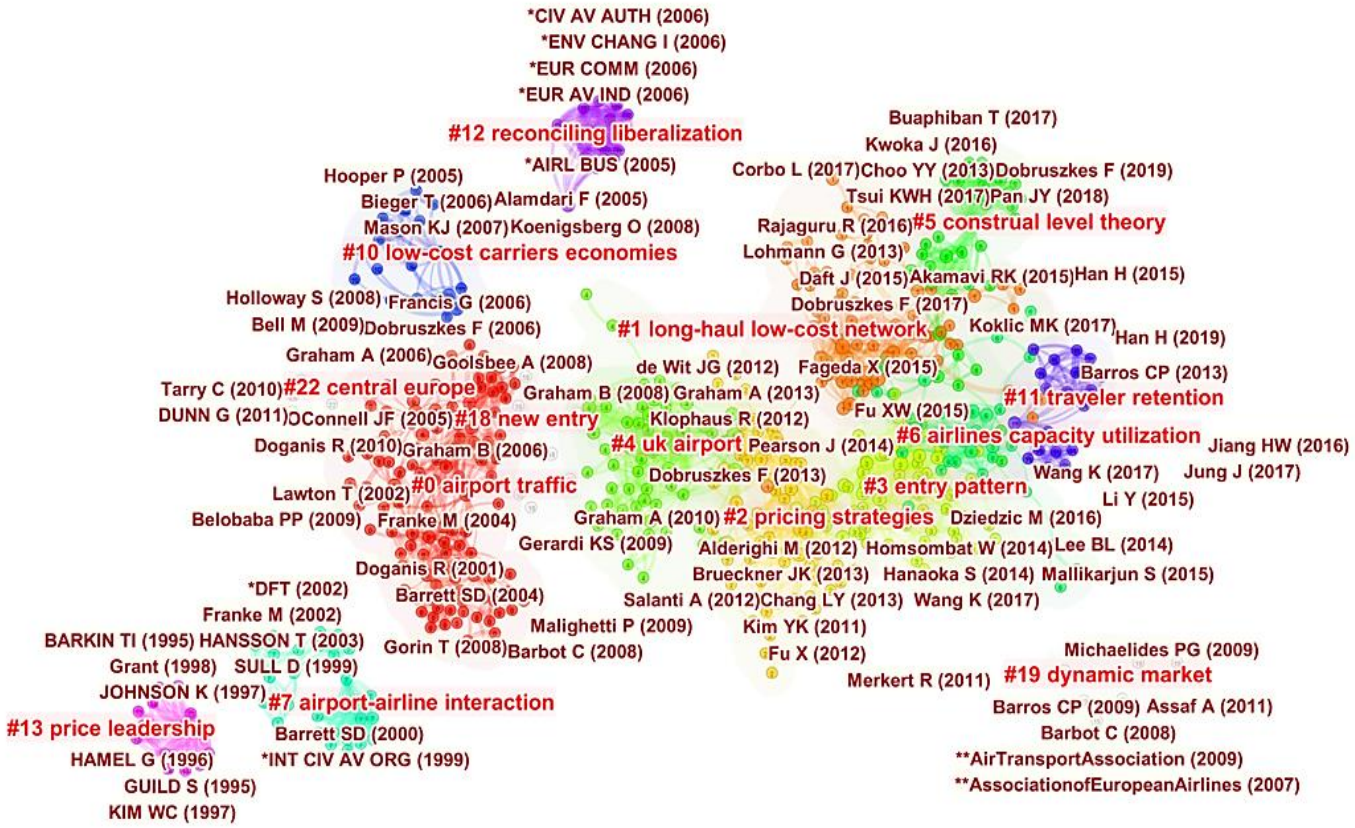

Figure 6. Document co-citation of ABM literature

Table 5: Topic clusters in line with document co-citation analysis

Cluster-ID	Size	Mean Silhouette	Label (TF-IDF)	Label (LLR)	Average Year
0	117	0.886	Low-Cost Carriers	Airport Traffic (109.15. 1.0E-4)	2003
1	75	0.851	Low-Cost Carriers	Long-Haul Low-Cost Network (80.99. 1.0E-4)	2016
2	73	0.865	Low-Cost Carriers	Pricing Strategies (143.14. 1.0E-4)	2011
3	70	0.764	China	Entry Pattern (95.53. 1.0E-4)	2014
4	67	0.932	Low-Cost Carriers	Uk Airport (85.15. 1.0E-4)	2009
5	41	0.919	Airline Selection	Construal Level Theory (70.75. 1.0E-4)	2016

