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Exploration of Hotel Reservation Through Mobile Online Travel Agencies

Sunny Sun[1] | Rob Law[2] | Sunghyup Sean Hyun[3]

[1]College of Sustainability and Tourism, Ritsumeikan Asia Pacific University, Oita, Japan | [2]Asia-Pacific Academy of Economics and Management, Department of Integrated Resort and Tourism Management, Faculty of Business Administration, University of Macau, Macau, China | [3]School of Tourism, College of Social Sciences, Hanyang University, Seoul, South Korea

Correspondence: Sunghyup Sean Hyun (sshyun@hanyang.ac.kr)

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ABSTRACT

The number of tourists who use smartphones to make hotel reservation is continuously increasing. Nonetheless, only a few studies have investigated the attributes to make hotel reservation via mobile devices (e.g., smartphones). Hence, the present study comprehensively evaluates the attributes to make hotel reservation through mobile online travel agencies (OTAs) based on the web function design framework to identify the perceived important attributes to make hotel reservation via mobile OTAs from the perspective of tourists and to find out the possible factors with specific attributes to measure hotel reservation via mobile OTAs through an online questionnaire survey method. Findings reflect that the perceived important attributes of tourists have changed from those allowing them to meet their hierarchical needs to those supporting their nonhierarchical intertwined needs. In addition, four factors of hotel reservation via mobile OTAs are identified: hotel information provision, relationship and social media, design and layout, and consumer requests.

1 | Introduction

Electronic (e-) commerce has gained in popularity since the early 2000s, particularly in relation to hotel reservation (Confente and Vigolo 2018; Gilbert and Powell-Perry 2001; Salavati and Hashim 2015). In recent years, the Internet has been widely adopted in the hospitality industry to effectively communicate with consumers (DeFranco and Morosan 2017; Lim et al. 2021; Sun, Law, and Schuckert 2020). Since the outbreak of coronavirus disease 2019 (COVID-19), contactless mobile-related technologies have been gradually adopted by hotels to solve the hygiene concerns of consumers (Bonfanti, Vigolo, and Yfantidou 2021; Tiwari and Mishra 2023). Indeed, extensive applications of information and communications technology (ICT) have increased the ease of information disclosure, product distribution, transactions related to hotel products and services, and the life quality of local residents (Golmohammadi, Jahandideh, and O'gorman, K. 2012; Law et al. 2024; Praesri et al. 2022; Shin, Noone, and Robson 2020). Hotel practitioners acknowledge the growing trend of travelers switching from desktop computers to mobile devices to reserve hotel rooms (Yin et al. 2022; Wang and Xiang 2012). Murphy, Chen, and Cossutta (2016) found that hospitality practitioners do not consider personal computer or notebook users as their distinctive customers that, at present, tend to use multiple devices, including smartphones, for hotel reservation. Smartphones have increased consumer convenience—as long as they are connected to a Wi-Fi or cellular network, customers can search for information and reserve hotels, regardless of time and place. Premasinghe et al. (2021) mentioned the adoption of smartphones can help the hospitality and tourism industry in reaching a wide client base.

Certain sensors, such as gyroscopes and accelerometers, have further contributed to the development of adaptive systems and effective operations. Hence, mobile (m-) commerce is now regarded as an ecosystem because it can deliver immediate and personalized services that consumers consider valuable (Grönroos and Voima 2013; Morosan and DeFranco 2015; Um, Chung, and Stienmetz 2023).

The use of mobile apps has also increased with the development of power-efficient processors. Apps enable travelers to use mobile technology at home and overseas owing to modern operating systems and user-friendly interfaces (Höpken et al. 2010). Smartphones also help fulfill the distinct needs of individual users. At present, smartphone owners tend to use mobile apps instead of desktops or other electronic devices for travel planning (Wang and Xiang 2012). Consequently, smartphones and their associated apps have enjoyed rapid adoption and account for a large proportion of hotel reservation. Fong, Lam, and Law (2017) argued that mobile apps are a new and cost-effective channel for online travel agencies (OTAs) to increase sales, revealing the importance of hotel reservation in mobile travel planning. OTAs are presently regarded as a key hotel reservation platform, with China being the leading market for mobile hotel bookings, thereby proving the critical role of mobile devices/apps in hotel reservation (Azdel et al. 2023; Christin and Nugraha 2023; Jimura and Lee 2020; Yin, Goh, and Law 2019). To summarize, hotel reservation via mobile OTAs has gradually become a new channel for consumers to book travel-related products using smartphones or other mobile devices through General Packet Radio Service (GPRS) 4G/5G, Wi-Fi, or other wireless networks.

Over the past two decades, the effectiveness of websites in encouraging hotel reservation has been examined by considering two important dimensions: website functionality and usability (Au Yeung and Law 2004; Bai, Law, and Wen 2008; Ting et al. 2013). In general, website functionality denotes the provision of information, whereas website usability encompasses information use and processing (i.e., design). Since 2010, consumers have been relying more on smartphones than on desktops to search for travel information because of the convenience provided by personalization features (Eriksson 2014; Tnooz 2014; Wang et al. 2016b; Wang and Wang 2010). Wong, Leung, and Law (2020) reported that customers demand fast download speeds, customized designs, and good compatibility between mobile apps and devices. Nonetheless, the development of a smooth, personalization-capable, eco-mobile hotel reservation system is challenging because of certain characteristics, such as the perception of low security in m-commerce (Ha et al. 2012).

