

“Knowledge map of digital tourism: A bibliometric approach using CiteSpace”

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KNOWLEDGE MAP OF DIGITAL TOURISM: A BIBLIOMETRIC APPROACH USING CITESPACE

Abstract

Digital tourism is an essential product of the digital economy, which is significant in promoting sustainable tourism. The study aims to analyze the current research status of digital tourism with the CiteSpace tool. One thousand thirteen documents related to digital tourism, AI tourism, and tourism digitization in the Web of Science (WOS) database from 1991–2022 were collected. This study conducts bibliometric analysis to portray the knowledge map. Furthermore, this paper explores the publication years, co-occurrence of authors, institutions, subjects, research hotspots, and evolution of digital tourism research. The analysis findings revealed that social and environmental sciences are the core disciplines in digital tourism research. Hong Kong Polytechnic University is the foremost institution, and Tussyadiah and Wirtz are the authors with the highest contribution rate. Moreover, the results emphasized the frontier studies of digital tourism referring to technology, consumption, tourists' reviews, and the progress of the tourism industry. In addition, China, Europe, and the United States should strengthen their digital tourism cooperation with Africa and the South America to promote the sustainable development of global tourism. Finally, the results implicate the future development trends of digital tourism.

Keywords

artificial intelligent tourism, sustainable tourism, digital economy, tourism robots, tourism consumption

JEL Classification

Q01, O14, O33, Z30

INTRODUCTION

In the era of the digital economy, information technology has become representative of the contemporary advanced productive forces and has penetrated all areas of social life, including tourism (Zhou, 2022). The development of AI and Industry 4.0 has dramatically affected traditional tourism management, tourism services, and marketing methods. At the same time, tourism has a strong dependence on information technologies (Pencarelli, 2020). Since the 1980s, countries worldwide have tried to use information technology to manage and publish various resources of tourism destinations and network marketing of tourism resources (Cristobal-Fransi et al., 2018). Currently, tourism has become one of the four major application fields of e-commerce, alongside finance, software, and publications (Daskalakis et al., 2022).

Digital information can help operators to analyze and forecast the tourism market to take targeted measures (Mariani & Wamba, 2020). With modern information technologies, tourists can choose their preferable destinations and routes (Li et al., 2019). The concept of digital tourism originates from the digital earth (Akhtar et al., 2021). Digital tourism is the extension and expansion of the concept of digital earth and the tourism information system with tourism information as the core (Stylos et al., 2022).

Computer technology and network technology as the primary means have already become the development potential for the global economy (Mariani & Wamba, 2020). The informatization of tourism is the demand and necessity of modern economic and technological development and the demand for tourism's development (Halkiopoulou & Giotopoulos, 2022). With the further improvement and maturity of web technology, virtual reality, 3D graphics, and e-commerce, numerous web-based digital routes, scenic spots, museums, e-commerce interactive platforms, and other tourism information service systems have emerged and shown a rapid growth trend (M. H. Ronaghi & M. Ronaghi, 2022).

Digital tourism plays an essential role in promoting the sustainable development of the tourism industry (Stylos et al., 2022). It paid attention to the opportunities brought by digital technologies to the tourism industry earlier (Ivars-Baidal et al., 2021). Moreover, other developing tourism countries use digital technologies to promote the development of the tourism industry and attract more customers (Toubes et al., 2021). Digital tourism is a mature topic of discussion (Stylos et al., 2022). Nevertheless, a limited number of publications considered the research status of digital tourism applying a bibliometric method.

1. LITERATURE REVIEW

Digital tourism is an essential field of information technology, referring to the digitization and networking of tourism activities (Toubes et al., 2021). Digital tourism is supported by 3S (RS, GIS, GPS), distributed computing, three-dimensional visualization, virtual reality, database technology, data mining, data fusion, broadband network technology, communication technology, cloud computing, and service-oriented frameworks (Toubes et al., 2021). The digital tourism system is a project comprising all kinds of tourism information, including spatial and non-spatial information. Information processing is the realization of various application functions in the digital tourism system, and the output is all services the digital tourism system provides (Mileti et al., 2022).

Digital technology promotes the continuous interactive development of multimedia platforms, which profoundly affects tourism marketing (M. H. Ronaghi & M. Ronaghi, 2022). The tourism destination marketing system is an information application system (Halkiopoulou & Giotopoulos, 2022). It uses the Internet as the primary platform and combines database, multimedia, and network marketing technologies (Stylos et al., 2022). As a result, the tourism destination marketing system has become the practice of advanced international tourism destinations at the forefront of marketing and the core system of tourism industry informatization (Ivars-Baidal et al., 2021).

Digital tourism emerged with the development of information technology and tourism. It is divided into narrow-sense and broad-sense concepts from its conceptual connotation (Zhang, 2022). In a narrow sense, digital tourism is the computer information system with the core of tourism information. It is usually determined as the application system of tourism information in the network environment, which mainly refers to a link in the process of tourism (Zhang & Dong, 2021). Digital tourism, in a broad sense, is the computer information system with the core of tourism information and services. It usually refers to the system that combines spatial geographic information with tourism information under the network environment and virtually realizes the tourism information service system with a sense of authenticity in the computer network. It is a digital realization of the whole process of tourism (Wang et al., 2022).

There have been many achievements in the study of digital tourism in recent years. Adeola and Evans (2019) studied the linear and non-linear effects of mobile phones and the Internet on African tourism from 1996 to 2017 using the system universal moment method. With the peak of Millennials' travel, Millennials' common characteristics and travel behavior include total digital tourism (Ketter, 2021). The value of digital marketing in small and medium-sized tourism enterprises to adopt and create digital tourism destinations is becoming increasingly evident (Alford & Jones, 2020). In addition, digital media, including Twitter, Instagram, and Facebook, are essential for travel

decision-making. Robot services have a unique position in the tourism market (Devasia & P.V., 2022). The contribution of post-Covid-19 artificial intelligence and robots to tourism is prominent. At the same time, it provides more convenient and scientific services while reducing labor costs. Therefore, many studies focus on the changes in digital technology in the tourism industry (Perić & Vitezić, 2021).

