The dawning of Artificial Intelligence in Tourism: A brief bibliometric analysis and research agenda

O despontar da Inteligência Artificial no Turismo: Uma breve análise bibliométrica e da agenda de investigação

Los albores de la Inteligencia Artificial en el Turismo: Breve análisis bibliométrico y de la agenda de investigación

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Abstract: Considering the significant role that intelligence has assumed in society and especially in such industries as tourism, this research paper aims to present the state of art in Artificial Intelligence and tourism research. To do so, a brief bibliometric analysis was developed using the literature published in SCOPUS and, afterwards, an analysis was performed using VOSviewer. This investigation allowed us to understand which are the most cited and influential authors, articles, and journals, as well as the origin of the mentioned research.
Keywords: Artificial Intelligence; tourism; bibliometric analysis; VOSviewer

Resumo: Dada a importância crescente que a Inteligência Artificial tem assumido na sociedade e em especial em indústrias como o turismo, o presente artigo tenciona dar a conhecer o ponto de situação da investigação em Inteligência Artificial e turismo. Para tal foi desenvolvida uma breve análise bibliomética com recurso aos artigos publicados na SCOPUS aplicando, posteriormente, uma análise com recurso ao VOSviewer. Este estudo permitiu-nos entender quais os autores, artigos e journals mais citados, influentes, bem como a origem das referidas investigações.
Palavras-chave: Inteligência Artificial; turismo; análise bibliométrica; VOSviewer

Resumen: Dada la creciente importancia que la Inteligencia Artificial ha adquirido en la sociedad y especialmente en industrias como el turismo, este artículo pretende presentar el estado de la investigación en Inteligencia Artificial y turismo. Para ello, desarrollamos una breve análisis bibliométrico a partir de los artículos publicados en SCOPUS y posteriormente aplicamos un análisis utilizando VOSviewer. Este estudio nos permitió comprender cuáles son los autores, artículos y revistas más citados e influyentes, así como el origen de las investigaciones referidas.
Palabras clave: Inteligencia Artificial; turismo; análisis bibliométrico; VOSviewer

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1.   Introduction

Tourism has been a fertile ground for the development and early application of technology. For this reason, information and communication technologies have revolutionized the tourism industry in recent decades (BUHALIS, 2006; BUHALIS; LEUNG; LIN, 2023). As we enter the second decade of the 21st century and witness the rapid flourishing of Artificial Intelligence (AI), it would be expected that the tourism sector adopts it quickly.

Artificial Intelligence has been consistently on the agenda during 2023 with access to these tools becoming widespread and being recognised as having a high disruptive capacity in many sectors. As one of the most dynamic industries and with the greatest relevance in the global economy, tourism could not be left out of the new trends in the field of technology. In fact, the tourism industry has been a pioneer in the use of information and communication technologies for decades. As such, and as expected, in recent years AI has become part of the day-to-day life of companies in tourism (SHARMA; JAIN; DHIR, 2022). Proof of the importance of these type of tools, for some years now, AI has been applied in companies in the tourism industry, such as Yotel in New York, Hotel 1000 in Seattle, Henn-na in Sadebo Japan, Eccleston Square in London England, NH Collection Madrid or Eurobuilding in Madrid, Spain, Alofs Hotels, The Henn na Hotel in Japan, Lufthansa, Expedia and Ctrip (KOTLER; BOWEN; BALOGLU, 2022; MENEGAKI; AGIOMIRGIANAKIS, 2019; UKPABI; ASLAM; KARJALUOTO, 2019; WANG; SHAO, 2022), being also present in other tourism sectors such as airlines, restaurants and attraction (KOTLER et al., 2019; MORRISON; MAXIM, 2022), thus fostering a consumer-centric revolution in what Loureiro (2018) calls the fourth industrial revolution or Life 3.0 (KOTLER et al., 2019; TEGMARK, 2017). The use of these instruments have been promoted by COVID-19 and its restrictions (PERIĆ; VITEZIĆ, 2021; VAN ESCH et al., 2022), becoming, as Sharma et al. (2022) state, an excellent ally of the tourism industry during the pandemic, mitigating risks.

The concept of AI emerged in 1955 and was coined by John McCarthy, considered the father of Artificial Intelligence. Although the concept has been around for decades, it has only recently become technically feasible to make it widely accessible, with ChatGPT being the most visible face to most people. Simply put, the authors have defined AI as machine intelligence that can be used in different contexts, functioning in a similar way to a human, performing tasks that imply cognitive ability. The large volume of existing data contributes to this, allowing equipment to analyse it and solve problems autonomously. For Prentice et al. (2020, p. 740) "AI is manifested in intelligent performance and behaviours by machines, computers, or robots that are used to assist humans and businesses", being that, in the services

sector, the integration of this kind of systems is especially noticeable in the digital and robotic context to support the consumer during his experience.

For those reasons and because of the impact that progress in the field of IA has been taking, it becomes extremely important to assessment of the current state of progress and understand the dynamics of tourism research regarding IA.