Although the use of mobile technology apps for hotel reservation has been discussed by previous studies, the implications are in general, and specific implications to the hospitality industry are relatively lacking (Bai, Law, and Wen 2008; Chen and Lin 2018; Chiou, Lin, and Perng, 2011; Law 2019). Considering the differences between desktop and mobile websites (Meunler 2012; Wu and Law 2019), the important attributes of hotel reservation via OTAs through mobile devices perceived by consumers remain unclear, and the possible factors with specific attributes to measure hotel reservation via mobile OTAs are unknown. However, Wu and Law (2019) revealed significant perception differences between consumers who use smartphones and those who prefer websites to reserve hotels. Meanwhile, the applicability of the attributes of website functionality and usability to mobile hotel reservation remains ambiguous. Even though Lei and Law (2019) investigated functionality for mobile hotel websites, usability of mobile hotel websites has been disregarded. In addition, evaluation of functionality and usability of hotel reservation via OTAs (i.e., key hotel reservation platform in China) has received limited attention from previous studies. To fill in the aforementioned research gap, the performance of hotel reservation via mobile OTAs is examined from the two fundamental dimensions for website evaluation: functionality and usability. Mobile functionality denotes hotel information provision-related function via mobile devices, whereas mobile usability refers to hotel information and processing (i.e., design) via mobile devices.

With the growth of mobile technology and the acceleration of ICT innovation (Liao and Yang 2020; Wang, Park, and Fesenmaier 2012; Wang and Xiang 2012), limited attention has been given to the investigation of hotel reservation via mobile devices. To fill in the aforementioned research gap, the present study aims to evaluate hotel reservation via mobile OTAs based on web-based destination marketing systems. Web-based destination marketing systems mainly focus on a four-level web function design framework, namely, information, communication, transaction, and relationship levels, initially advocated by Wang (2008). Findings of the present study contribute to the identification of the possible attributes and dimensions to measure hotel reservation via mobile devices. Moreover, findings reflect the change from hierarchical needs to their nonhierarchical intertwined needs from the perspective of tourists. Meanwhile, results of this study provide detailed practical implications to hospitality and tourism practitioners to be informed of the important attributes of hotel reservation via mobile devices to facilitate mobile hotel reservation.

2 | Literature Review

2.1 | Mobile Hotel Reservation

Mobile communications, as communication and marketing channels, are the essence of m-commerce. Moreover, they are an integral part of the overall consumer experience in the hospitality industry (Ip, Lee, and Law 2010; Kim, Chua, and Han 2021; Wu, Law, and Liu 2018). From the supplier perspective, m-commerce offers more market opportunities than existing e-commerce because of the former's inherent characteristics (e.g., effectiveness of mobile communications) (Fong, Lam, and Law 2017; Kim, Park, and Morrison 2008). From the consumer perspective, m-commerce provides users with opportunities to access the Internet anywhere and at any time (Wu and Law 2019). Okazaki et al. (2014) summarized the main advantages of adopting mobile technology—convenience, personalization, immediacy, and entertainment. Note that mobile technology plays a crucial role in the hospitality industry and provides considerable flexibility for travelers to satisfy their hierarchical information needs (Camilleri, Troise, and Kozak 2023; Oh, Lehto, and Park 2009). Buhalis and Law (2008) confirmed

the importance of mobile technology as a change agent in the hospitality industry. Camilleri, Troise, and Kozak (2023) confirmed the increasing popularity of the use of mobile apps to purchase travel-related products.

Although the performance and attributes of travel-related websites have been examined by previous studies (Bastida and Huan 2014; Morrison, Taylor, and Douglas 2004; Sun, Cárdenas, and Harrill 2016), the mobile and desktop versions of travel-related websites differ in terms of content and design, as indicated by Meunler (2012) and Wu and Law (2019). Regarding content, desktop websites display detailed information, whereas mobile websites (i.e., websites displayed by mobile devices) show relatively targeted information (Google Developers 2015). Moreover, desktop websites have more filters than their mobile versions. Mobile websites, unlike desktop websites, provide instant previews and autocomplete results. From a design perspective, desktop and mobile websites differ from each other from four aspects (Google Developers 2015; Meunler 2012). During login, desktop versions follow the normal website address input method, whereas mobile devices also allow for the QR code scan/direct login/always-logged-in methods. In addition, desktops have larger screens and relatively higher screen resolution than mobile devices. Mobile usage has been investigated in terms of the emergence and evolution of mobile technology (Peres, Correia, and Moital 2011; Wang, Park, and Fesenmaier 2012; Wang and Xiang 2012). Peres, Correia, and Moital (2011) and Wang, Xiang, and Fesenmaier (2016a) investigated consumer intentions to use smartphones for travel purposes. Yu, Lee and Hyun (2021) and Yu, Seo, and Hyun (2021) investigated the influence of perceived risk of COVID-19 and the hygiene attributes on the revisit intention of hotel guests. Nonetheless, the performance of mobile hotel reservation remains unclear.

Certain features, such as personalization and portability, differentiate m-commerce services in the hotel industry from traditional and e-commerce (Chong, Chan, and Ooi 2012; Wu and Law 2019). Hotel websites have been extensively examined along with ICT development (Chen and Lin 2018; Li et al. 2017; Park, Gretzel, and Sirakaya-Turk 2007; Zhang and Von Dran 2002). Wang et al. (2016b) indicated that compared with making hotel reservation through websites, current mobile technologies can fulfill users' desire for efficiency, satisfy their entertainment needs, and assist them in making immediate mobile-based decisions. The impact of mobile technology on hospitality and the adoption of ICT is being increasingly studied to keep pace with recent trends (Camilleri, Troise, and Kozak 2023; Ha et al. 2012; Katz and Sugiyama 2006; Morosan 2018). In terms of mobile functionality, Ha et al. (2012) found that the ability to meet unique consumer preferences is a critical function of hotel apps. For mobile usability, Wang et al. (2016b) revealed that several attributes, such as ease of use, visibility, and safety, can be used to measure the effectiveness of smartphone apps in delivering functions and content. To summarize, the m-commerce ecosystem of the hotel industry facilitates fast, accurate, comprehensive, and personalized information flow between hotels and guests (Morosan 2018) or lists the characteristics of mobile communication related to hotel reservation, such as convenience, personalization, flexibility, and timely information accessibility (Oh, Lehto, and Park 2009). Nevertheless, systematic investigations of the important attributes of hotel reservation via mobile devices have remained limited.