Overall, digital tourism benefits from the welfare of technological development and greatly aids sustainable economic and social development. Nevertheless, only some studies have systematically analyzed digital tourism using visualization technology. Therefore, this study helps to promote the understanding of the development trends in digital tourism by researchers and practitioners in the tourism industry.

Although digital tourism is a significant product of the digital economy and has an essential impact on the tourism development and economic development during post-Covid-19, there is little literature on the visual analysis of digital tourism research. Therefore, this paper aims to adopt a bibliometric method to visualize and analyze the current research status by describing the knowledge map of cooperation among authors, institutions, countries, and subjects. Moreover, it has tried to determine the frontier topics and cutting-edge prospects based on 1,013 related publications in the Web of Science since 1991.

2. METHODOLOGY

This paper collects the literature data from Web of Science by using the method of keyword retrieval, and conducts bibliometric analysis on digital tourism by using visual analysis, thus predicting the development trend of digital tourism research, cooperation among authors, institutions, countries, moreover to conclude the research hot spots and future topics.

CiteSpace is a software based on Java language, which implements keyword extraction, co-citation analysis, co-occurrence analysis, and other functions (Yang et al., 2022). This study constructed the knowledge map of digital tourism by

CiteSpace. Furthermore, it quantitatively analyzes the relevant literature collected in the Web of Science from 1991 to 2022.

This investigation portrayed the knowledge map to provide a reference for researchers on digital tourism. The retrieved documents are exported in plain text as a data source containing information such as authors, institutions, titles, journals, and keywords. Based on the exploring formula, this study collected 1,013 papers. The data collection conditions are as follows:

$(((((TS=(digital\ tourism))\ OR\ TS=(AI\ tourism))\ OR\ TS=(artificial\ intelligence\ tourism))\ OR\ TS=(tourism\ digitalization))\ AND\ LA=(English))\ AND\ DT=(Article))$

3. RESULTS

3.1. Temporal distribution map of digital tourism

The annual volume of research papers is an important indicator to measure the development trend and research heat in this field (Hong et al., 2019). Therefore, based on the Web of Science retrieval results, the annual volume of publications in digital tourism research is analyzed.

Literature studies show that digital tourism could be traced back to the early 1990s because the digital industry was still in its initial stage worldwide from 1990 to 2000, and digital technology was rarely involved in the tourism industry. In the last decade of the 20th century, the research on digital tourism is still a frontier topic, although the results could be better. However, since the 21st century, the topic of digital tourism research has increased because technology has become the main driving force of economic development, and the impact of digital technology on the tourism industry is more and more apparent after 2000.

The significant growth trend in 2015–2020 reflects the considerable development of digital tourism in this period. It continues to receive attention, indicating that the impact of digital technology on tourism is becoming more and more significant, especially the benefits of artificial intelli-

Source: Authors' elaboration.

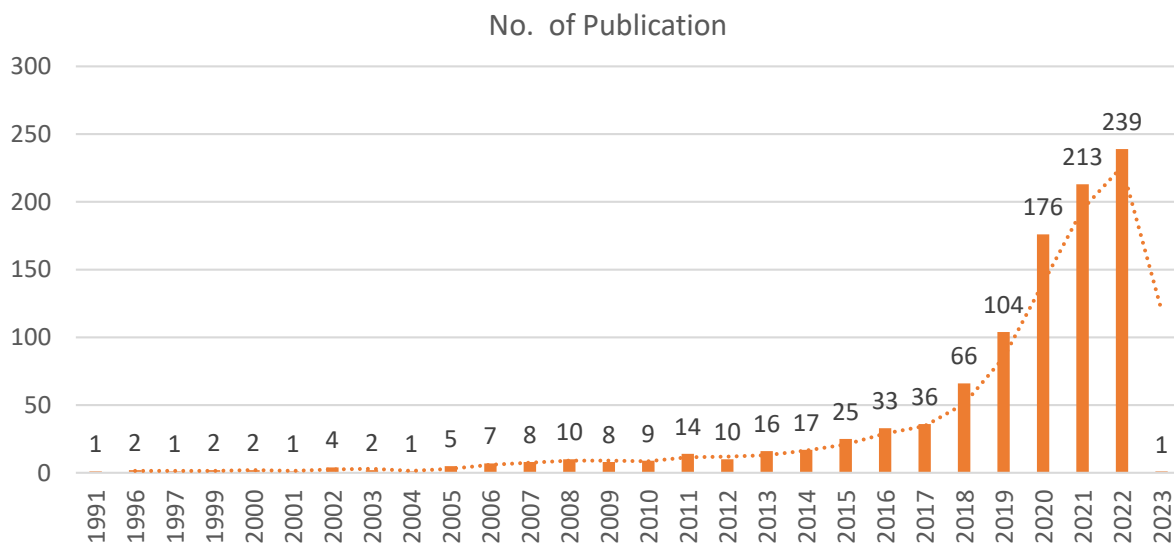


Figure 1. Annual volume of digital tourism studies

gence with tourism, which has drawn worldwide attention. Although Covid-19 has been sweeping the globe since 2020 and has significantly influenced the tourism industry, it still needs to affect research enthusiasm. Therefore, the research on digital tourism is a fundamental idea of current and future attention (Figure 1).

3.2. Knowledge map of authors' cooperation in digital tourism

Constructing a co-occurrence map of authors in this field can visually show the distribution of researchers and the cooperative network relationships (Yang et al., 2022). Author co-occurrence

Source: Authors' elaboration.

