How Smart Tourism Technologies Influence Destination Image, Tourist Satisfaction, and e-WoM: The Critical Impact of Place Dependence

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ABSTRACT

Objective: although STTs have been receiving much attention in tourism literature, there is still a research gap regarding the main marketing aspects. This research aims to fill this gap by investigating how STTs affect destination image (DI), tourist satisfaction (TS), and electronic word-of-mouth (e-WoM), considering the moderating effects of place dependence (PD). **Methods:** considering mediation and moderation influences, the study examined survey results from 393 tourists, applying structural equation modeling and the PROCESS package in SPSS to analyze the hypotheses. **Results:** the study verified that STTs significantly influence DI, TS, and e-WoM; DI and TS mediate the relationship between STTs and e-WoM; and PD moderates the relationships between STTs and TS, and between STTs and e-WoM. **Conclusions:** several recommendations are provided in the research to successfully manage marketing activities in tourism destinations and to apply efficient strategies for promoting exemplary behaviors among travelers who have a strong sense of PD.

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INTRODUCTION

The 21st century has witnessed the rapid development of smart tourism technologies (STTs), which have resulted in a noteworthy transformation in tourism. These innovative technologies, including mobile apps and virtual reality, which offer personalized services, have transformed how travelers get involved in destinations all over the world (Jeong & Shin, 2020; Y. Li et al., 2017). According to Y. Zhang et al. (2022) and Gajdošík and Orelová (2020), tourists are accustomed to using STTs before, during, and after the trip.

Utilizing STTs enhances destination image, which is an important predictor of tourist satisfaction (Azis et al., 2020; Shahijan et al., 2018). Destinations can succeed in attracting tourists by improving their image and satisfying visitors (J. Li, 2012). Besides, favorable comments on social media are also important for destinations to be competitive in terms of their image and to achieve positive electronic word-of-mouth (e-WoM) (García-Maroto et al., 2024; Ng et al., 2023).

The way tourists communicate with each other has been reshaped by e-WoM. According to Herstanti et al. (2024) and Rahimizhian et al. (2020), e-WoM is a digital tool that refers to the online spreading of visitors' first-hand impressions and opinions about a destination to demonstrate its touristic potential. This process provides tourists with valuable and reliable information, which significantly improves their perceptions of destinations and helps them make travel decisions (Herstanti et al., 2024; Pourfakhimi et al., 2019). According to García-Maroto et al. (2024), Torabi et al. (2023), and Perles-Ribes et al. (2019), positive e-WoM enables destinations to reach a wide range of potential audiences and motivates them to visit these places.

J. Li. (2012) described the process from the formation of a destination image to the post-travel behavior of tourists in her model. Although destination loyalty was chosen as the primary outcome, specifically post-travel behavior, the effects of a positive destination image and tourist satisfaction on word-of-mouth (WoM) were also examined within this framework. In our work, several modifications were made to J. Li's (2012) model: (1) STT was added to the model as an antecedent of destination image; (2) destination image, a variable that was studied in J. Li's (2012) model by dividing it into several components, was considered as a single dependent variable, namely a consequence of STTs; (3) tourist satisfaction was considered as a dependent variable, namely a consequence of destination image and an antecedent of e-WoM; (4) e-WoM, not destination loyalty as in J. Li's (2012) model, was considered as the main outcome; and (5) place dependence was also studied as a moderator of the relationship between STTs and tourist satisfaction, and between STTs and e-WoM.

This study specifically aims to (1) investigate the direct and indirect impacts of STTs on e-WoM by considering the mediating roles of destination image and tourist satisfaction in this relationship, and (2) examine how place dependence moderates the relationships between STTs and tourist satisfaction, and between STTs and e-WoM.

STTs play a crucial role in tourism by actively contributing to the formation of destination image (De Los Reyes & Dael, 2023; J. Li, 2012) and enhancing tourist satisfaction (De Los Reyes & Dael, 2023; Jeong & Shin, 2020; Pai et al., 2020), ultimately improving e-WoM (Goyal & Taneja, 2023; Sharipudin et al., 2023). STTs empower tourists by providing real-time information, facilitating seamless navigation, and offering personalized experiences tailored to individual preferences (Neuhofer et al., 2015). Consequently, they improve destination image by providing accessible tourist services (Tavitiyaman et al., 2021a; Tavitiyaman et al., 2021b), while tourists may become more satisfied as a result of using STTs, which is important for their future behavior as e-WoM (Jeong & Shin, 2020; Pai et al., 2020; Sharipudin et al., 2023; Y. Zhang et al., 2022). Therefore, studying these variables explains how smart technologies facilitate convenience and engagement for tourists. To this end, the study uses J. Li's (2012) framework of destination image theory, which is based on Gunn's (1972) seven-stage model (see Figure 1).

Based on Gunn's (1972) seven-stage model of destination image, J. Li. (2012) proposed a framework by combining the seven stages of destination image formation, which were offered by Gunn (1972), into three categories (pre-image, actual travel experience, and overall post-image) and adding post-visit behavior (destination loyalty). According to this theory, the destination image may change to positive, negative, or remain the same after traveling. In all these cases, tourists tend to spread various WoM messages according to the images, while STTs help facilitate travel processes. When planning a trip, for example, tourists receive preliminary information from the internet through their mobile phones, which forms initial thoughts about the destination; in other words, the image of the destination begins to form. Then, based on online reviews, ratings, and several different criteria, tourists decide whether to visit the destination. During the trip, STTs help tourists have a satisfactory trip with location determination, taxi calling, online maps, food ordering, and many other options. After the trip, STTs help and encourage tourists to actively share their experiences and spread e-WoM.

