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Blockchain Technology in Tourism Industry: A Bibliometric Analysis

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ABSTRACT

The integration of Industry 4.0 (I4.0) technologies has significantly transformed the tourism industry. Additionally, the COVID-19 pandemic has accelerated the adoption of I4.0 technologies in this sector. However, there is limited evidence on how specific I4.0 technologies, such as blockchain, support the tourism industry, particularly in the post-pandemic era. This review seeks to provide insights into emerging research trends that incorporate blockchain technology into the tourism sector. To achieve this, a systematic literature network analysis (SLNA) was conducted, combining a systematic literature review (SLR) with bibliometric analysis. The analysis was based on a corpus of 163 studies published from 2017 to 2024, sourced from the Scopus database, and was carried out using the Biblioshiny tool in R-studio. The findings indicate that blockchain technology has gained popularity in recent years, with most research focusing on developed economies, while there is a notable gap in studies from emerging and developing economies. Tourism practitioners should consider the results of this study from multiple perspectives to enhance their current and future operations and strategies. This study introduces several novel areas, particularly concerning methodology and research context. The innovative SLNA approach was used to review blockchain applications in the tourism industry, though the study was limited to this sector. Future research could explore related topics, such as cryptography, ecosystems, and technology adoption, which are still developing in this and other fields.

Keywords: Blockchain, Industry 4.0, SLNA, Tourism, Bibliometric

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INTRODUCTION

In the digital age, advanced technologies have revolutionized organizations across multiple dimensions, including consumer interactions, human resource management, operational processes, and strategic planning (Ali & Johl, 2023). The contemporary economy, characterized by shorter product life cycles and increased internationalization, has amplified the importance of human-related factors for organizational survival and success (Khan et al., 2023). As a result, organizations are increasingly reliant on stakeholders to provide strategies

for the adoption of emerging technologies. Moreover, the only viable path to achieving a sustainable competitive advantage lies in the comprehensive implementation of these new technologies across all organizational levels (Pilkington, 2016; Yaga et al., 2019; Zheng et al., 2017). The concept of digitalization, or Industry 4.0 (I4.0), was first introduced in Germany in 2011 and has since garnered significant interest from both researchers and practitioners. In recent years, I4.0 has evolved into an umbrella term encompassing a range of transformative technologies, including big data, smart manufacturing, artificial intelligence (AI), and blockchain technology (Sony et al., 2021). These emerging technologies have the potential to fundamentally disrupt existing industries, processes, and markets, with blockchain, introduced in 2008, serving as a notable example (Nakamoto, 2008; Lustenberger et al., 2021).

Since its establishment in 2009, blockchain technology has garnered significant attention, largely due to Satoshi Nakamoto's introduction of Bitcoin in 2008, a pioneering form of cryptocurrency (Thurner, 2018; Bogart & Rice, 2015; Thees et al., 2020). The first implementation of blockchain technology in 2009, with the creation of the initial block containing transaction records, marked the commencement of the blockchain era. Today, blockchain has evolved into an indispensable tool for both organizations and consumers (Narayanan et al., 2016). At its core, blockchain technology is a distributed ledger system that employs cryptography to securely link blocks of transaction data in a manner that is resistant to tampering (Kwok & Koh, 2019). Each block contains a record of transactions, forming a chain that, once added to the ledger, is distributed across the entire network (White, 2017). This decentralized structure enables businesses and organizations to operate with enhanced transparency and trust, eliminating the need for a centralized control node (Seffinga et al., 2017). Additionally, the system generates a unique identifier for each block, ensuring both the accuracy of data tracking and the security of the system (Kumar et al., 2020). On a broader scale, blockchain technology functions within a novel distributed infrastructure and computing paradigm, characterized by its data validation and storage structure, consensus algorithms, cryptography, and the deployment of self-executing digital contracts (Nakamoto, 2008).

The integration of blockchain technology with smart contracts has the potential to significantly disrupt traditional financial transaction methods within the travel and tourism industry, and it is poised to exert a profound influence on this sector in the near future (Bell & Hollander, 2018; Treiblmaier & Önder, 2019). This technology offers enhanced security and efficiency for both business-to-business (B2B) and business-to-consumer (B2C) transactions, particularly through the use of digital payments and cryptocurrencies (Lindman et al., 2017). Several leading airline companies, including Amadeus, Avinoc, and Eurowings, as well as tourism enterprises, have already developed blockchain-based platforms to facilitate booking, baggage tracking, tourist identity management, and bed load optimization. Additionally, advancements in information and communication technologies (ICTs) are providing financial support to tourism businesses, thereby enabling these companies to invest in and enhance the overall visitor experience.

Technologies such as blockchain and other emerging digital solutions present significant opportunities for the tourism industry to innovate and expand its service offerings, while simultaneously enhancing service quality (Bolici et al., 2019). Blockchain technology, recognized as one of the major trends with profound implications for the future of the tourism sector, has the potential to address several of the industry's longstanding challenges, including inadequate infrastructure management, limited business credit, and opaque pricing mechanisms. These challenges can be mitigated through blockchain's exceptional attributes, such as high transparency, resistance to tampering, data provenance, and traceability (Nam et

al., 2021). The adoption of blockchain technology in the hospitality and tourism sectors is therefore not only vital for optimizing current services but also essential for ensuring sustainable future development.

The current application of blockchain technology remains largely experimental, with limited empirical data supporting its adoption (Ying et al., 2018). This is particularly evident in the tourism sector, where there is a notable lack of empirical research on blockchain adoption (Korže, 2019; Önder & Treiblmaier, 2018; Sigala, 2017). Moreover, to date, no bibliometric studies have specifically investigated the role of blockchain technology within the tourism industry. The majority of existing research on blockchain implementation tends to be theoretical or conceptual in nature (Kwok & Koh, 2019; Nam et al., 2021; Pilkington, 2017; Rejeb & Karim, 2019; Treiblmaier, 2018; Treiblmaier & Önder, 2019; Tyan et al., 2021; Wahab et al., 2020). While previous studies have predominantly focused on the adoption of blockchain technology in supply chain management (Jardim et al., 2021; Queiroz & Wamba, 2019; Wong et al., 2020), they have largely overlooked the perspectives of tourists regarding the adoption and operation of blockchain systems. The increasing implementation of blockchain technology underscores the necessity of investigating and elucidating its potential benefits for tourism businesses (Vistro et al., 2021). Given the scarcity of research in this area, further studies are crucial for deepening our understanding of the relevant concepts and frameworks (Wahab et al., 2020). Thus, the following research questions were developed:

RQ1. What are the current states and trends of publications on blockchain technology in the field of tourism?
RQ2. What are the highly cited documents in this study domain?
RQ3. Who are the most productive contributors among these publications?
RQ4. How is the collaboration between countries in this field of study?
RQ5. What is the current state of knowledge structure?
RQ6. What are the themes involved in research on blockchain technology in tourism?

This study is organized as follows: The first section provides an introduction and background on blockchain technology, along with its application within the tourism sector. The subsequent section offers a comprehensive literature review that traces the development of blockchain technology in the tourism industry. Section three details the bibliometric technique employed, utilizing the Biblioshiny tool, and includes references and a flowchart outlining the process for conducting bibliometric analysis. Following this, the study presents a detailed analysis addressing the research questions, which is then followed by a discussion of the findings, contributions to the field, limitations of the study, and recommendations for future research.