This research sought to undertake an assessment of the publication dynamics concerning Artificial Intelligence within the realm of tourism research. To do so, a bibliometric analysis was carried out based on publications indexed in the SCOPUS database, utilizing the VOSviewer software.

The research allowed us to observe a significant increase in the quantity of investigations in this research area, especially after 2018. Similarly to other research fields, China emerges as the country with a particularly dynamic publication output in the field of Artificial Intelligence, although the most impactful scientific production is generated in the West.

2. Literature Review

2.1 Artificial Intelligence

The rapid growth of this area is due, among others, to the development of more powerful hardware and new algorithms that have allowed Artificial Intelligence to quickly begin to change the labour market and have a major impact on everyday life (ANTHES, 2017; FRANA; KLEIN, 2021; KOTLER; BOWEN; BALOGLU, 2022; MICH, 2022). AI is considered an umbrella term for various technological means, often being used as a synonym for automation, i.e. without human intervention, not necessarily being accurate to say so (BAGGIO; BAGGIO, 2020; MICH, 2022), carrying out tasks that would traditionally involve cognitive ability (MOISA; MICHOPOULOU, 2022). It is so difficult to define AI that Parnas (2017, p. 27) admits that, in over 50 years of using the term, he was still unaware of a scientific definition, keeping it as a buzzword that "many believe they understand but no one can define".

However, Mich (2022) reinforces that IA includes several research areas (computer science and computer engineering, control theory and cybernetics, also robotics, mathematics, physics, statistics, economics, neuroscience, biology, psychology, linguistics, philosophy, and more recently, ethics and law are involved) and has different applications, having witnessed different periods of growth and decline. It is also possible to distinguish between two types of AI, strong AI that aims to imitate the human body and mind to create a machine carrying

consciousness, and weak AI whose goal is to mimic intelligent behaviours (MICH, 2022). AI allows not only improving human-machine interaction, but also machine-machine interoperability by automatically aggregating and consolidating data from multiple sources (BUHALIS; LEUNG, 2018).

Risks related to AI technologies are also recognised, especially in terms of security, privacy and ethical issues, being recommended that these instruments should be developed according to existing laws and seeking to improve people's quality of life, helping them to solve problems in a non-complex way (MICH, 2022).

2.2 AI in Tourism

Tourism has been a pioneer industry in the adoption of ICTs, following the same pattern in the introduction of AI, and there are tools for all tourism stakeholders, travellers, tourists, operators, DMOs, OTAs, among others (MICH, 2022). It is recognised that with the advances in technology and specifically robotics and AI, process automation will become part of everyday life in many work areas (PIZAM et al., 2022), replicating a human task more quickly and efficiently, changing the way consumers' needs and desires are met (BRYLSKA; COBANOGLU; DOGAN, 2022). It is true that robotics has already been used for decades in several industries, including tourism, however, AI allows increasing their decision-making capabilities (BUHALIS; LEUNG, 2018; PIZAM et al., 2022). In tourism, Artificial Intelligence is considered one of the most fascinating technologies, combining predictive analytics with database-based information, thus helping managers to find patterns of consumption by customers, changing the way the tourism and hospitality industry operates (KOTLER; BOWEN; BALOGLU, 2022; LEUNG, 2022) and giving birth to "Life 3.0" (TEGMARK, 2017), inevitably impacting the future of the working world and service delivery (KOTLER et al., 2019). These types of solutions will also contribute to companies deepening their digital branding.

Ivanov et al. (2019) identified a number of areas where robotics and AI will intervene in the future of tourism, leading to a total re-adaptation of the industry, from destination selection, to reservations and route creation (BUHALIS, 2022). In the field of hospitality, AI could allow the system to cross-reference the revenue generated by the rooms with other departments of the hotel/resort such as the casino, restaurant, spa, allowing the maximization and optimization of resources (BUHALIS; LEUNG, 2018; HUANG, 2014). Service personalisation is one of the ways in which AI is most visible in tourism. For this reason, companies have increased their investment in personal assistants, personalising the customer

experience from booking to check-out, allowing them to increase productivity and reduce operational costs. This commitment is not risk-free, since there is the possibility of making the customer experience too robotic (BRYLSKA; COBANOGLU; DOGAN, 2022).

For this reason, companies will have to adapt all processes to ensure that robotisation and workers can optimise the experience lived by the tourist/customer. In this context, some problems are also acknowledged in the tourism industry, such as the suppression of human interaction, the fact that it is something recent and that it leaves no room for improvisation, with all solutions being anticipated and programmed (MOISA; MICHOPOULOU, 2022). In this sense, it is admitted that if companies fail to maintain the present need for human contact and interaction, there is a real risk of the emergence of a robophobia (KAZANDZHIEVA; FILIPOVA, 2019), since the difficulty remains in finding a correct balance between purely digital interaction and human interaction (NAUMOV, 2019).

3.   Methodology

3.1   Research Question

In order to develop the bibliometric analysis four research questions were defined.

Q1 What is the volume of publications on the relationship between tourism and AI?