Although previous studies have examined the influences of STTs on destination image (Balakrishnan et al., 2023; Chang, 2022; García-Maroto et al., 2024; Peong et al., 2023; Tavitiyaman et al., 2023), tourist satisfaction (Azis et al., 2020; Peong et al., 2023; Torabi et al., 2023; Ximenes et al., 2024; Yang & Zhang, 2022), and e-WoM (García-Maroto et al., 2024; Ng et al., 2023; Torabi et al., 2023; Wang et al., 2024), the direct effects of STTs on these variables have been overlooked by them. In turn, other studies have examined the direct impact of STTs on destination image (Shafeeque & Azees, 2024; Tavitiyaman et al., 2021a; Tavitiyaman et al., 2021b), tourist satisfaction (Chakraborty et al., 2023; Ng et al., 2023), and e-WoM (Al-Gasawneh et al., 2023; Feitosa & Barbosa, 2020; Wahyuningtias et al., 2024), but not all of these variables have been studied in a single model, while digital development is making destination managers face digital challenges to achieve a competitive advantage. In addition, the mediating effect of destination image and tourist satisfaction on the relationship between STTs and e-WoM, as well as the moderating role of place dependence on the relationship between STTs and tourist satisfaction and between STTs and e-WoM, have also been neglected in these studies.

In this sense, this work makes theoretical and practical contributions. The modifications to J. Li's (2012) model, as listed above, represent the theoretical contributions of this work. For practical contributions, tourism managers and policymakers may find actionable insights to achieve tourist satisfaction and positive e-WoM by utilizing STTs and considering the moderating effects of place dependence. Understanding these dynamics is essential for destination managers, marketers, and policymakers to harness the potential of smart technologies effectively and decide where to invest (e.g., providing appropriate STTs such as websites, mobile apps, etc., to improve destination image) and what to focus on (e.g., using STTs to improve destination image and satisfy tourists to encourage them to share positive e-WoM).

LITERATURE REVIEW
Smart tourism technologies

STTs have been defined by Huang et al. (2017) as "all forms of online tourism applications and information sources such as online travel agents, personal blogs, public websites, company websites, social media, smartphone apps, and so on" (p. 5). Torabi et al. (2023) found STTs important since they provide accessible, valuable, and up-to-date information, enabling tourists to interact with their friends and engage in destination activities. Additionally, Shafeeque and Azees (2024) emphasized that mobile applications benefit both tourism service providers and tourists by providing opportunities such as quick access to relevant and reliable information, real-time assistance, payment systems, and effective interactive communication. Considering the importance of STTs, their various aspects in the field have been examined in the literature. Particularly, prior studies have discussed the roles of mobile applications in the enhancement of destination image and tourists' behavioral intentions (Shafeeque & Azees, 2024; Tavitiyaman et al., 2021a; Tavitiyaman et al., 2021b; Torabi et al., 2023), how STT acceptance by tourists contributes to the efficient use of resources and effective marketing of tourism products in a destination (Chen et al., 2024; Chung et al., 2015), the influence of virtual reality technology on destination image and tourists' travel intentions (Ghorbanzadeh et al., 2024; Xiong et al., 2023), the role of artificial intelligence in the enhancement of tourists' emotions, engagement, and experiences (Sousa et al., 2024; Tsaih & Hsu, 2018), and how social media improves destination brand awareness and image (Ghorbanzadeh et al., 2023). Nevertheless, how STTs directly influence destination image and the way tourists are satisfied with a destination and then spread positive e-WoM still requires further investigation, considering the reasons mentioned above for the modifications made to J. Li's (2012) model in this work. Therefore, Figure 1 illustrates how this research aims to address the gaps above through a proposed framework.
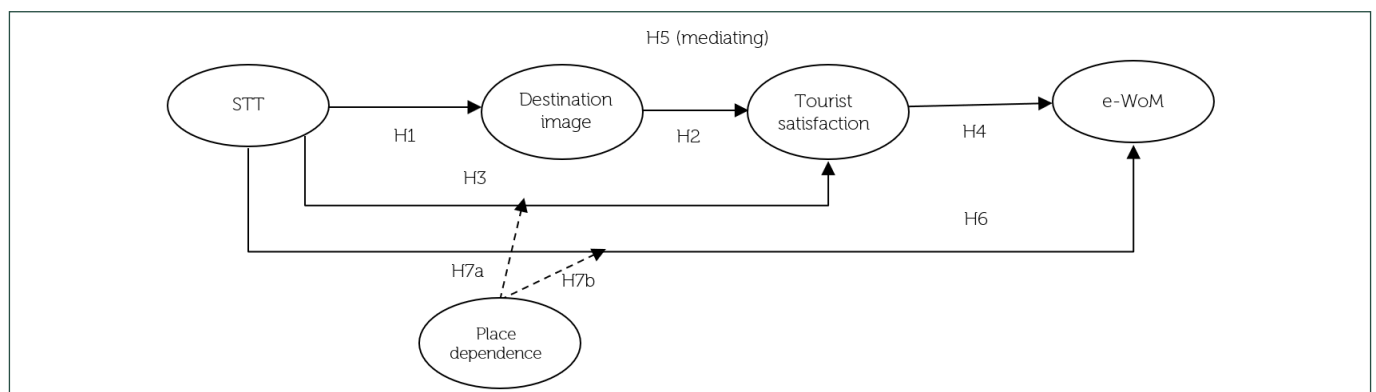
Source: Developed by the authors.