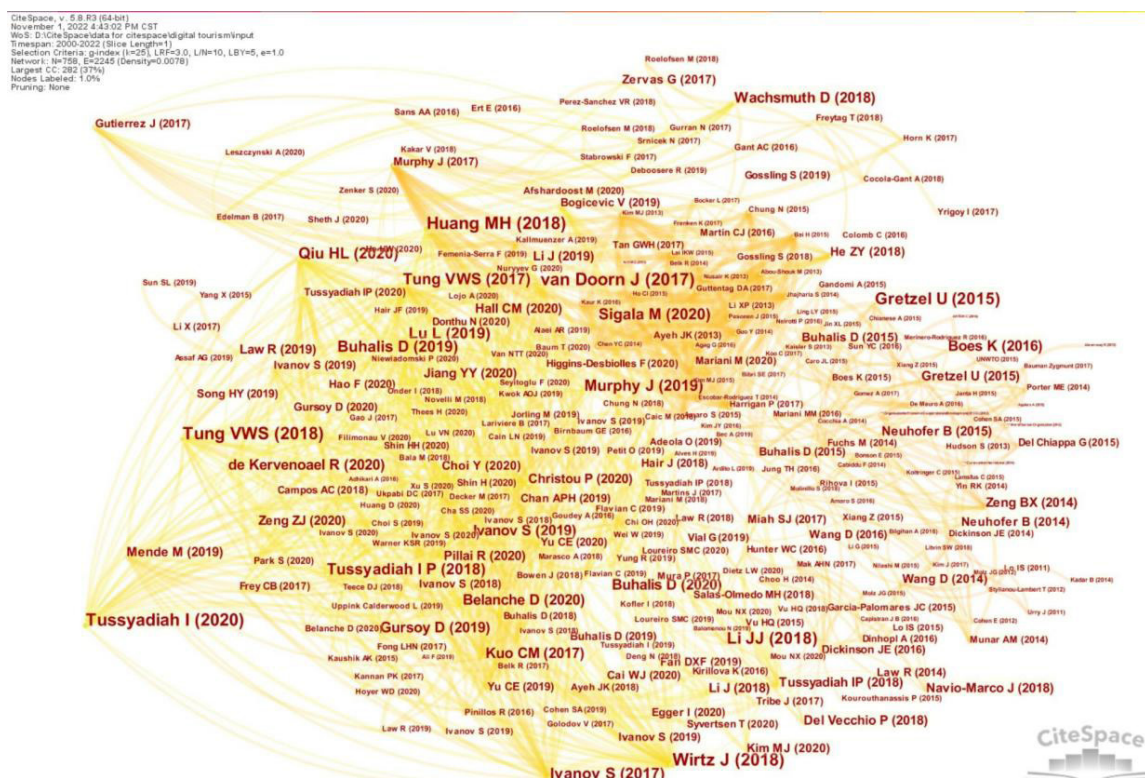


Figure 2. Knowledge map of author collaboration in digital tourism research

Table 1. Number of publications by core authors in digital tourism research

Source: Authors' elaboration.

No.	No. of Publications	Year	Author
1	27	2020	Tussyadiah
2	27	2018	Wirtz
3	25	2018	Huang
4	23	2018	Tung
5	23	2017	Doorn
6	21	2018	Li
7	19	2015	Gretzel
8	18	2017	Tung
9	18	2019	Buhalis
10	18	2019	Lu
11	17	2019	Murphy
12	17	2018	Tussyadiah
13	17	2017	Ivanov
14	16	2020	Qiu
15	15	2020	Sigala

analysis using CiteSpace is performed. Setting the period from 1991 to 2022, the “Node” type is “Author,” and the time slice is one year. A total of 758 nodes, 2,245 connections, and 0.0078 densities are obtained for authors of digital tourism studies, as shown in Figure 2.

Figure 2 indicates that the author co-occurrence map in the field of digital tourism research is relatively dense; there are many author notes, and the connections between them are significant. There is much cooperation among researchers in this field. A total of 758 researchers were included in the data set. Core authors and publications with more than 15 articles are listed in Table 1. Wirtz and Tussyadiah published 27 studies. Huang, Doorn, Tung, and Li have more than 20 studies on digital tourism. Gretzel, Tung, Buhalis, Lu, Murphy, Tussyadiah, Ivanov, Qiu, and Sigala contributed between 15 and 20 studies.

3.3. Knowledge map of institutional cooperation in digital tourism

The institute co-occurrence map describes the relationships between institutions and inter-agency collaborative networks engaged in this field. With the node type set to an institution and the rest of the parameters set unchanged, Figure 4 shows 398 nodes, 285 links, and a density of 0.0036.

The core institutions in digital tourism research are more than ten published. Table 2 introduces Hong Kong Polytechnic University as the largest organization in the field of digital tourism research, with a total of 24 articles. Bournemouth University posted 13 articles; Kyung Hee University posted 12, ranking third. University of Surrey and other institutions, including Griffith University, CNR, Chinese Academy of Sciences, University of Queensland, University of Canterbury, University of Oulu, Linnaeus University, University of Macau, University of Porto, Bucharest University of Economic Studies, Autonomous University of Madrid, Lund University, University of Naples Federico II, and Zhejiang University have become the main force and foothold of digital tourism.

From the perspective of cross-institutional cooperation, many nodes in the map and links exist. The cooperation between research institutions is relatively significant. However, the cooperation shown in Figure 3 is more concentrated, so there may be regional and cooperation restrictions for research. There are many scattered institutions around the map because there may be no cooperation between these institutions. In addition, Lund University, Linnaeus University, University of Oulu, University of Macau, and University of Porto, as new players in digital tourism research, have had some impact in 2020–2021.