Q2 Which journals publish the largest amount of research on the relationship between tourism and AI?

Q3 What are the relationships established between authors and countries of affiliation within the scope of research in this area?

Q4 Which are the most influential journals and authors?

3.2   Search process

For this systematic bibliometric analysis, SCOPUS was used as the database for the investigation due to the volume and quality of the indexed literature.
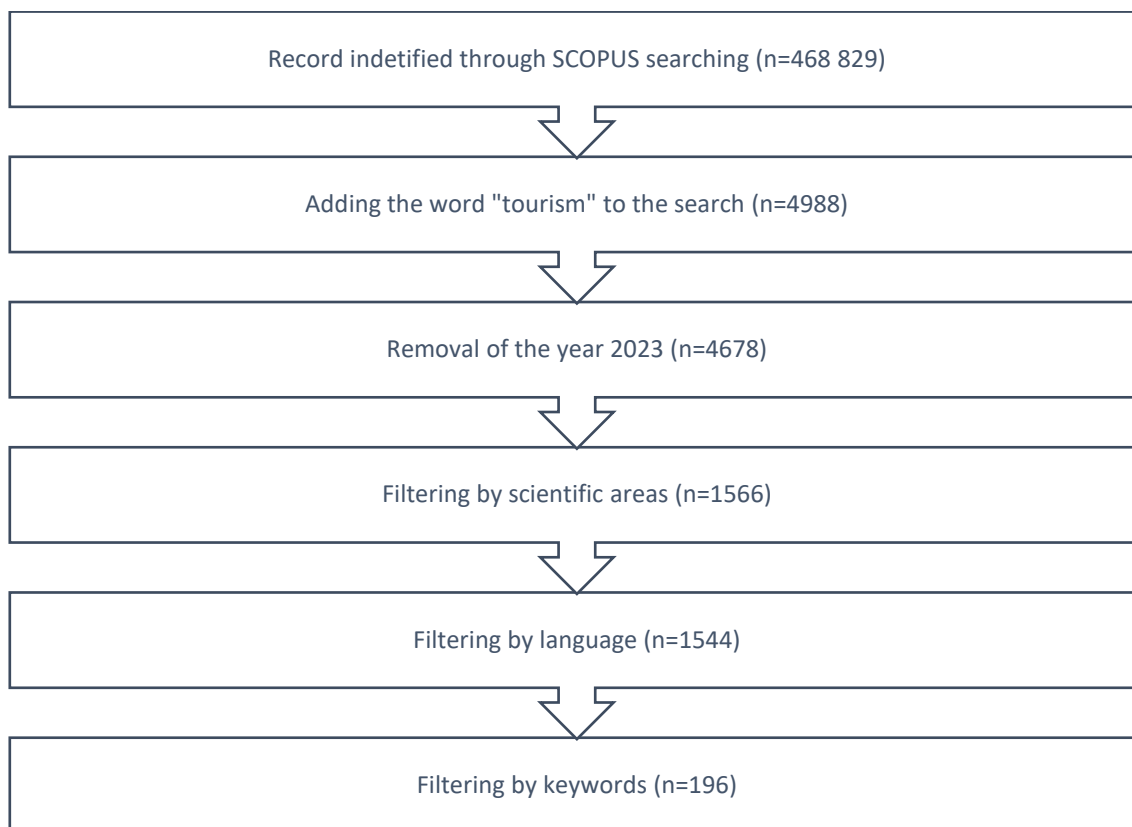
Table 1 Filtration methodology at SCOPUS

Search Terms in Scopus		
Field Tag	Title, Abstract and keywords	(TITLE-ABS-KEY ("artificial intelligence")) AND (tourism)
Year		(EXCLUDE (PUBYEAR,2023))
Subject Area		(LIMIT-TO (SUBJAREA,"BUSI") OR LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"ECON") OR LIMIT-TO (SUBJAREA,"ARTS"))
Language		(LIMIT-TO (LANGUAGE,"English"))
Keywords		(EXACTKEYWORD,"Tourism Development") OR LIMIT-TO (EXACTKEYWORD,"Hospitality") OR LIMIT-TO (EXACTKEYWORD,"Hospitality Industry") OR LIMIT-TO (EXACTKEYWORD,"Tourism Management") OR LIMIT-TO (EXACTKEYWORD,"Hotels") OR LIMIT-TO (EXACTKEYWORD,"Tourism Industry") OR LIMIT-TO (EXACTKEYWORD,"Tourist Destination") OR LIMIT-TO (EXACTKEYWORD,"Tourism Economics") OR LIMIT-TO (EXACTKEYWORD,"Hotel Industry") OR LIMIT-TO (EXACTKEYWORD,"Smart Tourism"))

Source: Own elaboration, 2023

The research in the SCOPUS database was conducted in March 2023 and began with the search for the terms "Artificial Intelligence" in all fields (titles, keywords, abstract), obtaining a total of 468 829 results (Table 1). In order to focus on tourism, the term "tourism" was added to the filtering, reducing the results to 4988 results and, to analyse only completed years, 2023 was excluded from the results, limiting the search to 4678. Given the disparity of scientific areas that, even so, appeared in the results, a filtering was made by the areas with greater affinity with tourism research, namely social sciences, business, management and accounting, arts and humanities, economics, econometrics and finance, obtaining 1566 results. Finally, the last filtering rounds led us to filter by language and keywords. Thus, only research published in English and keywords related to the tourism industry were selected. In this sense the keywords tourism, tourism development, tourism management, tourism industry, tourism destination, tourism economics, smart tourism, hospitality, hospitality industry, hotel industry and hotels were chosen. After all the above-mentioned steps, the result of the search in SCOPUS was summarized to 196 results (Figure 1).

