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Review

Mobile Communications for Tourism and Hospitality: A Review of Historical Evolution, Present Status, and Future Trends

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Abstract: As the fifth-generation (5G) mobile communication technology captures public attention, reviewing the first to fourth generations with the anticipated implications of 5G and afterward, and future research would present a useful value to the literature. This study uses a systematic content analysis methodology to provide a comprehensive and interdisciplinary review of mobile communication research in tourism and hospitality to help academic researchers and industry practitioners understand the research area. The study also analyzes the future changes that mobile communication technologies and their applications will bring to tourism and hospitality research trends and industry practices. This study not only contributes to identifying some research gaps in the extant research, but can also provide significant theoretical guidance and practical implications for further academic and industrial research related to mobile communication technologies in tourism and hospitality.

Keywords: mobile communication technology; 5G; tourism and hospitality; interdisciplinary research; content analysis

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1. Introduction

The fifth-generation (5G) mobile communication technology era officially began in 2020. The future effect of mobile communications on hotels and tourism needs to be anticipated. Mobile communication iterates once every decade. Based on previous generations, the new generations of mobile communication systems are innovated and developed with high indicators and new features [1]. In the 1980s, the first generation (1G) only provided voice or messaging services. In the 1990s, the second generation (2G) had voice data and SMS facilities. The third generation (3G), which coincided with the 21st century, provided high-speed data, voice, picture, and video services. In the 2010s, the fourth generation (4G) met people's needs for dynamic information access [2]. For example, the representative product of the 1G era is a phone that can call within a specified area. The mobile phone of the 2G era had functions of making calls, sending messages, and low-speed internet access, whereas that of the 3G era could process images, music, and videos. The live video and online payment functions were only enabled in the 4G era. However, with the rapid growth of the number of mobile devices, data volume, and data rate [3], 4G fails to meet people's increased demands for speed, connection, performance, and services. Therefore, 5G mobile communication technology is important.

Compared with 4G, 5G latency is reduced by a factor of five, the number of connected devices increases by a factor of 10, and mobile data expands by a factor of 1000, while user data rates and battery life increase [4]. Specifically, 5G ensures an improved experience, extremely low end-to-end latency, higher capacity, high-speed data transmission, lower

cost, and larger device connections [5]. Furthermore, 5G is user-oriented [6]. Users can use 5G characteristics and advantages, which means that mobile communications can become intelligent, traditional mobile service capabilities can improve, and various networks can be connected to form a unified system [7]. These benefits provide the public with a truly wireless world [4]. The application of 5G further supports various industries and fields [8]. For example, intelligent transportation, autonomous driving, smart city, smart agriculture, mobile healthcare, industrial automation, ultra-high-definition video live broadcast, and ultra-smooth augmented reality (AR) and virtual reality (VR) [9] experiences can all be realized. New technologies and features of mobile communications also bring new changes to tourism and hospitality.

Although mobile communication technology has long been used in the hotel and tourism industry, the corresponding academic research on "tourism/hospitality and technology" remained limited. For instance, Law et al. [10] collected mobile-related research published in the magazine Hotel and Travel from 2002 to 2017 based on specific dimensions from the perspectives of suppliers and consumers. Dorcic et al. [11] reviewed articles in smart tourism related to mobile technology and applications from 2012 to 2017 and divided them into the following three perspectives: consumer, technology, and provider. These previous studies provided strong support for the application of mobile communication technology in hotels and tourism from theory and practice. However, the speed of academic research differs from that of rapid technological development. In detail, previous review studies only covered the technologies until 4G and lacked analyses of 5G and its future development. Second, research was often based on articles in tourism and hospitality without reviewing those in other areas. Therefore, the present study attempts to bridge the above two knowledge gaps using content analysis, combined with the relevant literature after the emergence of 5G. Bridging these knowledge gaps can make a broader cross-disciplinary review of research from 1G to 5G mobile communications in tourism and hospitality. In particular, this study explores the effect of each generation of mobile communication and the changes brought about in tourism and hospitality. Different from empirical studies, as a review article, the objectives of this study are threefold. First, this study aims to provide an in-depth literature review and summarize the previous research with examples of the latest applications and stakeholder acceptance of mobile communication technology in tourism and hospitality. Second, this study aims to help relevant academia and industry personnel understand the research field [12]. Finally, the study intends to grasp the effect of future 5G mobile communication technology and its applications on tourism and hospitality to a certain extent, rather than presenting new theories or insights in response to research gaps [10,11]. Hence, pioneering on looking backward across 1G–4G with anticipation of 5G implications and future research, this study provides important theoretical guidance and practical significance for academia and industry to conduct further research of mobile communication technology in tourism and hospitality.