2.2 | Functionality and Usability of Mobile Websites

In the present study, the mobile functionality of hotel reservation refers to the function of hotel information delivery via mobile devices. Mainstream OTAs, such as Expedia, Booking, Ctrip, and TripAdvisor, have launched mobile apps to gain additional platform exposure for hotel reservation (Wang et al. 2016b; Wong, Leung, and Law 2020). Consumers who use smartphones for hotel reservation either browse websites or use smartphone apps. Murphy, Chen, and Cossutta (2016) found that smartphones are increasingly being used to share information or encourage hotel reservation. Mobile websites can be classified into three types (Starkov 2010). The first type is the simple and direct transfer of desktop-based, hotel-related OTA websites to mobile platforms, supported by smartphones. The second type is the user-friendly mobile website. Several OTAs have developed websites especially for mobile devices (e.g., smartphones) rather than directly converting laptop-based websites into mobile platforms. The third type is information delivery through mobile apps, which refers to application software specifically designed for mobile devices. Dickinson et al. (2014) reported that the availability of mobile apps is an important smartphone feature. Overall, smartphone devices and their associated apps improve the efficiency of information delivery and enable considerable customer personalization. Park, Gretzel, and Sirakaya-Turk (2007) identified various dimensions of smartphone-related hotel reservation to evaluate travel agencies—information, customer service, and design and layout. Wu and Law (2019) showed that consumers who reserve hotels using websites focus more on website usability, whereas those who use mobile apps focus on app functionality.

According to Wang (2008), functionality encompasses a four-level web function design, with mobile websites or apps serving as distribution channels. Wang et al. (2016b) stated that information represents the data displayed on mobile apps, while the quality of information signifies its reliability, completeness, and being up-to-date. Despite the basic information provision, the communication level involves communications between suppliers and consumers despite its basic information-delivery-only feature. Meanwhile, mobile usability for hotel reservation is measured via three main aspects: design, efficiency, and speed (Au Yeung and Law 2004; Baloglu and Pekcan 2006; Dickinson et al. 2014; Höpken et al. 2010). Appropriate layout, navigation, personalization, and user-friendly interfaces are indicators of design; adaptive and modern operating systems are two representative attributes to measure efficiency; and download rate measures speed. Wang, Xiang, and Fesenmaier (2016a) found that location-related information is increasing in mobile services. In terms of mobile usability for hotel reservation, Morosan (2018) reported that guest perceptions of personalization and their trust in hotels significantly affect their use of mobile devices to reserve hotel rooms.

In summary, when making hotel reservation, smartphones can facilitate navigation and help consumers address their immediate needs and assist them in making time-critical arrangements (Dickinson et al. 2014; Wang et al. 2016b). Although Wang (2008) classified functionality, mainly reflected in information into four levels, usability is disregarded. Given the differences between web-based and mobile systems, the present study considers functionality and usability for hotel reservation because they are inseparable within the mobile context.

2.3 | Theoretical Framework

The theoretical framework that the present study is based on is the web-based destination marketing systems, particularly focusing on a four-level hierarchical web function design framework advocated by Wang (2008). In particular, a four-level hierarchical web function design includes four levels: information, communication, transaction, and relationship levels. The reason that the present study adopted Wang's (2008) framework is that it is comprehensive by considering four different levels of web function design. Moreover, the applicability of the four-level hierarchical web function design framework within mobile context can be tested.

Information level mainly represents information quality, whereas communication level indicates a platform that can enhance communication between suppliers and consumers. Transaction level is considered the next step in consolidating the relationship, and the relationship level refers to high-level interactions, such as relationship building between suppliers and consumers (Chen, Hyun, and Lee 2022; Liu, Zhao, and Jang 2021). Limited studies have discussed transaction-level information. According to Wang and Xiang (2012) and Wang et al. (2016b), smartphone apps can provide hotel information and also be used as tools for translation, entertainment, and social communication. Consumers can even communicate with hotels' customer service department via mobile apps. Regarding the relationship level, Anuar, Musa, and Khalid (2014) indicated that mobile platforms, particularly smartphones, play an important role in product distribution, customer relationship establishment, and brand loyalty. Wang et al. (2016b) reported that mobile platforms enable interactions with other consumers, thereby enabling travelers to seek information and make travel decisions. Moreover, consumers find it useful when social network elements are integrated into the mobile platform. For example, consumers perceive OTA apps favorable in terms of integrating the ratings and reviews of other consumers with social network functions.

In summary, although mobile devices have been widely used to make hotel reservation, extensive evaluations of the important attributes of mobile hotel reservation from the perspective of consumers are limited (Morosan 2018; Ozturk et al. 2016). Hence, the present study uses the web function design framework advocated by Wang (2008) as basis to systematically evaluate the performance of hotel reservation via mobile OTAs. First, the present study explores the important attributes to make hotel reservation via mobile devices by considering functionality and usability. Second, this research identifies the factors with specific attributes to comprehensively measure mobile hotel reservation.