LITERATURE RESEARCH

Blockchain Technology in Tourism Industry

Previous studies have explored and identified the causes and impediments to blockchain technology adoption, as well as demonstrated cause-effect correlations, which contribute to avoiding failures in its implementation (Sharma et al., 2021). Pilkington (2017) examined the application of blockchain technology in Moldova's medical tourism sector, discussing its practical implications for supply chain management, customer reviews, and heritage protection within the context of medical tourism. Mofokeng and Matima (2018) investigated the adoption

of blockchain technology in virtual environments for digital tourism marketing, revealing that its application in virtual reality (VR)-based tourism could positively impact the industry. Willie (2019) recommended that discussions on blockchain technology adoption be extended to the destination level, noting that blockchain has already been implemented in the hotel industry for both strategic and practical purposes, with significant benefits including increased operational efficiency, effectiveness, and overall profitability. However, regarding the broader acceptance of blockchain technology, Korže (2019) argued that the tourism sector lags behind other industries.

Furthermore, the findings of Kwok and Koh (2019) offer valuable insights into how small island economies, such as those in the Caribbean and Aruba, benefit from the implementation of blockchain technology. They highlighted the potential for increasing stakeholder engagement through blockchain, along with improved data management practices, particularly in the context of privacy considerations.

Bolici et al. (2019) investigated ongoing discussions on the major social network platform, Twitter, revealing a growing interest in blockchain and cryptocurrencies. The content of the tweets provided preliminary, yet potentially significant, insights into how blockchain and cryptocurrencies could be leveraged to drive innovation in tourism services.

Past Bibliometric Studies

Guo et al. (2021) provided a comprehensive overview of blockchain technology using bibliometric analysis tools such as CiteSpace and VOSviewer, highlighting a significant increase in blockchain research since 2016. Despite this growing body of work, there remains a notable lack of bibliometric research specifically addressing blockchain technology in the tourism sector. While bibliometric studies on blockchain can be found in adjacent fields, such as smart cities, there is a gap in the tourism context. A recent study by Rejeb, Rejeb, Simske, and Keogh (2021) employed bibliometric analysis to explore blockchain applications in smart cities, examining 48 articles published between 2016 and 2020. They found that blockchain technology could enhance the sustainability of smart cities, particularly in sectors such as logistics and supply chain management, transportation, and public administration. Additionally, in related fields such as logistics and supply chain management, Rejeb, Rejeb, Simske, and Treiblmaier (2021) conducted a bibliometric review of blockchain research and observed that most studies still emphasize the conceptualization of blockchain rather than its practical applications.

MATERIALS AND METHODS

Study Design

This study aims to explore the application of blockchain technology within the tourism industry and to delineate future research agendas. While numerous studies have examined blockchain technology, they have largely overlooked its implications in the context of tourism. To address this gap, this study employs a systematic methodology that has been previously lacking in the literature. Specifically, it utilizes a novel research design that integrates a systematic literature review (SLR) with a bibliometric approach known as “systematic literature network analysis” (SLNA) (Colicchia & Strozzi, 2012). Developed a decade ago, the SLNA approach has

garnered attention in fields such as safety climate (Bamel et al., 2020), information systems (Zeng et al., 2020), and circular economy (Khitous et al., 2020). This approach was chosen to effectively address the research questions and objectives. By combining the SLR and bibliometric methodologies, this study aims to maximize the advantages of both approaches while mitigating their respective limitations (Colicchia & Strozzi, 2012).

Initially, data were collected through a systematic process, which offers a robust and effective mechanism for selecting the most pertinent literature across broad research domains. Concurrently, bibliometric analysis provides insights into authors' contributions and publication trends (Donthu et al., 2021). This bibliometric approach is well-suited for uncovering statistical patterns and gaining deeper insights into specific research areas, such as tourism, thereby enhancing understanding in related academic disciplines (Koseoglu et al., 2016). The technique has gained popularity for its ability to deliver a comprehensive and nuanced understanding of a particular field through science mapping on a database of publications (Rahman et al., 2022).

Data Collection

This section highlights the data collection procedures involving defining the search terms, inclusion, and exclusion criteria, which are outlined in the following sub-sections.

Defining keywords

The search was conducted using the article title as the primary search criterion, thereby facilitating the retrieval of precise and relevant results related to blockchain technology in the tourism industry. For data collection, a search string was crafted incorporating two key sets of terms to identify relevant articles. The first set included keywords related to blockchain, such as "blockchain," "block-chain," "smart contract," "digital ledger," and "cryptocurrency." The second set comprised terms associated with tourism, including "tourism," "travel," and "tourist," which are sometimes used interchangeably. Consequently, the search in the title field utilized the following keywords: TITLE ("blockchain" OR "block-chain" OR "smart contract" OR "digital ledger" OR "cryptocurrency") AND ("tourism" OR "travel" OR "tourist").

Search Strategy and Protocols

The second step of data collection involved developing search protocols. Referring to Casino et al. (2019), “Preferred Reporting Items for Systematic Reviews and Meta-Analysis” (PRISMA) was adopted as a review protocol. Page et al., (2021) stated that the PRISMA statement facilitates gaining an in-depth understanding, transparency, and reproducibility of the studies (Ali & Johl, 2022). Figure 1 illustrates the PRISMA diagram, which highlights the study selection process.