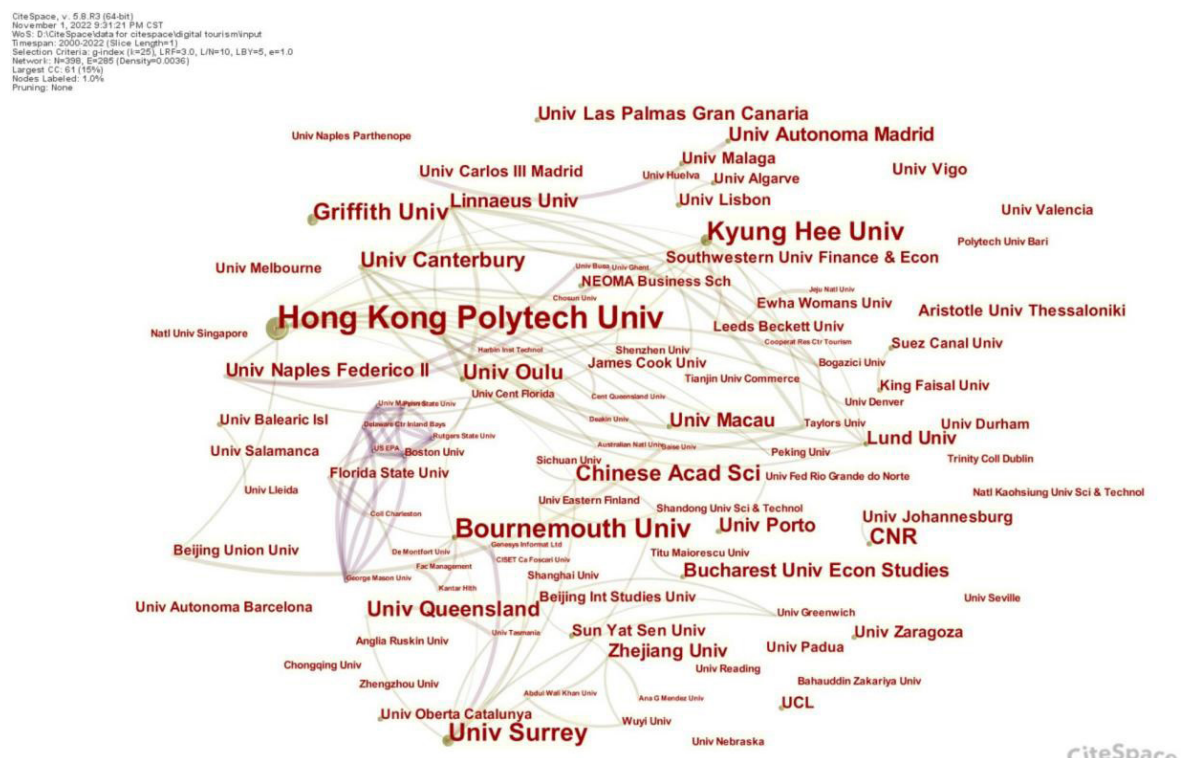


Figure 3. Knowledge map of institutional cooperation in digital tourism

Table 2. Core institutions in digital tourism research

No. of Publications	Year	Institutions
24	2003	Hong Kong Polytechnic University
13	2010	Bournemouth University
12	2015	Kyung Hee University
11	2002	University of Surrey
9	2017	Griffith University
8	2011	CNR
8	2008	Chinese Academy of Sciences
7	2013	University of Queensland
7	2008	University of Canterbury
7	2020	University of Oulu
6	2020	Linnaeus University
6	2020	University of Macau
6	2021	University of Porto
6	2015	Bucharest University of Economic Studies
6	2006	Autonomous University of Madrid
5	2020	Lund University
5	2008	University of Naples Federico II
5	2007	Zhejiang University

3.4. Knowledge map of national cooperation in digital tourism research

Considering Figure 4 and Table 3, China ranks first in digital tourism research with 188 articles, Spain (116) ranks second, and the United States and the United Kingdom follow with 87. Meanwhile, Italy, Australia, Taiwan, Portugal, South Korea, and France have all made outstanding contributions to the studies of digital tourism, entering the top 10 countries. Figure 4 portrays that these countries contributed earlier, focusing on the years before 2010.

In the past five years, the research on digital tourism has mainly focused on developing countries, including Ethiopia, which contributed to digital tourism research in 2018, Kenya, Saudi Arabia, and Vietnam. The Czech Republic, Ecuador, Georgia, Hungary, Norway, and other countries also contributed to digital tourism research in 2019. In addition, Bulgaria, Colombia, Cyprus, Indonesia, Lithuania, Montenegro, Nepal, Qatar, Russia, Singapore, Slovakia, Tunisia, Brunei, Jordan, Pakistan, Ukraine, Albania, Bangladesh, Iraq, Malta, Mauritius,



Figure 4. Knowledge map of national cooperation in digital tourism

Nigeria, Peru, Rwanda, Slovenia, South Korean, Trinidad Tobago also contributed to digital tourism research after 2020.

Therefore, whether in developed or developing countries, there is more and more research on digital tourism. Digital tourism research has become a global trend, occupying an increasingly important global position. In the face of Covid-19, digital tourism research will also face new challenges and opportunities, and there are still many contents worth exploring.

Table 3. Top countries in digital tourism research

Source: Authors' elaboration.

No. of Publications	Year	Country
188	2008	China
116	2008	Spain
87	2000	USA
87	2008	England
74	2008	Italy
62	2008	Australia
41	2010	Taiwan
34	2009	Portugal
33	2015	South Korea
131	2012	France

Constructing the discipline distribution map of domain research can reveal the core disciplines in the cross-disciplinary and broad field and analyze the internal relationship and evolution between the disciplines, to assess the general situation in the field (Yang et al., 2022). This study builds a discipline distribution map of digital tourism research (Figure 5), which explains the distribution of related disciplines. Furthermore, it supports relevant researchers and managers in scientific research and policy-making.

