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Looking Back Three Decades of Hospitality and Tourism Technology Research: A Bibliometric Approach

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Purpose

This study aims to identify the knowledge development and thematic evolvement in hospitality and tourism technology research, and to suggest potential directions for studies in hospitality and tourism research.

Design/methodology/approach

A total of 440 technology articles published from 1990 to 2022 were retrieved from six top-tier journals. By employing bibliometric analysis, 440 technology articles were analyzed to discover the proportion of technology research in the hospitality and tourism discipline, knowledge development, intellectual turning points, and thematic evolvement of hospitality and tourism technology research.

Findings

The findings indicated the proportion of technology research has continuously increased over the past three decades. The findings revealed the key intellectual turning points in technology research. The topical trends showed the popular topics of technology research for the 1990s, 2000s, 2010s, and from 2020. The thematic map analysis results described how the major themes in technology research have evolved and shifted.

Originality

To the best knowledge of the authors, this study is the first bibliometric analysis focusing on technology research in the hospitality and tourism discipline, thereby providing a broad understanding of how technology research has developed in the discipline.

Research limitations/implications

By synthesizing past three decades of hospitality and tourism technology research, this study provides an overview of how technology research has evolved in the context of hospitality and tourism and offers suggestions for future studies on technology.

Keywords: Technology Research, Bibliometric Analysis, Hospitality Technology, Tourism Technology, Knowledge Development

Paper Type: Research Paper

Research Background

There was one thing that changed everything in the hospitality and tourism industry: technology. The introduction and advancement of technology have been a game-changer as technology altered the landscape of the entire hospitality and tourism industry (Law *et al*., 2020). At an early stage, technology was used to increase operational efficiency, such as reservation systems and property management systems (Joyce, 2013). As technological innovation was focused on the operational aspects (e.g., operational efficiency) of the hospitality and tourism industry, the center of the hospitality and tourism technology research also lay on the strategic adoption of technology for efficient management (e.g., Buhalis, 1998). However, with consumers' increasing demands for technology and the exponential development of consumer-focused technologies, various technologies became available in guest-facing areas despite the human-oriented nature of the industry (Shin and Jeong, 2020). Moreover, technological innovation is expected to continuously change the hospitality and tourism industry and even become an integral part (Law *et al*., 2020).

Accordingly, many researchers have shown keen interest in technology, regardless of the user groups or areas of implementation. Specifically, the antecedents and consequences of technology adoption have been the heart of technology research. In terms of organizations' technology adoption, Siguaw *et al*. (2000) investigated the hotel industry's adoption of information technology (e.g., Internet/online reservations, e-mail system, teleconferencing, Wi-Fi), whereas Spencer *et al*. (2012) used employed organization decision-making and leadership aspects to assess small travel organizations' technology adoption. The obstacles of hotels' environmental technology adoption were also examined (Chan *et al*., 2018). From consumer behavior point of view, the factors' affecting consumers' adoption of biometric technologies (Murphy and Rottet, 2009), websites (Herrero and San Martín, 2012), mobile phones (Morosan, 2014), self-service technology (Lee, 2016), augmented reality (Jung *et al*., 2018), service robots (Shin and Jeong, 2020), and artificial intelligence (Chi *et al*., 2022) were investigated.

As technology has developed at a surprisingly fast pace and substantial knowledge regarding technology in the hospitality and tourism industry has been developed thanks to researchers' keen interests in technology, many studies (e.g., Buhalis and Law, 2008; Morosan and Bowen, 2022; Law *et al*., 2014; Law *et al*., 2019) have tried to explore the knowledge development in technology research using different techniques, such as qualitative content analysis and bibliometric analysis. Particularly, bibliometric analysis has become popular among researchers as it allows researchers to statistically identify the patterns of research in a certain field (Leung *et al*., 2017). However, previous literature employing bibliometric analysis has focused on a specific area, rather than looking at technology articles from a holistic perspective (general hospitality and tourism technology). On the one hand, some recent bibliometric studies focused on the role of technology in specific operation areas, such as human resource management (Gonzalez *et al.*, 2020), or business domains, such as sharing economy (Mody *et al.*, 2021) or dining services (Gonzalez et al., 2022). On the other, other review studies targeted a certain type of technologies, including artificial intelligence (Huang *et al.*, 2021; Li *et al.*, 2021), online platforms (Zhou *et al.*, 2021), self-service technology (Shin and Perdue, 2019; Shiwen *et al.*, 2021), social media (Nusair *et al*., 2020), or smart tourism (Johnson and Samakovlis, 2019). Thus, it is difficult to understand how technology research in the hospitality and tourism discipline developed and thematically evolved. In other words, the overall technology research has not been clearly pictured. Accordingly, it was challenging for researchers and industry practitioners to understand which technologies and themes have been 'trendy' and 'popular' at a

specific time period. Furthermore, the absence of a holistic view on hospitality and tourism research hampers researchers to come up with potential studies that would rigorously advance knowledge development. Given that the development of technology has been expedited even faster, it is of utmost importance to comprehensively examine technology research in the hospitality and tourism discipline. Specifically, how technology research has developed over time, what were the main topic areas of technology research, how the themes of technology research evolved need to be examined.

Therefore, in order to address the gap in the current literature, this study aims (1) to identify the increasing importance of hospitality and tourism technology research, (2) to examine how technology research in hospitality and tourism discipline has evolved, (3) to investigate the trends and technology shifts in hospitality and tourism technology research, and (4) to suggest directions for future studies in hospitality and tourism technology. Different from the previous review studies on technology in the hospitality and tourism field, this study attempts to take a holistic perspective about the topic by not limiting our focus only to a specific business domain or type of technologies. In order to achieve the research objectives, a series of bibliometric analyses were conducted, including descriptive analysis, co-citation analysis, intellectual turning points identification analysis, topical trends analysis, and thematic evolvement analysis.

The current study will theoretically contribute to the literature by (1) synthesizing the previous literature on hospitality and tourism technology over the past three decades, (2) expediting the accumulation of knowledge of hospitality and tourism technology, and (3) providing a direction for researchers to develop future research agendas. Moreover, the findings of this study will shed light on the hospitality and tourism industry by (1) summarizing previous research on hospitality and tourism technology so that the industry practitioners can easily keep up with the huge volume of academic research, and (2) playing a role as a reference for industry practitioners when academic evidence is necessary.

Methodology

Bibliometric Analysis

Bibliometric analysis is a quantitative technique to explore patterns of publications within a certain field or discipline (De Bellis, 2009). As bibliometric analysis allows the researchers to discover the intellectual structure of a discipline (Cobo *et al*., 2011), many scholars have applied bibliometric analysis to understand the knowledge development in a discipline (Mulet-Forteza *et al*., 2019), particular journals (Ali *et al*., 2019; Cunill *et al*., 2019; Sigala *et al*., 2021), or specific topics. There have been many hospitality and tourism studies using bibliometric analysis for a specific topic, such as customer engagement (So *et al*., 2021), crisis management (Jiang *et al*., 2019), gastronomy (Okumus *et al*., 2018), trust (Palácios *et al*., 2021), sharing economy (Mody *et al*., 2021), and social media (Leung *et al*., 2017). These studies demonstrated the advantages of bibliometric analysis in exploring the thematic evolution of a particular research area (Cobo *et al*., 2011). Thus, bibliometric analysis was employed to achieve the goals of this study.

Data Collection

In order to track knowledge development in hospitality and tourism technology research, the year of 1990 was selected as the starting point because the technology acceptance model (Davis, 1989), the most influential theory in technology, was introduced in 1989. Specifically, technology acceptance model has been one of the most cited paper in information technology

research in the hospitality and tourism discipline (Yuan *et al*., 2019). As technology acceptance model has been recognized to substantially contribute to theoretical and practical understanding regarding information technology (Dube *et al*., 2020), it is adequate to select technology acceptance model as the starting point. The target journals were selected based on multiple criteria, including Scopus cite scores, H-Index, SCImago journal and country ranking, social science citation index (SSCI), Australian Business Deans Council (ABDC) Journal Quality List and previous research that used systematic review or bibliometric analyses (e.g., Li, 2008; Philips and Moutinho, 2014; Sainaghi *et al*., 2013). Based on these criteria, three leading hospitality journals (*International Journal of Hospitality Management [IJHM], International Journal of Contemporary Hospitality Management [IJCHM], Journal of Hospitality and Tourism Research [JHTR]*) and three leading tourism journals (*Annals of Tourism Research [ATR], Journal of Travel Research [JTR], Tourism Management [TM]*) were selected. The primary reason for using only leading hospitality and tourism journals is that the articles published in these journals are commonly recognized as certified topic knowledge (So *et al*., 2021), and tend to set research trends in various topic areas (So *et al*., 2020). Lastly, journals solely dedicated to technology research (e.g., *Journal of Hospitality and Tourism Technology [JHTT])* were not included to assess the increasing importance of technology research in general hospitality and tourism research.