Figure 1. Proposed conceptual framework.

Regarding STTs, Buhalis and Amaranggana (2015)and Huang et al. (2017) identified four key attributes: information, accessibility, interactivity, and personalization. In addition, Pai et al. (2021), Gretzel et al. (2015), and Y. Zhang et al. (2022) explored STTs by considering a fifth attribute: security. Therefore, five STT attributes were discussed in this study.

The first attribute is informativeness, which indicates the quality and reliability of the information provided by advanced technologies at a tourist destination (Huang et al., 2017; No & Kim, 2015). Information credibility and quality are important aspects that might affect visitors' experiences during their travel, as tourism is an intangible industry (Jeong & Shin, 2020). Similarly, the usefulness of social media in travelers' information searches depends on the trustworthiness of the content (Chung et al., 2015), whereas travel information on websites significantly influences the formation of destination image (Ghorbanzadeh et al., 2023; Jiang et al., 2021). Therefore, developing an effective marketing strategy to advertise the destination across various platforms was one of the key reforms suggested by Torres et al. (2022) to help the destination recover from the pandemic.

The second attribute, interactivity, demonstrates how STTs can offer tourists immediate feedback and facilitate discussion (Huang et al., 2017). Tourists' high level of interactivity makes finding information much easier, leading to favorable opinions of STTs (García-Maroto et al., 2024; Ghorbanzadeh et al., 2024), motivating frequent use of STTs (No & Kim, 2015), and encouraging the sharing of positive suggestions (Ghorbanzadeh et al., 2024). Accordingly, interactivity provides and enhances mutual communication between tourism service providers and tourists, inspiring travelers to enrich their travel experiences (Gretzel et al., 2015).

The third attribute is personalization, which is defined by No and Kim (2015) as a customer's preference for a specific kind of goods or services. Thus, personalized services contribute to tourist experiences and satisfaction (No & Kim, 2015) by assisting travelers in managing their time efficiently during their travel and reducing the time spent looking for required information (Jeong & Shin, 2020).

Accessibility refers to the opportunity for visitors to retrieve and use information via STTs at a destination (Jeong & Shin, 2020). If tourists consider it easy to access and employ online tourism information, they may improve their travel experiences and be satisfied with the service (Huang et al., 2017). Smart applications could lead to a positive destination image when they are accessible to tourists (Tavitiyaman et al., 2021a).

Lastly, security is a critical topic in online dealings related to technology (Lee et al., 2018; Um & Chung, 2019),

referring to the safety of travelers' private data when they are utilizing STTs (Huang et al., 2017). Although safety concerns may not stop the use of technologies entirely now, they are considered one of the main factors that may lead tourists to avoid using technologies when planning their travel (Xiang et al., 2015). Guaranteeing the safety of tourists' private data may help destinations inspire travelers to utilize smart technologies (Pai et al., 2021), because tourists' worries regarding the risks of cyberattacks and private information breaches are critical aspects affecting the utilization of STTs (Huang et al., 2017). Shin et al. (2021) concluded that tourists may be dissatisfied and may not prefer to use smart technologies if destinations do not ensure the safety of their private data.

The aforementioned attributes contribute to the ease of use and perceived usefulness of STTs (Huang et al., 2017; Um & Chung, 2019) by helping tourists find destination information easily, offering more interactivity between all users in real time, guaranteeing high accessibility of information, helping users retrieve the information required for their vital needs (Buhalis & Amaranggana, 2015; Um & Chung, 2019), ensuring the cyber safety of tourists, and playing a significant role in their wide use of STTs and decision-making regarding visiting a destination (Jeong & Shin, 2020; No & Kim, 2015).

Destination image

The explanation of destination image is crucial to describe its relationship with STTs. According to Akgün et al. (2020), destination image is explained as the combination of cognitive beliefs and affective sentiments that a person holds and remembers about a tourism destination. Destination image may be expressed as thoughts, expectations, views, and beliefs that are formed by evaluating particular features in the destination (Chu et al., 2022; Josiassen et al., 2016). Hence, this process is critical in attracting visitors and influencing their destination choices (J. Zhang et al., 2019). According to J. Li's (2012) framework of destination image formation, the pre-image stage is described as the starting phase of destination image formation to the phase when travelers decide to visit the destination. In the beginning, the destination image starts to build purely based on the individual's common opinion, where no commercial or tourism media, such as brochures, advertising, or videos, can influence consumer perceptions of a destination.

As for the link between STTs and destination image, the information delivered by STTs causes modifications in destination image, as theoretically justified in the framework suggested by J. Li (2012). Ghorbanzadeh et al. (2023) found that individuals may become aware of the available tourist services in a destination via vid-

eo content posted on social media and visualize how they would feel while engaging in these activities. This process leads to the formation of cognitive and affective images of the destination in line with these circumstances, which in turn influence tourists' future behavior. Furthermore, Tavitiyaman et al. (2021b) mention that developments in information technology can improve tourists' memorable experiences, resulting in an advanced level of perceived destination image. Likewise, Ghorbanzadeh et al. (2024) highlight that immersive virtual reality technology has a positive influence on destination image. Accordingly, Buhalis and Amaranggana (2014) mentioned that tourism beneficiaries may be attracted by destination image and advanced technologies, which help them share information and improve tourism experiences, since tourism stakeholders frequently promote the destination and monitor the market via destination image, using it as a marketing tool to make their place competitive and sustainable (Hamdy et al., 2024). Thus, we propose the following hypothesis:

H1. STT is positively related to destination image.

