



Bibliometric Analysis on Internet of Things (IoT) and Tourism Industry: A Study Based on Scopus Database

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Abstract

The systematization of scientific expositions and methodology for exploring the Internet of Things (IoT) and tourism penetration every day reveals that researchers have made significant contributions to enhance this field of study. This article outlines the scholarly discussion on altering Tourism industry procedures in the face of the rapid rise of the Internet of Things. The primary goal of this research is to evaluate the structure and functions of scholarly papers related to the concerns of IoT development from the perspective of the tourism industry. The research idea is an analysis backdrop on exploring the trend in the interaction between the IoT and tourism business and published in the reputable database Scopus till 2021. The collection of scholarly papers indexed in the Scopus database by the keywords "Internet of Things" and "Tourism" serves as the research object. As of December 17, 2021, a total of 340 relevant publications surfaced in Scopus Database that matched the search criteria. Consequently, only 26 articles, review papers, conference papers, and book chapters were appropriate to be included in the next step. The article titles, abstracts, and keywords were used to do the publishing search. This analysis used data released in many topic areas from 2013 to 2021. VOSviewer and Scopus software were used to visualize the chosen papers. Thus, the bibliometric analysis enabled the illustration of the dynamic of publishing activity, highlighting the most impactful articles and credible journals, visualizing keyword co-occurrences in papers, co-authorship between nations, and the trend of the publication year by year.

Keywords: tourism industry, Internet of Things, smart tourism, ecotourism, big data, sustainable development

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INTRODUCTION

According to the United Nations World Tourism Organization (UNWTO), just 25 million travellers arrived worldwide in 1950. This amount has climbed to 1.4 billion international arrivals per year after 68 years (Nunes & Cooke, 2021). Tourism is a challenging sector to describe since, unlike other sectors, it does not have a single component. Instead, it encompasses a diverse variety of sectors, including hotels, sites, transportation, museums, parks, and travel agencies, to name a few. In its broadest sense, tourism refers to individuals travelling and staying in areas other than their typical surroundings for pleasure, business, medical tourism, or other purposes for less than a year. Travel and tourism were predicted to contribute more than 4.7 trillion US dollars to global GDP in 2020. The global coronavirus (COVID-19) outbreak in early 2020 significantly impacted the tourist sector. Before Covid-19, travel and hospitality (including its direct, indirect, and influencing effects) accounted for one-fourth of worldwide employability, 10.6 per cent of total jobs (334 million), and 10.4 per cent of global GDP (US\$9.2 trillion) (Aharon et al., 2021). World tourist expenditure in 2019 was US\$1.7 trillion (6.8 per cent of overall exports, 27.4 per cent of global service exports as per Horaira & Devi, 2021).

Tourism is among the most vibrant sectors in the world. However, somehow it is also one of the sectors that will be substantially and directly influenced by the fourth industrial revolution, as proven by the Internet's influence on the development of the tourism sector. Emerging innovations, such as IoT, play an essential role in preventing and managing this business, particularly how supply and demand are related. The Internet of Things (IoT) is a critical feature in the tourism and hotel industries allowing new business opportunities. Even though the Internet of Things can assist many businesses, the tourism industry is currently at the forefront of IoT development (Xiang et al., 2015). The technique provides a network to devices over the internet or

clouds service by embedding sensors in equipment to collect and distribute information and make analytics easier, more reliable, and authentic. The gadgets are not only conveying numbers, but they are also assisting in the fragile utilization of equipment in businesses, client service in consumer-focused businesses, and overall statistics. Among the most critical features of adopting IoT in tourism is personalizing what is on offer depending on information recorded and obtained from the visitors' connections. Modern technologies like IoT and machine intelligence like AI are used to streamline various industrial operations in response to the requirements of a new type of tourist. The tourist's profile should contain features for managing tourists' experience via smartphones, such as transportation, tourist guides, bookings, and actual data. Businesses in the tourist industry must also utilize these technologies to understand visitors' demands effectively and as a channel to identify and retrieve data to design innovative connected plans for the entire value chain of the tourism sector.