Figure 1 - Search process at SCOPUS

| Record indetified through SCOPUS searching (n=468 829) |
| --- |
| Adding the word "tourism" to the search (n=4988) |
| Removal of the year 2023 (n=4678) |
| Filtering by scientific areas (n=1566) |
| Filtering by language (n=1544) |
| Filtering by keywords (n=196) |

Source: Own elaboration, 2023

Subsequently, the results were analysed considering the year of publication, publication type, research origin and scientific area. An analysis based on the VOSviewer software version 1.6.19 was also applied with the purpose of obtaining a clearer analysis of the research focus.

4.   Results

The first characteristic that stands out when processing the data is how recent and fast research in the Artificial Intelligence area has been developing (Figure 2). If we consider only the last ten years, the period when the number of publications starts to be more consistent, in three years we witness the publishing of more than 60% of the results presented. However, and as noted by Baggio & Baggio (2020), some good introductory works are already relatively old.

Figure 2- Search results per year

Year	Count
2022	47
2021	41
2020	38
2019	17
2018	12
2017	6
2016	1
2015	2
2014	3
2013	1
2012	0
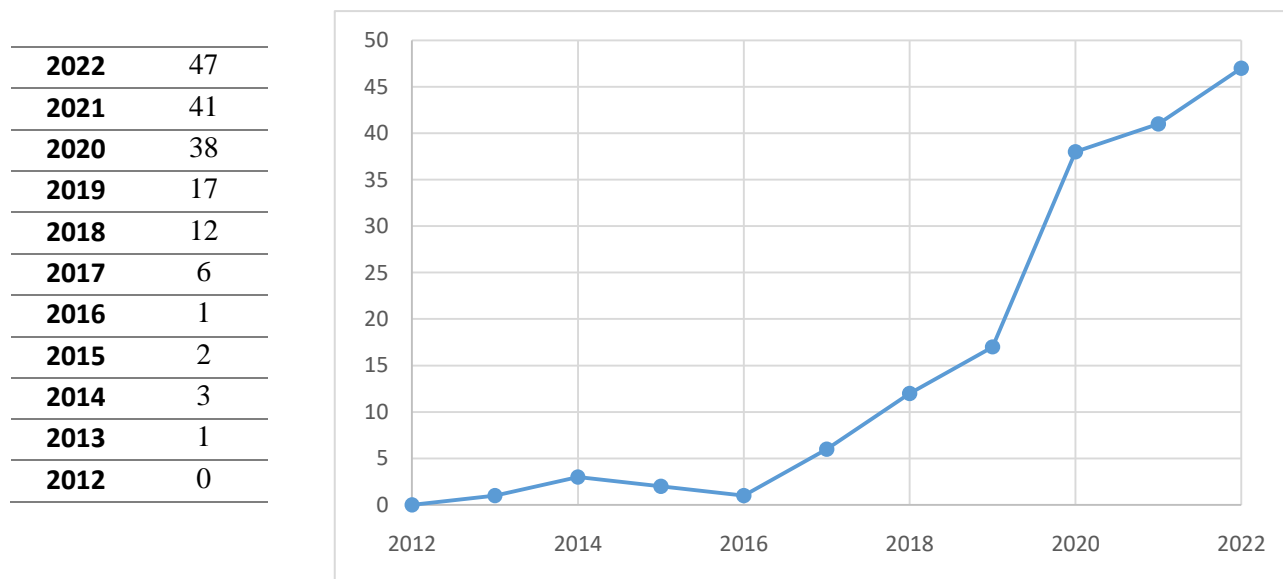
Source: Own elaboration, 2023

In this context, and according to the methodology used in the search and filtration, most of the publications are in the Business, Management and Accounting category (153) and Social Sciences (110). Of these, about two-thirds are articles (133). The filtration processes allowed us to observe that the keyword "Artificial Intelligence" with 148 references stands out from the second "tourism" (79 occurrences) and the third "tourism development" (31 occurrences).

If we consider the source, we can find the journal "Sustainability Switzerland" with 96 publications, and the first journal specialized in tourism, Tourism Management, with 11 publications, followed by the Annals of Tourism Research with 8 (Table 2).