Scopus and Web of Science (WoS) were compared to decide the database for data retrieval. While both Scopus and WoS are reliable data sources for bibliometric analyses, Scopus was chosen as the data source of this study because it covers a larger number of documents than WoS (Huang *et al*., 2020; Visser *et al*., 2021). In addition, Scopus has been much utilized for data retrieval for systematic review and bibliometric analyses (e.g., Ali *et al*., 2019; Andreu *et al*., 2020; Cunill *et al*., 2019; Mulet-Forteza *et al*., 2019) as it represents a high level of scholarly publications. Once Scopus was determined as the data source, data collection criteria were set. Specifically, only full-length articles written in English in the selected journal were included since publications, such as editorial and book review contribute to knowledge development only to a certain extent (Ali *et al*., 2019; Gomezelj, 2016; Law *et al*., 2019). Then, potential search keywords were identified. At first, keywords that might be associated with technology were identified, such as technology and information technology. After two rounds of keywords review processes, ‘technology’, ‘technologies’, and ‘tech’ were selected as search keywords in title, abstract, and keywords. Such keywords indicating a specific technology as augmented reality and artificial intelligence were not used since it might affect the coverage of technologies.

A total of 632 articles were retrieved from Scopus on January 6, 2022, and further screened to ascertain their relevance and suitability for inclusion. All members of the research team read the title and abstract of each article and evaluated the relevance and appropriateness, respectively. Two members of the research team had their research expertise in hospitality and tourism. On the other hand, the other member’s research expertise was in strategic management in hospitality and tourism, thus providing a new perspective. After excluding those articles that the majority of the research team members found irrelevant or limited contribution to knowledge development, 440 articles were proceeded for further analyses.

Data Analysis

For data analysis, R 4.1.1. and multiple packages were used (e.g., *bibliometrix*). First of all, descriptive analyses were performed to investigate the information about the retrieved articles, such as document contents, authors, collaborations, and scientific production.

Furthermore, citation analysis was also performed to identify the most cited references and cumulative occurrence of author-defined keywords. In addition to overall analyses, the articles were divided into four groups based on publication year to assess periodic trends in technology research: 1990s, 2000s, 2010s, and from 2020. By conducting co-citation analysis, the intellectual structure of technology research was detected. In order to capture the topical trends and themes of technology research, thematic evolution and thematic mapping analyses were performed to conceptually examine technology research.

Results

Overall Description of Hospitality and Tourism Technology Research

As shown in Table 1, the number of technology research has continuously increased since 1990. The number of technology research in the 2010s was about 5.5 times that of the publications in the 1990s. Almost for about two years (2020 – 2022), the number of technology research was greater than 120, and the proportion of technology research increased from 1.5% in 1990s to 5% in 2020s (see Table 2), demonstrating the importance of technology research has been exponentially increasing. Furthermore, the number of authors involved in technology research has continuously increased. In general, hospitality journals have published more technology articles than tourism journals (see Table 2 and Figure 1). Among tourism journals, JTR (3.5%) has the highest proportion of technology research, and IJCHM (4.8%) is the most favorable to technology research among hospitality journals. IJCHM (n = 105) has the largest number of technology research publications, followed by TM (n = 102) and IJHM (n = 100).

[Tables 1 & 2]
[Figure 1]

During the past three decades, Law (n = 24), Morosan (n = 13), Buhalis (n = 11), and Fesenmaier (n = 11) were the most productive authors, and their articles were also one of the most cited articles (see Total citation (TC) in Table 3). This finding is different from the review studies that discussed the role of technology in a specific operation area (see Gonzalez *et al.*, 2020) or a business domain (see Gonzalez *et al.*, 2022). This difference indicates that the key researchers in terms of the number of articles could be different by whether the role of technology is discussed in a certain or an overall context of the hospitality and tourism field.

TM has been the home for the most cited articles. Buhalis and Law (2008) were the authors of the most cited paper (TC = 1628), followed by Litvin *et al*. (2008), as the papers provided an overview of technology research at the early stage of technology adoption in the hospitality and tourism industry. The seminal work by Buhalis and Law (2008) comprehensively reviewed and analyzed studies in information technology (IT) in the context of tourism, thereby providing an overview of IT research in tourism discipline, knowledge development, and potential challenges. The second most cited paper by Litvin *et al*. (2008) described the impact of electronic word-of-moth (eWOM) in the hospitality and tourism industry as well as issues associated with eWOM, such as technological and ethical concerns. In the 1990s, the paper on the strategic use of information technology (Buhalis, 1990) was much cited. In the 2000s, articles on the Internet and Web (e.g., Pan *et al*., 2007) were much sought. Studies focused on factors affecting consumers' intention to use technology were much cited in the 2010s, such as Amaro

and Duarte (2015), and Ayeh *et al*. (2013). From 2020, papers on service automation (e.g., de Kervenoael *et al*., 2020; Park, 2020; Tussyadiah, 2020) were notable.

[Table 3]

Co-Citation Analysis of Hospitality and Tourism Technology Research

Co-citation Analysis and Clusters

Co-citation analysis is one of the most commonly used bibliometric analyses to detect disciplinary structure (Leung *et al*., 2017). Co-citation indicates two articles cited together in an article (Small, 1973). When two articles are regularly cited together in an article, they are considered to have a conceptual, methodological, or practical correspondence (Appio *et al*., 2014). Because of the strength of co-citation analysis in depicting the knowledge structure in a discipline, the interrelated patterns of technology research were explored by using co-citation analysis with reference as network, and the foundations of technology research were identified (Shin and Perdue, 2019). In this study, the references were used as the unit of network to identify the studies that were frequently cited together in a paper. With the top 30 co-cited articles, there were six major clusters: (1) technology adoption, (2) research methods/statistics, (3) business utilization of information system, (4) consumers' utilization of information technology, (5) robots, and (6) virtual reality (see Figure 2).

The first cluster included the preeminent theories (e.g., Theory of Reasoned Action, Technology Acceptance Model). In other words, the same theories have been frequently applied to technology research as the theoretical background. For example, many studies have employed technology acceptance model as their theoretical support (e.g., Herrero and San Martín, 2012; Kim and Qu, 2014; Lee, 2016). Similarly, seminal papers in methodology and statistics (e.g., Structural Equation Modeling) consisted the second cluster, indicating that technology research have employed similar methodological approaches. The third and fourth clusters (i.e., suppliers' and consumers' usage of technology) were consistent with previous review studies on hospitality and tourism technology while the names were divergent, such as interaction of organization or people and information technology (Yuan *et al.*, 2019), business functions and demand of consumers (Navío-Marco *et al.*, 2018), or organizational use and users (Cai *et al.*, 2019). Different from above-mentioned four clusters, the last two clusters (i.e., robots and virtual reality) depicted which technologies have played a pivotal role in the knowledge structure in the hospitality and tourism discipline. These two clusters were not much discussed in the past review papers since most of the studies have targeted a specific type of technology (Nusair *et al*., 2019; Zhou *et al.*, 2021). The identification of the last two clusters implies the importance of taking a holistic perspective when reviewing technology articles to find out much-investigated technologies in the industry. The following section briefly describes each cluster.

[Figure 2]

Cluster 1: Technology Adoption: Cluster 1, the biggest cluster in technology research, focused on hospitality and tourism technology adoption. As the technology acceptance model (TAM) has been well-recognized as the most influential theory in technology research, the original research suggesting TAM (Davis, 1989) had the top betweenness centrality (438.93), further demonstrating it has been the key intellectual turning point in technology research. The

root of TAM (i.e., theory of reasoned action (TRA), theory of planned behavior (TPB), and extensions of TAM were also major articles in the cluster, as well as Moore *et al*. (1991). Furthermore, the studies on the factors affecting technology adoption, such as technology readiness (Parasuraman, 2000) and innovativeness (Rogers, 1995), were a part of Cluster 1. Studies employing the above theories were categorized into this cluster. For example, Morosan and Jeong (2008) employed TAM to investigate how perceived usefulness, ease of use, and playfulness affect users' perception of hotel reservation websites. In the context of tourism, the antecedents of consumers' behavioral intention to purchase travel online were identified (Amaro and Duarte, 2015). Applying UTAUT, Okumus *et al*. (2018) examined the psychological factors influencing consumers' intention to adopt restaurant mobile ordering apps.