Tourist satisfaction

According to J. Li's (2012) model of destination image, the positive destination image achieved through available opportunities at the destination contributes to tourist satisfaction. For example, considering the various habits and customs of tourists to improve accommodation conditions, particularly allowing them to choose between smoking and non-smoking rooms, will positively affect their satisfaction. Accordingly, other authors (Agag & El-Masry, 2017; Jeong & Shin, 2020; Phi et al., 2022) considered destination image a predictor of tourist satisfaction because a positive image serves as the basis for a positive destination assessment, which in turn improves tourist satisfaction. Therefore, destinations should strive to enhance their image and achieve tourist satisfaction by providing travelers with suitable conditions for their visit. Thus, we propose the following hypothesis:

H2. Destination image is positively related to tourist satisfaction.

Since technology helps to satisfy visitors' different needs, J. Li (2012) mentioned it as the main information source for travelers. According to Lee et al. (2018), tourist satisfaction can be improved by tourists' positive perceptions when they have favorable feelings and views toward STTs. Pai et al. (2020) and Y. Zhang et al. (2022) concluded that high-quality accessibility and interactivity of STTs may enhance tourist satisfaction by

facilitating tasks for visitors. Also, Um and Chung (2019) and Huang et al. (2017) argue that STT accessibility has a significant relationship with visitors' perceived quality of technology use, which might increase tourist satisfaction. Additionally, some studies (No & Kim, 2015; Um & Chung, 2019) highlighted that two attributes of STTs, such as informativeness and personalization, significantly influence tourist satisfaction. For instance, C. Li et al. (2023) stated that various mobile apps may contribute to tourist satisfaction by enabling travelers to be aware of traffic jams on the roads, eventually reducing visitors' driving time. The present discussion indicates that the aforementioned attributes of STTs are strong predictors of tourist satisfaction, which can be the basis for the following hypothesis:

H3. STT is positively related to tourist satisfaction.

e-WoM

According to Wang et al. (2024), e-WoM refers to a user's online activities, such as sharing thoughts, suggestions, and understandings with the assistance of social media, websites, blogs, and other channels. Furthermore, it includes communication between companies and their clients, or among customers themselves. Unlike classical WoM, e-WoM enhances a customer's choices to find information about particular goods and services (Rosario et al., 2020) by offering low-cost and reliable dissemination of content (Meenakshy et al., 2020). Thus, e-WoM delivers information to large audiences, which enables companies to monitor and adjust their facilities.

According to J. Li's (2012) theory regarding the formation of destination image, the post-visit behaviors of tourists happen after visiting the place and engaging in activities. In this phase, destination services may lead to a positive destination image by satisfying visitors, which may inspire them to disseminate favorable comments on social media or other online channels. In the context of tourism, favorable WoM about a destination may be achieved by satisfying tourists with memorable experiences (Lin & Ryu, 2023; Meenakshy et al., 2020; Shafeeque & Azees, 2024) or making their experiences surpass their expectations (Hultman et al., 2015), whereas tourist dissatisfaction causes negative WoM (Jeong & Shin, 2020). Duarte et al. (2018) highlighted that online customer satisfaction has a positive and significant relationship with e-WoM, whereas Pang (2021) emphasized the positive and noteworthy relevance of mobile social media user satisfaction and e-WoM. Thus, we propose the following hypothesis:

H4. Tourist satisfaction is positively related to e-WoM.

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Travelers tend to recommend the place and show positive future behavior when they perceive STTs as useful and are satisfied with destination services (Shafeeque & Azees, 2024). Besides, a positive destination image advanced by STTs motivates tourists to recommend the destination (Shafeeque & Azees, 2024; Tavitiyaman et al., 2021a). In addition, STT is a significant predictor of destination image (Tavitiyaman et al., 2021a; Tavitiyaman et al., 2021b) and tourist satisfaction (Jeong & Shin, 2020), thus inspiring visitors to disseminate positive e-WoM. In terms of mediating effects, Phi et al. (2022) stated that destination image has a positive relationship with tourists' intention to revisit, where tourist satisfaction and WoM are considered mediators. According to J. Li's (2012) framework of destination image formation, the information offered by STTs contributes to forming the destination's pre-image, which tourists expect to match the actual image, while Azis et al. (2020) suggest, based on Oliver's (1980) expectancy-disconfirmation theory, that tourist satisfaction may be achieved when tourists perceive the service and other conditions in a destination as suitable for their expectations (pre-image). Eventually, they will be eager to disseminate positive e-WoM. According to the discussions above, we conclude that destination image and tourist satisfaction may be mediators in the relationship between STT and e-WoM. Therefore, we propose the following hypothesis:

H5. Destination image and tourist satisfaction mediate the relationship between STT and e-WoM.

According to Yang and Zang (2022) and Haro-Velasteguí et al. (2024), the number of tourists who are eager to use STTs is showing a rising trend, specifically social media and other online platforms such as Facebook, Twitter (X), and YouTube, which contribute to e-WoM (Mishra & Satish, 2016) by helping visitors engage and share their experiences. Besides, Y. Zhang et al. (2022) found that tourists who are satisfied with the facilities in a destination are likely to recommend it and disseminate favorable WoM. Torabi et al. (2023) investigated the impact of STTs on tourist satisfaction and revisit intention in rural areas and found that STTs may inspire visitors to interact and spread positive WoM. The analysis above may lead to the suggestion that there is a positive relationship between STTs and e-WoM. Thus, we hypothesize as follows:

H6. STT is positively related to e-WoM.