Table 2 - Sources with more article in the results

Journal	Conference Proceedings	Book	Book series
Sustainnability Switzerland (17)	2011 2nd International Conference On Artificial Intelligence Management Science And Electronic Commerce Aimsec 2011 Proceedings (20)	Big Data And Innovation In Tourism Travel And Hospitality Managerial Approaches Techniques And Applications (1)	Lecture Notes In Business Information Processing (1)
Tourism Management (11)	Proceedings Of The International Conference On Electronic Business Iceb (2)	Future Of Tourism Innovation And Sustainability (1)	---
Annals of Tourism Research (8)	Springer Proceedings In Business And Economics (2)	GIS Applications In The Tourism And Hospitality Industry (1)	---
International Journal of	Transport Infrastructure And Systems Proceedings Of The Aiit	Smart Cities Policies And Financing	---

| Contemporary Hospitality Management (5)	International Congress On Transport Infrastructure And Systems Tis 2017 (2)	Approaches And Solutions (1)	
Journal of Hospitality Marketing (5)	---	Technology Adoption In The Caribbean Tourism Industry Analyzing Service Delivery In The Digital Age (1)	---

Source: Own elaboration, 2023

When examined the geographical origin of the research it becomes visible the strong scientific production in this topic coming from China, with 51 articles, more than twice as many as the second country, the United Kingdom, with 25, a number similar to India, with 22, and the United States of America with 21. These differences remain similar when analysed the affiliations of the authors. In this domain, Hong Kong Polytechnic University is the leader with 11 articles, followed by the University of Surrey with 7.

When taken into account the citations, the articles by Zeng et al. (ZENG; CHEN; LEW, 2020) with 288 citations, Akehurst (2009) with 286 citations, Buhalis & Sinarta (2019) with 237 citations, Song et al. (2019) with 225 citations and Cho (2003) with 208 citations are prominent. Of the articles with a number of citations above 200 stands out for seniority Cho (2003) and Akehurst (2009). However, SCOPUS recognizes greater relevance to the articles by Lv et al. (2022), X. Lv et al. (2021) and Goel et al. (2022).

Regarding to authors there are no special highlights for the number of articles published. Nevertheless, Dogan Gursoy emerges with the largest number of articles (5), closely followed by Dimitrios Buhalis (4) and Oscar Hengxuan Chi (4).