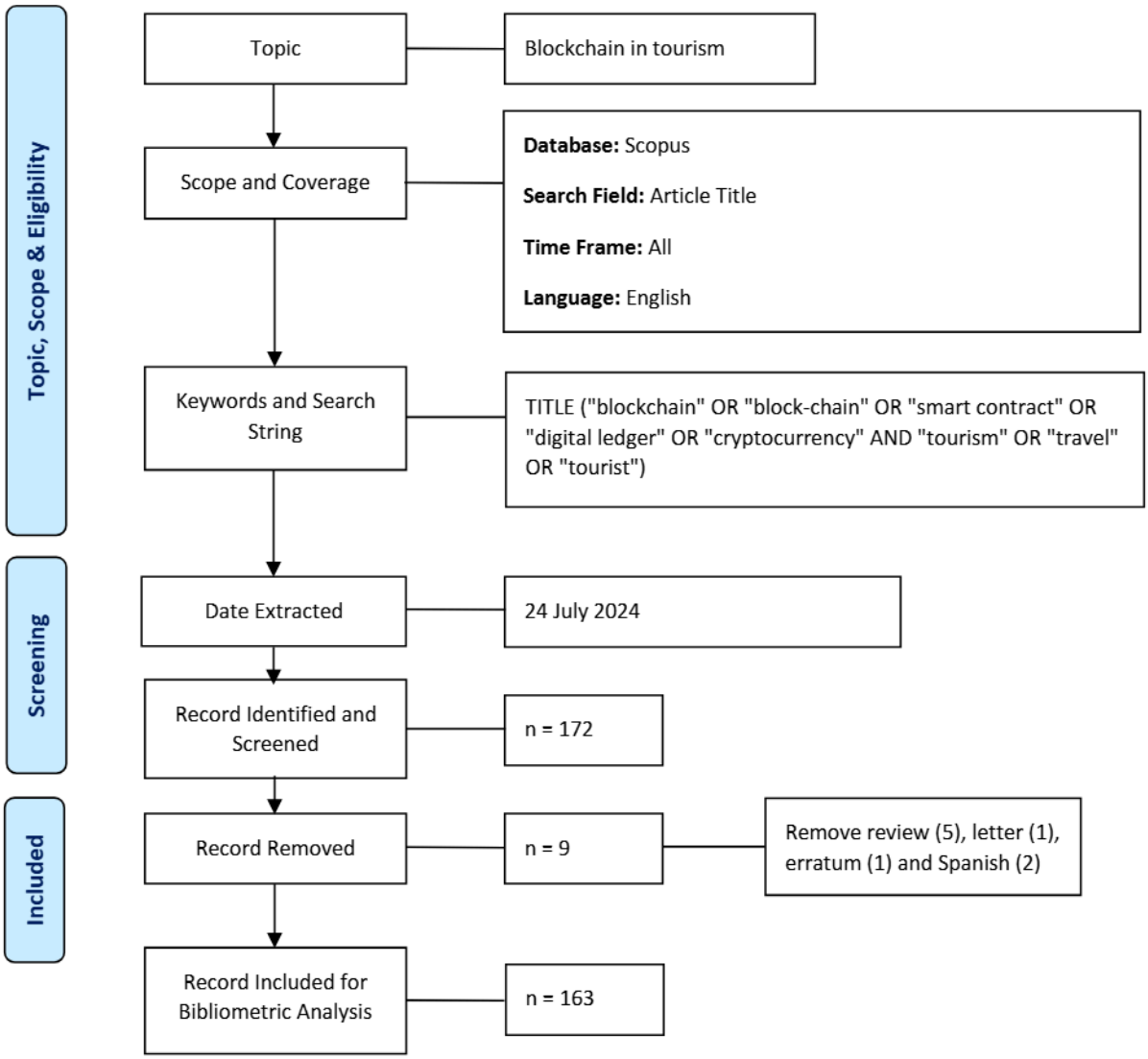
The three major research databases are Scopus, Web of Science (WOS), and Google Scholar (Sureka et al., 2022). Unlike Google Scholar, both Scopus and WOS offer functionalities to download datasets that are compatible with bibliometric software. Scopus is an extensive abstract and citation database that spans a wide array of academic fields, including the sciences, social sciences, arts, and humanities. It aggregates a broad spectrum of academic publications and conference proceedings, making it highly suitable for bibliometric analysis across various disciplines. As a comprehensive resource, Scopus is invaluable for researchers, academics, and

institutions aiming to stay abreast of the latest developments and understand the broader research context. Maintained by Elsevier, Scopus is recognized as one of the largest abstract and citation databases available, employing a sophisticated algorithm to assess the quality and relevance of articles, thereby providing users with a detailed overview of specific research landscapes. Its extensive coverage across multiple fields makes it particularly useful for investigating interdisciplinary patterns and overarching themes. Consequently, Scopus was selected for gathering publications related to the application of blockchain technology in the tourism sector.

The inclusion and exclusion criteria were identified in the final step. The search strings were used to extract data from Scopus. The research inclusion criteria include several steps. First, articles published from 2017 to 2024 were selected. The year 2017 was chosen as the base year as the first study of blockchain in tourism was published during that time. The search query found a total of 172 documents, comprising a compilation of academic works focused on the application of blockchain technology in the tourism industry. The information presented herein serves as the foundation for our systematic evaluation, enabling a precise depiction of the current state of the subject and the discernment of upcoming trends and issues. Additionally, only English-written articles were included in the dataset, hence two articles in Spanish were excluded from the dataset. In order to maintain the focus of our study on original research publications, certain document types were excluded from the dataset, resulting in further refinement. The dataset consisted of many categories of documents, specifically review (5), letter (1), and erratum (1), that were subsequently eliminated. Therefore, the review dataset comprised articles (81), conference paper (56), book chapter (25) and a book (1) published between 2017 and 2024.

Following the completion of the exclusion procedure, the dataset consisted of a total of 163 original research papers. These publications were employed to assess the current state of blockchain research within the tourism industry and to identify key patterns, challenges, and opportunities in this field. This approach ensured that our study was rooted in primary sources, capturing recent and relevant advancements in the application of blockchain technology in tourism. The procedure is depicted in Figure 1.

Figure 1
The PRISMA Flow Diagram of the Search Strategy



Data Cleaning and Harmonisation

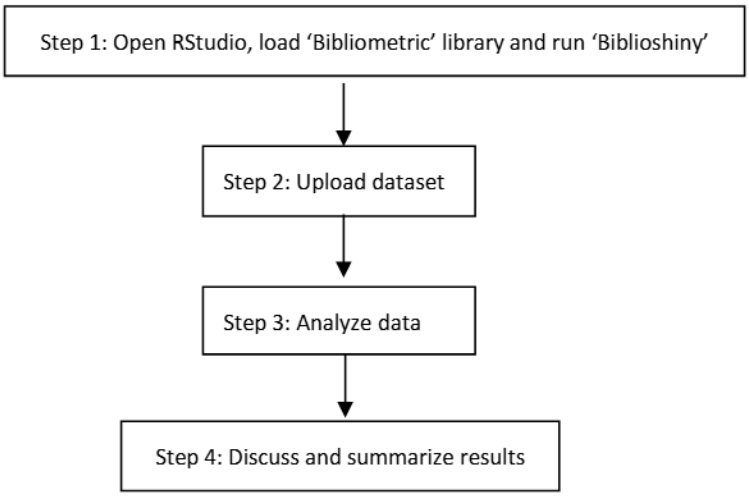
For conducting bibliometric analysis, it is crucial to clean and harmonize datasets to ensure the accuracy, consistency, and reliability of the results. Data cleaning involves identifying and rectifying errors, inconsistencies, missing values, or outliers in the dataset, with categories requiring attention including keywords, author names, affiliations, countries, and references. This process is essential for ensuring that the information used in the analysis is both accurate and dependable. Harmonizing data involves standardizing different attributes or variables to ensure they are measured or represented consistently. Effective cleaning and harmonization help to mitigate biases that may arise from inconsistencies, errors, or variations within the dataset. These steps are fundamental in transforming raw data into a standardized, consistent, and reliable format, thereby enabling researchers to derive accurate insights and conclusions from their analyses.

In this study, the raw dataset obtained from Scopus was cleaned and harmonized using specialized bibliometric software, namely biblioMagika 2.3 (Ahmi, 2023) and OpenRefine. This process involved addressing inconsistencies in author names, affiliations, countries, keywords, and references. The thoroughly cleaned and harmonized data were then exported and prepared for further bibliometric analysis. By ensuring that the data are clean and harmonized, we enable more robust statistical analysis, visualization, and modeling, which facilitates the extraction of meaningful insights, identification of trends and patterns, and more accurate conclusions.