Place dependence

Place dependence is one of the sub-components of place attachment, together with place identity, affective attachment, and social bonding (Isa et al., 2020; Kuo et al., 2021; Saut & Ly, 2023; Zhao et al., 2023). According to Han et al. (2021), the concept of place dependence refers to a destination's ability to best address a person's functional needs in comparison with other locations. Specifically, place dependence connects an individual to a particular area at a destination, such as a building, home, cafeteria, or hostel. As a result, it makes tourists more interested in engaging with STTs, feel comfortable at a destination, and show a high level of satisfaction with their trip. When visitors are highly dependent on a place, they are likely to show a sense of responsibility and have a favorable attitude toward the destination's infrastructure, its functional attributes, and sustainability (Isa et al., 2020; Kuo et al., 2021). By providing an appropriate environment for visitors to have desirable travel experiences, this attribute motivates them to utilize STTs more and show a high level of interaction. This leads to the enhancement of tourist satisfaction by confirming that the relationship between STT and tourist satisfaction increases owing to place dependence. Thus, previous studies (Ispas et al., 2021; Zhao et al., 2023) highlighted that place dependence is positively related to tourist satisfaction. Furthermore, the more place-dependent tourists are, the more likely they are to revisit a destination (Isa et al., 2020; Ispas et al., 2021). Hence, place dependence may make tourists show revisiting behaviors and favorable WoM (Xu & Zhang, 2016). At the same time, visitors who have favorable feelings toward STTs and the destination are eager to disseminate positive e-WoM about their memorable experiences. This leads to the conclusion that place dependence plays a crucial role in the relationship between STTs and tourist satisfaction as a moderator. Considering the mutual relationship between place dependence and STTs, and the discussion above, the following hypotheses have been proposed:

H7a. Place dependence moderates the relationship between STTs and tourist satisfaction, strengthening it as place dependence increases.

H7b. Place dependence moderates the relationship between STTs and e-WoM, strengthening it as place dependence increases.

METHODOLOGY
Sample

The data for this study were collected via personal interviews using convenience sampling. To safeguard participants' privacy, it was clearly explained to them before starting the survey that the study would maintain the strict confidentiality of all respondent information and that any data collected would be used solely for scientific purposes after aggregation. The city of Khiva was chosen for this process because it is one of the ancient, famous, and most visited cities not only in Uzbekistan but also on the Great Silk Road and is highly rated by tourists for the quality of its services and digitalization (Bekjanov & Matyusupov, 2021). Thus, the survey was performed by communicating with tourists in hotels, cafeterias, tea houses, exhibition halls of museums, and shopping centers in Khiva. Before the survey, a pre-test was carried out with the participation of experts, researchers, and teachers from Urgench State University, together with local tour operators. The survey was carried out from September to November 2022.

The total number of questionnaires gathered in the survey was 404; however, after eliminating those containing outliers, the final result consisted of 393 tourists. The Z-score technique was used to remove outliers (Bakker & Wicherts, 2014). Of the respondents, 43.8% were female, with an average age of 28 years, and 62.6% had a first-level university degree. The respondents came from European countries (e.g., Spain, France, Germany, and Italy), the United Kingdom, China, Japan, South Korea, the United States, Russia, Kazakhstan, and Uzbekistan.

Measures

All the scales used were taken from previous studies and showed strong psychometric properties. Some information regarding this process is provided in the Appendix 1. There are seven-point items in the scales, ranging from one (strongly disagree) to seven (strongly agree).

Specifically, STT was determined by utilizing scales adapted from Huang et al. (2017), Pai et al. (2021), Jeong and Shin (2020), No and Kim (2015), and Lee et al. (2018), consisting of 19 items structured into five dimensions: informativeness, accessibility, interactivity, personalization, and security. The last dimension (security) was made up of three items, while the others comprised four items per dimension.

Next, tourist satisfaction was determined by using a four-item scale adapted from Pai et al. (2021). The destination image was evaluated by utilizing a five-item scale adapted from Abbasi et al. (2021) and Jalilvand et al. (2012). e-WoM was determined using the three-item scale adapted from Kakirala and Singh (2020). Place dependence was quantified using a three-item scale adapted from Kim et al. (2016) and Xu and Zhang (2016).

Method

PLS-SEM was used to confirm the reliability and validity of the measurement model. As Rigdon (2016) stated, PLS is a recommended method for analyzing latent-construct models composed of composites. As noted by Chin and Newsted (1999), it is difficult to predict and explain novel phenomena. Therefore, the PLS method is suitable for studying mobile tourism applications.

Second, to examine the hypotheses involving mediation and moderation, conditional process analysis was conducted using version 4.2 of the PROCESS package for SPSS. For this study, Model 85 (Hayes et al., 2022) was employed, where STT (X) was the antecedent variable, destination image (M1) and satisfaction (M2) were the mediator variables, e-WoM (Y) was the consequent variable, and place dependence (W) was the moderator. The interaction term variables were centered to avoid issues related to interpretation. To establish the percentile bootstrap confidence intervals, 5,000 bootstrap samples were used.