The use of the VOSviewer software allows us to draw further conclusions on the publishing dynamics on the relationship between tourism and Artificial Intelligence. The first analysis requested to VOSviewer was related to co-authorship (the relatedness of items based on their number of co-authors documents) using the analysis unit author. Given the reduced number of results and the fact that few authors have more than 2 publications in these results, it was considered that the minimum number of documents per author would be 1 to obtain a broader view, ignoring authors without any connection or the number of citations, thus summarizing the participants in 33 researchers. The results obtained (Figure 3) highlight the importance of co-authorship work developed especially by Zhang X., but also by Kong H. and Zhong L., publishing with a substantial number of other authors.
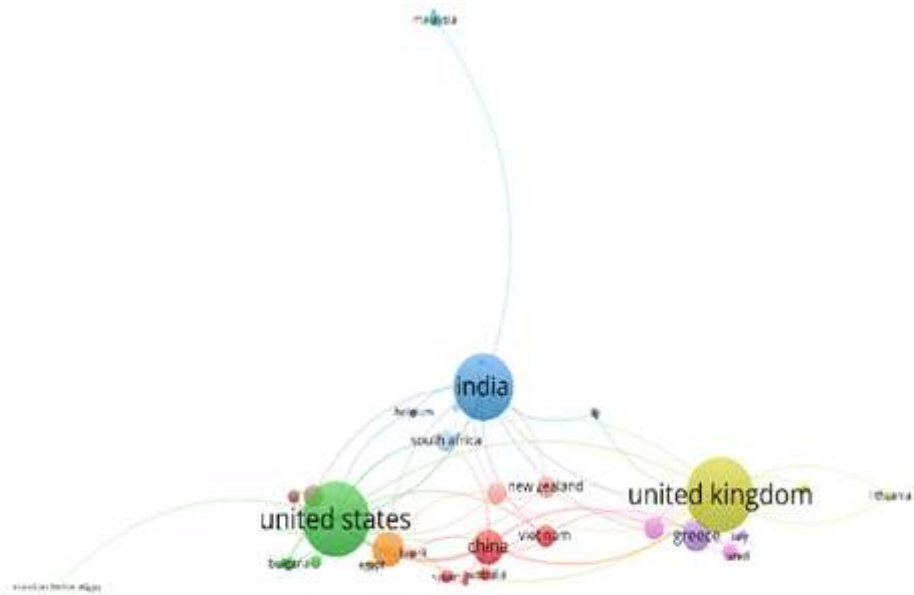
Figure 3 - Co-authorship analysis
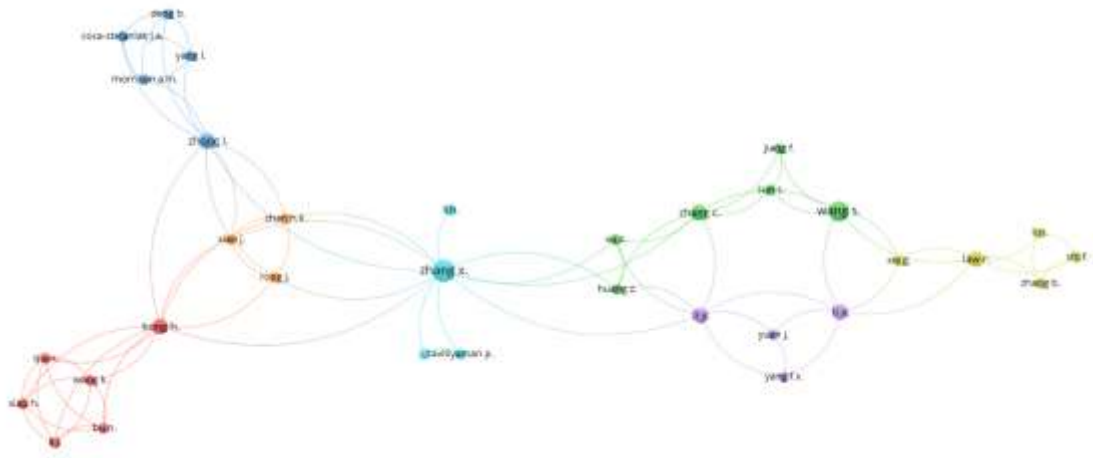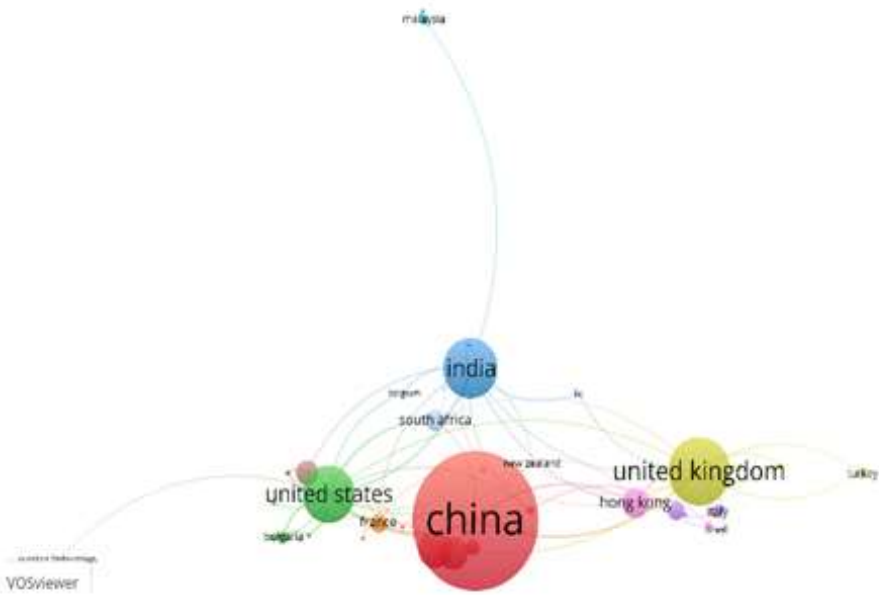

Source: Own elaboration, 2023

Following the same criteria of the preceding analysis, a new co-authorship evaluation was created, but this time applied to the countries of provenance. In this analysis two quite distinct realities emerge. When the criteria used in the VOSViewer map is connections, the United States of America, India, and the United Kingdom stand out (Figure 4) due to the significant networking carried out by authors affiliated to institutions in these countries, appearing recurrently as co-authors with other from different countries. However, if the criterion is the number of documents, China emerges as the most prominent country (Figure 5), reflecting the high number of authors affiliated with Chinese institutions in the publications.

Figure 4 - Co-authorship (countries) in links weight visualization

Source: Own elaboration, 2023

Figure 5 - Co-authorship (countries) in documents weight visualization
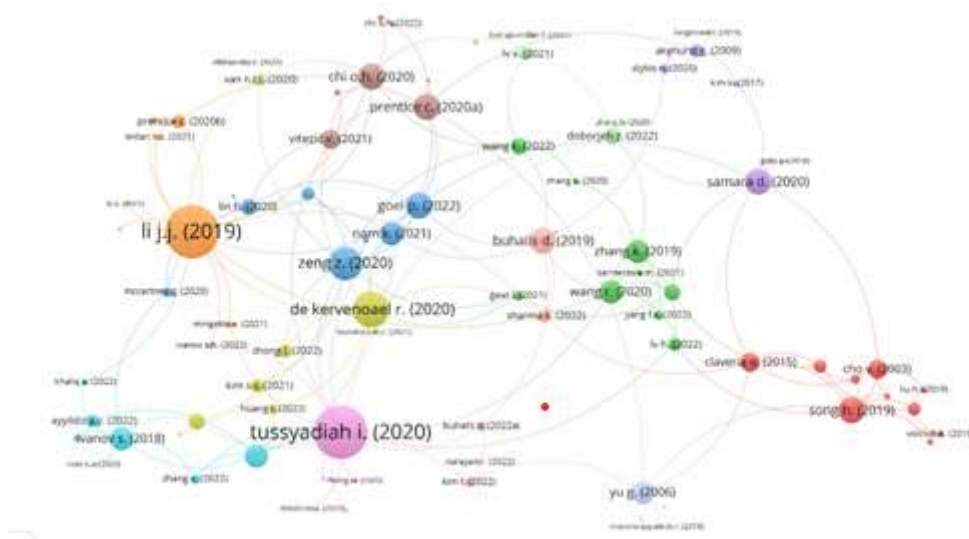