Table 4 describes the contributions of the top ten publications in the subject classification. From the statistical results, Social Sciences (260) has the most prominent contribution. Secondly, the research on digital tourism in Environmental Science and Ecology (240) has also made more achievements, ranking second. Finally, SSCI (207) has the third contribution rate in digital economy research. At the same time, Business and Economics, Hospitality, Leisure, Sport and Tourism (SSCI), Environmental Sciences, Science and Technology, and Green and Sustainable Science and Technology also pay more attention to the development of digital tourism. Although these disciplines have made significant contribu-

CiteSpace, v. 5.8.R3 (64-bit)
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WeS: D:\CiteSpace\data for citespacedigital tourism\input
Timespan: 2000-2022 (Slice Length=1)
Selection Criteria: g-index (k=25), LRF=0.0, U/N=10, LBY=5, w=1.0
Network: N=218, E=1315 (Density=0.0558)
Largest CC: 205 (94%)
Nodes Labeled: 1.0%
Pruning: None

Source: Authors' elaboration.

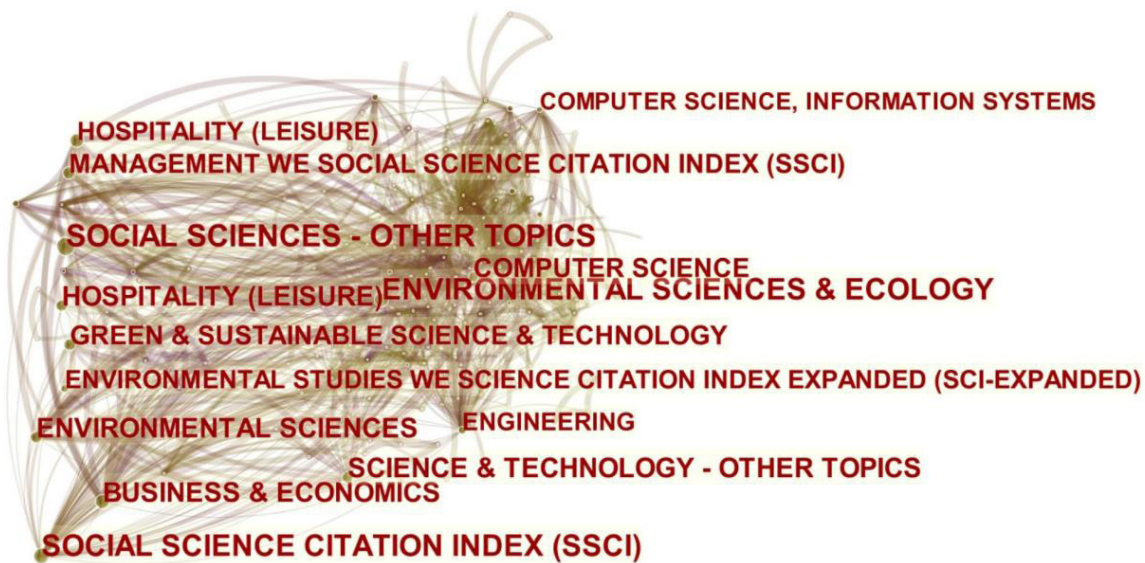


Figure 5. Knowledge map of disciplines distribution in digital tourism research

tions to the research of digital tourism, mainly from 2000 to 2010. Therefore, the research on digital tourism has made breakthroughs in new fields in the past five years.

In 2018, Humanities, Multidisciplinary (7), Social Sciences, Interdisciplinary Social Science Citation Index (SSCI) (7), Arts and Humanities (7) started to consider the content of digital tourism. The following year, Public, Environmental and Occupational Health (SCI-Expanded) (14), and Physics (SCI-Expanded) (8) studied digital tourism in 2019. Furthermore, Psychology (11), Psychology, Multidisciplinary, Mathematics (SCI-Expanded) (5) began to research digital tourism after 2020.

Digital tourism is playing an increasingly important role in various fields. From the perspective of sociology, hotel management, psychology, mathematics, computer science, and neuroscience, the discussion of this topic is becoming more comprehensive and professional. Therefore, the research on digital tourism shows the characteristics of interdisciplinary integration. The diversified distribution of disciplines in the field makes the research content of digital tourism more abundant and promotes the mutual transformation of the research content of different disciplines.

Table 4. Disciplines distribution in digital tourism research

Source: Authors' elaboration.

No.	No. of Publications	Year	Category
1	260	2002	Social Sciences – Other Topics
2	240	2000	Environmental Sciences and Ecology
3	207	2006	Social Science Citation Index (SSCI)
4	160	2002	Business and Economics
5	146	2007	Hospitality, Leisure, Sport and Tourism (SSCI)
6	144	2000	Environmental Sciences
7	140	2000	Science and Technology – Other Topics
8	119	2008	Green and Sustainable Science and Technology
9	116	2005	Computer Science
10	110	2002	Management (SSCI)

3.5. Knowledge map of keywords in digital tourism research

The keywords in the literature are the researchers' refined summary and generalizations of research contents (Ding et al., 2022). This study digs into the hot topics in digital tourism by summarizing the keywords with high frequency. The study adopts the clustering algorithm (LLR log-likelihood algorithm) to cluster the keywords in the domestic, cross-border education fields and draw a clustering map. Figure