Tool and Data Analysis

To achieve the research objective and address the research questions, the bibliometric analysis was performed using Biblioshiny, which is a shiny app for the Bibliometric R package developed by Aria and Cuccurullo (2017). This app can integrate with a wide range of databases and citation management tools combined with its robust set of organisational and collaboration features, which provide a comprehensive solution for managing and sharing research information. One of the crucial features of Biblioshiny is its ability to integrate with an extensive range of citation management tools and databases, such as Scopus. Figure 2 displays the bibliometric analysis process using Biblioshiny.

Figure 2
Detail Steps for Bibliometric Analysis using Biblioshiny



ANALYSIS AND RESULTS

This section presents a study overview of blockchain technology and tourism containing publications from 2017 to 2024 and all information about the present status of publications, research tendencies, highly cited papers, publishing sources, nations, institutions, and prolific authors, and the authors' keyword selections.

Main Information

The first study that discussed blockchain technology in the tourist business emerged in 2017 under the Scopus database. The analysis reveals an average annual growth rate of 56.51% in

the number of publications. Table 1 provides a comprehensive summary of all articles published on blockchain technology in the field of tourism from 2017 to 2024. This table includes metrics such as average citations per document, average citations per year, document types, document contents, author information, and patterns of author collaboration.

Table 1
Sample Based on Industry

Description	Results
MAIN INFORMATION ABOUT THE DATA	
Time span	2017:2024
Sources (journals, books and etc.)	108
Documents	163
Annual Growth Rate %	56.51
Document Average Age	2.09
Average citations per doc	16.46
References	6933
DOCUMENT TYPES	
Article	81
Book	1
Book chapter	25
Conference paper	56
DOCUMENT CONTENTS	
Keywords plus (ID)	537
Author's keywords (DE)	396
AUTHORS	
Authors	450
Authors of single-authored documents	23
Authors of multi-authored documents	427
AUTHORS COLLABORATION	
Single-authored documents	25
Co-authors per document	3.22
International co-authorships %	24.25

Annual Publication Trends

The yearly publishing trends for 2017 to 2024 are illustrated in Table 2 and Figures 3 and 4 along with the details of total publication, total citation, citation per document, and citation per year. The bibliometric analysis found that the peak publications on blockchain in tourism were in 2023, with 47 articles.

Figure 3
Annual Publication Trends

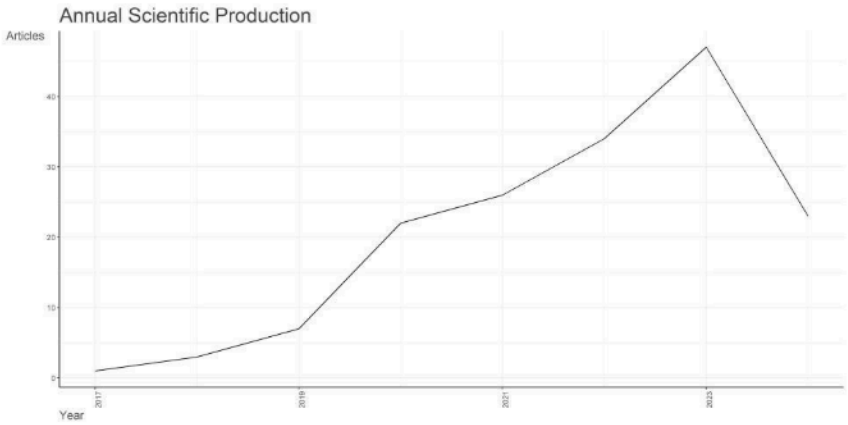
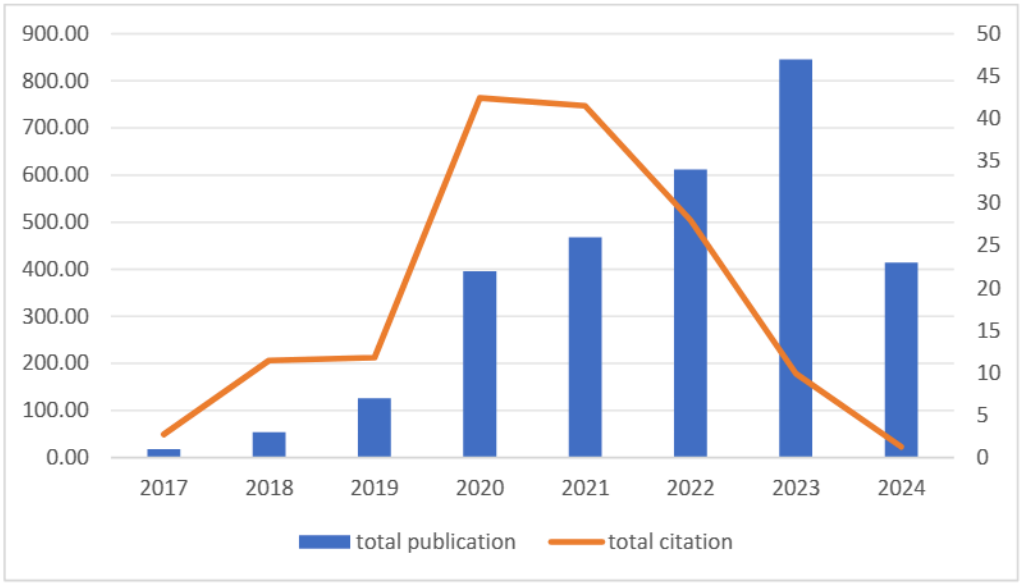


Table 2
Annual Publication Trends

Year	Total publications	Total citations	Citation per publication	Citation per year	Citable Years
2017	1	49.00	49.00	6.12	8
2018	3	206.01	68.67	9.81	7
2019	7	212.03	30.29	5.05	6
2020	22	764.06	34.73	6.95	5
2021	26	746.98	28.73	7.18	4
2022	34	503.88	14.82	4.94	3
2023	47	178.13	3.79	1.90	2
2024	23	23.00	1.00	1.00	1

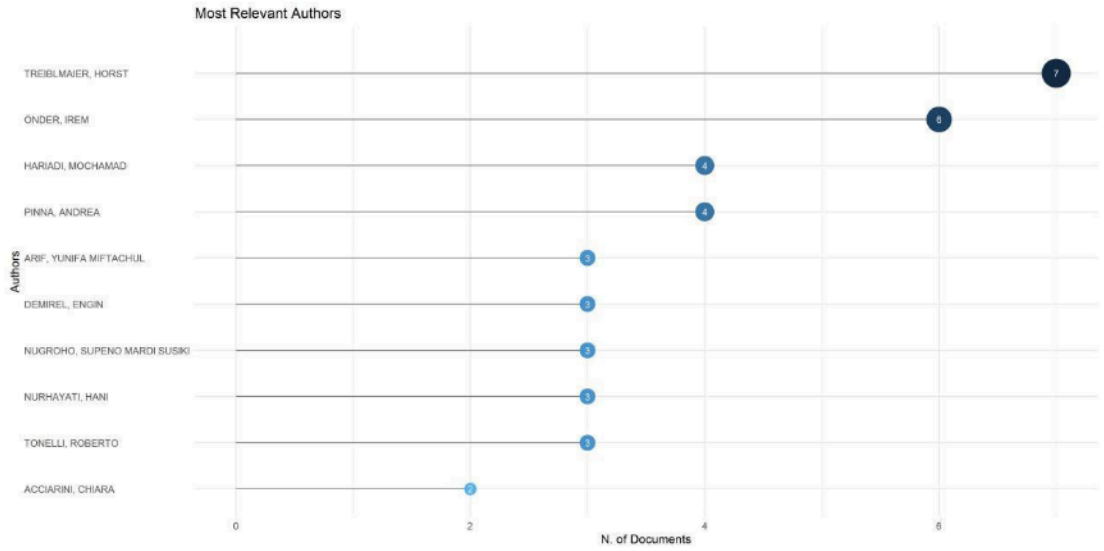
Figure 4
Growth and Publications Impact Per Year



Most Productive Authors

Figure 5 displays the top 10 authors by publication count. Treiblmaier stands out with seven papers, making him a notable contributor in blockchain technology for tourism, followed by Önder and Hariadi, with six and four articles each.