Table 6: Top 10 documents out of 25 with citation burst

Rank	Bursts	References	Cluster ID	Begin	End	1985 - 2021
1	9.86	Doganis R. 2001. AIRLINE BUSINESS 21. 0. 0	0	2003	2006	
2	9.40	de Wit JG. 2012. J AIR TRANSP MANAG. 21. 17	4	2015	2017	
3	8.88	Fu XW. 2015. TRANSPORT RES A-POL. 79. 3	3	2017	2021	
4	8.69	Klophaus R. 2012. J AIR TRANSP MANAG. 23. 54	4	2014	2017	
5	8.61	Francis G. 2006. J TRANSP GEOGR. 14. 83	10	2008	2011	
6	8.39	Fageda X. 2015. J AIR TRANSP MANAG. 42. 289	1	2016	2021	
7	8.13	Dobruszkes F. 2017. J AIR TRANSP MANAG. 59. 50	1	2017	2021	
8	8.05	Dobruszkes F. 2013. J TRANSP GEOGR. 28. 75	4	2014	2018	
9	8.03	Franke M. 2004. J AIR TRANSP MANAG. 10. 15	0	2006	2009	
10	7.74	Graham A. 2013. TOURISM MANAGE. 36. 66	4	2014	2018	

5.2. Author collaborations

Fig. 7 visualizes the collaborative network between authors contributing to the ABM literature. Different colors in the figure represent different networks/clusters. In addition. the closeness of the authors shown in the figure indicates the degree of network collaboration relationship between authors. Accordingly. there are 3 different author collaboration clusters in the ABM literature. Renato Redondi is located at the center of the red cluster. In addition. most of the authors who constitute this cluster is from the University of Bergamo (Renato Redondi. Paolo Malighetti. and Stefano Paleari). While John O'Connell is at the center of the cluster seen in green. we can express that this cluster is UK-based and shaped by researchers from Cranfield University. Finally. at the center of the cluster. which is visualized in pink. is Anming Zhang. a senior author in the field. and this cluster originates from China. As a result. we can say that spatial proximity and citizenship have a significant impact on academic collaborations. and these concepts are important catalysts in the formation of author collaboration clusters over time.

5.3. Institution and country collaboration networks

Fig. 8 and Fig. 9 show institution and country collaboration networks that shape the ABM literature. Fig. 8 consists of three different clusters in parallel with the author's collaboration network. As mentioned before. the closeness of the names of the institutions in the figure reveals the level of collaboration between them. The UK institutions (Cranfield University and the University of Loughborough) are at the center of the network cluster in red. and these institutions carry out their academic cooperation on ABM with institutions in Australia. Although the green cluster in the network highlights the collaborations of institutions from different countries (Hong Kong. Canada. and the UK). we can see that Chinese researchers from these different institutions are behind those

institutional collaborations here when we make a deeper analysis by benefiting from the author collaboration network. Finally. it is possible to say that two institutions in Italy stand out in the pink cluster. However. it should be noted that the institutions here are different from the institutions of the authors in the red cluster in the author collaboration network. One of the key factors that should be noted for institution clusters is also that former institutions of authors are significantly important in the formation of the institution clusters. In other words. the fact that changing institutions by authors over time and collaborating with authors from their former institutions constitute an important part of the institutional collaboration clusters. The country collaboration network in Fig.10 refers to the collaborations between the countries where the authors' institutions are located. Accordingly. countries such as the USA. England. Spain. Australia. and Italy at the center of the country collaboration network are prominent in the network.