Smart tourism addresses creative tourist attractions built on cutting-edge technology that ensures sustainable development of tourism destinations, easiness of accessibility encouraging the tourists to interplay with and assimilate into their environment, which tends to increase the tourist experience at the location, and improves the quality of life of the inhabitants. Smart tourism consists of several components and layers of "smart," including smart destinations, smart experience, accurate monitoring, and smart business, which refers to the complicated business ecosystem that generates and continues to support the interaction of tourism destinations information (Tsaih & Hsu, 2018a).

The purpose of this research is to get deep insights into the research areas in the field of the Internet of things and its impact on the tourist industry (Neidhardt & Werthner, 2018). In the context of this research, the authors intend to investigate: What foundation for examining the concerns of the interaction

between IoT and tourism is available in the reputable database Scopus till 2020? As a result, bibliometric analysis can give qualitative information through metrical investigation. As a result, this study aims to provide an excellent opportunity to outline future directions benefiting the field of IoT and the tourist industry. The following are the broader questions addressed in this paper:

Research Question 1: Which are the most used keywords in articles in the research domain?

Research Question 2: How has research on IoT used in the tourism industry evolved?

Research Question 3: Which journals are the most cited and can be considered in future research?

Research Question 4: What are the scientific collaborations between researchers from various nations in this field?

REVIEW OF LITERATURE

The dynamic study of publishing activity reveals an increasing trend in publishing interest in researching the IoT and tourism ideas. Furthermore, the concept of IoT and tourism were studied in several disciplines including Business, Management and Accounting, Arts and Humanities, and Social Science. As a result, a substantial research foundation was addressing IoT concerns. Accordingly, the scientific articles such as Tsaih and Hsu (2018b), Almobaideen et al. (2017), Maiti and Ghosh (2021), Pencarelli (2020), Balandina et al. (2015), Gcaba and Dlodlo (2016a), Ionescu et al. (2021), Loureiro and Nascimento (2021), Fernandes (2021), Sun et al. (2021), Anh and Huy (2021), Trung et al. (2021), Rahmadian et al. (2021a), Demirel et al. (2021), Kolobkova et al. (2021) and Yadav et al. (2020) targeted at researching the global usage of IoT in tourism. This research was committed to researching significant research themes to further the topic of the usage of IoT in the tourist industry.

Ye et al. (2021), Suhud and Allan (2020), Klimova et al. (2020), Zubiaga et al. (2019), Mehraliyev et al. (2019), Hughes and Moscardo (2019), Buhalis et al. (2019) and Eskerod et al. (2019) examined the growth drivers for pursuing sustainability through IoT technology in the tourism industry, ICT as future of tourist management, progress on smart tourism research and digital supply chain management role in the tourism sector. The researchers also stated the rise of the mobile-based app in the tourism context and how smart tourism management can control tourists' overflow. Moreover, the researchers such as Almobaideen et al. (2017), Balandina et al. (2015) took the use of IoT and smartphone in Healthcare tourism and Medicare activity. Healthcare and tourism are two of the fastest expanding industry sectors in the world. Other authors like Del Fiore et al. (2016), Gomez-Oliva et al. (2019) and Liu et al. (2020) revealed that in the tourist business, the Internet of Things, big data, cloud computing, smart technologies, and other younger generation of information systems, indicates about their vital role in the evolution of World Cultural Heritage Sites. The tourists can also discover highly intriguing changes in art and culture as tourism was considered one of the vital driving motors of modern civilization (Cunha et al., 2021). In the following study, IoT technologies were classed as ecological tracking and monitoring, detecting seas and rivers, tracking birds, identifying plant species, visitor centre services, hospitality, tourist marketing and climbing, and weather forecasting (Gcaba & Dlodlo, 2016b).

Furthermore, it was also discovered that the current study's orientation in using smart technology in sustainable entrepreneurship in Island tourism and the use of big data for sustainable tourism (Howells & Ertugan, 2019; Rahmadian et al., 2021b). Various studies such as Inanc–Demir & Kozak (2019), Zhang et al (2019) and Toapanta et al. (2019) presented the big data, and its supporting elements for tourism and hospitality marketing and security model applied to IoT with big data for tourist management in the cities of

Ecuador. Furthermore, the systematization of scientific sources (Kalra et al., 2018) indicated the significant enjoy community experience using social media and Constructing Virtual Backbones over Low-Cost Wireless Networks for Smart Tourism Services (Zervopoulos et al., 2019).