2. Methodology

This study uses content analysis, which allows researchers to obtain detailed concepts and insights by combining the analysis with the actual text to achieve objective conclusions [13]. In addition, this analysis is a systematic and rigorous method based on the four main steps, namely, data collection, data encoding, analysis, and the interpretation of the coded content [14]. Therefore, content analysis meets quantitative and qualitative research purposes and is used in an inductive or deductive manner [15]. Whether content analysis is a quantitative or a qualitative method is a controversy in academia. This study follows the viewpoint of Camprubí et al. [16] and regards content analysis as a mixed method. Applying content analysis can provide the following three main advantages. First, the flexibility of analysis can obtain the content from the statistical information of the text, to interpret the content as needed. Second, the usage cost of this method is low, and computer-aided text analysis technology provides convenience [17]. Third, the samples of

content analysis are mainly derived from objective data and are not affected by researchers' demand bias and informant recall bias [18].

The study is conducted with reference to and in conjunction with the systematic literature review approach of Kitchenham et al. [19] and the data coding mode of Kim et al. [20]. The steps of the content analysis method are documented below.

2.1. Search Process

According to the main steps of the content analysis method, the data collection began by searching and collecting the related literature on 1G to 5G mobile communication systems and hospitality/tourism published as of mid-March 2021. For an extensive literature collection, the search included articles from multiple online databases, including Web of Science, Elsevier Science Direct, SAGE, Emerald, Taylor and Francis, EBSCOhost, and Wiley Online databases. The search terms used were a combination of "1G", "2G", "3G", "4G", "5G", or "mobile communication" and "tourism", "travel", "hotel", or "hospitality" with "technology" [12,20,21]. A researcher responsible for searching the literature meticulously reviewed the retrieved papers for relevance based on inclusion and exclusion criteria, and another researcher verified the findings at this stage.

2.2. Inclusion and Exclusion Criteria

In screening the literature, a researcher carefully read and screened each article for analysis based on following three inclusion criteria:

- To ensure the scientific quality and rigor of the reviewed articles, the type of literature included needs to be research or review papers;
- The included articles must be related to mobile communications and hospitality/tourism. That is, terms related to mobile communication technologies (e.g., mobile communications, 1G–5G, and mobile technologies) and hospitality/tourism (e.g., hotels, tours, and restaurants) were included in the title, abstract, and keywords of the article. Based on this, the researchers further read through the entire article to ensure that the included studies are closely related to the topic of this research;
- Personal biases that may occur in the selection process [22] are minimized using the consensus of two researchers for literature inclusion. Subsequently, 108 articles were finally obtained for analysis.

2.3. Data Encoding

In this step, one researcher coded the data for the information obtained, and another checked the data extraction. When disagreements arose, the researchers discussed and agreed on the disagreements. The data extracted from each article in this research were as follows:

- Literature sources and complete references;
- Main discipline area to which the publication belongs;
- Year of publication;
- Research methods (qualitative methods, quantitative methods, or a mixture of both);
- Research questions and topics;
- Whether the study used a theoretical/theoretical model and specifically what the theoretical/theoretical model is;
- Type of data used in the study (primary, secondary, simulated, or mixed data);
- The mobile communication technology context to which the study belongs;
- Functional areas or applications of mobile communication technology in tourism and hospitality that the study is primarily focused on;
- The country/regional context in which the study is based.

2.4. Data Analysis and Interpretation of the Coded Content

Based on the collected literature and its coded data, this study develops content analysis and interpretation around the following research questions: (1) the effects and

changes brought by each generation of mobile communication on tourism and hospitality; (2) the effect of future 5G mobile communication technologies and their applications on the tourism and hospitality.

- Annual publication frequency trends of tourism and hospitality mobile communication research;
- Distribution of disciplinary areas and mobile communication system backgrounds to which tourism and hospitality mobile communication research belongs;
- Research methods, data types, and theoretical/theoretical model adoption;
- Relevant areas or applications supported by each generation of mobile communication technologies in hospitality and tourism and their corresponding articles.

In addition, the countries/regions studied by the articles are described and distinguished.

3. Findings

3.1. Trends and Background of Mobile Communication Technology Research in Tourism and Hospitality

Figure 1 shows the frequency of 1G to 5G mobile communications mentioned in tourism and hospitality research. The number of related studies is small at the beginning. Since 2001, academia has paid attention to the effect of mobile communications on tourism and hospitality. From 2001 to 2016, although the number of studies fluctuated, the overall number was still not large. Until 2017, related research gradually and steadily increased. A possible reason is that most hotel and tourism-related mobile communication research does not start from the perspective of 1G–5G mobile communication systems. Thus, the number of censored articles obtained is small. However, with the increasing influence of 4G and 5G mobile communication technologies in recent years, the overall mobile communication systems have gained research attention.