Cluster 2: Research Methods/ Statistics: As numerous technology research used a quantitative approach, studies on statistical methods formed a cluster. Particularly, the seminal articles on structural equation modeling were notable (Anderson and Gerbing, 1988; Baggozzi and Yi, 1988; Fornell and Larker, 1981; Podsakoff *et al*., 2003). For example, Fornell and Larker's (1981) article on structural equation modeling had the third-highest betweenness centrality (187.44), demonstrating that structural equation modeling has been a popular statistical method in technology research. Furthermore, studies about partial least square structural equation modeling were also found, such as Hair *et al*. (2011) and Henseler *et al*. (2009).

Cluster 3: Business Utilization of Information System: Cluster 3 involved studies on businesses' utilization and strategies for information technology (Buhalis, 2003; Poon, 1993). Particularly, Buhalis's (1998) seminal work described information technology development, the influence of information technology in the tourism industry, and strategic utilization of information technology. Kothari *et al*. (2005) stated the e-procurement strategies in hotel supply chains. In the restaurant context, Rodgers (2007) illustrated how to use technologies as strategic innovation. The effectiveness and performance of hotel information technologies were assessed for strategic investment in information technology (Ham *et al*., 2015).

Cluster 4: Consumers' Utilization of Information Technology: Research investigating the role of technology in the hospitality and tourism industry shaped another cluster. While Cluster 3 was about businesses' utilization of technology, Cluster 4 focused on consumers' perspectives. For instance, with the increasing popularity of social media, the role of social media as an information source for travelers was explored, confirming social media as a key competitor of traditional travel information providers (Xiang and Gretzel, 2010). On the other hand, Wang *et al*. (2012) discovered the roles of smartphones in creating tourism experience. How smartphones were used by travelers and influenced their experience was examined (Wang *et al*., 2014).

Cluster 5. Robots: Cluster 5 included articles about human-robot interactions (HRI), consumer experience, and evaluation of service robots. Different from the four clusters mentioned above, Cluster 5 illustrated that researchers' attention has been on a specific technology: robots. Specifically, consumers' perceptions of service robots and their morphism were much investigated (Christou *et al*., 2020; Shin and Jeong, 2020). On the other hand, focusing on the key construct of the industry, studies on consumer experience with service robots were conducted (Tung and Au, 2018). As robotics was introduced in the industry, researchers (Ivanov and Webster, 2021; McCartney and McCartney, 2020; Tung and Law, 2018; Tussyadiah, 2020) also reviewed and shared their insights on robot interaction.

Cluster 6. Virtual Reality: Cluster 6 consisted of papers specifically focusing on virtual reality in the hospitality and tourism industry, such as how virtual reality could be implemented and utilized in the hospitality and tourism industry. Guttentag (2010) explained what virtual

reality is and virtual reality experience, including the key outcomes of virtual reality (e.g., immersion, psychological presence). As virtual reality was at the early stage of diffusion in the industry, Guttentag (2010) further illustrated how virtual reality could be applied in the tourism industry: planning & management, marketing, entertainment, education, accessibility, and heritage preservation. While the potential benefits of virtual reality were outlined, issues such as whether virtual reality can substitute for tourism and potential challenges were also discussed. Tussyadiah *et al*. (2018) empirically tested how virtual reality experience (i.e., presence, enjoyment) affects attitude and behavioral intentions. Based on these two seminal works, further studies (e.g., Bogicevic *et al*., 2019; Kim *et al*., 2020) on virtual reality were conducted to understand traveler behavior, such as how authentic experience of VR tourism affects travelers' behavioral intentions mediated by cognitive and affective responses.

Intellectual Turning Points

Besides the co-citation analysis, a betweenness centrality was assessed to detect the major intellectual turning points. In bibliometric analysis, betweenness centrality refers to the extent to which an article is co-cited with other articles (Shin and Perdue, 2019). Betweenness centrality is used to identify the intellectual turning points since papers with high betweenness centrality indicate the linkage between the articles and sub-network (Najmi *et al*., 2017). Table 4 describes top technology articles with a high betweenness centrality. Similar to co-citation analysis, the major intellectual turning point is related to the emergence or prevalence of specific technology, such as websites (Morosan and Jeong, 2008), social media (Lee *et al.*, 2012; Xiang and Gretzel, 2010), mobile devices, such as smartphones (Wang and Wang, 2010; Wang et al., 2012), virtual reality (Guttentag, 2010; Tussyadiah *et al*., 2018), online platforms and user-generated contents (Litvin *et al*., 2008; Ert *et al*., 2016), and self-service kiosks (Kim and Qu, 2014). Information technology utilization and strategy (Buhalis and Law, 2008; Kim *et al*., 2008; Litvin *et al*., 2008) was also an important turning point. In addition, the emergence of robots also found to be a new turning point as well (Tung and Au, 2018; Tung and Law, 2017). Complementing to the previous review studies focusing on a specific technology (Huang *et al.*, 2021; Li *et al.*, 2021; Shin and Perdue, 2019; Shiwen *et al*., 2021), this research reveals how much research attention has been paid to various types of technologies across different time periods in the hospitality and tourism field.

[Table 4]

Topical and Thematic Evolvement of Hospitality and Tourism Technology Research

Co-word analysis was conducted to depict the themes of hospitality and tourism technology research. The default for co-word analysis is typically keywords associated by the database (e.g., Scopus) as it considers synonyms, singular/plural, and various spellings (U.S. English, U.K. English) (Scopus, 2021). However, this study used author-defined keywords for the thematic mapping since they were selected by the authors, thereby reflecting the contents of the article more accurately (Scopus, 2021).

Topical Trends in Technology Research

In order to assess the topical trends in technology research, the author-defined keywords were analyzed. The circles in Figure 3 illustrate the number of appearances of a specific

keyword, whereas the horizontal lines describe the range between first quartile and third quartile. In other words, Figure 3 depicts from when a specific keyword became popular and how popular the keyword has been. Consistent with clusters based on co-citation analysis, technology adoption has been one of the most notable research topics from 2009 to 2020. The results illustrated that TAM had been the dominant theoretical background (see 'technology adoption,' 'technology acceptance,' 'TAM,' 'technology acceptance model,' and 'technology acceptance model (TAM)' in Figure 3). On the other hand, individuals' personal traits, such as 'innovativeness' (2013 - 2018) and 'technology readiness' (2017 - 2020), were trendy. The major area of research has been marketing for over 20 years (1993 - 2016) ('marketing' and 'internet marketing'). As the industry itself is considered a service-oriented industry, service-related topics have been popular ('service quality': 2009 - 2018, 'service innovation': 2018 -, 'service encounter': 2019 - 2020). Furthermore, as more guest-facing technologies became available, consumers' satisfaction with technology was also a salient topic ('customer satisfaction': 2007 - 2018).

Interestingly, the trends analysis results also described the major sectors of technology adoption. The hotel industry has shown steady growth in technology research as it has had many technologies available for guests ('hotels': 2005 – 2018): website (1994) and online booking (1995), Wi-Fi (2003), mobile apps (2009), and robots (2016) (Intelity, 2016). Much research has been also conducted in the context of 'tourism' (2006 – 2018). The median of tourism was in 2016, perhaps because of the introduction of smart tourism. General hospitality has also shown constant growth ('hospitality' or 'hospitality industry': 2010 – 2020), whereas sharing economy (i.e., Airbnb) appeared as a new trendy topic in technology research, particularly related to Airbnb guests' adoption of technologies ('Airbnb': 2019 -) (see Cao *et al*., 2022). The restaurant sector emerged relatively later than other sectors ('restaurants': 2018 – 2020), perhaps because most of the technologies in restaurants were for operational efficiency (e.g., POS) rather than technologies available for consumers (e.g., tablet-top tablets) up until the late 2010s (Goldstein, 2018).

While the results of topical trends analysis showed that some topics (e.g., 'customer satisfaction' or 'marketing') have been steady in technology research, it was also demonstrated that technology has developed at a faster pace. In other words, the time span for a specific technology has become shorter, demonstrating technology develops at an unprecedented speed. As shown in Figure 3, in the 1990s, no specific type of technology appeared as a trend. Then, 'e-commerce' appeared about ten years from 2004 to 2014. In the 2010s, a variety of new technologies emerged as trends, including 'social media' (2015 - 2018), and 'smartphone' and 'mobile technology' (2016 - 2018). While such research trends associated with big data as 'online reviews' (2018 -) and 'big data' (2019 -) were arising, more advanced technologies have risen as major trends as it comes closer to 2020s, such as 'service robots' (2019 -), 'virtual reality' (2019 -), and 'artificial intelligence' (2020 -). Furthermore, as the COVID-19 pandemic expedited the use of technology for contactless services, COVID-19 was also a key topic from 2021. Although the continuous changes in the technological environment were well explained in previous review studies on the development of technology in hospitality and tourism (Cai *et al.*, 2019; Law *et al.*, 2019; Yuan *et al.*, 2019), the pace of changes has been rarely discussed in the literature. By showing the faster pace of changes over time, this research adds on the argument of the existing literature: while researchers in the field have well adapted to the changes in the technological environment, they should be more prompt in responding to emerging technologies as time goes by.