RESEARCH METHODOLOGY

With the help of literature review, this study investigated existing published papers taken from the Scopus Database. The evaluation only includes journal papers that match the appropriate keyword combination. Scopus Network is a renowned abstract and citation database created by Elsevier in 2004. For the study purpose, the most relevant studies were evaluated using the framework of this study. Accordingly, the examination had carried out in the following order. The survey project was developed in the first stage. As the scanning formula for the data filtering, a mixture of the two essential keywords was used. The keywords used were "Internet of Things" and "Tourism". As of December 17, 2021, a total of 340 relevant publications surfaced in the Scopus Database that matched the search criteria. Therefore, all subject area research papers were removed from the study except Business, Management and Accounting, Arts and Humanities, and Social Science.

Consequently, only 88 articles, review papers, conference papers, and book chapters were found to be appropriate for inclusion in the next step. As a result, from 2013 to 2021, the remaining 85 documents were published in various languages in a specific subject area. The author also eliminated one research paper that was not written in English (written in the Chinese language). The complete study framework is depicted in Figure 1.

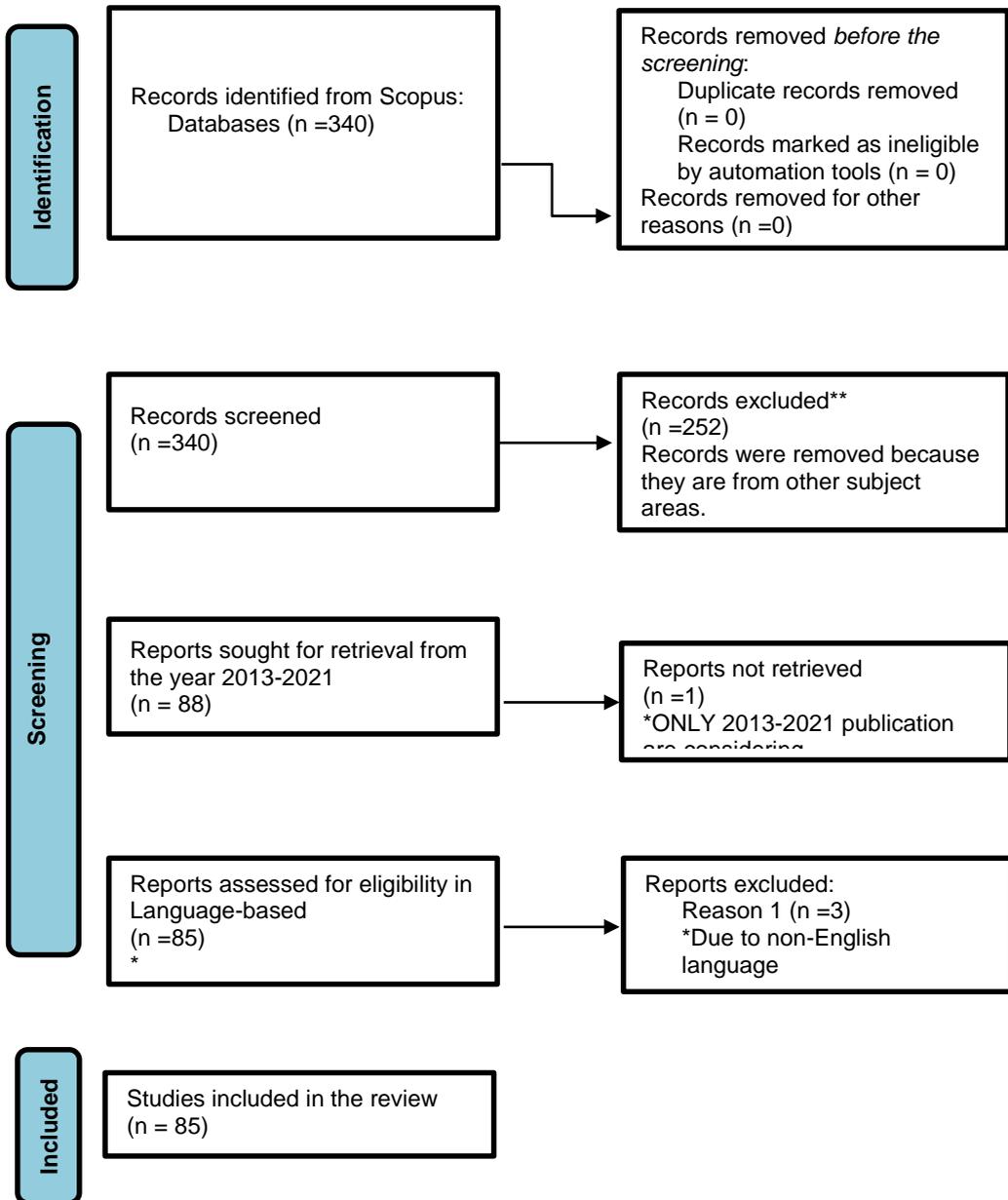


Figure 1: The data collection and filtering process for the bibliometric analysis
Source: Authors’ construction based on the PRISMA Framework

DISCUSSION OF THE STUDY

The first part of the discussion only considered data from 85 documents published in three subject areas from 2013 to 2021 in the English language. The Scopus database tools provided the publication activity dynamic in IoT and Tourism. Moreover, the most cited documents were highlighted. In addition, the study gave an evaluation of the