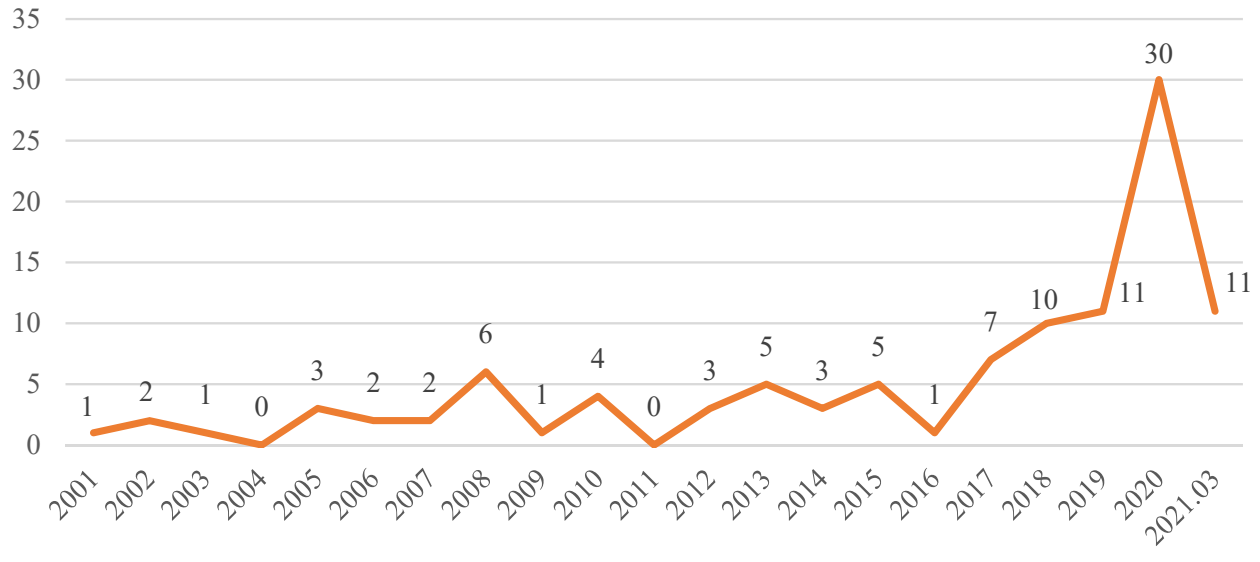

Figure 1. Trend of mobile communication technology research in hospitality and tourism.

Table 1 shows that of the 108 articles reviewed, only 42 are in the areas of hospitality, leisure, sport, and tourism. A total of 39 technical applied academic studies are represented by computer science, information systems, engineering, science and technology, and telecommunications. Furthermore, 13 articles are in transportation and geography. In terms of the generation background, the application of mobile communication in hospitality and tourism and its effect are only revealed in the 3G era. A total of 24 studies had 3G as background (22.22%), and 46 had 4G as background (42.59%). Despite its recent emergence,

5G was used as a research background in 38 articles. The results suggest an increasing trend in mobile communications research in hospitality and tourism. However, compared with other areas, such exploration has considerable room for improvement.

Table 1. Research background of mobile communication technology in hospitality and tourism.

Research Background	Frequency	Percentage
Research areas		
Hospitality, Leisure, Sport, and Tourism	42	38.89%
Computer Science/Information Systems/Engineering/Science and Technology/Telecommunications	39	36.11%
Transportation/Transportation Science and Technology/Geography	13	12.04%
Others (Urban Studies/Business and Economics/Agriculture/Information Science and Library Science/Communication/Public Administration/Education and Educational Research)	14	12.96%
Total	108	100.00%
Mobile communication systems		
3G	24	22.22%
4G	46	42.59%
5G	38	35.19%
Total	108	100.00%

3.2. Uses of Research Methods and Theories or Theoretical Models

Table 2 summarizes the methods, data sources, and theories or theoretical models in the articles. In this part, research was conducted from three perspectives, namely, tourism and hospitality (n = 50), non-tourism and hospitality (n = 58), and total number (n = 108). In terms of methods and data sources, quantitative research (n = 23) is the most commonly used in tourism and hospitality, which uses primary data (n = 25) or secondary data (n = 19). In comparison, non-tourism and hospitality studies mainly used a mix of qualitative and quantitative methods (n = 28) with a wide range of data sources. Secondary data (n = 18), mixed data (n = 18), and simulation (n = 14) show a high frequency of use.

In terms of theoretical foundation, only 30 of the 108 articles explicitly use theory or theoretical models. Among the 50 tourism and hospitality studies, 24 have theoretical foundations. Of the 58 non-tourism and hospitality studies, only six have theoretical foundations. The articles use a total of 23 theories or theoretical models, and they are mostly technology-related, with the technology acceptance model (TAM; n = 5) having the highest frequency.

3.3. Classification of Functional Areas/Applications

The specific changes that mobile communication technology has brought to hotels and tourism are analyzed by carefully dividing the reviewed function areas and applications. Table 3 shows the background of the mobile communication system on which the papers were based. The results indicate that since research on mobile communications in hotels and tourism began, the following seven items appear through each generation of mobile communication systems: travel services (travel self-service/smart service/tourism information system); tourism intelligent transportation/internet of vehicles (IoV) [23]; willingness and intent to use mobile communication technology; tourism/restaurant/hospitality management and marketing; mobile communication service quality; user security and privacy protection; and mobile communication travel experience. In addition, research on high-speed or railway communications and virtual tourism began with 4G and had received increasing attention. These items represent the key changes that mobile communication technology has brought to hotels and tourism. Furthermore, the stakeholders in these

functional areas and applications include customers, industry practitioners, governments, and technology providers.