3 | Methodology

3.1 | Measurements of Functionality for Mobile Hotel Reservation

A total of 22 attributes were used to measure the mobile functionality for hotel reservation, which was adapted from previous studies and the findings of a pilot test. In particular, measurements of the mobile functionality for hotel reservation were split across four levels. Information level was measured with the following nine attributes: hotel room types, pictures, price, location, contact information, check-in and check-out information, change policy, and cancellation policy (Baloglu and Pekcan 2006; Law, Chan, and Goh 2007; Toh, Raven, and DeKay 2011; Wang et al. 2016c; Ye, Law, and Gu 2009). Change and cancellation policies were added based on the findings of the pilot test to increase the comprehensiveness of the policy portion. Communication level was measured using four attributes: address requests, access to hotel reviews, promotions, and 24-h customer service (Baloglu and Pekcan 2006; Wang et al. 2016b; Ye, Law, and Gu 2009). One of the functionality measurements (i.e., "click to call") advocated by Baloglu and Pekcan (2006) was replaced by 24-h customer service because OTAs in China commonly adopt a 24-h customer service model. In comScore (2013), the two attributes of mobile check-ins and check-outs were used to measure mobile functionality for transaction-level information. By contrast, if consumers in China make hotel reservations via OTAs rather than hotel websites, then mobile check-in and check-out services are unavailable. Thus, quick and easy-to-complete hotel reservations were used to measure transaction-level information within the context of mobile hotel reservation. Furthermore, the relationship level was measured by the following four attributes: comments, rating, social networking, and loyalty program account access. Lastly, the overall quality of hotel information was measured using three attributes: reliability, completeness, and being up-to-date (Wang et al. 2016b).

3.2 | Measurements of Usability for Mobile Hotel Reservation

This study used the previous literature as basis in using five attributes to measure the mobile usability (i.e., design) of hotel reservation: appropriate layout (Au Yeung and Law 2004), navigation (Baloglu and Pekcan 2006), personalization (Morosan 2018), user-friendly interface (Au Yeung and Law 2004; Dickinson et al. 2014), and download speed (Baloglu and Pekcan 2006; Google 2013). Although adaptability is considered an attribute to measure efficiency (Dickinson et al. 2014; Gretzel 2011; Höpken et al. 2010), the findings of the pilot test indicate that adaptability is no longer a problem when consumers make hotel reservation via mobile devices and modern operating systems. Thus, the two attributes were excluded. Although the measurements are mostly based on previous studies, their evaluation in the context of mobile hotel reservation is not known. All the aforementioned

measurements used a 7-point Likert-type scale, ranging from 1 ("strongly disagree") to 7 ("strongly agree").

3.3 | Pilot Test

Before data collection, a pilot test was conducted by the researcher in person with 23 respondents who have had at least one-time experience of using mobile devices (e.g., smartphones) to make hotel reservation. The pilot test aims to appraise the participants' understanding of the questionnaire, clarity of each statement included in the questionnaire survey, and estimated time required to complete the questionnaire survey. Given that the respondents were Chinese, a native Chinese speaker translated the questionnaire from English to Chinese. Thereafter, back translation was performed to ensure the quality of the translated questionnaire following the pilot test.

3.4 | Data Collection

Measurements of functionality and usability for mobile hotel reservation were finalized based on the pilot test findings. Thereafter, data were recently collected in first-tier cities in China (i.e., Beijing, Shanghai, Guangzhou, and Shenzhen) by the researcher and Sojump, an online questionnaire survey company. The reason for selecting Sojump is that it is the largest online data collection company in China with over 2,600,000 samples in its database (Chen and Chen 2020). Chinese samples were selected because of China's rapid mobile technology development in recent times and its leading position in mobile hotel reservation (Gong et al. 2020). Certain criteria, such as the time required to answer the questionnaire and the IP addresses of the respondents, were used to ensure the quality of the sample. For example, Sojump set a standard time to complete the questionnaire, such that the respondents must spend at least 5 s to answer each question to prevent random selection. In addition, only one response was allowed per IP address.

The screening question of the questionnaire survey for the present study was "Have you made a hotel reservation via OTAs (e.g., Ctrip app/mobile website of Ctrip) by mobile devices (e.g., smartphone)?" The respondents who answered "yes" proceeded further to complete the questionnaire survey. That is, the respondents who had a hotel reservation via OTAs by mobile devices completed the online questionnaire survey. A total of 892 questionnaires were collected. After excluding invalid questionnaires, 879 questionnaires were considered valid, in which 787 valid data were collected by Sojump and 92 valid data were collected by the researcher. To test the homogeneity of the data from the online questionnaire survey company and the researcher, Chi-square test was conducted, and no significant differences are found in terms of the demographic information of the respondents from the two sources. Accordingly, data collected from the two sources were combined and used for further analysis.

3.5 | Data Analysis

Given that one of the main objectives of the present study is to identify the important attributes of hotel reservation via mobile OTAs, the mean value and standard deviation of each item under each level were calculated in the initial stage. Thereafter, the validity and reliability of each construct were examined. Results show that the average variance extracted (AVE) of each construct is higher than the squared correlation, which confirms discriminant validity. Given that AVE of each dimension is above 0.50, convergent validity is confirmed. The reliability of each construct was further tested based on the value of Cronbach's alpha. Accordingly, reliability is confirmed because the Cronbach's alpha of each construct ranges from 0.898 to 0.968.

Principal component analysis (PCA) using IBM SPSS 25 was adopted to reduce the number of attributes to measure each dimension for hotel reservation via mobile OTAs from the perspective of consumers. PCA has been widely adopted in many different disciplines (Bro and Smilde 2014; Papadimitriou, Kaplanidou, and Apostolopoulou 2018). For example, within the web context, Llodrà-Riera et al. (2015) reduced the attributes to three dimensions—"information sources without Internet," "Web 1.0," and "Web 2.0"—to form an information source construct. In this way, the present study can categorize mobile hotel reservation attributes into different dimensions by considering the mobile functionality and usability of hotel reservation.