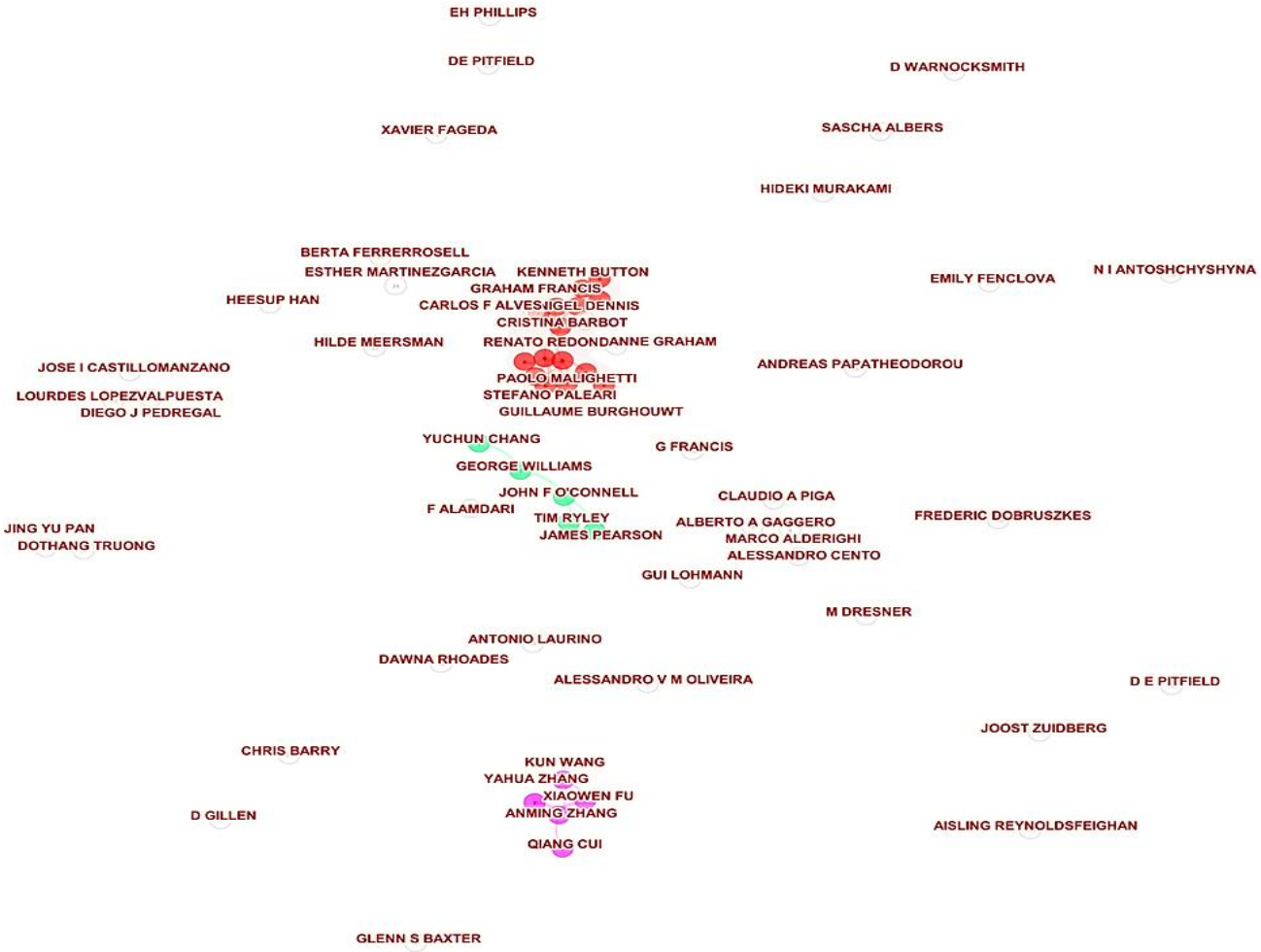

Figure. 7. Author collaboration network

5.4. Co-word analysis

Co-word analysis reveals the interests of a particular field through the keywords used by the authors for indexing documents (Tanrıverdi et al.. 2020). Accordingly. while Fig. 10 presents the visualization of co-word analysis of 652 studies in our sample. Table 7 shows the frequencies of the studies subject to analysis. Also. Table 8 demonstrates the results for bursts detected with the CiteSpace software. When we look at Fig. 10. we can see that the important keywords for the ABM literature are in the center and with larger fonts compared to the others. The word frequencies given in Table 7 also confirm this. Here. the study performs two different word frequency analyses to reveal the prominent words recently. While the first column of Table 7 gives the result for all studies between January 1985 and March 2021 (652 publications). the second column of the table includes the results of word frequency analysis for 58 studies published between January 2020 and March 2021 by referencing the emergence of the Covid-19 pandemic. Accordingly. the first column of Table 7. highlights the most essential keywords of the ABM literature as “airline (n:106)". “Impact (n:101)". “Competition (n:81)". “Model (n:76)". "Carrier (n:70)" respectively. It is possible to say that these words are among the most used keywords in ABM studies examining different business models. The right column of Table 7. reflecting the analysis results of studies published after the pandemic. almost completely parallels the words in the left column reflecting the analysis results of all studies. In addition. the concept of “low-cost carrier” on the during-Covid-19 period side of the table is three steps above the left side of the table. Moreover. there has been a noticeable increase in the frequency of the word "strategy". We can express the reason leading this as the fact that the importance of the low-cost concept has increased with the occurrence of Covid-19. and the airlines have focused on recovery and tried to produce strategies for their economic sustainability. However. although at least one year has passed since the onset of the pandemic and soon special issues have been published