Table 2. Applied research methods and theories or theoretical models.

-	Hospitality and Tourism Research		Other Research Areas		Total	
-	F	%	F	%	F	%
Methodological approaches						
Qualitative	20	40.00	23	39.66	43	39.81
Quantitative	23	46.00	7	12.07	30	27.78
Mixed methods	7	14.00	28	48.28	35	32.41
Total	50	100	58	100	108	100
Data sources						
Primary data	25	50.00	8	13.80	33	30.56
Secondary data	19	38.00	18	31.03	37	34.26
Simulation	0	0.00	14	24.14	14	12.96
Mixed data	6	12.00	18	31.03	24	22.22
Total	50	100	58	100	108	100
Theoretical foundations						
Yes	21	42.00	4	6.90	25	23.15
No	29	58.00	54	93.10	83	76.85
Total	50	100	58	100	108	100
Theories/Theoretical models						
Technology acceptance model/Technology adoption model	5	10.00	0	0.00	5	4.63
Elaborated likelihood model	1	2.00	0	0.00	1	0.93
Technology–organization–environment framework	1	2.00	0	0.00	1	0.93
Unified theory of acceptance and use of technology	0	0.00	1	1.72	1	0.93
Spreading activation theory	1	2.00	0	0.00	1	0.93
Theory of value co-creation	1	2.00	1	1.72	2	1.85
Modified value attitude–behavior model	1	2.00	0	0.00	1	0.93
Value-based adoption model	2	4.00	0	0.00	2	1.85
Quantile Autoregressive Distributive Lag model	0	0.00	1	1.72	1	0.93
Social cognitive theory	1	2.00	0	0.00	1	0.93
Theory of mind and self-aware	0	0.00	1	1.72	1	0.93
Extended-self theory	0	0.00	1	1.72	1	0.93
Maslow's hierarchy of needs	0	0.00	1	1.72	1	0.93
Theory of reasoned action	1	2.00	0	0.00	1	0.93
Theory of planned behavior	1	2.00	0	0.00	1	0.93
Grounded theory	1	2.00	0	0.00	1	0.93
Innovation diffusion theory	1	2.00	0	0.00	1	0.93
Big data specific framework	1	2.00	0	0.00	1	0.93
Agent-based modelling	1	2.00	0	0.00	1	0.93
Unified theory of acceptance and use of technology	2	4.00	0	0.00	2	1.85
Smart destination model	1	2.00	0	0.00	1	0.93
Contextual marketing theory	1	2.00	0	0.00	1	0.93
Information system success model	1	2.00	0	0.00	1	0.93

Note: F = frequency; % = percentage.

Table 3. Functional areas or applications of mobile communication technology in hospitality and tourism.

Systems	Functional Areas/Applications	Frequency	Publications	Total	Percentage
3G	Network mobility	1	Huang et al. [24]	10	9.26%
	Wireless systems	1	Chevillat et al. [25]		
	Knowledge-driven destination	1	Racherla et al. [26]		
	Tourism future trends	1	Yeoman et al. [27]		
	New generation mobile communication services	1	Hultkrantz [28]		

Table 3. *Cont.*

Systems	Functional Areas/Applications	Frequency	Publications	Total	Percentage
	Balance between the use of electronic communications and travel	1	Roy et al. [29]		
	Tourism spatial interaction	1	Kwan [30]		
	Tourist security monitoring	1	Hu et al. [31]		
	Navigation support for visually impaired pedestrians	1	Hunaiti et al. [32]		
	Navigation aid to tourists	1	Chang [33]		
4G	The impact of mobile technology on travel behavior	2	Dal Fiore et al. [34], Ciochetto [35]	15	13.89%
	Situation of hotels adopting mobile technology	1	Leung et al. [36]		
	4G wireless scenarios	1	Iera et al. [37]		
	Mobile tourism research trends	1	Liang et al. [38]		
	Visitor monitoring	1	Miyasaka et al. [39]		
	Countryside tour	1	Li [40]		
	User acceptance of mobile taxis	1	Ooi et al. [41]		
	Mobile learning	1	Tu et al. [42]		
	Intermediate connection and sense of belonging in the travel experience	1	Berry et al. [43]		
	Travel-based multitasking	1	Pawlak [44]		
	Location and guidance in a non-internet connected environment	1	Lodeiro-Santiago et al. [45]		
	Tourist decision-making	1	Zhang et al. [46]		
	Human mobility patterns base on mobile signaling data	1	Xu et al. [47]		
	Mobile payment	1	Uwamariya et al. [48]		
5G	Intelligent monitoring and protection of infrastructure based on the IoT	1	Lerario et al. [49]	12	11.11%
	Analysis of tourist time usage and spatiotemporal activity patterns	1	Xu et al. [50]		
	Developing an eMarketing model for tourism and hospitality	1	Chiang [51]		