4 | Findings and Discussion

4.1 | Sociodemographic Information of the Respondents

Descriptive statistics provide an overview of the general information on the respondents, including sociodemographic information, such as gender and age. To ensure comprehensiveness, the present study includes user experience (Table 1). For the smartphone operating system (OS), the respondents use for mobile hotel reservation, and the findings show that 47.4% use Android, while 51.4% use iOS. That is, Android and iOS dominate the smartphone OS market. For OTAs, the respondents use for hotel reservation, Ctrip captures 55.7% of the market share, followed by Qunar (17.5%) and Alitrip (8.0%). The three brands comprise 81.2% of the OTA market share for hotel reservation in the sample cities (i.e., first-tier cities) in China. This result reflects the increasing number of consumers who use Ctrip for their mobile hotel reservation. For gender distribution, females accounted for 53.1% of the sample. Among all the respondents, 24.6% were 18–27 years old; 49%, 28–37 years old; 21.5%, 38–47 years old; 4%, 48–57 years old; and 0.9%, 58 years old or above. The findings show that a majority of the respondents are young, showing that the possible future target market for mobile hotel reservation can be the younger generation.

4.2 | Perception of Important Attributes of Mobile Hotel Reservation

4.2.1 | Hotel Information

Table 2 presents the evaluation of hotel reservation information from seven aspects with 31 attributes, with the sequence of each attribute based on the mean value (i.e., from

TABLE 1 | Descriptive statistics of user experience and sociodemographic information.

User experience	Frequency	Percentage	Cumulative percent
Mobile device operating system			
Android	417	47.4	47.4
iOS	452	51.4	98.9
Windows OS	10	1.1	100.0
OTA used for hotel reservation			
Ctrip	490	55.7	55.7
Qunar	154	17.5	73.3
Alitrip	70	8.0	81.3
Tuniu	46	5.2	86.5
eLong	44	5.0	91.5
Lvmama	9	1.0	92.5
MaFengWo	5	0.6	93.1
CY	1	0.1	93.2
Others	60	6.8	100.0
Sociodemographic information			
Gender			
Male	412	46.9	46.9
Female	467	53.1	100.0
Age-group			
18–27	216	24.6	24.6
28–37	431	49.0	73.6
38–47	189	21.5	95.1
48–57	35	4.0	99.1
58 or above	8	0.9	100.0
Total	879	100.0	

high to low). For Section A. Hotel Information, the statement "Detailed hotel location information is provided (A4)" has the highest mean value ($m = 5.548$) compared with other statements. Conversely, the statement "Detailed information about hotel change policy is provided (A8)" has the lowest mean value ($m = 4.988$). Thus, OTAs can consider indicating the hotel change policy more clearly compared with the current version. Lee, Denizci Guillet, and Law (2013) indicated the importance of the provision of cancellation policies and reasonable guarantee to enhance the consumers' use of websites when making hotel reservations.

4.2.2 | Communication Information and Promotion

For Section B. Communication Information and Promotion, the statement "I can easily read the hotel reviews (B3)" has the highest mean value ($m = 5.389$). Conversely, the statement "I can easily see the request form (B2)" has the lowest mean value ($m = 4.771$) compared with the other statements. The results reveal that customers can easily access hotel reviews, but they have difficulty in finding the request form on the OTA platform (i.e., mobile website/app). Thus, OTAs can consider adjusting the layout for customers to easily find the request form.

4.2.3 | Transaction and Relationship and Social Media

For Section C. Transaction, both statements measuring this dimension have relative higher mean values compared with those of the other dimensions, indicating that reserving hotels via OTAs is easy ($m = 5.430$) and quick ($m = 5.378$). For Section D. Relationship and Social Media, the mean values of the four attributes are relatively consistent. The statement "Logging in to my membership account is easy (D3)" has the highest mean value ($m = 5.471$), whereas "Sharing hotel-related information through social media is easy (D4)" ($m = 5.318$) has the lowest

TABLE 2 | Evaluation of hotel reservation via mobile OTAs.

	Min	Max	Mean	Std. deviation
A. Hotel information				
A4. It provides detailed hotel location information	1.0	7.0	5.548	1.810
A5. It offers detailed hotel contact information	1.0	7.0	5.476	1.818
A3. Hotel room price is clearly displayed	1.0	7.0	5.464	1.706
A1. It provides detailed information on hotel room types	1.0	7.0	5.338	1.592
A6. Hotel earliest check-in time information is clear	1.0	7.0	5.297	1.757
A7. Hotel latest check-out time information is clear	1.0	7.0	5.241	1.719
A2. Hotel room photos are referential	1.0	7.0	5.174	1.593
[2]A9. It provides detailed information about the hotel's cancellation policy	1.0	7.0	5.130	1.551
[1]A8. It provides detailed information about the hotel's change policy	1.0	7.0	4.988	1.535
B. Communication information and promotion				
[5]B3. I can easily read the hotel reviews	1.0	7.0	5.389	1.506
[6]B4. I can easily see the hotel promotion information	1.0	7.0	5.246	1.508
[3]B1. I can easily see "24-h customer service" availability information	1.0	7.0	4.849	1.518
[4]B2. I can easily see the request form	1.0	7.0	4.771	1.588
C. Transaction				
C2. It is easy to complete the hotel reservation	1.0	7.0	5.430	1.698
C1. It is quick to complete the hotel reservation	1.0	7.0	5.378	1.668
D. Relationship and social media				
[9]D3. It is easy to log in my membership account	1.0	7.0	5.471	1.501
[8]D2. It is easy to rate the hotels	1.0	7.0	5.400	1.534
[7]D1. It is easy to post comments	1.0	7.0	5.356	1.511
[10]D4. It is easy to share hotel-related information through social media	1.0	7.0	5.318	1.520
E. Usability				
[11]E1. It provides a personalized search function (e.g., sort by price)	1.0	7.0	5.326	1.468
E5. Navigation is easy to follow	1.0	7.0	5.158	1.583
E3. The layout of the hotel information is appropriate	1.0	7.0	5.125	1.592
E4. The interface is user-friendly	1.0	7.0	5.117	1.556
E2. The overall speed of switching pages is fast	1.0	7.0	5.107	1.579
F. Compared with your actual stay, the overall quality of hotel information provided by mobile OTA is:				
F2. Complete	1.0	7.0	5.135	1.542
F1. Reliable	1.0	7.0	5.119	1.539
F3. Up-to-date	1.0	7.0	5.072	1.572