on the Covid-19 pandemic in the leading transport journals (e.g., Journal of Air Transport Management SI: Air Transport Covid-19). words such as “Covid”. “Covid-19”. "Coronavirus". "Pandemic". "Outbreak". "recovery" and "crisis" were surprisingly not seen in the list of the most used keywords. We can express the main reason behind this as the studies published on the pandemic are not yet at the expected level despite the elapsed time. or that these words are not included in the keywords of the studies published by their authors.

Citation burst results do not give the recent trend but give the prominent words in a certain period in the past and present. While 7 words with citation burst are observed within the calculations made by CiteSpace software. the words with the strongest burst value are low-cost airline (Burst strength = 4.96). low-cost airline (Burst strength = 4.71). China (Burst strength = 4.3). Burst values provide clues about the effectiveness levels of the related words in the years in which they were effective. Although the years (1997-2012) in which it was most effective are over. we can say that the low-cost business model still continues to be a hot topic as the business model on which the most studies have been published in the ABM literature so far (see Fig. 4). In addition. we can say that the effects of words such as “China”. “Growth” and “High-speed rail”. which have gained citation burst value with their influence in the ABM literature in recent years. will continue for a while. As a remarkable result. we must mention the long-haul low-cost (LHLCC) business model. is a new ABM here. Fig. 4 indicates that the studies on this business model have been increasing recently. Moreover. the gathering of studies on LHLCC around the label of "long-haul low-cost network" (see Table 5) shows that researchers' interest in studies on LHLCC has increased. and therefore, studies on LHLCC have increased. The ongoing debate over the LCCs' competitiveness with FSCs in long-haul markets and their sustainability will continue to be a hot topic in the ABM literature until airlines adopting the LHLCC business model are completely eliminated.