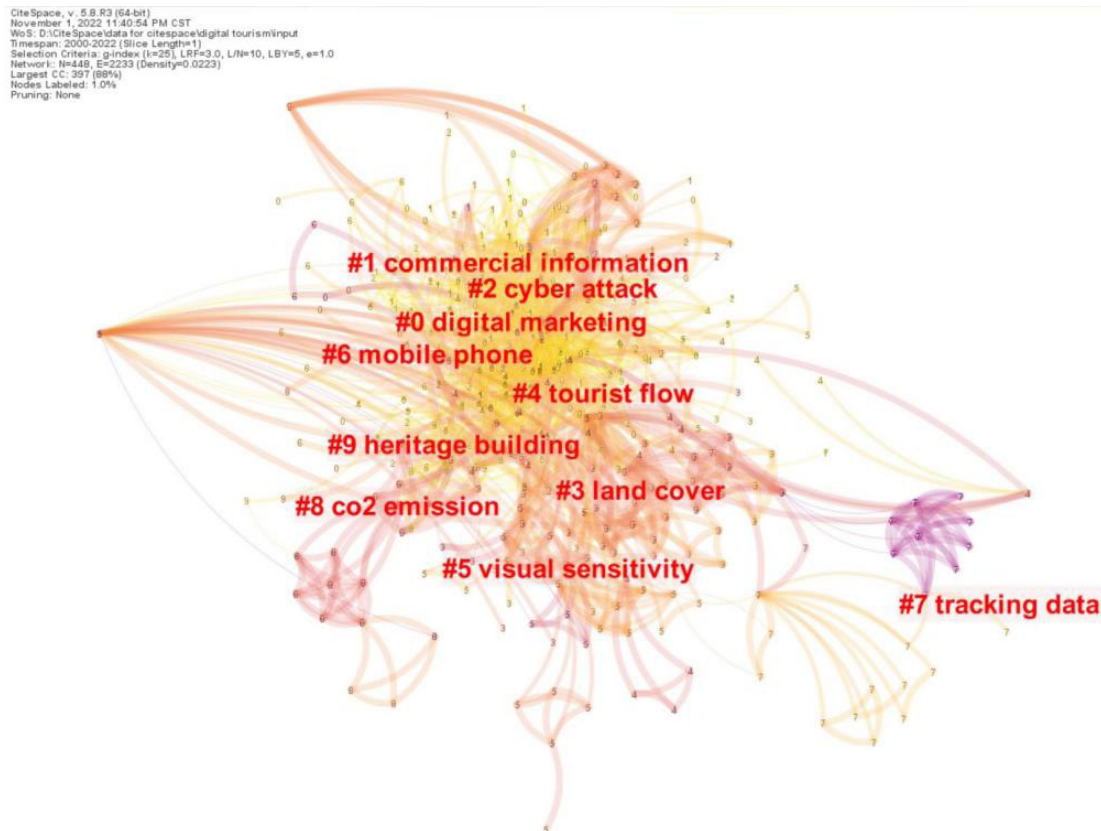


Figure 6. Knowledge map of keywords cluster analysis

6 describes the cluster map containing ten hot topics in digital tourism: digital marketing, commercial information, cyber-attack, land cover, tourist flow, visual sensitivity, mobile phones, track data, CO2 emissions, and heritage building.

Based on the keyword clustering map, Table 5 summarizes the co-occurrence network clustering. The keywords are contained in each cluster. The cluster size represents the number of keywords contained in the cluster. Figure 6 and Table 5 suggest that the core theme of digital tourism is social media. Social media tourism resources and information have become the primary basis for tourists to travel in the digital era. Robots and artificial intelligence are also the main contents in digital tourism research. The successful development of relevant technologies and theories in service robot research has attracted attention because there is no doubt that technology supports tourism.

The clustering of the keyword co-occurrence network reflected the spatial distribution of hot topics in digital tourism research. The large-to-small

clustering reflects the research topics' distribution from macro to micro. At the macro level, social media, service robots, and land cover have always been the core topic. For an extended period, researchers in different periods have focused on tourism students, the hospitality industry, plant communities, CO2 emissions, digital recruitment, and focus on sustainable development issues related to tourists, hotels, environment, and employment. At the medium level, digital footprints, land uses, social media adoption, carbon neutrality, hybrid intelligent algorithm model, carbon dioxide, destination management information systems, and tourism destinations have become hot topics.

The research content is relatively specific and has the characteristics of time dependence and hot spot aggregation. At the micro level, digital tourism emphasizes urban agglomeration, information science, sustainable human resources, competitive productivity, and destination managers. Thus, researchers practice around a specific problem in digital tourism problem characterized by locality and practicality.

Table 5. Keywords clusters in digital tourism

Source: Authors' elaboration.

Cluster code	Size	Keywords (Top 5)
0	69	social media; social media travel information sources; tourism information sources; mean scores; information science
1	63	service robots; positive relation; tourism students; future professionals; low factor loadings
2	55	service robots; socio-technical systems theory; socio-technical systems; front line service employees; employee health
3	48	land cover; land uses; long-term development; shifting cultivation; new land
4	37	tourist flows; digital footprints; digital footprint; research framework; urban agglomeration
5	34	integrative conceptual framework; competitive productivity; destination managers; destination management information; systems; tourism destination
6	26	hospitality industry; social media; innovation theory; organizational adoption; social media adoption
7	24	plant communities; tourism development; environmental changes; vegetation changes; urban occupation
8	22	CO2 emissions; carbon neutrality; hybrid intelligent algorithm model; carbon dioxide; above-mentioned carbon
9	19	digital recruitment; social networks; human resources; tourism sector; sustainable human resources

3.6. Frontier evolution of digital tourism

Research frontiers can highlight the past and future of research. By identifying and tracking the frontiers, researchers can understand the evolution of various stages, predict the development trends, and identify problems that need further exploration (Wang & Lu, 2020). With the help of CiteSpace software tools, this paper can excavate the emerging theoretical trends, new topics, and other research frontiers and conduct comprehensive analysis and judgment based on the analysis of emerging literature and words. Through the analysis of emerging keywords in the field of digital tourism research, one can understand its context. By constructing a table of emerging keywords (Figure 7), combined with further analysis of research literature, the study obtained the frontier issues and evolution trends that concern digital tourism research.

The early research frontier in digital tourism emerged from 2000 to 2009. Researchers focused on sea level, habitat, web, dynamics, and adaptation during this period. In the first decade of the 21st century, the global digital economy is still in its infancy. However, under the influence of digital technology, the tourism industry continues to pay attention to the tourism environment, dynamic development, and consumer behavior. The impact of web information on the tourism industry and consumer behavior was gradually recognized in this period. At the same time, research on the use

of digital technology in the tourism industry has begun to emerge.