Table 3. *Cont.*

Systems	Functional Areas/Applications	Frequency	Publications	Total	Percentage
	Smart Museum	1	Chen et al. [52]		
	Digital interactive archaeological site/museum	1	Quattrini et al. [53]		
	5G core network agile management	1	Choi et al. [54]		
	Technical support for large-scale cultural and sports activities	1	Kassens-Noor et al. [55]		
	Beach monitoring, connection communication, and data management framework	1	Alam et al. [56]		
	Smart city information management	1	Stone et al. [57]		
	High-frequency forecasting/Travel forecasting	1	Ramos et al. [58]		
	Smart business	1	Ballina [59]		
	Smart city sports tourism	1	Liao et al. [60]		
3G–5G	Travel services (travel self-service/smart service/tourism information system)	9	Agarwal et al. [61], Mahapatra et al. [62], Bhatt [63], Rodriguez-Sanchez et al. [64], das Neves et al. [65], Bae [66], Inkinen [67], Beritelli et al. [68], Jing et al. [69]	41	37.96%
	Tourism intelligent transportation/IoV	7	Lu et al. [70], Mastrosimone et al. [71], Lee et al. [72], Zhao et al. [73], Gundlegård et al. [74], Stathopoulos et al. [75]; Qian et al. [76]		
	Willingness and intent to use mobile communication technology	6	Xu et al. [77], Jeng [78], Lu et al. [79], O' Regan et al. [80], Kim et al. [81]; Sharma et al. [82]		
	Tourism/Restaurant/ Hospitality management and marketing	7	Shin [83], Buhalis et al. [84], Lee et al. [85], Buhalis et al. [86], Dou et al. [87], Lau [88], Pillai et al. [89]		

Table 3. *Cont.*

Systems	Functional Areas/Applications	Frequency	Publications	Total	Percentage
	User security and privacy protection	4	Luo et al. [90], Rengaraju et al. [91], Yang et al. [92], Potter [93]		
	Mobile communication service quality	3	Lipovac et al. [94], Mohorko et al. [95], Becchetti et al. [96]		
	Mobile communication travel experience	3	Ballina et al. [97], Wang et al. [98]; Kokkinou et al. [99]		
	Mobile technology in tourism	1	Chen, Law, Xu, and Zhang [12]		
	5G/XR/IoT integration	1	Davoli et al. [100]		
4G–5G	High-speed/Railway communications	5	Singh et al. [101], He et al. [102,103], Li et al. [104], Pan et al. [105]	30	27.78%
	Virtual tourism	4	Vishwakarma et al. [106], Eom [107], Hu et al. [108], Hyun et al. [109]		
	Smart tourism IoT service/Smart tourism destination	8	Peng et al. [110], Fabry et al. [111], Byun et al. [112], Mercan et al. [113], Wang et al. [114], Wang et al. [115], Choe et al. [116], Ivars-Baidal et al. [117]		
	Tourism smart application	3	Batalla, Krawiec, Mavromoustakis, Mastorakis, Chilamkurti, Negru, Bruneau-Queyreix and Borcoci [9]; Gelashvili, Martínez-Navalón and Herrera Enríquez [23], Kamboj et al. [118]		
	Promote sustainable tourism and ecotourism	2	Razzaq et al. [119], Sarkar et al. [120]		
	Robot service	3	Choi et al. [121], Pillai et al. [122], Seyitoğlu et al. [123]		
	Tourism big data	4	Reif et al. [124], Stylos et al. [125], Zhang et al. [126], Gao [127]		
	Mobile health	1	Baroutsou et al. [128]		
Total				108	100.00%

3.4. Study Regions

Among the 108 articles reviewed, 81 (75.00%) clarify the target areas of study, and 12 (11.11%) have a global perspective. A total of 43 articles are related to Asia, with China (n = 18), Japan (n = 8), and South Korea (n = 8) as the most mentioned countries. Europe ranked second (n = 24), with Spain (n = 7) and Switzerland (n = 4) being in the lead. North America is in third place (n = 11), mainly for the United States (n = 10). Only a few studies targeted Africa (n = 4), Oceania (n = 3), and South America (n = 1). With the strengthening and widening application of mobile communication technology, the present study suggests expanding the scope of research to non-popular areas or countries.

4. Discussion and Implications

4.1. Overview of Mobile Communication Technology Research in Hospitality and Tourism

The trend of mobile communication technology research and the background of mobile communication systems indicate the gradual increase in its influence on and role in hospitality and tourism. The number of related studies is predicted to continue to increase in the future. Meanwhile, the analysis results of the research area background, computer science, information systems, engineering, science and technology, telecommunications, transportation, and geography contribute considerably to the research on mobile communication technology in hospitality and tourism. The research in these areas generally explained or proposed a solution to a specific problem in mobile communications, which has a relevant effect on hotels and tourism [54,93]. Statistical data show that the research contributions of hospitality and tourism to mobile communication technology lag behind other fields. Therefore, the recommended approaches are strengthening research on mobile communication technology in hospitality and tourism and appropriately refer to the internet and technology.