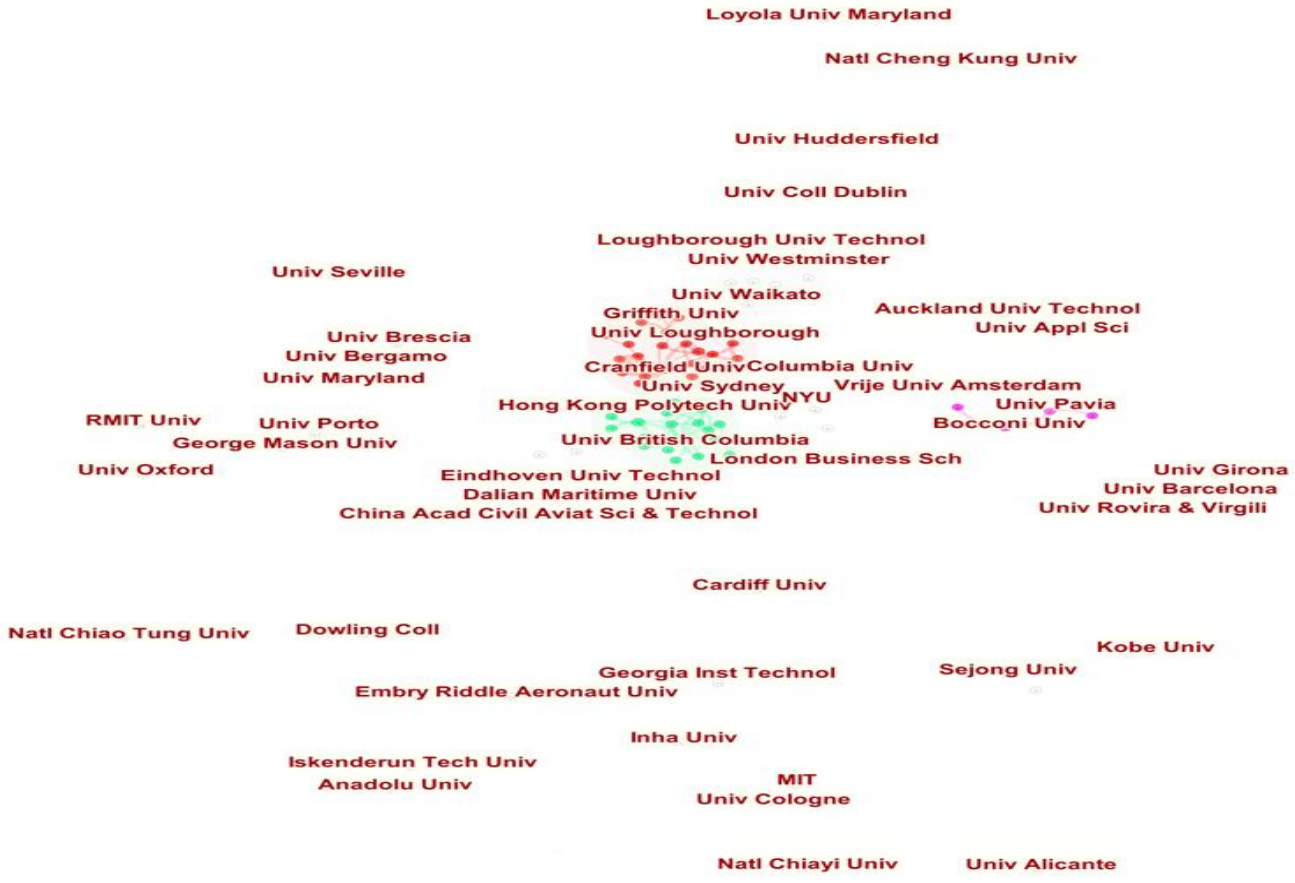

Figure 8. Institution collaboration network

6. Discussion and new trends of ABMs

Regarding the results of the study. it is possible to mention some overlaps and differences with the literature. First. Bergiante et al. (2015). which examines the relationship between air transport and business model in the literature. reveals that England. the USA. and Taiwan are the research centers for ABM studies. The results of this study are similar to the previous result by one difference (Spain instead of Taiwan). LCCs represent one of the main dynamics of the airline industry. especially since the early 2000s. Capacity. congestion. and competition have become the leading concepts of the airline industry as LCCs' activities increase (Dixit and Jakhar. 2021). Accordingly. the fact that the cluster with the highest number of members is “airport traffic” (LLR) under the label of “low-cost carriers (TFIDF)” (the average year of publication of the studies in the cluster is 2003). is an important proof of that. In recent years. LCCs seem as a rival to FSCs in long-haul markets. In this sense. one of the remarkable clusters that emerged as a result of the cluster analysis in our study is the "long-haul low-cost network" (LLR) under the low-cost carrier (TFIDF) label as a result of

the increase in studies on LHLCCs (average publication year is 2016). This is a significant indicator that LCCs are taking the competition to a different level as a natural consequence of the LCC storm that has taken the industry by storm. In a study carried out by Tanrıverdi et al. (2020) in the leading journal of air transport. the Journal of Air Transport Management. the fact that the "low-cost carrier" is the largest cluster. seriously reveals the effectiveness of LCCs in the last 20 years. The literature also argues that the competitive environment created by low-cost airlines has a positive impact on the services and prices of airlines (Tanrıverdi and Küçük Yılmaz. 2021). In this direction. it is possible to say that the issue of "pricing strategies (LLR)". which emerged as the third-largest cluster (average publication year 2011) under the label of "low-cost carrier (TFIDF)" in our study. is still among the issues that the airlines think about the most (Avogadro et al.. 2021; Wang et al.. 2018). On the other hand. ensuring efficiency and productivity has become the main agenda for airlines that desire to increase their load factor by achieving more demand at reasonable prices in the industry where costs can hardly be met (Yakath Ali et al.. 2021). The most cited studies in the ABM literature also reveal the quest for efficiency and productivity by airlines adopting different business models in a fiercely competitive environment (Merkert and Hensher. 2011; Franke. 2004; Barbot et al.. 2008). One of the results of our study that is similar to the literature is the results of the word analysis revealed by Tanrıverdi et al. (2020). Both studies overlap in terms of prominent words such as "airline". "model". "airport". "impact" and "service quality". This shows the consistency of the results of this study with the literature and means that the words mentioned are also significant words for ABM. However. we can interpret the prominence words "strategy" and "high-speed train" unlike the literature in studies published post-Covid-19 as follows. First. airlines are in quest of exit/survival/recovery/mitigation strategies from the Covid-19 crisis. Second. especially in short and medium-haul markets. the competition between high-speed rail and LCCs has increased in the recent period since high-speed rail is more dominant than LCCs in terms of frequency and cost. As a result. we can state that these two factors among the most critical factors for the future of ABMs will play an important role in the shaping of ABMs for the period post-Covid-19.