RESULTS AND DISCUSSION
Measurement model analysis

Cronbach's alpha and composite reliability were used to assess the internal consistency of the construct (Table 1), where internal consistency indicates the degree to which the items measure the same latent variable. Cronbach's alpha provides a value for the internal consistency of each construct ranging from zero to one, with higher values indicating greater internal consistency. Typically, the minimum acceptable limit for the internal consistency of a construct is set between 0.6 and 0.7 (Hair et al., 2005). The values in this model are within this range; therefore, the internal consistency of the model can be confirmed.

All the constructs (as presented in Table 1) meet the requirements for Dijkstra–Henseler's indicator (rho_a), with all values above 0.7 (Dijkstra & Henseler, 2015).

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Table 1. Cronbach's alpha, rho_A, composite reliability, and AVE.

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	The Average Variance Extracted (AVE)
STT	0.966	0.967	0.969	0.621
Destination Image	0.888	0.891	0.918	0.690
Satisfaction	0.892	0.892	0.925	0.755
e-WoM	0.853	0.854	0.911	0.773
Place Dependence	0.902	0.905	0.938	0.835

Note. Developed by the authors.

Discriminant validity refers to how one construct is distinct from the others in a model. A two-stage analysis was performed to evaluate the discriminant validity of the proposed model. First, the measurement model was assessed to confirm that the average variance extracted (AVE) square root was higher than the correlation between the construct and the other constructs in the model (Fornell & Larcker, 1981).

Second, the structural model was assessed to confirm that each construct revealed more variance with its indicators than with the other constructs in the model (Henseler et al., 2009). It can be seen from Table 2 that both conditions were satisfied, showing the discriminant validity of the model's constructs.

Table 2. Fornell-Larcker criterion.

	e-WoM	Destination Image	Place Dependence	STT	Satisfaction
e-WoM	0.879				
Destination Image	0.495	0.831			
Place Dependence	0.616	0.536	0.914		
STT	0.625	0.610	0.684	0.788	
Satisfaction	0.521	0.627	0.514	0.560	0.869

Note. Developed by the authors.

Henseler et al. (2016) highlighted that the heterotrait–monotrait ratio (HTMT) is the most efficient technique for determining a lack of discriminant validity. The HTMT is obtained by averaging the heterotrait–heteromethod correlations and the monotrait–heteromethod correlations. A properly specified model should reveal lower heterotrait correlations than monotrait correlations, and an HTMT ratio below 0.9 is indicative of discriminant validity (Henseler et al., 2016). Table 3 shows that the proposed model fulfills this criterion, thus confirming the discriminant validity of the constructs. Particularly, the HTMT value between place dependence and STT is the highest (0.731), although still well below the threshold established in the literature, suggesting that these constructs are closely associated but conceptually distinct. A similar observation can be made when considering the HTMT value between satisfaction and destination image (0.705), which reflects a significant relationship without crossing the threshold that would question discriminant validity. In contrast, lower HTMT values, such as those observed between e-WoM and destination image (0.570) and between e-WoM and satisfaction (0.597), imply more moderate correlations between the constructs. The results lead to the conclusion that each construct in the model is sufficiently different from the others, thus satisfying the requirement of discriminant validity.

Table 3. Heterotrait-monotrait ratio (HTMT) — Matrix.

	e-WoM	Destination Image	Place Dependence	STT	Satisfaction
e-WoM					
Destination Image	0.570				
Place Dependence	0.701	0.596			
STT	0.687	0.655	0.731		
Satisfaction	0.597	0.705	0.571	0.602	

Note. Developed by the authors.

Hypothesis testing

A conditional process model was employed to examine all the hypotheses of the study, considering the mediating and moderating influences. Particularly, the relationship between STTs and e-WoM was tested using a moderated mediation model where destination image and tourist satisfaction were considered mediators. Furthermore, the indirect effect was expected to be conditional on place dependence, which acted as a moderator. The results of this model, estimated using Hayes's methodology, are presented in Table 4.

Table 4. Model coefficients for the conditional process model.

	Consequent								
	M1 (Destination Image)			M2 (Satisfaction)			Y (e-WoM)		
Antecedent	Coeff.	SE	p	Coeff.	SE	p	Coeff.	SE	p
Constant	6.180	0.047	<.01	3.123	0.336	<0.01	4.348	0.433	<0.01
X (STT)	0.334	0.044	<0.01	0.145	0.050	0.040	0.345	0.059	<0.01
M1 (Destination Image)	---	---	---	0.437	0.054	<0.01	0.044	0.068	0.518
M2 (Satisfaction)	---	---	---	---	---	---	0.154	0.059	0.009
W (Place Dependence)	---	---	---	0.223	0.048	<0.01	0.367	0.057	<0.01
M1xW	---	---	---	0.074	0.031	0.020	---	---	---
M2xW	---	---	---	---	---	---	0.124	0.037	0.001
	$R^2 = 0.429$; p <0.01			$R^2 = 0.475$; p <0.01			$R^2 = 0.498$; p <0.01		

Note. Developed by the authors.

The model estimation results indicate that STT is a significant predictor of destination image (β = 0.334, p < .01) and satisfaction (β = 0.145, p = 0.040), and satisfaction, in turn, significantly predicts e-WoM (β = 0.154, p < .01). Destination image also predicts satisfaction (β = 0.437, p < .01). Additionally, a significant positive direct effect of STT on e-WoM is observed (β = 0.345, p < .01). The obtained positive and significant coefficients associated with the interaction terms (β = 0.074, p = 0.020; β = 0.124, p = 0.001) are the first evidence of moderation by the place dependence variable. These findings suggest that STT has a positive impact on e-WoM through direct and indirect pathways involving both destination image and satisfaction. Moreover, the strength of the indirect effect is contingent on the level of place dependence.