most popular sources for publishing the papers. In the second stage, the thematic proximity of investigated articles was demonstrated utilizing the VOSviewer computer software. It is worth noting that, despite the limits indicated below, VOSviewer aided in building the co-occurrences network map: 1) Analysis type: coo-occurrence; 2) Analysis unit – All keywords; 3) Counting method – full counting; 4) The minimum number of keyword occurrences in the titles, keywords, and abstracts of the identified articles –The minimum number of occurrence of keywords was considered: 3 and out of the 674 keywords, 45 met the threshold.

Further, it should be noted that the network maps are made up of many different coloured circles and linkages with varying strengths. In turn, the cluster was formed by numerous circles of one colour. Depending on the analysis method, the circle size symbolizes the number of articles (co-occurrences, co-authorship, citation, bibliographic coupling, or co-citation). The wider the circle, the more records were made available. Furthermore, the spacing between circles denotes the frequency with which items appear. Given this, the greater the distance between the two circles, the weaker their relationship. Furthermore, the number of linkages reveals how many connections exist between certain things.

RESULTS OF THE STUDY

The bibliometric analysis was carried out utilizing the VOSviewer software tool to explore the relationship between IoT and tourism. The sample of the study consisted of 340 documents from the Scopus database. There are

several constraints in building a network map, which are as follows. 1) Analysis type: coo-occurrence; 2) Keywords as a unit of analysis; 3) Counting method - complete counting 4) The smallest number of keyword occurrences in the chosen papers' titles, keywords, and abstracts – The minimum number of occurrences of keywords was considered : 3 and out of the 674 keywords, 45 met the threshold.