Note: Since the options for some statements include N.A., the sample sizes of some statements are different. Please refer to the following note: 1. $n = 833$, 2. $n = 831$, 3. $n = 828$, 4. $n = 839$, 5. $n = 827$, 6. $n = 837$, 7. $n = 831$, 8. $n = 833$, 9. $n = 828$, 10. $n = 828$, 11. $n = 827$.

mean value. Given that the differences between the two statements are small, OTAs are doing well in the social network function, particularly for membership account logging in. Moreover, OTAs can continue maintaining and further improving the integrated social media-related functions to meet the concurrent needs of consumers (Michael and Fusté-Forné 2022; Qiu, Chen, and Lee 2021). Inversini and Masiero (2014) explained the need for the hospitality industry to gain additional exposure on social media sites for social booking technology creation.

4.2.4 | Usability and Overall Quality of Information

For Section E. Usability, the statement "A personalized search function is provided (e.g., sort by price) (E1)" has the highest mean value ($m = 5.326$), whereas the statement "The overall speed of switching pages is fast (E2)" has the lowest mean value ($m = 5.107$). Findings indicate that a personalized search function is provided, even though the overall speed of switching pages can be further enhanced. For Section F. Overall Quality of Information, the mean values of the three attributes are relatively consistent, indicating that the information provided by OTAs is generally complete ($m = 5.135$), reliable ($m = 5.119$), and up-to-date ($m = 5.072$). Accordingly, maintaining the overall quality of information, such as in-time necessary information provision, is significant to prepare for the uncertainties of the constantly changing world affected by the COVID-19 pandemic (Khan and Hashim 2020; Kim and Hyun 2024).

4.3 | PCA of Mobile Hotel Reservation

PCA was adopted in the present study to reduce the dimension with a number of variables that can preserve as much information as possible (Tsiotas et al. 2020). Before conducting PCA, the correlations among the attributes for mobile hotel reservation were checked (Table 3A,B). The findings reveal high correlations among the different attributes ($p = 0.000$): A1 = Room type; A2 = Room photo; A3 = Room price; A4 = Hotel address; A5 = Hotel contact information; A6 = Earliest check-in time; A7 = Latest check-out time; A8 = Change policy ($n = 833$); A9 = Cancellation policy ($n = 831$); B1 = 24-h service ($n = 828$); B2 = Inquiry form ($n = 839$); B3 = Hotel reviews ($n = 827$); B4 = Promotions ($n = 837$); C1 = Quick to complete transaction; C2 = Easy to complete transaction; D1 = Post comments ($n = 831$); D2 = Give rating ($n = 833$); D3 = Log into membership account ($n = 828$); D4 = Share information on social media ($n = 828$); E1 = Search function ($n = 838$); E2 = Speed of switching pages; E3 = Layout; E4 = Interface; and E5 = Navigation. The coefficients of each of these attributes are high and consistent.

PCA was conducted further owing to the high coefficient value among the attributes. The scree plot of hotel reservation information shows that the most appropriate number of component is four. Thus, the extraction method "Fixed number of factors (4)" was selected. Findings show that the value of communalities of each attribute is relatively consistent, ranging from 0.698 to 0.886.

After the extraction of the attributes with Varimax rotation and Kaiser normalization, the four possible components with coefficients above 0.5 are listed in Table 4. Factor 1 is "*Hotel Information (HI)*," which has seven attributes: "hotel earliest check-in time," "hotel contact information," "hotel room price," "hotel latest check-out time," "hotel location information," "hotel room types," and "hotel room pictures." Thus, 25.053% of the total variance is explained.

Although the identified Factor 1 is similar to the information level advocated by Wang (2008) within the website context, findings show that hotel information provided by mobile devices is considerably targeted and specific within the context of mobile hotel reservation. Although Baloglu and Pekcan (2006) found that only general hotel information (e.g., photo) is provided for website hotel reservation, the present study demonstrates that the attribute to measure hotel information provided by mobile devices is detailed and specific, such as "Hotel room photos are referential."

Factor 2 is "*Relationship and Social Media (RS)*," which has eight attributes: "easy to give rating," "easy to post comments," "log into membership account," "quick to complete transaction," "easy to complete transaction," "easy to share hotel information," "easy to read hotel reviews," and "easy to see any promotions." Thus, 21.979% of the total variance is explained. The second level of the study of Wang (2008) is communication level. However, the present results extend the findings of Wang (2008) and reveal that interaction is integrated into communication when consumers use mobile devices for hotel reservation. Interactions, such as "easy to post comments," "log into membership account," and "easy to share hotel information," are perceived as important attributes by consumers and exist simultaneously with communication.

Factor 3 is "*Design and Layout (DL)*," which contains five attributes: "interface is user-friendly," "navigation is easy to follow," "layout is appropriate," "speed of switching pages is fast," and "personalized search function is provided." Thus, 18.221% of the total variance is explained. The last component is Factor 4 "*Consumer Requests (CR)*," which has four attributes: "easy to find the enquiry form," "provides 24-hour customer service," "provides information on change policy," and "provides information on cancellation policy." Thus, 15.709% of the total variance is explained. Total variance is equal to 80.692.