[Figure 3]

When the topical trends were assessed using keywords associated by Scopus database, technological development had the longest popularity (2002 – 2018). Stakeholders' behavior (consumer behavior, tourist behavior, travel behavior), tourism-related topics (tourism, tourist attraction, destination, tourism management, tourism development, tourism economics), and methodological approach (qualitative analysis, empirical analysis, conceptual framework) were found to be popular topics over the three decades. While general topics, such as information and communication technology, technology adoption, and the internet, were on-trend, specific types of technology were also found, including virtual reality and World Wide Web. Interestingly, different from author-defined keywords trends analysis, virtual reality showed a longer span (2012 -) when Scopus keywords were used, whereas social media had a shorter span (2019 -) than author-defined keywords. Mobile phones and artificial intelligence were also trendy topics from the mid-2010s.

Thematic Evolvement of Technology Research

In thematic mapping (Figure 4), density refers to how cohesive the theme was represented by the cluster (Neff and Corley, 2009). Thus, density specifies the degree of development of the theme (Della Corte *et al*., 2019). On the other hand, centrality is the measure indicating how often researchers in the discipline invoke the keywords in the cluster (Neff and Corley, 2009). Hence, centrality expresses the importance of the theme (Della Corte *et al*., 2019). Based on the two dimensions (i.e., density, centrality), the themes were divided into four different groups and placed into a two-dimensional map based on their density and centrality: motor, basic, emerging/decline, and niche themes (Cobo *et al*., 2011). Motor themes indicate research themes with strong centrality and high density; basic themes refer to important research themes which are not fully developed yet; emerging/declining themes imply weakly and marginally developed themes; lastly, niche themes well-developed themes of which importance is marginal (Cobo *et al*., 2011).

When all articles were analyzed for thematic network, the thematic map showed consistent points with the results of co-citation analysis and topical trends analysis (Figure 4). The theme of TAM, 'technology acceptance model (TAM),' was placed in the second quadrant (niche themes), indicating that TAM research has been well-developed, but the theoretical importance is very specialized and subsidiary. Perhaps, these results might be attributed to many other theories have introduced, such as UTAUT and the information system success model. The following themes appeared as motor themes: 'artificial intelligence,' 'social media,' and 'virtual reality.' This demonstrates the increasing importance of advanced technologies. On the other hand, 'big data' was placed in the third quadrant, revealing that it is an emerging theme.

[Figure 4]

As technology research has shown considerable progress, thematic map was created to uncover the thematic evolvement of technology research in the context of hospitality and tourism. Figure 5 illustrates the thematic map of technology research in the hospitality and tourism discipline in the 1990s, 2000s, 2010s, and 2020s. In the 1990s, all discovered themes

were categorized as basic themes, suggesting notable importance of the themes and at the same time showing the necessity of further development.

[Figure 5]

In the 2000s, a greater number of themes emerged. Consistent with the findings from the intellectual turning points assessment, the utilization of information technology for business operation (i.e., 'technology-led strategy') was a well-developed theme with high significance. However, the number of articles on 'technology-led strategy' was limited (the size of a sphere describes the number of articles associated with the theme). As shown in topic trends analysis, 'internet' and 'internet marketing' were the motor themes in the 2000s. As the internet is the ground for internet marketing, the number of 'internet' articles was greater than 'internet marketing' articles. At the same time, 'online marketing' was found as an emerging theme, demonstrating digital marketing evolved from World Wide Web (WWW)-based marketing to broader ranges of tools (Schwarzl and Grabowska, 2015). Furthermore, in the 2000s, themes of 'e-procurement' and 'e-commerce' appeared as basic themes, suggesting electronic platforms became important in the industry. Theme 'hotels' was located in the basic theme because the keywords (biometrics, hotel websites) were relatively under-developed in the literature with high importance.

In the 2010s, the 'information technology' theme was still a basic theme, which needed further development. Based on the keywords in 'information technology' themes, it suggested that actor value formation (keywords: S-D logic, value co-creation) via technology, security-issues with technology (keywords: trust, privacy, security), and user adoption of technology (keywords: innovativeness, conversion, diffusion, facilitating conditions) were critical research themes which deeper exploration was imperative. The emergence of 'service encounter' as arising research theme indicated that more technologies were implemented into guest-facing areas during the period (e.g., Choi *et al*., 2019; Liu and Mattila, 2019). The 'smartphone' appeared as a basic theme, proposing the urgent need for further studies. Based on the keywords (e.g., mobile technology, augmented reality, virtual reality, wearable technology) in the smartphone theme, it seemed that the smartphone theme was categorized as a basic theme because various types of technologies became available for end-users through their smartphones, calling for further studies. On the other hand, 'mobile applications' themselves were categorized into niche themes. With the introduction of big data analytics, 'social media' became a motor topic since numerous studies (e.g., Mariani *et al*., 2019; Wong *et al.*, 2019) focused on social media and user-generated contents (e.g., analytics of social media contents).

About three years since 2020, much research has been conducted about COVID-19 and technology ('COVID-'). Accordingly, COVID-19 was one of the motor themes showing technology research was well-developed in conjunction with the pandemic. The 'virtual reality' was another main theme, which might be attributed to the fact that virtual trips have become popular due to travel restrictions to prevent the spread of COVID-19. Or, virtual reality technology has developed exponentially recently, and various virtual reality devices have become available, thereby separating virtual reality from the theme smartphones in the 2010s. The 'smart tourism' was located in the borderline between motor themes and basic themes, showing continuous knowledge development since the seminal work by Buhalis and Amaranggana (2013). The 'artificial intelligence' (keywords: service robot, automation, robotics) was the most critical theme, although the density (degree of development) was not so

high. Among 122 articles from 2020 to 2022, 45 articles (37%) had keywords related to artificial intelligence, demonstrating the importance of advanced technologies. Despite 'social media' being a motor theme in the 2010s, it became a basic theme in the 2020s, possibly because the proportion of articles that used social media as keywords decreased from 34% to 10%. Interestingly, 'self-service technology,' a keyword in hotel themes in the 2010s because they were most prevalent in the hotel industry, became a theme. Perhaps, the increasing number of self-service technologies in the entire hospitality and tourism industry might be the underlying reason. The future directions for hospitality and tourism technology research are discussed in the next section. Most of these findings are different from what previous review studies on the technological development in hospitality and tourism found. For example, the emergence of COVID-19 as an important and much-studied theme has not been indicated and smart tourism has been often regarded as a theme which has been under-researched in the previous review studies (Cai *et al.*, 2019; Law *et al.*, 2019; Yuan *et al.*, 2019). By covering a recent period of time, our findings show what research themes have changed in terms of their importance and appeared within the last few years.

Conclusions

Using bibliometric analysis, all research objectives were achieved. First, this research identified the increasing importance of hospitality and tourism technology research by finding the growth in both the number and portion of technology research in the discipline and the increase rate. Second, this research examined the evolution of technology research in hospitality and tourism discipline technology by depicting six major clusters of the disciplinary structure (i.e., technology adoption, research methods/statistics, business utilization of information system, consumers' utilization of information technology, robots, and virtual reality) and by detecting a list of major intellectual turning points via co-citation analysis (e.g., websites, social media, mobile devices, virtual reality, online platforms and user-generated contents, self-service kiosks, and robots). Third, this research investigated the trends and technology shifts in hospitality and tourism technology research by exploring the major topics (e.g., 'website': 1994, 'mobile apps': 2009, 'robot': 2016) and themes across different time periods (e.g., a motor theme in the 2000s: internet marketing, that in the 2010s: social media, that in the 2020s: virtual reality) via thematic evolution and thematic mapping analyses. In the following section, this research suggests directions for future research of hospitality and tourism technology based on the findings to achieve the last aim.

Future Hospitality and Tourism Technology Research

As the development of technology has accelerated, the topical shift of technology research has also been also expedited. Thus, future studies were proposed based on the results of co-citation cluster analysis and thematic mapping from 2020 in order to provide the most up-to-date ideas. According to the thematic mapping results, most of the themes were categorized as basic themes, indicating these themes are highly important but need further development. Particularly, the theme artificial intelligence, which included keywords of artificial intelligence, robots, automation, blockchain, cryptocurrency, and big data, was the top in its centrality (importance) but ranked as the lowest in knowledge development. Hence, considering co-citation network results, researchers are strongly recommended to investigate the factors affecting the adoption of artificial intelligence, blockchain, and robots (Cluster 1). However, it should be noted that the morphism of robots was relatively well developed, even though additional knowledge development was essential. Future studies examining the role of artificial intelligence (e.g., automated service, robots) in creating consumer experience (Clusters 4 and 5) would be beneficial. Furthermore, it is imperative to identify how artificial intelligence can be utilized in the industry (Cluster 3). For example, the strategic utilization of big data in the hospitality and tourism industry and its operational benefits can be a potential area of research.