Figure 5
Most Relevant Authors



Most Cited Papers

Figure 6 and Table 3 present the most referenced papers globally and regionally. The top-cited paper, authored by Önder and Treiblmaier (2018), explores blockchain's impact on tourism with 163 citations. Following closely is a paper by Nuryyev et al. (2020) delving into blockchain adoption in tourism and hospitality SMEs, gathering 162 citations. Nam et al.'s (2021) work on blockchain in smart city and smart tourism follows with 152 citations.

Figure 6
Most Globally Cited Documents

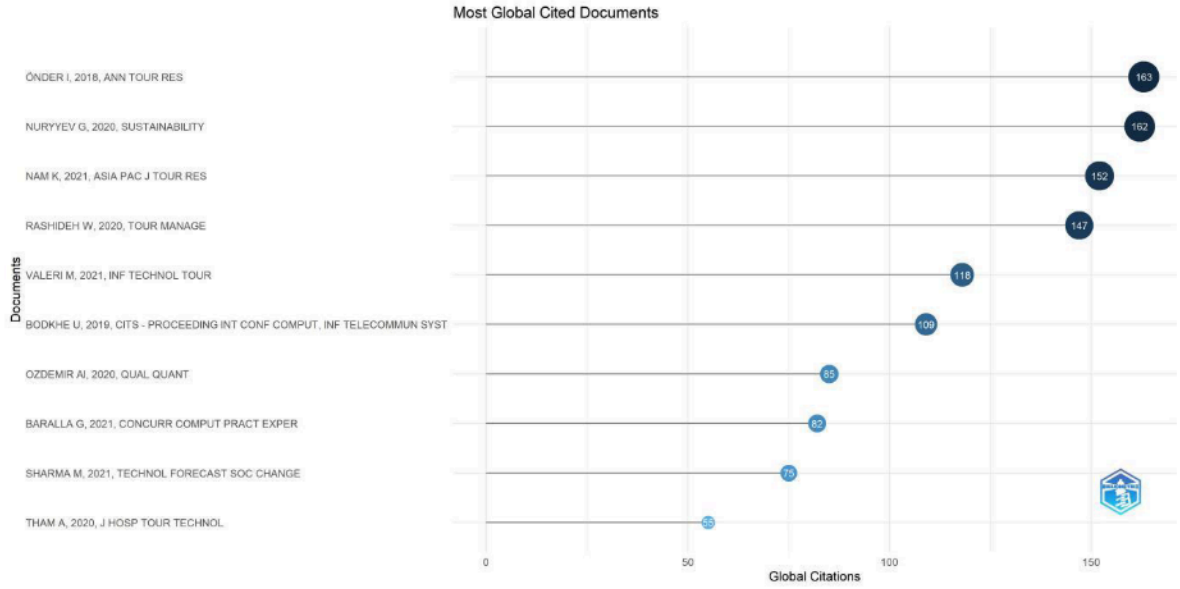


Table 3
Top 10 Highly Cited Papers

No	Author(s)	Title	Total Citations	Citations per Year
1	Önder and Treiblmaier (2018)	Blockchain and tourism: Three research propositions	163	23.29
2	Nuryyev et al. (2020)	Blockchain technology adoption behaviour and sustainability of the business in tourism and hospitality SMEs: An empirical study	162	32.40
3	Nam et al. (2021)	Blockchain technology for smart city and smart tourism: latest trends and challenges	152	38.00
4	Rashideh (2020)	Blockchain technology framework: current and future perspectives for the tourism industry	147	29.40
5	Valeri and Baggio (2021)	A critical reflection on the adoption of blockchain in tourism	118	29.50
6	Bodkhe et al. (2019)	BloHosT: Blockchain enabled smart tourism and hospitality management	109	18.17
7	Ozdemir et al. (2020)	Assessment of blockchain applications in travel and tourism industry	85	17.00
8	Baralla et al. (2021)	Ensuring transparency and traceability of food local products: A blockchain application to a Smart Tourism Region	82	20.50
9	Sharma et al. (2021)	Technology assessment: Enabling Blockchain in hospitality and tourism sectors	75	18.75
10	Tham and Sigala (2020)	Road block (chain): bit (coin) s for tourism sustainable development goals?	55	11.00

Most Productive Countries

Table 4 presents the top 10 most productive nations. China, Austria, the United States, Italy, the United Arab Emirates, , Turkey, Korea, the United Kingdom, India, and Spain had the most published papers on blockchain technology in the tourism industry.

Table 4
The Top 10 Most Productive Countries

Country	Total publication	Total Citations	Average Article Citations
CHINA	90	284	12.30
AUSTRIA	82	269	44.80
USA	45	216	30.90
ITALY	40	161	26.80
UNITED ARAB EMIRATES	29	152	152.00
TURKEY	19	132	26.40
KOREA	19	121	20.20
UNITED KINGDOM	18	119	39.70
INDIA	15	112	6.20
SPAIN	12	95	19.00

Most Productive Affiliations

Biblioshiny can identify the most productive academic institution or affiliations. The number of papers produced by the most prolific affiliations or institutions is depicted in Table 5, which includes the top 10 affiliations for convenience. CHRIST and Modul University Vienna are the leading institutions, each publishing 8 articles on blockchain technology in the tourism.