Source: Own elaboration, 2023

For the most cited authors analysis, the researchers with at least one publication among the results were taken into account. We obtained 524 authors, of which 246 had links. In this analysis three researchers are highlighted among the most cited in the research results (Figure 6). The most cited authors are Dogan Gursoy (Washington State University System), present in 5 publications and connection to 51 other authors, Dimitrios Buhalis (The Business

School at BU) and Oscar Hengxuan Chi (University of Florida), present in 4 publications, the first being connected to 39 authors and the second to 41. However, if we take into consideration only the connections to other authors the reality changes significantly, being Mark A. Bonn, with only one publication, the one to show a higher number of connections (61), followed by Lis Tussyadiah with two publications and 51 connections. Although in some cases they have a lower number of citations, they are cited by a greater variety of authors.

Figure 6 - Most cited authors

Source: Own elaboration, 2023

The citations were also examined (Figure 7). The first unit of analysis was the mutual citations of the publications that appeared in the research results, being identified connections between 87 publications. With this analysis it becomes clear which studies were most cited by the other articles involved in this research. When analysed the citations contained in SCOPUS search results (see above), these are also the publications that appear with stronger links to the remaining articles, especially Tussyadiah (2020), Li et al. (2019), Zeng et al. (2020), Buhalis & Sinarta (2019), B. Zeng & Gerritsen (2014) and de Kervenoael et al. (2020), with no direct relationship found between the number of citations and the number of links between the results of the search.
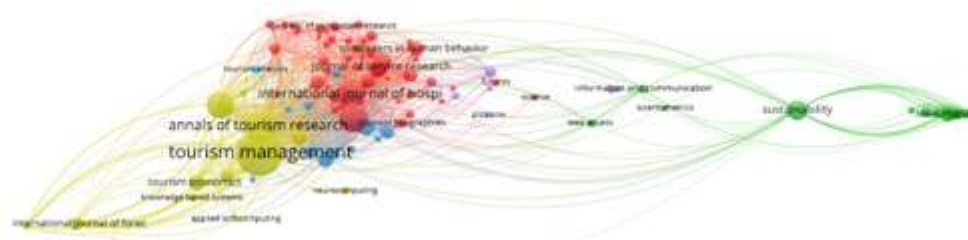
Figure 7 - Most cited articles in the papers under analysis (top) and the publications with the most links (bottom)
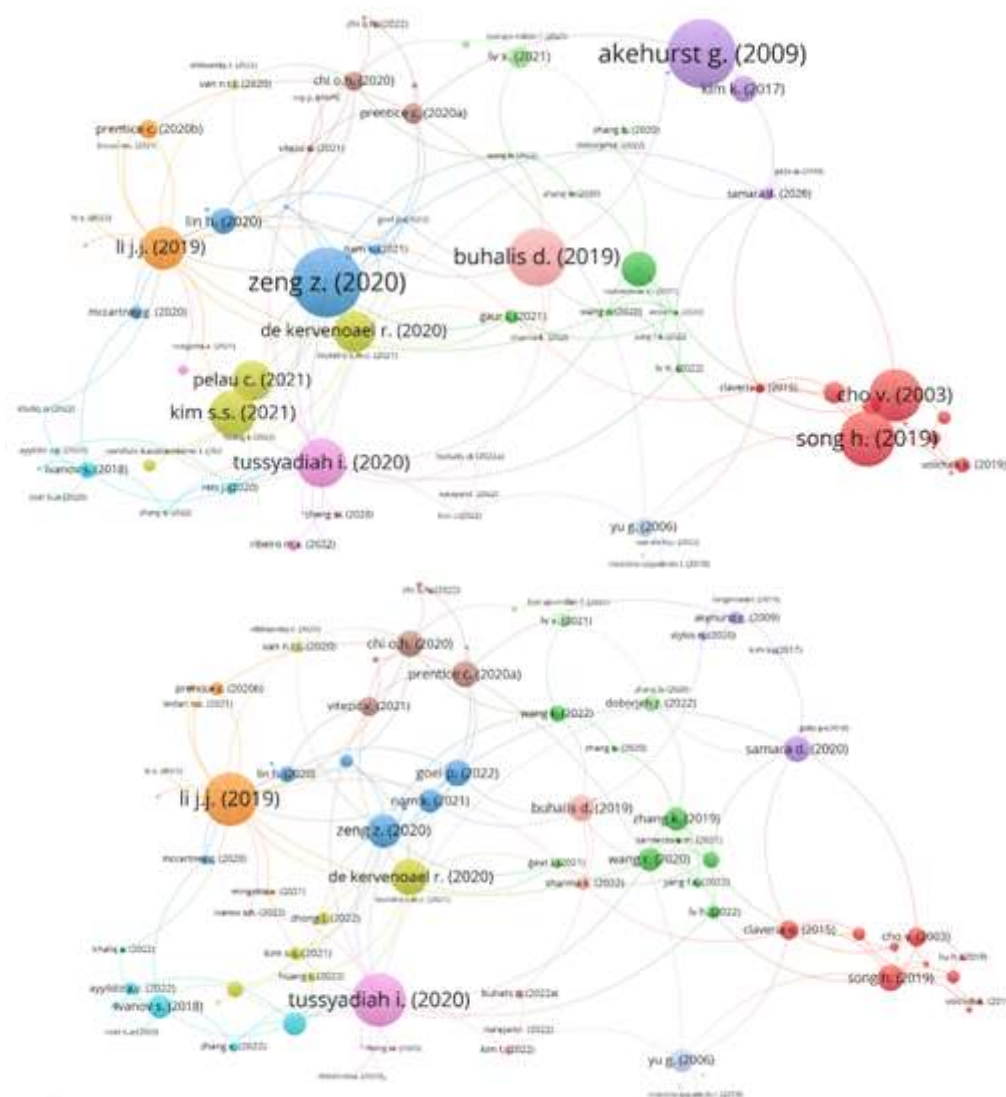
Source: Own elaboration, 2023