Another potential research area is restaurant technology. The implementation of technology in restaurants became common recently because of the outbreak of COVID-19. Accordingly, technologies in restaurant were found to be the second critical theme in technology research since 2020, such as consumers' adoption of restaurant technologies. Since it is unclear whether consumers will continuously use technologies when the COVID-19, pandemic is over, future studies about consumers' perceived value of services that are delivered by technologies and intention to continue their use of restaurant technology would be beneficial (Cluster 1). Also, consumer experience with technology (e.g., self-service technology, robots) and how consumers perceive service failure that is resulted from technology are worth investigating (Cluster 4).

Considering smart tourism is defined as the enhanced quality and experience of various stakeholders supported by the integration of technology (Jeong and Shin, 2020), the embedment

of smart technology in the hospitality and tourism industry can be seen as smart tourism from a broader perspective, describing the substantial importance of the theme. However, knowledge development has been deficient compared to the importance of smart tourism research. Since much smart tourism research has focused on smart tourism destinations (Gretzel *et al.*, 2015), travelers' experience at smart tourism destinations (Buhalis and Amaranggana, 2015) and smart tourism technology (Jeong and Shin, 2020), future studies on different stakeholders' value co-creation at smart tourism destinations would be valuable. Furthermore, assessing the return on investment of smart tourism, such as traveler satisfaction, economic growth, resident satisfaction, and environmental sustainability, would offer substantial practical implications. Specifically, the longitudinal approach would describe the increasing effectiveness of smart tourism and/or the stakeholders' psychological and behavioral changes.

Theoretical and Practical Implications

Technology has been recognized as one of the most influential changes in the industry. Accordingly, much research about technology in the hospitality and tourism industry has been conducted. However, despite the rapid growth of technology research, literature on how technology research has evolved was still scarce, resulting in an incomplete picture of technology research development. By employing bibliometric analysis, this study synthesized the literature on hospitality and tourism technology from 1990 to 2022 (January), facilitated the accumulation of knowledge in hospitality and tourism technology, and provided a potential direction for researchers. In other words, this study analyzed the knowledge structure and development of hospitality and tourism technology research for the past three decades, thereby contributing to the literature.

This study contributes to the hospitality and tourism literature as it provides an overview of how technology research has developed in the hospitality and tourism discipline. One of the key contributions of this study lies in the broader coverage of technology articles. To the best knowledge of the authors, this study is the first attempt encompassing general technology research in the hospitality and tourism discipline. While many studies well portrayed the knowledge development about a specific type of technologies, such as artificial intelligence (Huang *et al.*, 2021; Li *et al.*, 2021), online platforms (Zhou et al., 2021), self-service technology (Shin and Perdue, 2019; Shiwen *et al.*, 2021), social media (Nusair *et al*., 2019), or smart tourism (Johnson and Samakovlis, 2019), and technologies in a certain area, such as human resource management (Gonzalez *et al.,* 2020), sharing economy (Mody *et al.*, 2021) or dining services (Gonzalez *et al.*, 2022), this study used a more comprehensive approach when selecting articles. In other words, different from previous studies focusing on a specific technology or area of application, this study did not limit the areas to a specific technology or theme, thereby describing a holistic picture of how technology research has developed and the topical trends in hospitality and tourism research. For example, the holistic approach of this study indicated two clusters that were associated with particular technologies: robot (Cluster 5) and virtual reality (Cluster 6). Furthermore, these two technologies were consistent with the findings of topic trends and thematic evolvement. Thus, the findings showed which technology was popular for a certain period and the shift of researchers' attention on technology over time, which was unable to be found in other bibliometrics papers focusing on a specific type of technology.

Second, this study has a comprehensive coverage in it time span, domains, and methodologies. Specifically, this study covered a broad time span of technology research, ranged from 1990 to 2022. Although previous literature review research on technologies covered less

than or about a decade (Khatri, 2019; Law *et al.*, 2009; Law *et al.*, 2019; O'Connor and Murphy, 2004), this study analyzed technology articles published over a 30-year period. Thus, the results of this study revealed the growing status of technology research in the hospitality and tourism discipline. While researchers and industry practitioners have noticed the increasing importance of technology in the hospitality and tourism industry, the growing status of technology research has not been documented. By dividing the time period into four time period based on publication year (i.e., 1990s, 2000s, 2010s, and from 2020), the present study illustrated increasing volume and importance of technology research over time. Furthermore, this study did not limit the domain or technique of research. Particularly, the articles collected for this study involved various research domains, such as consumer behavior (e.g., consumer technology adoption, consumer satisfaction) (Wang *et al.*, 2012; Xiang and Gretzel, 2010), organizational behavior (e.g., internal marketing, employee technology adoption, employees' perception of technology) (Kim *et al.*, 2008; Kothari *et al.*, 2005), strategic management and business innovation (e.g., strategic utilization of information technology, performance management) (Buhalis, 2003; Poon, 1993), and so on. This study well-described the umbrella of the hospitality and tourism industry, as the contexts of the collected articles encompassed the various sectors of the industry (e.g., hotel, restaurant, event, tourism). The articles showed the diversity in methodology and data type of technology research, including qualitative approach (conceptual paper, literature review, in-depth interviews, etc.) and quantitative approach (survey, big data, SEM, PLS-SEM, etc.). Accordingly, the current study demonstrated that technology research has been continuously developed by extending its methodological approaches and data analysis techniques.

From methodological perspectives, this study used reference-based co-citation analysis. The results of co-citation analysis exhibited that two clusters (technology adoption, research methods and statistics) were closely associated with other disciplines, such as psychology and business, demonstrating the interdisciplinary nature of hospitality and tourism technology research. Furthermore, using thematic mapping, this study categorized the identified themes into one of the four quadrants based on their centrality and density. Particularly, how themes were evolved was identified by conducting thematic mapping not only for the entire period but also by decade. Based upon the identified themes' importance (centrality) and the degree of development (density), potential areas of future research were proposed as well as challenges. Accordingly, researchers would have a clearer understanding of the current status of technology research development and plan future studies in the proposed areas. In addition, the results also showed the proportion of technology research for each journal, thereby helping researchers to see which journal has the best fit with their research. For instance, the findings indicated that IJCHM has the highest proportion of technology research. Therefore, junior researchers or postgraduate students who are not familiar with various journals fits might consider IJCHM as their first choice if their research is about technology.

Lastly, this study also offers practical implications. This study synthesized past three decades of technology research in the top hospitality and tourism journals. Due to the time constraints, it is challenging for industry practitioners to keep up with the huge volume of academic research on hospitality and tourism technology. Accordingly, although research papers provide both theoretical and practical insights, the practical implications could not fully reach out to industry practitioners. By synthesize previous technology research published in top-tier journals in the hospitality and tourism discipline, this study can play as a reference for industry practitioners to find relevant academic articles for their situations. For example, if a hotel plans to implement service robots and wants to understand the factors affecting consumers' adoption

of service robots and its consequences, they might want to check the articles in Custer 1 (Technology Adoption), Cluster 4 (Consumers' Utilization of Information Technology), and Cluster 5 (Robots) to increase their understanding of how consumers perceive service robots. If a tourism destination considers introducing virtual reality, the destination might check Cluster 5 (Virtual Reality) to understand the key components of virtual reality in creating positive responses.

Limitations

This study is subjected to some limitations. First of all, the findings of this study were based on the six top-tier journals in the hospitality and tourism discipline. Although the selected journals are the leaders of hospitality and tourism knowledge development, future studies are strongly suggested to expand the target journals to further compare the knowledge development and evolvement of technology research published in different tiers of journals. In addition, this study relied on a single platform as the data source. Thus, researchers may employ multiple data sources (e.g., WoS, Google Scholar, Dimensions) so that broader ranges of academic publications (e.g., books, conference proceedings, dissertations) can be retrieved for their analyses. Lastly, publications that did not use the term 'technology' were not included in this study even though they investigated technology in the hospitality and tourism context. Accordingly, future studies are recommended to broaden their search keywords based on the results of the topical trends in this study to increase the coverage of their research.

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Xiang, Z. and Gretzel, U., 2010. Role of social media in online travel information search. *Tourism Management*, *31*(2), pp.179-188.