The Johnson–Neyman approach was utilized to examine the interactions, and the results are presented in Tables 5 and 6. Table 5 includes estimates of the effect of STT on satisfaction for various levels of the place-dependence moderator variable, along with significance levels and confidence intervals. Table 6 shows the effect of STT on e-WoM. In the first case, the significance region for the impact of place dependence on satisfaction is indicated by a value of −0.319 on the place dependence scale. The analysis revealed that the effect of satisfaction was not statistically significant when place dependence was below this threshold. However, above this value, the effect becomes positive and increases in magnitude, reaching a maximum of 0.239 at the highest point on the scale (when place dependence equals 1.281). In the second case, the significance region for the effect of place dependence on e-WoM is indicated by the value of −1.386 on the place dependence scale. The effect reaches a maximum of 0.504 at a place dependence value of 1.281.

Table 5. Conditional effect of satisfaction at values of the place dependence.

Place dependence	Effect	SE	t	p	LLCI	ULCI
-4.053	-.155	.142	-1.092	.275	-.433	.124
-3.786	-.135	.134	-1.009	.314	-.398	.128
-3.519	-.115	.126	-.915	.361	-.363	.132
-3.253	-.096	.118	-.808	.420	-.328	.137
-2.986	-.076	.111	-.685	.494	-.294	.142
-2.719	-.056	.103	-.544	.587	-.259	.147
-2.453	-.037	.096	-.380	.704	-.225	.152
-2.186	-.017	.089	-.189	.850	-.192	.158
-1.919	.003	.082	.035	.972	-.159	.165
-1.653	.023	.076	.297	.766	-.126	.172
-1.386	.042	.070	.606	.545	-.095	.179
-1.119	.062	.064	.965	.335	-.064	.188
-.853	.082	.059	1.375	.170	-.035	.198
-.586	.101	.055	1.831	.068	-.007	.210
-.510	.107	.054	1.966	.050	.000	.214
-.319	.121	.052	2.310	.021	.018	.224
-.053	.141	.051	2.777	.006	.041	.240
.214	.160	.050	3.189	.002	.061	.259
.481	.180	.051	3.508	.001	.079	.281
.747	.200	.054	3.722	.000	.094	.305
1.014	.219	.057	3.839	.000	.107	.332
1.281	.239	.062	3.882	.000	.118	.360

Note. Developed by the authors.

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Table 6. Conditional effect of STT at values of the place dependence.

Place dependence	Effect	SE	t	p	LLCI	ULCI
-4.053	-.158	.165	-.957	.339	-.482	.166
-3.786	-.125	.156	-.801	.424	-.431	.181
-3.519	-.092	.147	-.625	.533	-.380	.197
-3.253	-.059	.138	-.425	.671	-.329	.212
-2.986	-.025	.129	-.197	.844	-.279	.228
-2.719	.008	.120	.064	.949	-.229	.244
-2.453	.041	.112	.365	.715	-.179	.261
-2.186	.074	.104	.714	.476	-.130	.278
-1.919	.107	.096	1.119	.264	-.081	.295
-1.653	.140	.088	1.590	.113	-.033	.313
-1.465	.163	.083	1.966	.050	.000	.327
-1.386	.173	.081	2.135	.033	.014	.333
-1.119	.206	.075	2.761	.006	.059	.353
-.853	.239	.069	3.462	.001	.103	.375
-.586	.273	.065	4.218	.000	.145	.400
-.319	.306	.061	4.985	.000	.185	.426
-.053	.339	.059	5.696	.000	.222	.456
.214	.372	.059	6.278	.000	.255	.488
.481	.405	.061	6.681	.000	.286	.524
.747	.438	.063	6.899	.000	.313	.563
1.014	.471	.068	6.959	.000	.338	.604
1.281	.504	.073	6.908	.000	.361	.648

Note. Developed by the authors.