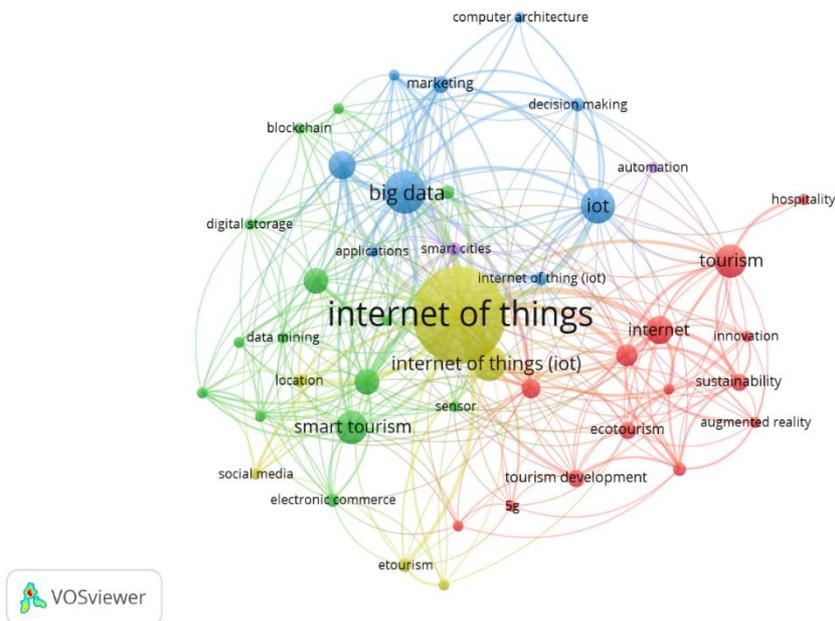


Figure 2: The Network Map

Source: Created by Authors based on VOS-viewer Software

It should be noted that the academics' interest in this topic first emerged in 2011, but till then, very little research was done; after 2013, the level of research on this theme increased ultimately. As a result, the study spans the years from 2013 to 2021. The keywords used to create the collection of papers were "Internet of Things" and "Tourism," which appeared in the article titles, keywords, and abstracts. Considering the limitations described above, the

findings of the bibliometric study revealed 5 clusters (Figure 2). It allowed for the definition of thematic closeness in the examined subject and the assumption of future research paths. In turn, the largest cluster (total link strength 123, occurrences 38) represents the scope of publications targeted at analyzing the characteristics of the Internet of Things (IoT). The authors tried to explore the function of Internet of Things research in the smart tourism business, digital storage, big data, and e-tourism, as well as the decision-making process of visitors.

Thus, the following keywords were added in the first cluster: IoT, e-tourism, sustainable development, tourism, Internet, 5G big data, digital storage, digital mining, social media, and smart cities, among others. It is important to note that the evaluation of this cluster revealed the researchers' interest in researching virtual and augmented reality. The second cluster (total link strength 65 and occurrences is 15 items) demonstrates the documents devoted to the keyword of big data. As a result, this cluster focuses on the connection between IoT, tourism, smart tourism, electronic commerce, data mining, social media, marketing, and decision-making. The documents cover the issues on the use of big data technology in tourism, smart cities, change in marketing, and reforming the tourism development under big data transformation.

Moreover, there is a comprehensive investigation of smart tourism features and IoT in the frame of studies on big data. The third cluster (total link strength 30 and occurrences 11 items) includes articles about smart tourism potential. Thus, the study focus shifted to investigating the influence of smart tourism on the tourism sector, tourist site preferences, the function of IoT in smart tourism, how big data revolutionized smart tourism and smart cities, and so on. Herewith, more attention devotes to how the smart tourism concept was transformed by the Internet of Things. Finally, the fourth cluster introduces new study directions in the tourism term. The studies illustrate the characteristics of

transitioning to sustainable development. As a result, the relevant themes include IoT, ecotourism, big data, Internet development, augmented reality, and innovation, among others.

It should be noted that the vector of scientists' publishing development may be observed. Furthermore, exploring the Internet of Things (IoT) themes is becoming more popular. Therefore, it is important to explore the influence of IoT on the tourism business and development of smart tourism, sustainability, smart cities, e-tourism, augmented reality, and the tourist decision-making process, among other things.

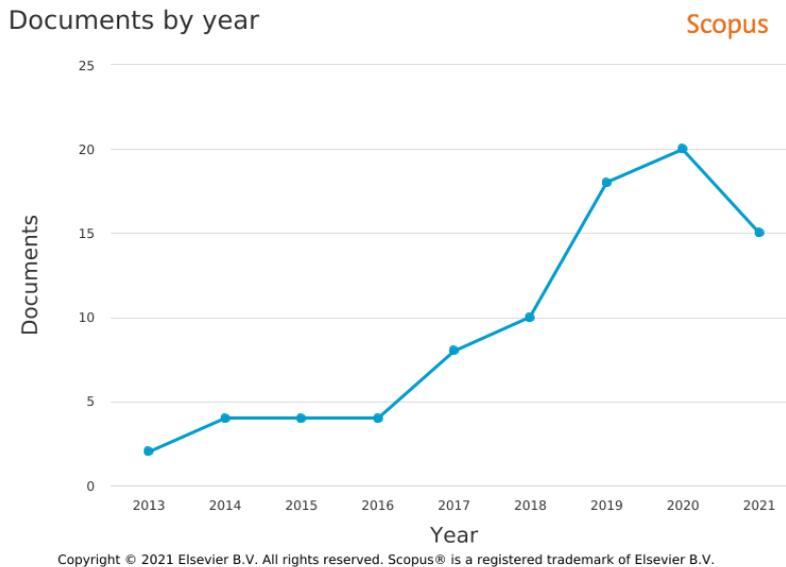


Figure 3: The trend of published documents on for is "IoT" and "Tourism"
Source: *Scopus - Analyse Search Results (2021)*