Table 5
Top 10 Productive Institutions

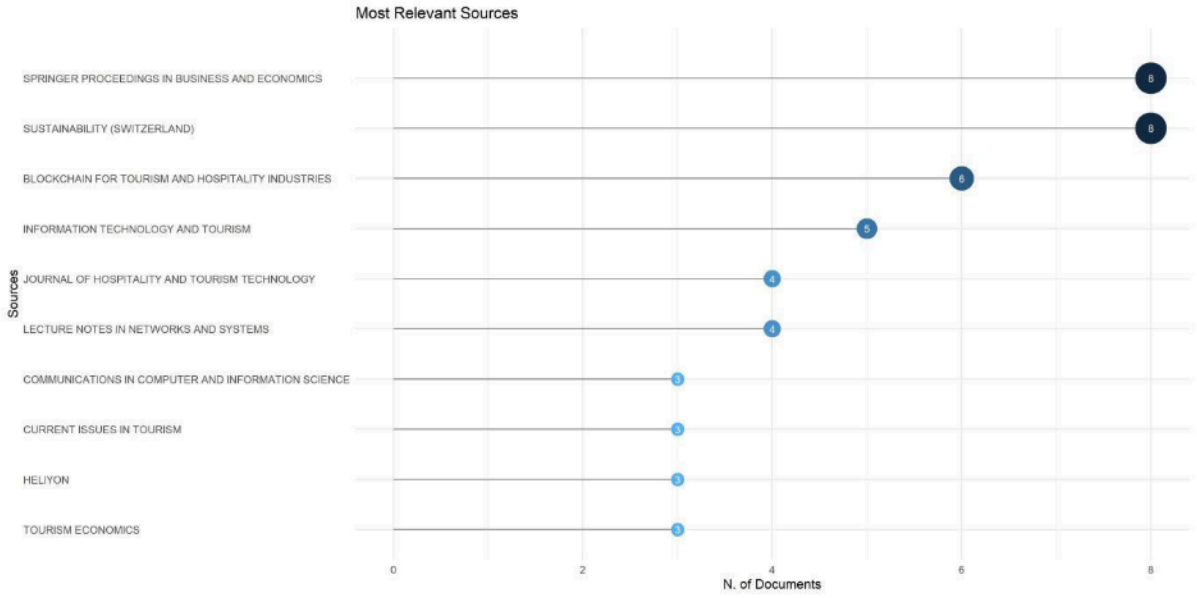
Affiliations	Total publication
CHRIST (DEEMED TO BE UNIVERSITY)	8
MODUL UNIVERSITY VIENNA	8
NANJING UNIVERSITY OF POSTS AND TELECOMMUNICATIONS	7
JEJU NATIONAL UNIVERSITY	6
NATIONAL SUN YAT-SEN UNIVERSITY	6
O. P. JINDAL GLOBAL UNIVERSITY	6
UNIVERSITAS PENDIDIKAN NASIONAL	6
UNIVERSITY OF MALAGA	6
UNIVERSITY OF SURREY	6
UNIVERSITY OF TEHRAN	6

Most Frequent Journals

Biblioshiny also determines the most prevalent journals. In Figure 7, the 10 most-cited journals are shown. Spring Proceedings in Business and Economics and Sustainability with eight

relevant articles are the two journals with the highest frequency of debates and publications on blockchain technology in the tourism industry.

Figure 7
Top 10 Most Cited Journals



Most Frequent Keywords

Table 6 compiles the most frequent keywords in this bibliometric study on blockchain technology in the tourism industry and summarises the top 10 authors' and indexed keywords. Meanwhile, Figure 8 depicts the keyword word cloud. The analysis revealed that blockchain, tourism, tourism development, tourism industry are among the most frequently occurring terms used in blockchain technology in the tourism.

Table 6
Top 10 Keywords

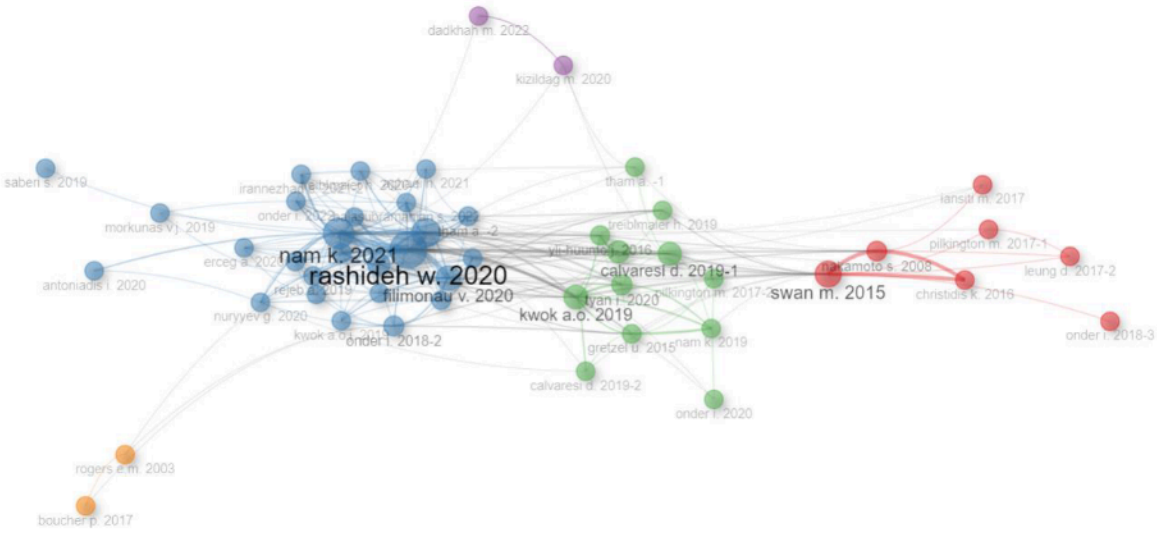
Author's keywords	Occurrences	Indexed keywords	Occurrences
blockchain	95	blockchain	53
tourism	41	tourism	37
blockchain technology	20	block-chain	36
smart tourism	18	tourism development	14
hospitality	11	tourism industry	12
smart contract	10	tourism market	11
cryptocurrency	9	leisure industry	8
bitcoin	8	china	7
sustainability	7	innovation	7
tourism industry	7	smart tourism	7

Figure 8
Word Cloud of Indexed Keywords

Co-citation Analysis

Research clusters emerge when numerous researchers co-cite the same pairs of publications, thereby highlighting thematic similarities within the literature. Co-citation analysis, combined with single-link clustering and multidimensional scaling methods, maps the structure of specialized research fields and the broader scientific landscape. Figure 9 illustrates the co-citation network of publications concerning blockchain technology within the tourism sector. Notably, three significant clusters of co-cited works are evident in the dataset, with nodes of the same color typically representing similar topics. This network visualizes the structure of frequent citations in blockchain research related to tourism. The highly referenced publications listed in Table 3 are integral to the co-citation network for this subject.

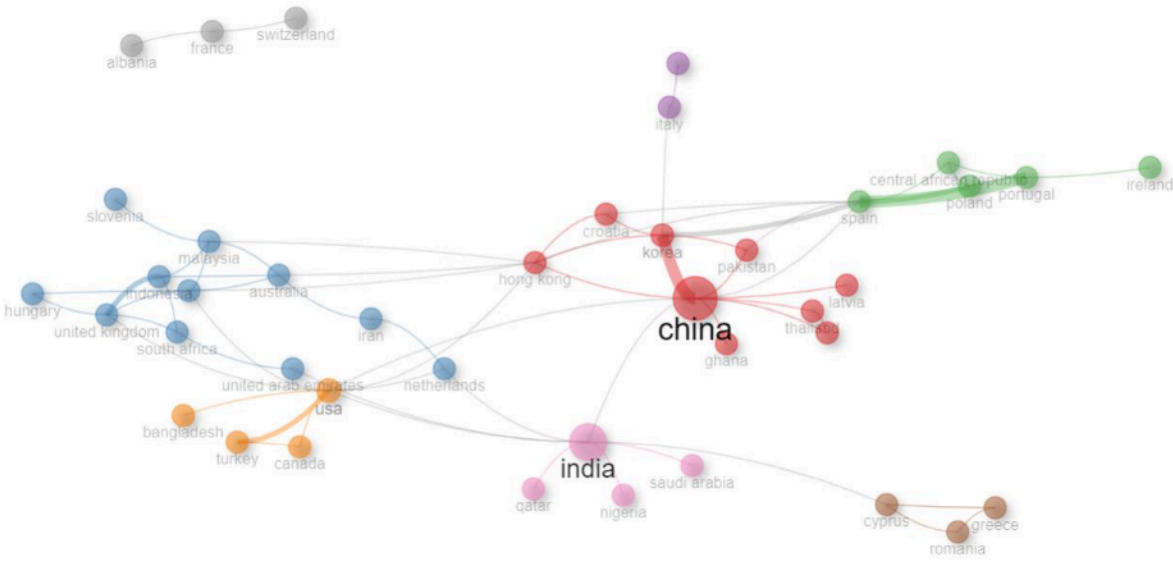
Figure 9
Collaboration Network of Documents



Collaboration Analysis

Figure 10 illustrates an overview of major cooperation between countries on blockchain technology in tourism. The researchers from China are the ones who are cultivating the partnership followed by those from India and the United State. These three prominent countries work together with other nations, such as Korea, Spain, Indonesia, and Italy.