This study also reveals the similarities and differences between the research models in hospitality and tourism and other areas. First, although methods and data source selections differ regardless of field, a certain data foundation exists as a support such that research can be more specific and scientifically presented. Furthermore, research in hospitality and tourism pays additional attention to the application of theoretical bases, whereas other areas rarely use theory or theoretical models. The possible reason for this discrepancy is that most other research areas in this study are technology applications that, unlike social science research, focus more on practical operations or are only supported by concepts. In addition, the reviewed articles frequently used technology-related theories, specifically the TAM [64]. Perceived usefulness and perceived ease of use are two key factors of the TAM [80]. Based on these two factors, the TAM is widely used to study user acceptance of technology [78] and is often combined with other theories in investigating the acceptance of mobile communication technology in hospitality and tourism [81]. Thus, this topic is studied as comprehensively and rigorously as possible. However, despite its most common use, the TAM is insufficient to cover the contents of the investigation. In summary, the present study suggests that the future related literature should pay more attention to the use of theoretical models, use theory to guide practice, and further promote the research academicity and reliability. Simultaneous initiatives are developing theoretical model frameworks that are suitable for the research of mobile communication technology in hospitality and tourism and enriching its theoretical foundations. Furthermore, the results show that research in hospitality and tourism tends to use either qualitative or quantitative methods. At this point, learning from methods in other research areas, adopting a mixture of qualitative and quantitative methods, and jointly exerting the advantages of the two research methods are recommended to provide a more solid methodological basis for the literature.

4.2. Effect of Each Generation of Mobile Communication Technology on Hotels and Tourism

Exploring the functional areas and applications of each generation of mobile communication technology in hotels and tourism is an important part of this study. This

exploration is an analysis of the effect of mobile communication technology on hotels and tourism and the changes they bring. This effect mainly began with 3G technology, when users can enjoy navigation aid [33], travel with intelligent transportation services [75], travel self-services [68], and mobile hotspot services [25]. Remote vision mobile devices also enable the navigation of visually impaired pedestrians [32]. Although many factors affect the user's willingness and intention to use mobile technology in hotels and travel environments, the use of 3G technology improves the travel experience [28]. Moreover, 3G technology plays a role in tourism security monitoring, tourism management, and marketing [31,86] and promotes the strategic plans and development trends of hospitality and tourism. For example, certain functions of 3G facilitate the creation of a universal network market for tourism [28]. Finally, ensuring the quality and safety of mobile communication services for users and enhancing user privacy protection when using mobile technology in the hotel and tourism environment are also proposed in the 3G context [93,95].

Compared with 3G, 4G has significantly expanded the range of functions or applications of mobile communications in hospitality and tourism. From the perspective of the continuation and improvement of 3G functions, 4G network services provide tourists with diverse video content, e-commerce, and reservation services at a faster speed, thereby improving their convenience [112]. In addition, at faster data transfer rates, mobile applications receive greater technical support to help hotel and travel providers in management and marketing. Lee, Hwang, and Hyun [85] used 4G mobile applications to collect restaurant customer information to formulate marketing plans, improve restaurant demand management, and promote customer relationships and intelligent capacity management. From the perspective of the new functional areas or applications brought by 4G, first, the Internet of things (IoT) and the IoV begin to take shape. Jing, Han, Meng, Jiang, Lin, and Chen [69] connected the lines, historical buildings, user tracks, and mobile applications in a scenic spot to build a convenient intelligent travel service system. Lee, Gutesa, Dimitrijevic, Zhang, Spasovic, and Singh [72] pointed out that connected vehicles using 4G network services can be easily plugged into an existing flow control management system without paying considerable additional funds, thereby reducing travel costs. Second, 4G provides technical support for virtual tourism and robot services in hotels and tourism. Virtual tourism is composed of considerable real-time videos, images, and information, benefiting from faster and more stable data transmission rates and larger data transmission capacity compared with 3G. Furthermore, AR, VR, mixed reality, and holographic projection technology can be used in tourism [108,109]. Second, 4G technology promotes the interaction between robots and hotel users or tourists [121]. Third, the expansion of mobile communication applications has a certain relationship with the development direction of tourism. In the context of its era, 4G is used in sustainable, ecological, and rural tourism. Finally, to meet the increasing user demand for high-speed travel, high-speed or railway communication technology has developed rapidly with 4G technical support [104].

Although the current 5G mobile communication network is still to become popular, the existing articles on 5G mobile communication in hotels and tourism indicate that 5G will create extensions and breakthroughs based on 4G. Among them, the most important is that 5G will have an effect on a macro level, compared with the changes brought by the previous generations of mobile communication technologies. A 5G network has characteristics of high speed, large broadband, high reliability, and low latency that are absent in a 4G network. These characteristics enable the IoT and IoV to truly play the role of the "Internet of Everything" in hotels and tourism. For instance, the 5G network realizes information interaction between cars, roads, people, and infrastructure, effectively improving the user's travel traffic experience [70]. Alam, Ferreira, Mumtaz, Ahmad Jan, Rebelo, and Fonseca [56] noted that a 5G-conceived architecture enables the coordination of the IoT of smart beaches and smart transportation, realizing multiple functions of real-time beach travel monitoring, beach travel planning, vehicle tracking, and management. The 5G technology also creates new possibilities for medical travel. Specifically, smart medical devices can sense the local environment through embedded communication functions

and integrated sensors and then use remote triggers in the IoT to sense or drive remote devices to generate data or operate [129]. These possibilities show that the management and services of medical tourism can also transcend time and space restrictions. For example, travelers can access services, such as real-time global networking of medical records or remote treatment. Furthermore, the concepts of smart cities, smart destinations, and smart travel applications break through previous presentation models and appear as new, highly coordinated models [110–112]. The possible effect is that the boundaries of relevant concepts in the hotel and tourism fields may gradually reduce, whereas the smaller stakeholders may have a broader definition [111].