Figure 3 depicts a developing trend in the publishing activity on the relationship between IoT and tourism. It is essential to mention that the term "Internet of Things" was coined in 1999 by K.Eshton, a brand manager at Procter & Gamble (Maiti & Ghosh, 2021). Despite this, the first publication on IoT was listed in the Scopus database in 2003. In response, the first paper delving into the link between IoT and the tourism industry was published in 2011. However, following 2013, the number of publications on this topic

increased yearly.

Furthermore, the number of articles grew by around 80% in 2020 compared to 2013. Table 1 shows the ten most referenced academic journals and conferences on IoT and tourism. According to the data, the journals "sustainability (Switzerland)" and "current concerns in tourism" had the highest average citation (per document) of roughly 41 and 61 citations respectively. These journals are the most preferred journals in the field of investigation to identify the impact of IoT in the tourism industry.

Table 1 lists the journals and conferences that published the most papers on the topic of this study in terms of the volume of published articles. According to this data, 36.47 % of the published articles had focused on the following journals and conferences.

Minimum number of documents of source: 2

Minimum number of citations of source: 2

Out of the 60 keywords, 11 met the threshold, but authors had only considered journals and conferences primarily related to the topic.

Table 1: Most productive Journals and Conferences for “Internet of Things AND Tourism” Filed (2013-2021)

Source	Docs	Citations	Average Citations
Sustainability (Switzerland)	8	33	4.125
Current Issues in Tourism	3	184	61.33
Information Technology and Tourism	3	55	18.33
Proceedings of the International Conference on Electronic Business (iceb)	3	9	3
"2016 ist-Africa conference, ist-Africa 2016."	2	30	15
Journal of Hospitality and Tourism Technology	2	22	11

"Big data and innovation in tourism, travel, and hospitality: managerial approaches, techniques, and applications."	2	19	9.5
Journal of Tourism Futures	2	17	8.5
"International archives of the photogrammetry, remote sensing and spatial information sciences - isprs archives"	2	3	1.5
"Proceedings - IEEE 2018 international congress on cybernetics: 2018 IEEE conferences on the internet of things, green computing and communications, cyber, physical and social computing, smart data, blockchain, computer and information technology, ithings/greencom/cpscom/smart data/blockchain/cit 2018"	2	3	1.5
"Proceedings of the 32nd international business information management association conference, ibima 2018 - vision 2020: sustainable economic development and application of innovation management from regional expansion to global growth"	2	3	1.5

Source: Prepared by authors through VOS-viewer Software based on Scopus Database (2021)

This theme's most productive country and territory is Italy (produce 12 articles, book chapter, review paper, and conference paper), followed by China and the United Kingdom/ United States (10 and 7 publications respectively). In the third step, the network map was created while keeping the following constraints in mind: 1) the type of analysis – co-authorship; 2) the unit of analysis – countries; 3) the counting technique – full counting, and 4) the lowest

number of documents of each author – 2. As a result, out of 39 countries, 13 met the thresholds.



Figure 4: Network map of the analyzed documents by countries (2013-2021)
Source: Created by the authors based on (VOSviewer, 2021).

Figure 4 depicts the scientific collaboration of scholars from various nations. There are just two clusters that demonstrate international cooperation. As a consequence of the collected findings, it was discovered that the Italian scholars published 12 documents on the researched area. Consequently, it has excellent scientific collaboration with researchers from China, Australia, and the United Kingdom.

The second cluster highlighted the fruitful interactions between Italian academics and Switzerland, Jordan, the United States, and the United Kingdom. Simultaneously, it displays the collaboration of scholars from China and the United States. It is worth noting that India has no single research outside the country on this specific theme. Therefore, we can conclude that Indian scholars should increase their link strength in this field and focus on collaborations with scholars from outside the country.