A reliability test was further conducted for each component. The Cronbach's alpha values are as follows: Factor 1 "*Hotel Information (HI)*," 0.968; Factor 2 "*Relationship and Social Media (RS)*," 0.963; Factor 3 "*Design and Layout (DL)*," 0.962; and Factor 4 "*Consumer Requests (CR)*," 0.898. Overall, the findings show that the attributes in each dimension are reliable in representing Factors 1, 2, 3, and 4. Wang et al. (2016b) examined the functional features of two different types of mobile apps that can facilitate hotel reservation. They showed that the basic function of mobile apps is to reserve hotel rooms, thereby supporting the findings of the present study that the basic function of mobile apps or websites is hotel reservation.

The present study used web function design framework advocated by Wang (2008) as basis to extend the previous framework by considering functionality and usability and to reveal that mobile hotel reservation can be categorized into four factors, namely, *Hotel Information*, *Relationship and Social Media*, *Design and Layout*, and *Consumer Requests*, through PCA.

TABLE 3 | Correlations of the attributes of hotel reservation information.

	A							
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**
A2	0.831***							
A3	0.838***	0.808***						
A4	0.823***	0.759***	0.877***					
A5	0.808***	0.767***	0.840***	0.902***				
A6	0.778***	0.746***	0.818***	0.829***	0.827***			
A7	0.766***	0.731***	0.798***	0.809***	0.799***	0.906***		
A8	0.639***	0.665***	0.613***	0.566***	0.588***	0.678***	0.698***	
A9	0.656***	0.663***	0.660***	0.612**	0.600***	0.714***	0.701***	0.859***

B														
	B1	**B2**	**B3**	**B4**	**C1**	**C2**	**D1**	**D2**	**D3**	**D4**	**E1**	**E2**	**E3**	**E4**
B2	0.778***													
B3	0.653***	0.640***												
B4	0.656***	0.641***	0.750***											
C1	0.584***	0.559***	0.745***	0.698***										
C2	0.552***	0.554***	0.747***	0.698***	0.934***									
D1	0.554**	0.569**	0.777**	0.719**	0.800**	0.807***								
D2	0.548**	0.558**	0.769**	0.702**	0.809**	0.802***	0.911**							
D3	0.507**	0.518**	0.754**	0.694**	0.808**	0.810***	0.844**	0.837**						
D4	0.595**	0.569**	0.725**	0.704**	0.762**	0.753***	0.794**	0.791**	0.791**					
E1	0.587**	0.576**	0.728**	0.730**	0.784**	0.778***	0.805**	0.802**	0.774**	0.779**				
E2	0.604**	0.621**	0.706**	0.719**	0.816**	0.813***	0.758**	0.746**	0.739**	0.725**	0.806**			
E3	0.609**	0.609**	0.717**	0.721**	0.794**	0.799***	0.727**	0.724**	0.740**	0.713**	0.785**	0.877**		
E4	0.619**	0.625**	0.713**	0.721**	0.801**	0.802***	0.729**	0.720**	0.734**	0.732**	0.801**	0.883**	0.913**	
E5	0.609**	0.612**	0.717**	0.737**	0.800**	0.825***	0.747**	0.745**	0.749**	0.740**	0.814**	0.896**	0.900**	0.914**

Note: A1 = Room type; A2 = Room picture; A3 = Room price; A4 = Hotel address; A5 = Hotel contact information; A6 = Hotel earliest check-in time; A7 = Hotel latest check-out time; A8 = Hotel change policy (n = 833); A9 = Hotel cancellation policy (n = 831); B1 = 24-h service (n = 828); B2 = Request form (n = 839); B3 = Hotel reviews (n = 827); B4 = Hotel promotion (n = 837); C1 = Quick to complete transaction; C2 = Easy to complete transaction; D1 = Post comments (n = 831), D2 = Give rating (n = 833), D3 = Login membership account (n = 828), D4 = Share information on social media (n = 828), E1 = Search function (n = 838), E2 = Speed of switching pages, E3 = Layout, E4 = Interface, and E5 = Navigation.
**Correlation is significant at the 0.01 level (two-tailed).
***Correlation is significant at the 0.001 level (two-tailed).

Unlike Wang (2008), who categorized web-based information into four hierarchical levels (i.e., information, communication, transaction, and relationship), findings of the present study reveal that the four factors identified within the mobile context reflect the change of consumers' needs from hierarchical needs (i.e., from basic information provision to higher level relationship management) to nonhierarchical intertwined needs. That is, consumers tend to have considerably personalized needs and requests, which can arise at any stage of the hotel reservation process via mobile devices. In addition, the present findings show that the measurements of mobile hotel reservation reflect distinct consumer needs, such as giving ratings and sharing hotel-related information through social media, when making hotel reservation. To summarize, the present study explores the important attributes of mobile hotel reservation by considering mobile functionality and usability and identifies four factors to measure mobile hotel reservation through PCA.

5 | Discussion and Conclusions

5.1 | Discussion

The PCA findings reveal that mobile hotel reservation can be classified according to four factors along with the measurement items. Contrary to hotel reservation via desktop websites, information delivery via mobile websites is more targeted and specific. Unlike the hierarchical information provided by the

TABLE 4 | Principal component analysis of hotel reservation via mobile OTAs.