When the key findings obtained at the end of the study are considered holistically. we can say that LCCs have established a competitive advantage over FSCs in short and medium-haul markets and they have started to focus on long-haul markets. In this direction. despite some unsuccessful initiatives at different times from the past to the present. LHLCCs have come to the fore again over 15 years. Albers et al. (2020). in their study. state that there are 31 LHLCC initiatives from the past to the present. and there were 18 active LHLCCs in the light of the pre-pandemic data. In addition. some airlines are planning to start operations. Norwegian. Cebu Pacific. and Azul Airlines are some of the active and leading LHLCCs. However. the recent popularity of LCCs in long-haul markets has pushed FSCs to seek the ULH non-stop markets as a new business model. Another major factor causing this situation is the recent activity of Bosporus-Gulf hubs. Bosporus-Gulf hubs such as Doha. Abu Dhabi. Dubai. and Istanbul have allowed intercontinental air transport to increase through their location and rise in recent years. Thus. the FSCs. which were adversely affected by the new competitive environment. found the solution by clinging to the ULH business model in response to this situation. New aircraft developed by aircraft manufacturers with a commercially viable payload and fuel efficiency stands out as an important advantage in terms of the applicability of the ULH business model (Grimme et al.. 2020). Bauer et al. (2020) also underline that ULH routes can be a lifeline for airlines. especially in the period after the Covid-19 pandemic. Modeling and scenario analyses carried out by the authors underline that this new ABM will outperform other ABMs and create a serious competitive advantage. The possible benefits of the ULH business model are also listed as follows: Simultaneous higher load factors (seat) and yields. high network flexibility and ability to bypass densely populated central airports. and unique health benefits achieved by eliminating transfer times and fatigue.

Figure. 9. Country collaboration network

Figure 10. Co-word analysis

Table 7: The 20 most frequently used words in the ABM literature

1985 January-2021 March		2020 January-2021 March (During Covid-19)	
Frequency	**Word**	**Frequency**	**Word**
106	Airline	22	Impact
101	Impact	15	Airline
81	Competition	10	Low-Cost Carrier
76	Model	9	Carrier
70	Carrier	8	Competition
63	Low-Cost Carrier	8	Airport
60	Airport	7	Loyalty
46	Entry	7	Choice
42	Performance	7	Service Quality
39	Industry	6	Market
39	Market	5	Air Transport
33	Demand	5	Strategy
28	Network	5	Intention
25	Choice	5	Model
24	Low-Cost Airline	5	High Speed Rail
24	Service	4	Determinant
21	Determinant	4	Quality
20	Behavior	4	Perception
20	Service Quality	4	Travel
20	Travel	4	Moderating Role

Table 8: Top 7 keyword with the strongest citation bursts

Rank	Keywords	Year	Strength	Begin	End	1985 - 2021
1	Low-Cost Airline	1985	4.96	1997	2012	
2	Low-Cost Airline	1985	4.71	2011	2012	
3	China	1985	4.3	2017	2021	
4	Growth	1985	4.15	2017	2019	
5	High Speed Rail	1985	3.93	2018	2021	
6	Airport	1985	3.88	2006	2009	
7	Density	1985	3.7	2001	2012	

7. Conclusions. Limitations. and Future Studies

The deregulation in 1978 and the subsequent liberalization process resulted in the entry of different business models from traditional airlines into the airline industry (Mrázová and Kazda. 2021). This study reveals the current trend and relationships in the ABMs literature with the bibliometric analysis of the studies published on the ABM between 1985-2021. The study also explores the clues about the future of ABMs post-Covid-19 by employing word analysis of studies published post-Covid-19. To do this. 652 studies related to the topic were included in the bibliometric analysis as a result of the examination and extraction of 1078 studies in terms of title. keywords. and abstract. retrieved ed in the search made on WoS using 12 keywords. Thus. the study investigated: 1) the most cited studies on the ABM. 2) the most prolific authors. 3) the clustering and grouping of the ABM literature under some themes. and 4) the past and future trends in the ABM through burst and word analyzes (for the post-Covid-19 era).