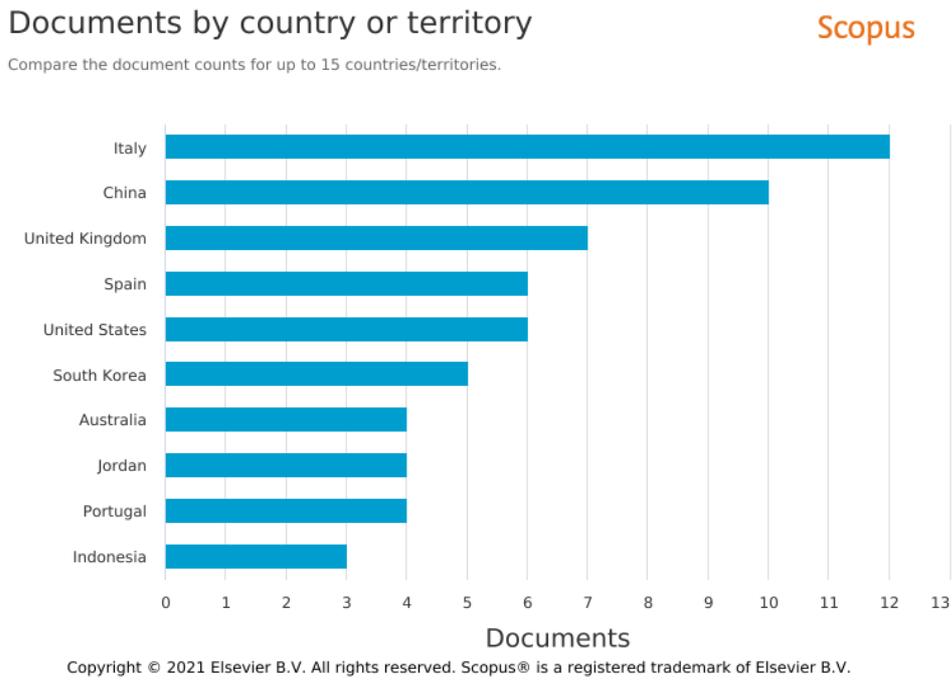


Figure 5: Most productive country and territory

Source: Scopus - Analyse Search Results (2021)

CONCLUSION AND LIMITATIONS OF THE STUDY

The findings of the bibliometric study revealed a link between the themes of the Internet of Things and tourism. As a result, there is an increasing trend in publishing activity in the research sector. Even though the first concept of the Internet of Things was published in the Scopus database in 1999, academic interest has expanded throughout the century. Furthermore, the first study devoted to investigating the link between the Internet of Things and tourism was conducted in 2011. The Scopus database used a sample of 340 papers for the bibliometric analysis. The research sample yielded a search utilizing the terms "Internet of Things" and "Tourism" in the article title, keywords, and abstracts. The time frame for papers to review sample data was 2013-2021. The VOSviewer and Scopus software tools were used to achieve the study aim.

Consequently, the acquired data enabled a visualization of five clusters of the thematic closeness of the studied research. As a result, there is a vector of the evolution of scientists' publications. That is, it would be an appropriate investigation of the impact of IoT on tourist development, smart cities, the tourism sector, big data, smart tourism, augmented reality, digital storage, social media and marketing, and so on. The investigation of author collaborations revealed a substantial scientific collaboration with academics from China, Australia, and the United Kingdom. The second cluster highlighted the fruitful interactions between Italian academics and Switzerland, Jordan, the United States, and the United Kingdom. It also displays the collaboration of scholars from China and the United States. In addition, it is worth emphasizing that India has no single scientific collaboration with researchers outside the nation on this specific topic. As a result, we may infer those Indian researchers should strengthen their links in this sector and collaborate with scholars from other countries.

This study has various limitations that can also be adjusted in future research. The study spans only up to ten years, from January 2013 to the end of 2021. The investigation will have vast scope in the future. In the future, other databases such as Web of Science, Google Scholar, and Dimensions will be accessible. The study only includes literature written in English; no other languages were covered.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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