2011–2017 is the mid-term frontier of digital tourism. During this period, the frontier hot spots of digital tourism research aim to understand the pattern, conservation, community, environment, media, forest, social media, perception, travel, classification, word of mouth, and knowledge. At this stage, the relevant construction and market of digital tourism have been relatively complete. The research discussed the tourism consumption mode, environmental problems in tourism, the impact of social media on tourism, and the discussion of knowledge and reputation of digital tourism on tourists' consumption. It reflects the increasingly significant impact of technology on the tourism industry.

Digital tourism is developing rapidly, exposing the environmental and consumption problems in the tourism process (Adeola & Evans, 2019). These issues will be global, which also means that stakeholders in the tourism industry may need to fully understand this topic and know more about digital technology in tourism. The uneven development of digital technology in different regions, diverse and complex information, and sustainable development issues in tourism may become research hotspots.

In order to solve the outstanding problems in digital tourism, all significant economic alliances and cooperation institutions around the world, espe-

Source: Authors' elaboration.

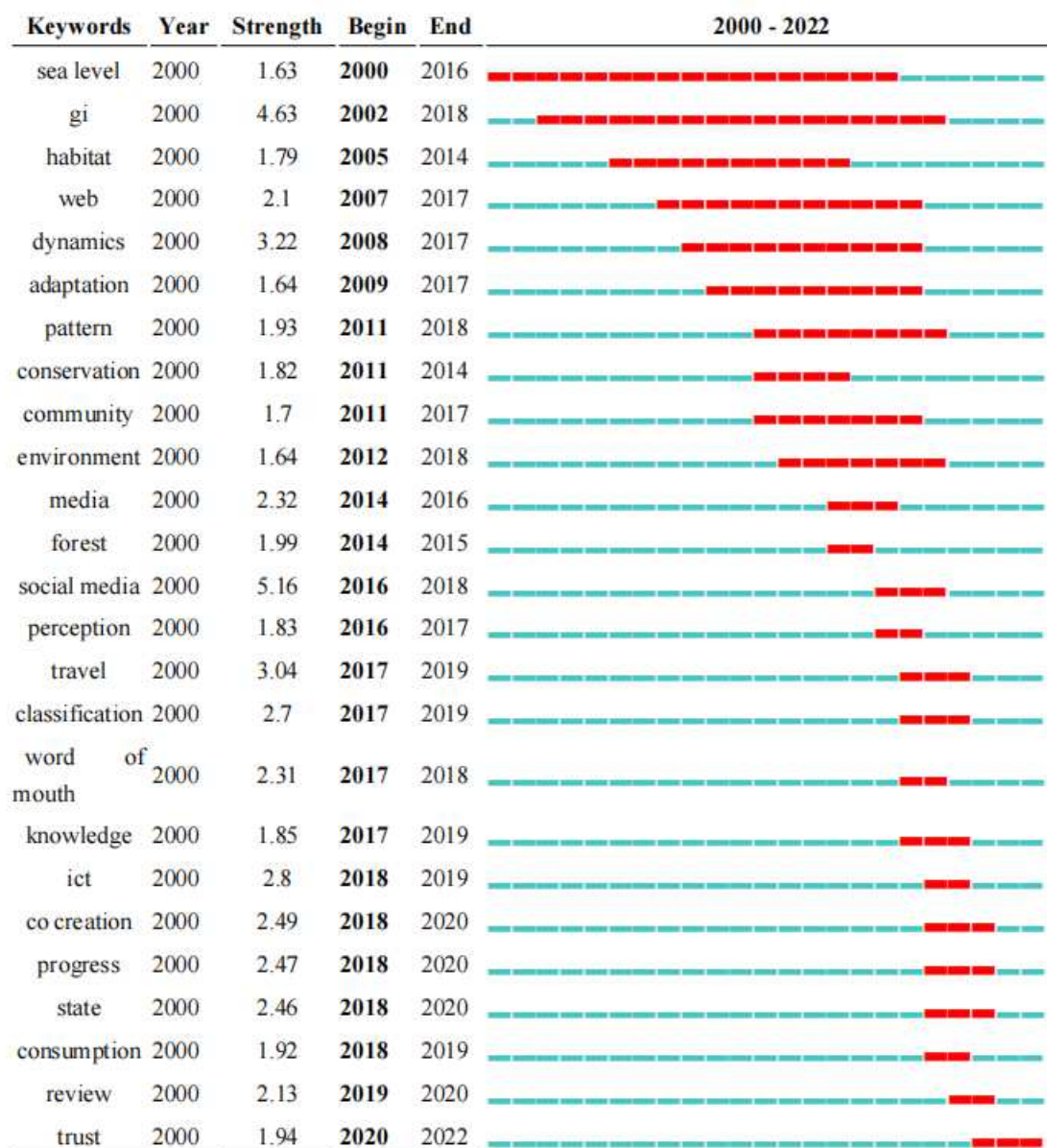


Figure 7. Top 25 keywords with the strongest citation bursts

cially tourism-related departments, pay attention to the opportunities of global cooperation to bring digital tourism development, actively participate in the process of tourism globalization, and emphasize the sustainable development in digital tourism (Anderson & Sanga, 2019). In addition, the World Tourism Organization has also issued many policies on this issue, focusing on the impact of technology on tourism, emphasizing the importance of digital technology in solving sustainable tourism development, and encouraging the world to join hands in sustainable tourism development (Hall, 2019). These contributions are

of great significance for adapting to the era of the digital economy, purifying the global digital tourism environment, improving the quality of digital tourism, and solving the problems in the field of digital tourism (Mondal & Samaddar, 2021).