Zhao, Y. and Bacao, F., 2020. What factors determining customer continuingly using food delivery apps during 2019 novel coronavirus pandemic period?. *International Journal of Hospitality Management*, *91*, p.102683.

Figures

Figure 1. Technology Research by Year

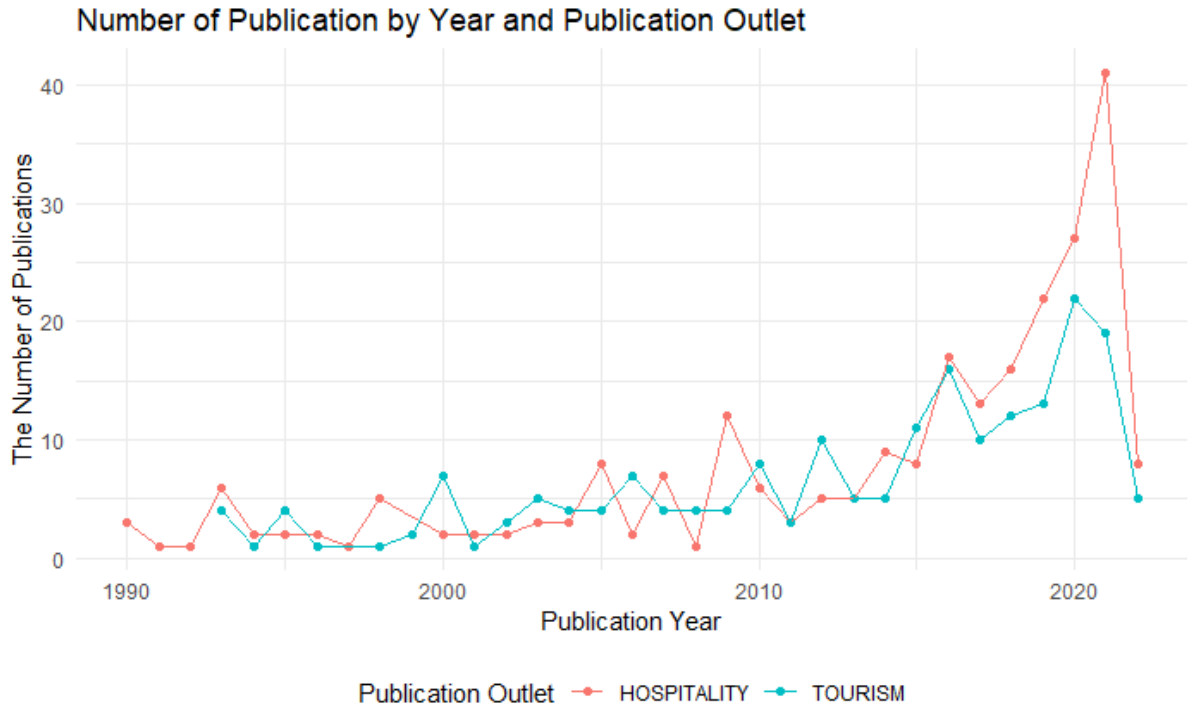
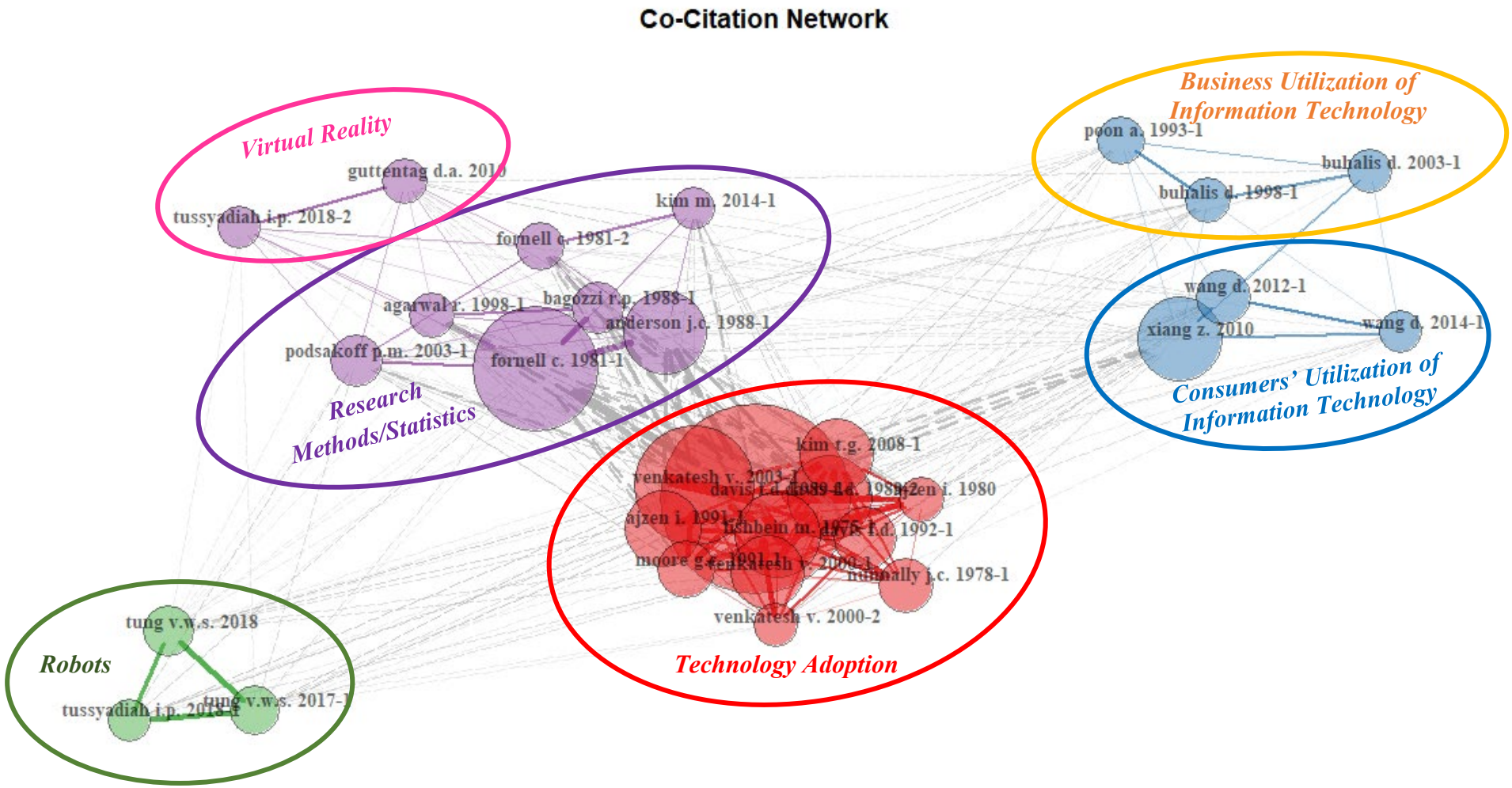
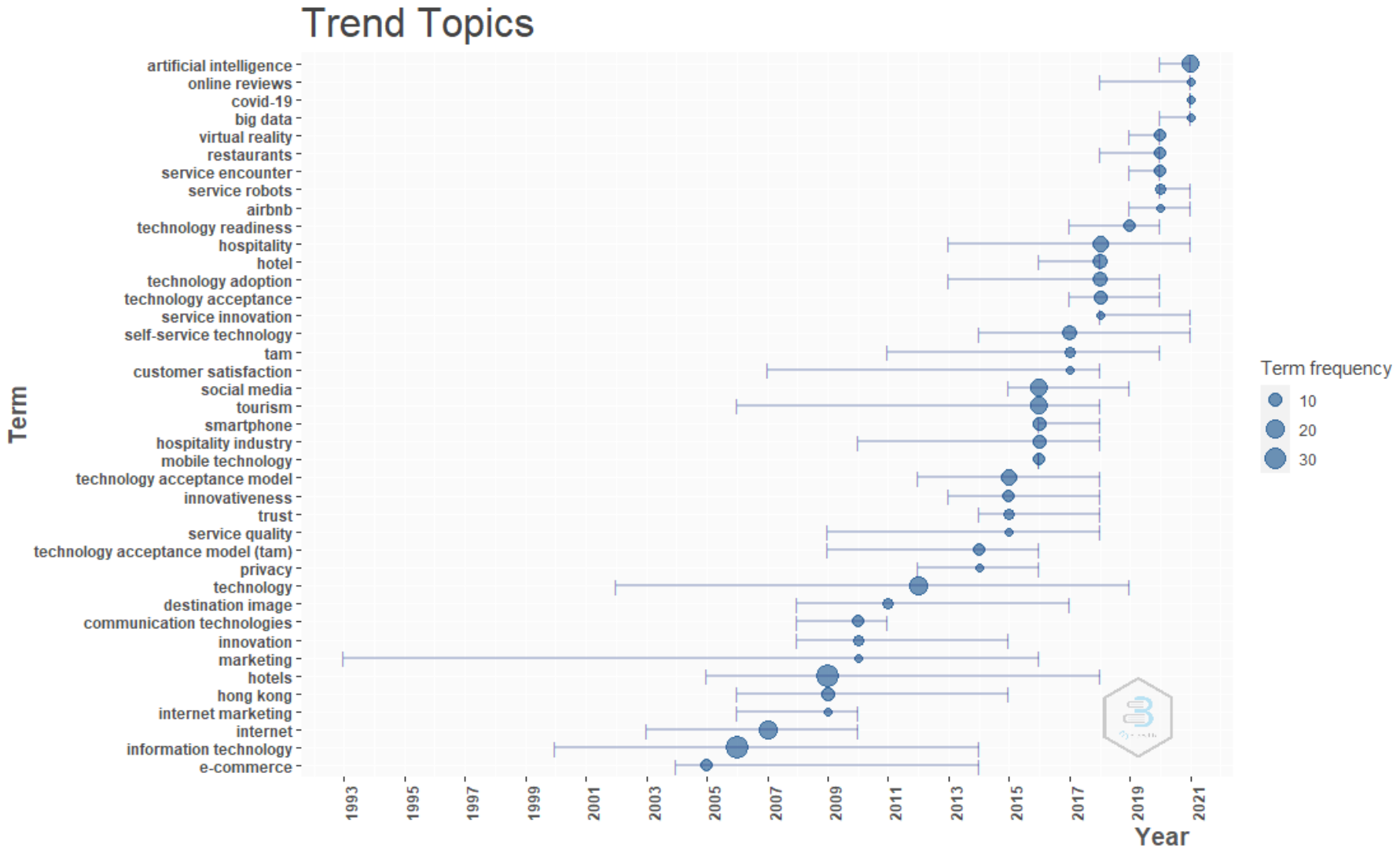