	Factor loadings	Variance explained	Cronbach's alpha
Factor 1. Hotel information (HI)		25.053	0.968
Hi1. The information about earliest check-in time is clear	0.761		
Hi2. Detailed hotel contact information is offered	0.746		
Hi3. Hotel room price is clearly displayed	0.741		
Hi4. The information about latest check-out time is clear	0.740		
Hi5. Detailed hotel location information is provided	0.732		
Hi6. Details about hotel room types are provided	0.652		
Hi7. Hotel room photos are referential	0.605		
Factor 2. Relationship and social media (RS)		21.979	0.963
Ci1. Giving a rating is easy	0.700		
Ci2. Posting comments is easy	0.695		
Ci3. Logging into my membership account is easy	0.680		
Ci4. Completing the hotel reservation is quick	0.655		
Ci5. Completing the hotel reservation is easy	0.640		
Ci6. Sharing hotel-related information through social media is easy	0.637		
Ci7. I can easily read the hotel reviews	0.597		
Ci8. I can easily see any promotions	0.548		
Factor 3. Design and layout (DL)		18.221	0.962
Dl1. The interface is user-friendly	0.755		
Dl2. Navigation is easy to follow	0.742		
Dl3. The layout of the hotel information is appropriate	0.741		
Dl4. The overall speed of switching pages is fast	0.709		
Dl5. A personalized search function is provided (e.g., sort by price)	0.551		
Factor 4. Consumer requests (CR)		15.709	0.898
Cr1. I can easily see the request form	0.807		
Cr2. I can easily see the "24-h customer service" availability information	0.795		
Cr3. Detailed information about the change policy is provided	0.624		
Cr4. Detailed information about the cancellation policy is provided	0.561		
Total variance explained		80.692	

Note: Extraction method: principal component analysis; rotation method: Varimax with Kaiser normalization; rotation converged in nine iterations.

former, the latter addresses tourists' needs at different stages, with interaction existing simultaneously with communication. For the ultimate goal of ensuring the provision of reliable, complete, and up-to-date information to tourists, tourism practitioners need to collaborate with OTAs or other online service providers to clarify their change policies, provide easy-to-find enquiry forms, upgrade social network functions, and improve the speed of switching pages (Yuan et al. 2022). Hotel practitioners should ensure that mobile hotel reservation through OTAs is simple, effective, and customer centric.

5.2 | Theoretical Implications

Theoretically, the present study is based on the web function design framework (part of web-based destination marketing systems) advocated by Wang (2008). Findings of the present study transcend the mere evaluation of information in hotel reservation through websites and consider the entire process of mobile hotel reservation by considering mobile functionality and usability. The present study extends Wang's (2008) web function design framework to the context of mobile hotel reservation through OTAs and also identifies the differences between information display and demand within between the website and mobile contexts. The PCA findings specifically illustrate that mobile hotel reservation can be categorized based on four nonhierarchical but intertwined factors: *Hotel Information*, *Relationship and Social Media*, *Design and Layout*, and *Customer Requests*. The results indicate that within the context of mobile hotel reservation, consumers may have distinct needs at any stage of the process (Buhalis and Sinarta 2019), thereby reflecting a switch from hierarchical to nonhierarchical intertwined needs. That is, when tourists reserve hotels, they search for hotel information and also communicate with hotels and interact with other guests simultaneously. Therefore, interaction exists simultaneously with communication within the context of mobile hotel reservation.

5.3 | Practical Implications

With regard to the evaluation of mobile hotel reservation information, OTAs duly provide detailed hotel location information, but the policy governing hotel reservation changes remains unclear for tourists. To improve and substantially market this aspect, hotel practitioners can communicate with OTAs to clearly indicate their change policies, such as providing detailed terms and conditions for tourists on making hotel reservations via mobile devices. For the relationship and social media aspect, tourists can easily read hotel reviews but cannot easily see inquiry forms. Therefore, adjusting the mobile website layouts of OTAs to easily locate such forms can be regarded as an effective marketing strategy to satisfy consumer needs (Camilleri, Troise, and Kozak 2023). Users also find it easy and quick to book hotels via OTAs using smartphones. Although logging into tourists' membership accounts is easy, they find sharing hotel-related information through social media complicated. Hence, highlighting the social network function can be considered one alternative to attract tourists and encourage mobile hotel reservation. Moreover, tourism practitioners, particularly hotel managers, should communicate with OTAs to improve social network functions (i.e., information sharing) to serve tourists better (Lee et al. 2024; Li, Hyun, and Kim 2024; Taylor 2020). For design and layout, tourists are satisfied with personalized search functions (e.g., sort by price) but are unsatisfied with the overall speed of switching pages. Thus, OTAs can consider improving the speed of switching pages and use this aspect as a selling point for hotel reservation. Given that the general hotel information provided by OTAs should be up-to-date, reliable, and complete from the perspective of tourists, hotels can continue to work closely with OTAs to ensure high-quality information.

5.4 | Limitation and Future Research

Mobile technology and its associated businesses, known as m-commerce, have witnessed remarkable growth. Since 2010, mobile technology advancements have led to an increasing number of mobile-device users (Kim, Park, and Morrison 2008; Liang et al. 2017; Morosan 2018). Although previous studies have evaluated hotel reservations via websites, reservations via mobile devices have received limited attention. To follow the current trend and fill in this gap, the present study evaluates mobile hotel reservation based on web function design framework (part of web-based destination marketing systems) advocated by Wang (2008).

The present study has two limitations. First, the investigation of mobile hotel reservation was conducted among Chinese users, who mainly use Chinese OTAs. Future studies can test whether the findings can be applicable to other countries or regions, specific OTAs, and other apps/hotel booking methods within/outside of the hospitality industry, and to those coping with new functionalities. Second, compared with the number of attributes to measure functionality, only a limited number of attributes are available in this research to measure usability for mobile hotel reservation. Thus, future research may conduct qualitative studies to further explore the attributes to measure usability for mobile hotel reservation.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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