The latest research frontier of digital tourism emerged in 2018–2022. Co-creation, progress, state, consumption, review, and trust became the main topics in digital tourism at this stage. After years of exploration and efforts, digital tourism has gradually stabilized. In order to regulate digital tourism, the World Tourism Organization has

stipulated the cooperation methods and measures for the development of digital tourism in the context of globalization, which provides a policy basis for the development of digital tourism and points out the direction for the sustainable development of various tourism countries. The current research encourages digital tourism consumption, promotes sustainable development, lays a foundation for subsequent tourism supply, and provides significant opportunities for expanding, optimizing, and upgrading digital tourism.

The research on digital tourism in the context of globalization answers how to strengthen transnational tourism cooperation, realize the joint development and sustainable development of international tourism, and promote the sustainable development of digital tourism in the context of globalization (Spencer, 2019).

Therefore, the latest research results are beneficial to improving the consumption quality of digital tourism. Consumers' trust in tourism destinations and comments may become important factors. In addition, co-innovation is a vital measure to promote the development of digital tourism. Studies after 2018 have concluded that digital tourism focuses on psychological issues, and digital tourism consumption behavior has become one of the main topics of current research.

4. DISCUSSION

This study systematically analyzed 1,013 articles about digital tourism in the past three decades, determined the incredible development trends of digital tourism, and revealed that the impact of digital technology on the tourism industry was booming.

There is close cooperation between research institutions and researchers in digital tourism, which means that digital tourism is a global topic with fruitful cooperation. Furthermore, the studies provided new evidence for both transnational and inter-institutional cooperation.

However, although the connection network is intensive, the primary authors are more prominent, and most are cooperative (Massimo, 2014). The cooperation between the primary authors needs to be closer

because almost all the prominent authors lead other partners. There needs to be a leading author cooperation group in digital tourism research. Therefore, mainstream research authors should make further efforts to form research pioneers and establish their academic schools to provide more theoretical support and research basis.

Secondly, Hong Kong Polytechnic University has apparent advantages in digital tourism and has made remarkable achievements in terms of duration and number of articles. Although there are many cooperative institutions in digital economy research, Asian and Australian countries and regions are the main ones. In recent years, many European institutions have integrated into the research market and formed strong cooperation (Boes et al., 2015; Barile et al., 2017). From the institutional cooperation map perspective, the research of transnational institutions needs to be closer, and academic achievements and research have a trend of regional monopoly. Therefore, the study emphasizes the importance of institutional cooperation for developing digital tourism.

As a significant country in digital tourism research, China greatly influences Europe and Southeast Asia. Britain, the United States, Italy, Australia, Portugal, and other countries have also contributed to digital tourism and formed close cooperative relations. The participation of Asian countries, including Japan, Malaysia, Saudi Arabia, and Vietnam, further proves that digital tourism is a worldwide topic (Kalia et al., 2022; Akhtar et al., 2021). Unfortunately, there are not so many African and American countries on the knowledge map of national cooperation.

Social sciences is the most prominent research on digital tourism, followed by environmental sciences in digital tourism. After 2020, although psychology (Choi et al., 2022), computer sciences (Tuo et al., 2021), and neuroscience (Kan & Li, 2021) try to pay attention to digital tourism, from the perspective of the atlas, except for social and environmental sciences, other disciplines are challenging to emerge in the breakthrough because their contribution status is almost the same. Therefore, the study suggests establishing a discipline specialized in digital tourism or bringing digital tourism into a specific field to make the research more symbolic and representative.

Digital tourism is closely related to artificial intelligence, web 2.0, Industry 4.0, and the development of high-tech industries under the technological revolution (Adeola & Evans, 2019). Social media, service robots, environmental issues, tourism management, and sustainable development have almost become the main contents of digital tourism (Gössling, 2021). Researchers have paid particular attention to the impact of digital tourism on sustainable consumption behavior and sought a way out through digital technology (Lubowiecki-Vikuk et al., 2021). From the perspective of the research frontiers, knowledge, consumption, and comments are the front-end contents of digital tourism research.

In the future, all institutions can strengthen cooperation and exchange with institutions led by Hong Kong Polytechnic University that have made outstanding contributions to digital tour-

ism research, form an academic research alliance of digital tourism, and promote the development of this field. Moreover, as a world-class topic, countries with mature digital tourism research in Europe, America, and Asia should actively promote sustainable tourism development, strengthen cooperation with more third-world tourism countries, and use digital tourism to solve environmental protection, health, economic, and other sustainable development problems in tourism. At the same time, this paper encourages other disciplines to integrate into the research of digital tourism because computer sciences and neuroscience are essential supports and tools for the digital economy to adapt to the development of contemporary society. Finally, the study implicates more scholars to discuss relevant content and make richer contributions to the development of this study.

CONCLUSION

This study applies CiteSpace to analyze and visualize the literature related to digital tourism presenting publication trends and cooperation of authors, institutions, countries, and subjects.

The results uncover that the publication trends are positive, especially after 2020. Moreover, the paper advocates cooperation between the authors, institutions, and countries. In addition, the multi-subjects should focus on the future study of digital tourism. Through the time distribution map, spatial distribution map, hot research topics, and frontier of digital tourism, the results conclude that the trust of tourists, tourist's review, digital tourism consumption, the progress of digital tourism, and joint innovation are the current hot spots of digital tourism research.

Certainly, strengthening the related research and education practice of digital tourism is conducive to promoting the high-quality development of digital tourism. The close network of research institutions and co-occurrence maps reflects the high degree of cooperation and sharing of results among institutions and researchers. However, it only forms a significant genre of the display. Keywords and citation highlights belong to complex disciplines, but they mainly focus on social science research and rare interdisciplinary research on digital tourism.

Therefore, the study of digital tourism should give opportunities for the construction of multi-faceted and multi-disciplinary perspectives, and emphasize the cooperation between different sectors and fields, to promote the research and sustainable development of digital tourism.

AUTHOR CONTRIBUTIONS

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