Figure 2. Co-Citation Network



Note. Analysis method = Co-citation; Network = Reference; N = 30; The size of circle represents the number of citations.

Figure 3. Topical Trend by Year based on Author-Defined Keywords



Note. The minimum frequency was set at 5: If a keyword appeared less than 5 times a year, it was not marked in the figure. The horizontal line for each keyword indicate the range between first quartile and third quartile.

Figure 4. Thematic Map based on Author-Defined Keywords

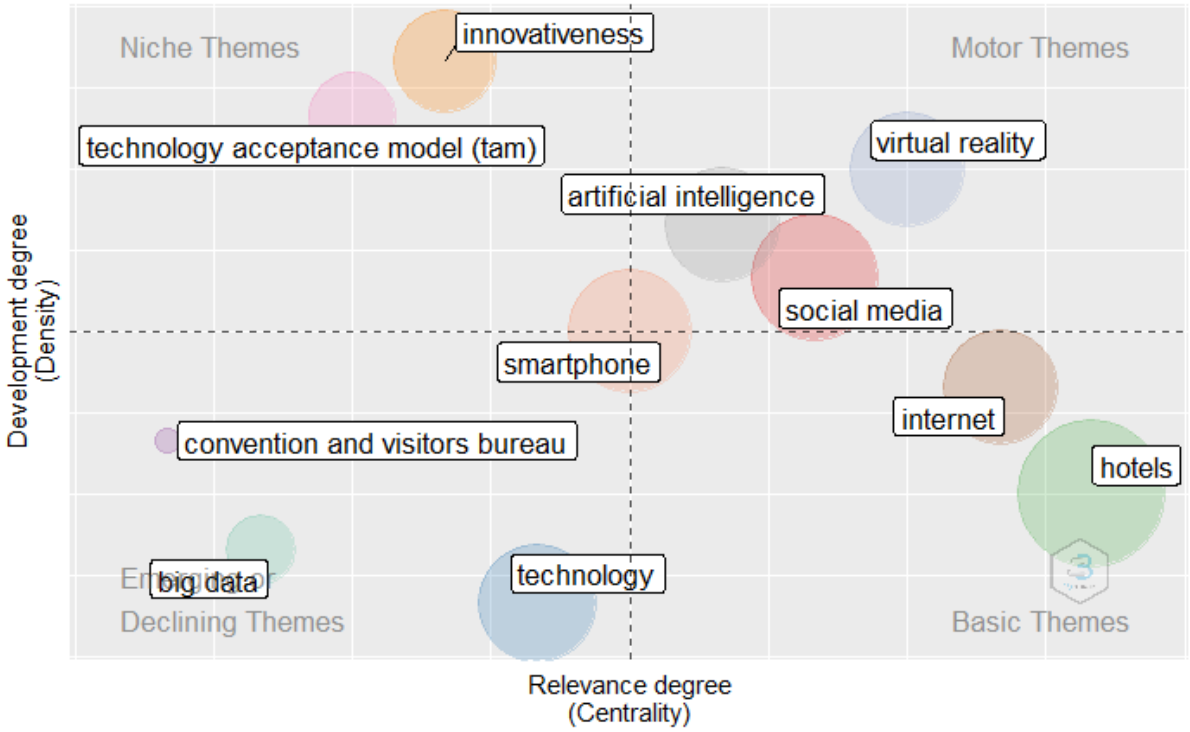
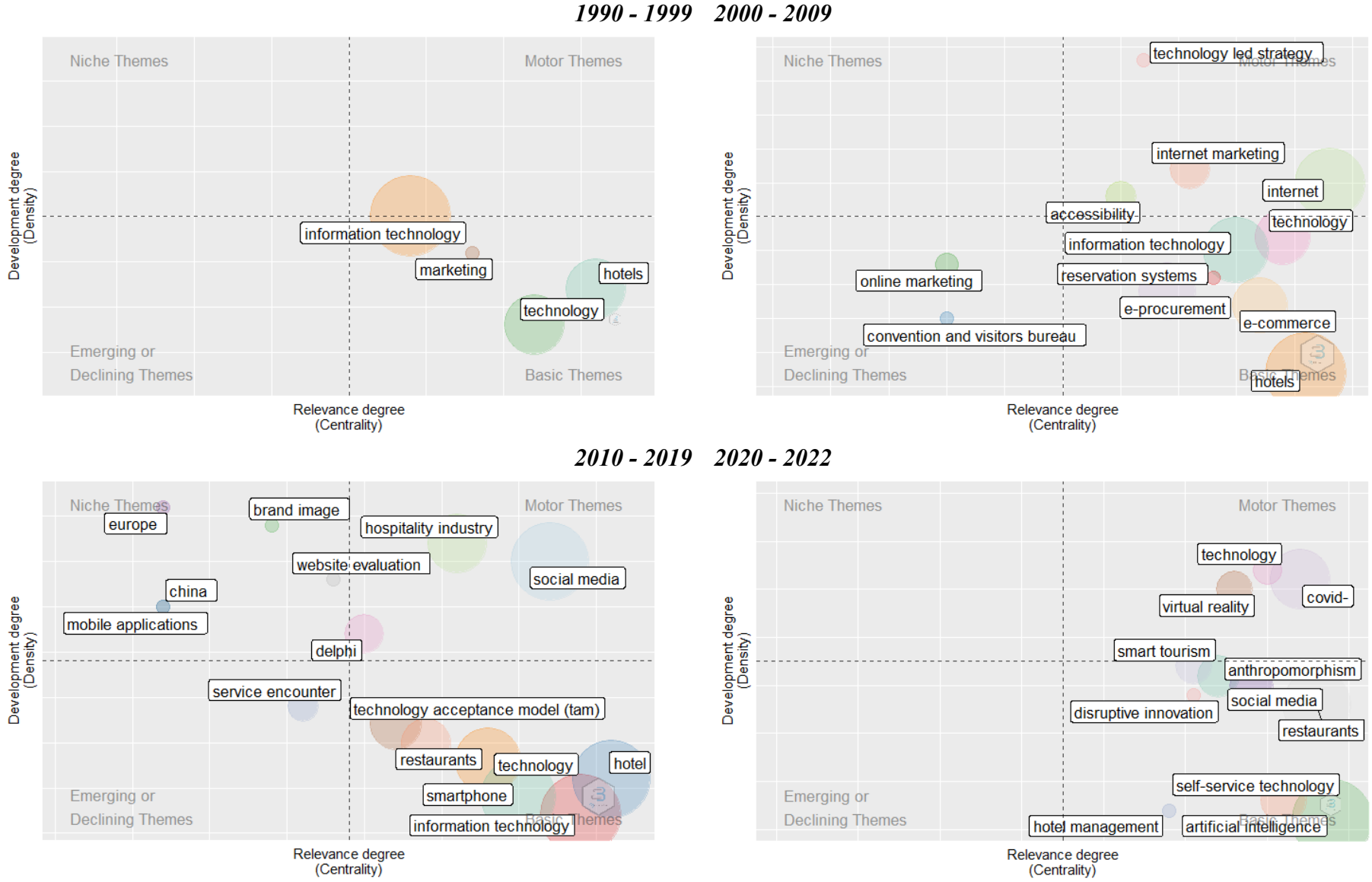