4.3. Changes That Future Mobile Communication Technology Can Bring to Hospitality and Tourism

The effect of future mobile communication technology on hospitality and tourism is discussed to complete the second goal of this study. According to the iteration time of the mobile communication system, 2020 to 2030 is the expected 5G era.

4.3.1. Mode of Tourism Service Output Will Change

Current academic research is dominated by the application of new 5G technologies in the industry, that is, the effect and changes on the supply side. With the effect of the coronavirus disease 2019 (COVID-19), IoT will continue to enhance the personalized and customized service experience. Hospitality areas that are severely affected by the epidemic can apply IoT to make real-time decisions on hotel occupancy, guest dining options (e.g., outdoor dining), large events, and cruise line arrangements [113]. The extremely short 5G latency solves vertigo caused by the delay lag of previous VR technology and promotes the development of the VR industry. The 5G networks combined with HD, 4 k/8 k, and panoramic video technologies meet the demand of tourists to visit immersive scenic spots anytime, anywhere. Self-service devices and robots will replace human beings to provide services to tourists, greatly improving the stability of service quality [89]. In addition, 5G technology will change the way people spend their time on travel. With more technology support, the money and time cost of travel is reduced and the frequency of travel spending will increase. During travel, travelers will have access to real-time services and experiences in a variety of contexts, such as smarter and more convenient transportation systems, hotels, and scenic spots. This access, in turn, makes a higher quality experience that will continue to stimulate travel demand.

4.3.2. Leisure Time and Leisure Quality Will Be Improved

At present, 5G is still at a primitive stage. It will take time for mass commercialization, and terminal products are relatively scarce. Therefore, for travelers, the changes they can feel at this stage are limited. However, in the long run, as the technology continues to develop and mature, the upgrade of product quality and traveler's experience brought by the technology will be more evident, and people's leisure time and leisure quality will be greatly improved. The scope and efficiency of artificial intelligence (AI) applications will increase dramatically, and productivity will also increase largely. Many jobs will be completed by robots, and people will have more leisure time and generate more demand for tourism consumption. In addition, IoT technology will be an important factor in meeting the needs of the new generation of visitors [110]. The IoT can have a significant effect on enhancing the value of the visitor experience. Smart tourism uses this technology to maximize information analysis and integration and to achieve convenient information exchange between users. However, the high level of information sharing also highlights the concerns of cybersecurity. Since the beginning of mobile technology being used in tourism and hospitality, user security and privacy protection have been gaining attention and are constantly being optimized and upgraded. Thus, research on cybersecurity issues will continue to accompany the application and development of mobile communication technology in the tourism and hospitality field. Visitors can feel the support of 5G technology during the whole process of travel, including ultra-high-definition video that provides

a cinema-like visual feast anytime, anywhere during the fragmented waiting time of travel and the ability to interact with friends and family through social platforms while waiting in line at restaurants.

4.3.3. Application Scenarios for 5G Technology Will Be More Diverse

The fifth generation has enabled mobile communication technologies to become more connected to other industries and will have a wider range of applications in tourism and hospitality. We can expect to see the use of technology in venues other than hotels and scenic spots. On the one hand, this technology can help the overall digital upgrade of tourism; on the other hand, smart technology is likely to create more amazing cultural and tourism experiences, with VR/AR, AI, and human–computer interaction breaking through the limitations of the original tourism experience. Specifically, with the integration of 5G networks into tourism intelligent transportation, 5G enhances the safety and reliability of tourism transportation systems, improves operational efficiency, and builds new modes of travel, such as driverless vehicles. Thus, travelers can be largely freed from the complexities of road environments and travel route planning, and travel service providers may reduce their investment in travel transportation. Fifth-generation mobile communication technology will also greatly enhance the comprehensive management capabilities of scenic spots. Moreover, safety emergency management and terminal monitoring based on 5G networks can help scenic spots achieve real-time monitoring, feedback, and handling of emergencies. The emergence of virtual tourism has also greatly enriched the supply of online tourism products, allowing people to travel without leaving home through online live streaming and remote interpretation, meeting the emerging market demand. Furthermore, IoT, AI, VR/AR, and other technologies in hotels ensure hygiene and cleanliness at every touchpoint in a hotel [89]. Some hotels are working to create emerging technologies, including the IoT, to respond to changing service evasions and customers' desire for social distance [113]. Interactive self-service technology in restaurants enhances customer experience [77]. The use of 5G technology in museums will improve online working and ticket booking services for museums, helping to develop digital museums and promote history and culture [52].