ABMs have attracted the attention of researchers. especially since 2010. and it is possible to say that this trend has reached a higher level in 2018-2020. We can express that the first factor to be mentioned here is the 2008 economic crisis. which was experienced just before 2010. and its reflection on ABMs through increasing costs. Second. we can explain the increase in the number of publications in recent years as the change in the needs and expectations of customers due to the advancement in technology and the effects of the Covid-19 catastrophic crisis. which is much more than the previous crises. In addition. studies on low-cost carriers are quite dominant compared to other ABMs. Moreover. we can say that the most notable event which occurred in this process is the emergence of LHLCCs. which peeked into the long-haul markets of traditional airlines. As a result of the convergence between the LCC business model and the FSC business model. the studies on the LHLCC business model have also tended to increase and a cluster on LHLCC has arisen in the ABM literature. Such developments. which are threatening to FSCs. have resulted in FSCs turning towards the ULH business model with the help of technological advances. We can say that FSCs will adapt to the ULH business model. which is the response of FSCs to LCC competition before long.

While the study also sheds light on the collaborations based on authors. countries. and institutions in the ABM literature. On the other hand. the USA. and England based on country. Cranfield University. the University of Bergamo. and the University of British Columbia based on institutions. and the Journal of Air Transport Management which is the flagship in the field of air transport. based on journal contribute to the literature at most. In addition. "airport traffic". "long-haul low-cost network" and "pricing strategies" are among the prominent topics in the ABM literature. Moreover. it is expected that research on "long-haul low-cost network". which has emerged relatively recently among others. will increase gradually. In addition. while Redondı R is the leader in the ABM literature in terms of publication performance. Dobruszkes. F. holds the leadership by far in terms of publication efficiency. with more citations to his fewer studies than Redondı. R. And the last. when we focus on the keywords used. we can see that the studies published post the Covid-19 pandemic did not differ much from the words used in the studies published before the pandemic. However. the word "strategy" is relatively prominent. and we can say that this is due to the research conducted on airlines' recovery and mitigation strategies. At this point. when considering that there are relatively few studies on the pandemic. we can express the reason as the ongoing publishing processes of studies on the pandemic in journals and expect an increase in terms of publication numbers on the pandemic near future.

The negative effects of the Covid-19 pandemic on the airline industry. as the most serious crisis experienced by the industry. are. of course. undeniable fact. The bankruptcy of some airlines or filing for bankruptcy protection of others (for example. LATAM. Alitalia. Atlas Global). regardless of size. can be expressed as proof of this. Thus. in the next period. airlines are expected to take actions to increase their resilience against more harmful crises and innovate their ABMs. considering the experience, they have gained from the current pandemic. To give an example. it is known that Covid-19 has increased people's tendencies toward technology. In this direction. although it is not among the results of the study. we can predict that this condition and the digital transformation trend that started before the Covid-19 pandemic will deeply affect the ABMs adopted by airlines in terms of their sustainability. In other words. airlines are required to innovate their business models in order to meet the demands and needs of their customers in the new digital world post the pandemic.

This study. which deals with the ABM literature comprehensively. bibliometrically. and visually. is expected to make a significant contribution to the literature. as it reveals the past and future trends of the ABM literature. However. the study also has some limitations. First of all. the documents examined in the study cover the years between 1985 and 2021. These documents are limited to articles published in journals indexed in the ESCI. SCI-E. and SSCI in the Web of Science database. In the following years. it would be appropriate to repeat this study by considering different criteria and conditions to reveal the development of the ABM literature. Secondly. the study focuses on ABM. one of the key topics of air transport. Conducting bibliometric studies focusing on different key topics of air transportation in the future will provide important insights on related topics to air transportation readers who closely follow the development of the topics. Finally. the study uses CiteSpace (5.8.R3). one of the visualization-based bibliometric analysis software. Possible bibliometric studies can be carried out using the up-to-date versions of the CiteSpace software at the time of analysis and the up-to-date analysis tools added to the software. In addition. studies can be carried out using the Bibliometrix library through the R programming language on the R Studio or using the VOSviewer.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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