Examining the citations by country of provenance (Figure 8) and using the same criteria of the previous analysis, the investigation conducted in China once again highlights by being represented in 51 documents. The country with the closest figure is the UK with 25 articles, followed by India with 22 and the USA with 21. However, if the analysis is focused on the number of citations per country, the results change slightly, with research developed in the UK being more cited (1173), followed by China (1116) and USA (1053).´

Figure 8 - Country of provenance by number of citations

Source: Own elaboration, 2023

Finally, a co-citation analysis was applied, in other words, it is an analysis based on the number of times they are cited together. For this, the authors are the unit of analysis, and the minimum number of citations is determined as 10. In this case four clusters are clearly visible (Figure 9 e 10).

Figure 9 - Co-citation analysis using authorship as a unit.

Source: Own elaboration, 2023

Figure 10 - Source-based co-citation analysis

Source: Own elaboration, 2023

The first cluster (red) is led by Ivanov Stanislav and Craig Webster, the second (green) led by Rob Law, the third (blue) by Song Haiyan and the fourth (yellow) by Dimitrios Buhalis. Closing is used the unit of analysis the sources, applying the same criteria as the previous one. The map created by VOSviewer denotes a great proximity between most journals, except those that are in cluster 2 (dark green). This fact reveals that, in general, the articles in the journals cite each other regularly, with some exceptions. Nevertheless, the journals Tourism Management, Annals of Tourism Research and the Journal of Travel Research are the most noteworthy in terms of the number of citations.

5. Discussion and Conclusions

The current research allowed us to draw some conclusions concerning the publication dynamics on the relationship between tourism and Artificial Intelligence.

1.   There is a sudden and significant increase on the number of articles published, demonstrating the relevance, timeliness, and interest on the subject.

2.   The focus of research in this topic has been mainly in the areas of Business, Management and Accounting and Social Sciences.

3.   If we consider the journals specialized in tourism, Tourism Management and Annals of Tourism Research stand out, although the number of articles is still relatively low.

4.   China is prominent regarding the presence in research about Artificial Intelligence and tourism. This is another confirmation of the growing dynamism of Chinese scientific production. This fact has been debated in the media sphere, as it is already common knowledge (LU, 2022), although some doubts still remain regarding its quality (OLCOTT; COOKSON; SMITH, 2023).

5.   The authors with the highest number of papers in this area are affiliated to institutions in the USA and the UK. This result contrasts with that reported in the previous

section. Among the various factors that may account for this phenomenon, one potential explanation is that leading countries in global scientific research are receiving an increasing number of citations compared to other nations conducting similar studies, which could disrupt the creation and dissemination of knowledge within the global scientific community (GOMEZ; HERMAN; PARIGI, 2022).

6.   Greater networking is visible in authors affiliated to US, UK and Indian institutions, leading to a significant co-authorship presence of authors from different countries.

7.   The most cited authors are not necessarily those with the greatest number of links to the other authors present in the search results, i.e. the higher number of citations is not synonymous of having more authors citing.

6.   Limitations

The small number of articles that were found according to the search criteria has limited the results of this research, however, it allows us to understand how recent and dynamic this topic has become within tourism research. The reduced number of studies also constrains the evaluation performed using the VOSviewer software, since it hinders the creation of bibliometric networks. As AI is an umbrella term, the use of it as a search element may lead to some studies that use other expressions within this area not being considered in the results.

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