5. Conclusions and Future Trends

This study extensively reviews articles in different interdisciplinary fields and explores the status and trends of mobile communication technology research in hospitality and tourism. In addition, this study analyzes the changes brought by each generation of mobile communication technology. The future effect of 5G mobile communication technology and its applications on hospitality and tourism are similarly discussed. The main findings are as follows. First, in addition to the hospitality and tourism industry, 61.11% of the 108 articles reviewed were from other subject areas. Thus, other areas such as computer science, information systems, engineering, science and technology, telecommunications, transportation, and geography also contributed considerably to the research of mobile communication technology in hospitality and tourism. Moreover, each area pays attention to the support of research data but generally lacks the use of theory and theoretical models. Second, from the analysis in this study based on the functional areas or applications of mobile communication technology in tourism and hospitality and the effect of each generation of mobile communication technology on hospitality and tourism, the study concludes that mobile communication technology has been widely used in hotels and tourism since the emergence of 3G. Moreover, with the development and upgrade of mobile communication systems, its functional areas or applications to hospitality and tourism continue to expand. Third, mobile communication technology may, and will very likely, bring about paradigm shifts in hospitality and tourism.

The third finding is based on an analysis of possible future trends in mobile communication technologies. Specifically, in the context of the current 5G era, mobile communication technologies will affect hospitality and tourism at a more macro-level and facilitate the

"Internet of Everything", for example, by changing the mode of tourism service output, improving leisure time and leisure quality, and diversifying the application scenarios. Yet, similar to the time when the possibilities of 4G could not be fully predicted from the 3G era, predictions on 5G and subsequent mobile technologies can only be made based on experience. Fifth-generation mobile communication technology can bring about the above changes but is by no means limited to these changes. Meanwhile, from a longer-term perspective, as 5G network construction advances, an increasing number of people have already been shifting their focus to the post-5G era, which is related to the rapid iteration of mobile communication technologies. In other words, 5G commercialization is still in its infancy and the design of the sixth-generation mobile communication technology (6G) standard is already underway on a small but global scale. It is well known that the latest generation of mobile communication technologies will be significantly optimized and improved from its predecessor in various aspects such as performance, architecture, and reliability. As such, significant impacts of 5G and each subsequent generation of mobile communication technologies on tourism and hospitality, as well as other areas, are expected. Nevertheless, what is clear is that no matter how mobile technologies are updated, they are likely to be developed around users, which is consistent with the nature of hospitality and tourism as a service industry. This also means that whether it is 5G, 6G, or any generations of mobile communication technology afterwards, it only makes sense to bring out the maximum potential usability of mobile communications to ensure that businesses and individuals can fully experience the real value that mobile communication technologies bring. As a result, it is highly likely that consumers, suppliers, governments, and technology providers will continue to experience the impact and changes that mobile communication technologies bring to them as it evolves.

From the perspective of customers, they will appreciate the future of mobile communication technology as one that focuses on user needs. This development trend will be reflected in the entire process of tourism and hospitality experience through the deep integration of real physical world and virtual digital world, including immersive interaction scenes, precise spatial interaction, multi-sensory and mental/consciousness level connected interaction, ubiquitous intelligent kernel, and mobile communication service all-area coverage, thus meeting the needs of consumers in various tourism and hospitality application scenarios in a comprehensive and all-round way. From the suppliers' point of view, the development of mobile communication technology will further provide them with the support to capture user needs in a timely manner and launch new products and services adapted to the market in the context of the changing and evolving macro environment such as the current social structure change, rapid economic development with high quality, and environmental sustainability. For instance, 6G may potentially support the spread of the digital twin, thus helping the medical tourism field to make disease diagnoses, design the best treatment plan, and simulate and test that treatment plan with information from the digital twin body, a digital mirror of the physical world. From the government's perspective, while the development of mobile technologies will assist it in optimizing and enhancing its services and management, deep intelligence and information technology also pose challenges for management organizations and departments. For example, as digital connections between people, objects and things are gradually realized and information about various subjects is shared in real time, user privacy and personal information security need to be further safeguarded. In addition to this, the various potential issues that arise with the technology require the government to develop timely norms, guidelines, or policies for each new generation of mobile communication technology to ensure that the use and development of mobile communication technology is in line with social trends and legal or ethical requirements. From the viewpoint of technology providers, in order to meet the increasingly diverse business applications of mobile communications technology and the ultimate performance requirements, technology providers need to continuously explore new network architectures and strive to achieve breakthroughs in key core technology areas.

Every study has limitations. This study limited the literature selection to review and research articles and excluded other types of papers. Additionally, the content analysis is limited to articles related to the search keywords. Future research is recommended to collect the reviewed articles from a wider range of literary types and keywords. Moreover, given the rapid development of mobile communication technology, the interval of review research related to mobile technology research in hospitality and tourism can be reduced. Reviews may be conducted every 3 to 5 years rather than 10 years.

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