Figure 10
Collaboration Network of Countries



Co-word Analysis

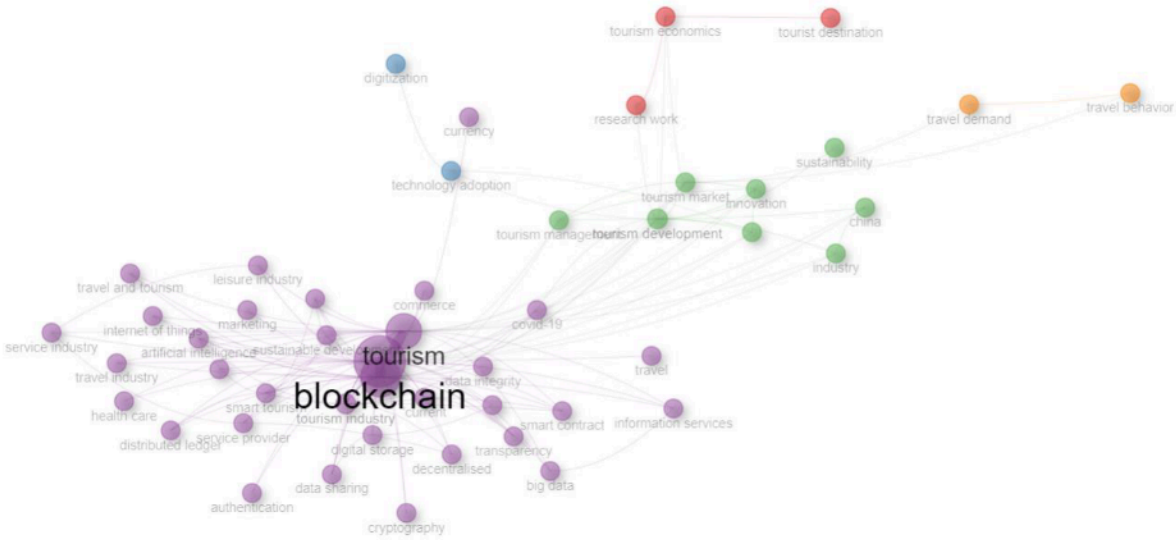
Co-occurrence refers to the frequency with which comparable terms appear in proximity across multiple publications, a concept also known as a semantic network. This analysis encompasses terms that are related and centered on the same subject but do not necessarily correspond directly. Figure 11 depicts the co-occurrence network of authors' keywords. In this graphic, a thicker line between keywords indicates a stronger relationship, while the absence of connecting lines signifies no evident link between the terms.

The words will be displayed on the network map closer to the centre of the map if the co-occurrences are discovered. The utilisation of closely related keywords by writers signifies a stronger connection, which leads to enhanced relationships. A larger bubble representing a keyword suggests a greater frequency with which it was used. The results revealed five thematic clusters. A unique colour is assigned to each cluster to ease identification. Moreover, the following themes were identified:

(1) Blockchain (purple bubbles)
(2) Tourism development (green bubbles)
(3) Tourism economics (red bubbles)
(4) Technology adoption (blue bubbles)
(5) Travel demand (orange bubbles)

Figure 11 indicates that the most important network or the most significant cluster of themes explored is blockchain, including tourism, smart tourism, service provider, cryptocurrency, and smart contract as some of its keywords. Meanwhile, the second network of tourism development, innovation and sustainability are the relevant keywords employed by the previous research.

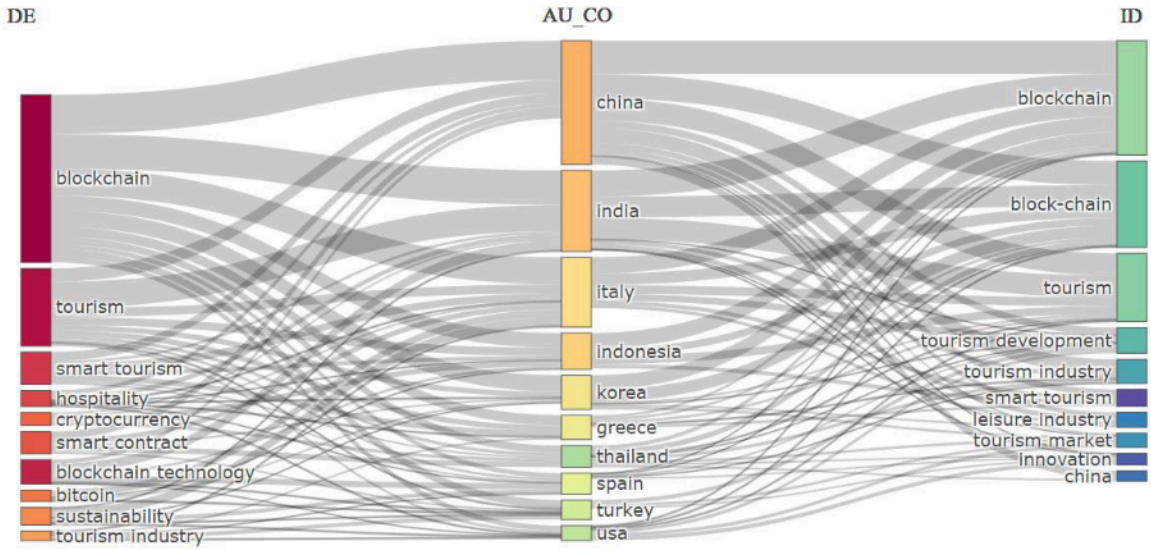
Figure 11
Co-occurrence Network of Author's Keywords



Three Fields Plot

Figure 12 is based on a three-field plot or a Sankey diagram, which illustrates the relationships between the most prolific writers, keywords, and nations. The term "blockchain" appeared 95 times, thus being the most used term overall. Similarly, authors have published several research using the terms "tourism" (41), "blockchain technology" (20) and "smart tourism" (18). The word "blockchain" was used the most by authors from China.

Figure 12
Three Field Plots



Thematic Evolution

Figure 13 displays the development of a specific theme based on the authors' keywords about blockchain technology application within the tourism industry. The field plots depict how the topics connected to blockchain technology in the tourism industry have developed from 2017 to 2021 and 2022 to 2024. The seven recurring themes in the earlier era have evolved into four underlying themes in the current period.