Figure 5. Thematic Map by Decade based on Author-Defined Keywords



Tables

Table 1. Descriptive Analysis of Technology Research

MAIN INFORMATION ABOUT DATA					
Timespan	1990-2022	1990-1999	2000-2009	2010-2019	2020-2022
Sources	6	6	6	6	6
Documents	440	36	85	197	122
Average years from publication[a]	8.69	27.4	16.8	6.34	1.3
Average citations per documents	60.47	37.61	118.7	69.19	12.57
Average citations per year per doc	6.978	1.423	7.163	9.331	4.689
References	26865	788	3350	14047	9397
DOCUMENT CONTENTS					
Keywords Plus (ID)[b]	331	24	97	216	123
Author's Keywords (DE)[c]	1443	61	255	769	553
AUTHORS					
Authors[d]	840	41	149	406	340
Author Appearances[e]	1186	49	193	542	402
Authors of single-authored documents	61	20	13	23	5
Authors of multi-authored documents	779	21	136	383	335
AUTHORS COLLABORATION					
Single-authored documents	70	24	15	26	5
Documents per Author	0.524	0.878	0.570	0.485	0.359
Authors per Document	1.91	1.14	1.75	2.06	2.79
Co-Authors per Documents	2.7	1.36	2.27	2.75	3.3
Collaboration Index	2.11	1.75	1.94	2.24	2.86
ANNUAL SCIENTIFIC PRODUCTION					
Annual Percentage Growth Rate	4.688913	-4.405192	6.601708	10.71732	-

Note. [a]*: The average years from publication to be cited.*

[b]*: The keywords associated by SCOPUS database.*

[c]*: The keywords provided by the author(s).*

[d]*: The frequency distribution of authors.*

[e]*: The number of authors' appearances*

Table 2. Distribution of Technology Research

	N of published articles	N of technology articles	Percentage of technology articles over total publication
By Period			
1990 - 1999	2440	36	1.5%
2000 - 2009	2859	85	3.0%
2010 - 2019	6104	197	3.2%
2020 - 2022	2481	122	4.9%
By Journal			
ATR (Tourism)	2533	34	1.3%
JTR (Tourism)	1700	59	3.5%
TM (Tourism)	3458	102	2.9%
IJHM (Hospitality)	2764	100	3.6%
IJCHM (Hospitality)	2200	105	4.8%
JHTR (Hospitality)	1139	40	3.5%
Subtotal (Tourism)	7711	195	2.5%
Subtotal (Hospitality)	6103	245	4.0%
Total	13814	440	3.2%

Table 3. Most Cited Articles

Period	Paper	TC[a]	TCY[b]	NTC[c]
1990 - 2022	Buhalis & Law (2008)	1628	108.5	2.27
	Litvin *et al*. (2008)	1426	95.1	1.99
	Guttentag (2010)	521	40.1	5.29
	Buhalis (1998)	515	20.6	4.24
	Munar & Jacobsen (2014)	479	53.2	3.78
	Pan *et al*. (2007)	460	28.8	4.40
	Stamboulis & Skayannis (2003)	386	19.3	4.07
	Buhalis & Licata (2002)	335	16.0	2.58
	Tussyadiah & Fesenmaier (2009)	322	23.0	4.71
	San Martín & Herrero (2012)	316	28.7	3.20
1990 - 1999	Buhalis (1998)	515	20.600	4.24
	Buhalis & Main (1998)	128	5.120	1.05
	Williams & Hobson (1995)	96	3.429	2.63
	Cheong (1995)	92	3.286	2.52
	Walle (1996)	76	2.815	2.40
	Sheldon (1993)	62	2.067	3.28
	Bennett (1993)	36	1.200	1.90
	Connell & Reynolds (1999)	34	1.417	1.89
	Stipanuk (1993)	29	0.967	1.53
	Cho & Olsen (1998)	28	1.120	0.23
2000 - 2009	Buhalis & Law (2008)	1628	108.5	2.272
	Litvin *et al*. (2008)	1426	95.1	1.991
	Pan *et al*. (2007)	460	28.8	4.400
	Stamboulis & Skayannis (2003)	386	19.3	4.074
	Buhalis & Licata (2002)	335	16.0	2.581
	Tussyadiah & Fesenmaier (2009)	322	23.0	4.709
	Doolin *et al*. (2002)	227	10.8	1.749
	Kim *et al*. 2009.	225	16.1	3.291
	Orfila-Sintes *et al*. (2005)	212	11.8	2.395
	Kim *et al*. (2008)	210	14.0	0.293
2010 - 2019	Guttentag (2010)	521	40.1	5.29
	Munar & Jacobsen (2014)	479	53.2	3.78
	San Martín & Herrero (2012)	316	28.7	3.20
	Law *et al*. (2014)	306	34.0	2.41
	Casaló *et al*. (2010)	285	21.9	2.89
	Escobar-Rodríguez & Carvajal-Trujillo (2014)	274	30.4	2.16
	Amaro & Duarte (2015)	262	32.8	2.97
	Ayeh *et al*. (2013)	258	25.8	2.20

	Wang *et al*. (2016)	253	36.1	4.52
	Tussyadiah *et al*. (2018)	240	48.0	4.88
2020 - 2022	Kim *et al*. (2020)	133	44.3	5.51
	Shin & Kang (2020)	97	32.3	4.02
	Tussyadiah (2020)	94	31.3	3.90
	de Kervenoael *et al*. (2020)	73	24.3	3.03
	Dolnicar & Zare (2020)	68	22.7	2.82
	Kim *et al*. (2021)	62	31.0	10.69
	Zhao & Bacao (2020)	56	18.7	2.32
	Park (2020)	45	15.0	1.87
	Jeong & Shin (2020)	34	11.3	1.41
	Gunden *et al*. (2019)	34	11.3	1.41

Note. [a] *= Total Citation;* [b] *= Total Citation per Year;* [c] *= Normalized Total Citation*

Table 4. Top Hospitality and Tourism Technology Articles with High Between Centrality

Article	Betweenness Centrality	Context	Methodology	Research Purpose
Morosan & Jeong (2008)	121.77	Hotel	Survey	To investigate how users' perceived usefulness, ease of use, and playfulness influence their attitude toward hotel reservation websites.
Xiang & Gretzel (2010)	94.28	Tourism	Search Engine Data	To examine the degree of which social media appear in search engine results in the tourism context.
Wang & Wang (2010)	88.59	Hotel	Survey	To develop a research model explaining gain and loss components affecting hotel guests' value perception and mobile hotel reservation system adoption.
Casaló *et al*. (2010)	81.62	Hospitality & Tourism	Survey	To investigate the key factors influencing consumers' intention to participate in a firm-hosted online travel community.
Kim *et al*. (2008)	76.78	Hotel	Survey	To identify the relationships among information system quality, perceive ease of use, perceived usefulness, perceived value, attitude toward hotel front office systems, and actual use of hotel front office systems.
Lee *et al*. (2012)	61.68	Events	Survey	To examine the effects of users' emotion on behavioral intentions toward events promoted through social media.
Wang *et al*. (2012)	51.54	Tourism	Online Review	To understand travelers' use of smartphones for their travel purposes.
Kim & Qu (2014)	49.50	Hotel	Survey	To investigate the factors affecting travelers' adoption of hotel self-service kiosks.
Litvin *et al*. (2008)	41.79	Hospitality & Tourism	Conceptual Paper	To understand eWOM as a cost-effective tool for the industry and discuss potential issues for hospitality and tourism marketers.
Buhalis & Law (2008)	31.73	Hospitality & Tourism	Literature Review	To analyze major IT developments and their effects on the tourism industry.

Supplementary Materials

Supplementary Material A. Search query for the data collection

The following was the search query for the data collection:

((ISSN (01607383) OR ISSN (00472875) OR ISSN (02615177) OR ISSN (10963480) OR ISSN (02784319) OR ISSN (09596119)) AND TITLE-ABS-KEY ("Technology" OR "IT" OR "ICT") AND PUBYEAR > 1989) AND (LIMIT-TO (DOCTYPE,"ar"))