Figure 13
Thematic Evolution Based on the Author's Keywords

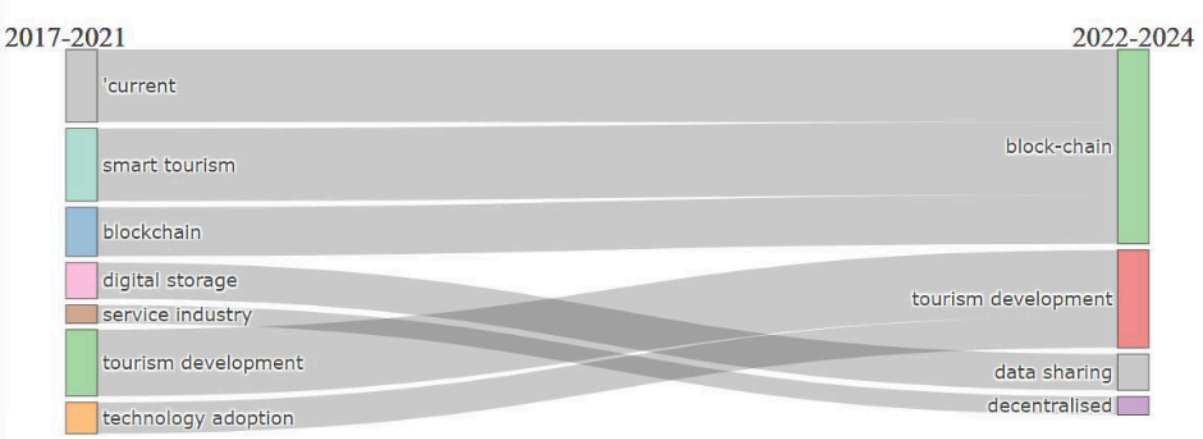
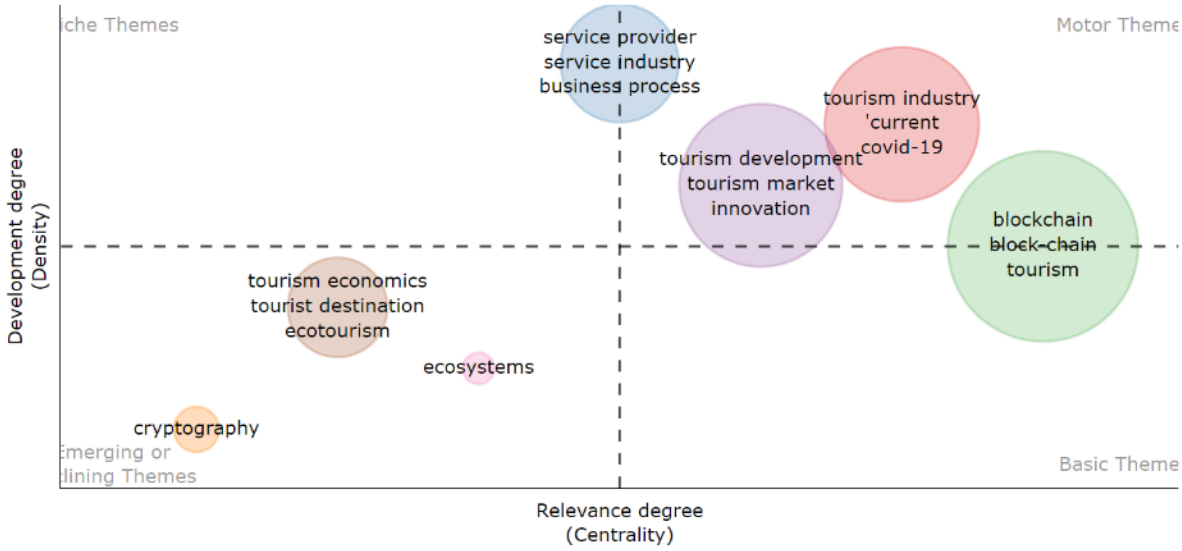


Figure 14 depicts the specific thematic map for these respective periods, which outlines the motor themes in the upper-right quadrant of the figure. The themes are characterised by high centrality and density, which is the most developed topic in the literature and the primary focus in blockchain technology research on the tourism business.

Blockchain is the primary focus of this section. Nonetheless, the upper-left quadrant displays high-density topics linked to minor external sources, hence only producing a limited impact on the field (low centrality). The themes that are developing or becoming less prominent may be observed in the lower-left quadrant. The tourism economics and tourism destination are some of the topics that fit within this quadrant. Those motor themes such as tourism industry and covid-19 are in the upper-right quadrant. Lastly, the themes that are fundamental and pervasive are observed in the lower-right quadrant.

Figure 14
Thematic Map



DISCUSSION AND CONCLUSION

The bibliometric analysis of blockchain studies focusing on the tourism sector has revealed a notable increase in publications, indicating a growing demand for further research into blockchain technology. This surge reflects the rising interest in blockchain applications. Scholars have increasingly highlighted concerns regarding blockchain-based privacy and security solutions, particularly as this technology integrates with smart applications in tourism and hospitality (Bodkhe et al., 2020). However, there is a paucity of studies addressing policy discussions. The expanding prevalence and evolution of blockchain technology underscore the need for research focusing on its policy implications. Additionally, the limited volume of research on blockchain technology within the tourism sector, with only 163 papers identified in this bibliometric study (Nam et al., 2021), points to a gap in the literature. Future research should also explore other related themes, such as cryptography, ecosystem development, and technology adoption, particularly in the context of tourism recovery post-COVID-19.

This study employs bibliometric analysis using R-software to scientifically map the development and current status of blockchain technology within the tourism industry. The findings offer valuable insights for academics, scholars, and stakeholders actively engaged with blockchain applications in tourism. The analysis constructs a timeline of the trend's evolution, providing detailed information on the articles examined, including publication years, types of articles, sources, and content. Additionally, the bibliometric analysis yields critical insights into annual publication trends, leading authors, highly cited papers, influential countries, productive institutions, and prominent sources. It also identifies the top keywords and includes analyses such as co-citation, co-citation network, collaboration, thematic evolution, and thematic mapping. Recently, several countries have prioritized blockchain technology to enhance their tourism sectors, with China, Austria, and the United States emerging as major contributors due to their high output and citation rates. However, the majority of research is concentrated in developed economies, with a significant gap in studies from emerging and developing countries. To foster growth in the tourism sector, other economies should intensify their exploration of blockchain implementations and related issues, thereby contributing to the accelerated and efficient advancement of blockchain technology in tourism.

This study provides novel insights into blockchain technology for stakeholders in the tourism sector, including both academics and practitioners. It offers a comprehensive overview of the current state of blockchain technology in the tourism industry and suggests potential future research directions. However, several limitations warrant consideration in future investigations. Notably, this study was limited to documents published in the Scopus database; future research should incorporate additional databases to broaden the scope of analysis. Furthermore, while this study identified key research hotspots and emerging trends, a more in-depth exploration of specific research topics, such as governance and security, is necessary to fully understand the complexities and nuances of blockchain technology.

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