The interpretation is supported by the graphs presented in Figures 2 and 3, which were generated by applying the method proposed by Dawson (2014). The diagrams demonstrate a positive association between STT and satisfaction, as well as between STT and e-WoM, for both tourist groups — those with low and high place dependence. Nevertheless, the slope is steeper for the latter group in both cases.
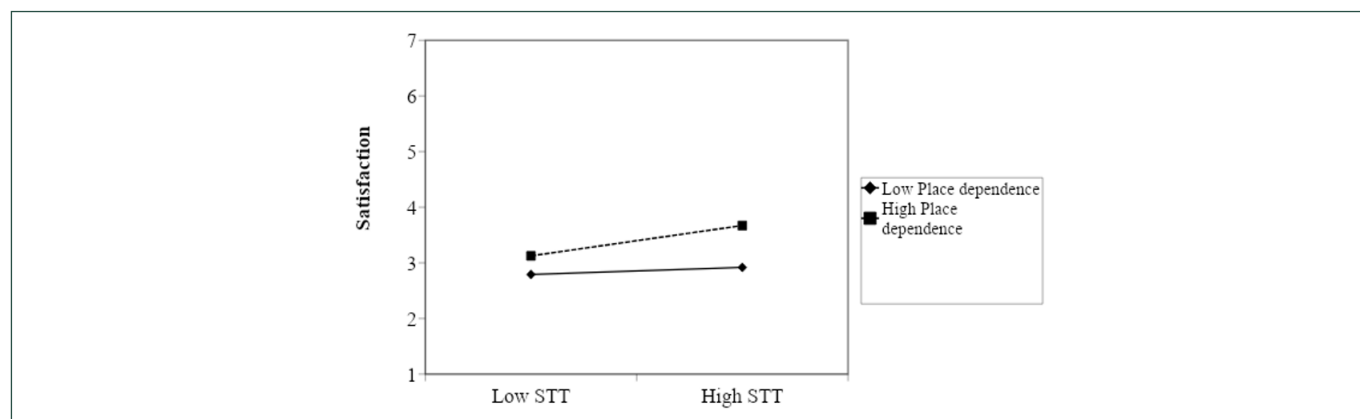
Source: Developed by the authors.
Figure 2. Conditional effects of STT on satisfaction: Two-way interaction effects for unstandardized variables.
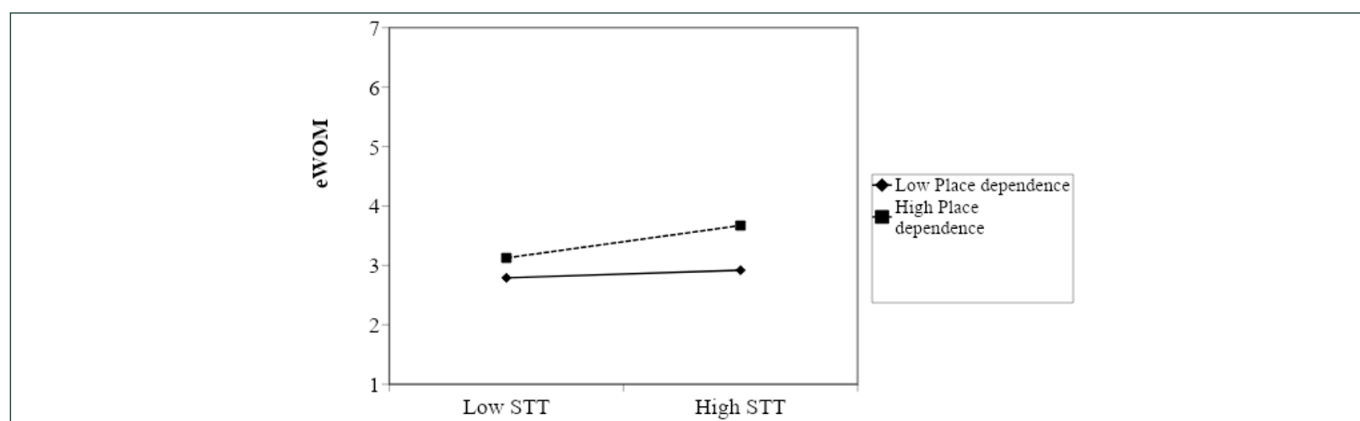
Source: Developed by the authors.
Figure 3. Conditional effects of STT on e-WoM: Two-way interaction effects for unstandardized variables.

A combination of the pick-a-point method (Rogosa, 1980) and bootstrapping (Malhotra et al., 2014) was used to test the indirect and conditional nature of these effects. The results indicate that STT has a direct conditional effect on e-WoM, intensifying as place dependence increases. More precisely, STT impacts e-WoM through two paths (STT → satisfaction → e-WoM and STT → destination image → satisfaction → e-WoM).

In the first path, the mediation through satisfaction strengthens with place dependence. At a moderate level of place dependence (place dependence = 0.281), the indirect effect is 0.026 (Boot LLCI = 0.003; Boot ULCI = 0.059), while at a high level of place dependence (1.281), the effect increases to 0.037 (Boot LLCI =

0.060; Boot ULCI = 0.079). This suggests that, for people with strong place dependence, their experience with STT thinking can positively influence their image of the destination, thereby fostering satisfaction and generating positive e-WoM.

In the second path, which incorporates both destination image and satisfaction as sequential mediators, the effect shows statistical significance exclusively at elevated levels of place dependence (indirect effect = 0.021; Boot LLCI = 0.003; Boot ULCI = 0.045). This suggests that, for people with a strong place dependency, their experience with STT thinking can positively influence their image of the destination, thereby fostering satisfaction and generating positive e-WoM.

Table 7. Direct and indirect effects of STT on e-WoM.

Conditional direct effects of STT on e-WoM						
Place dependence	Effect	SE	t	p	LLCI	ULCI
-1.386	0.173	0.081	2.135	0.033	0.014	0.333
0.281	0.380	0.059	6.396	0.000	0.263	0.497
1.281	0.504	0.073	6.908	0.000	0.361	0.648
Indirect effect						
Conditional indirect effects of STT → Destination image → e-WoM						
Place dependence	Effect	BootSE		BootLLCI		BootULCI
-1.386	0.015	0.032		-0.054		0.078
0.281	0.014	0.028		-0.045		0.068
1.281	0.014	0.027		-0.043		0.068
Conditional indirect effects of STT → Satisfaction → e-WoM						
Place dependence	Effect	BootSE		BootLLCI		BootULCI
-1.386	0.007	0.014		-.019		0.039
0.281	0.026	0.014		0.003		0.059
1.281	0.037	0.019		0.006		0.079
Conditional indirect effects of STT → Destination_image → Satisfaction → e-WoM						
Place dependence	Effect	BootSE		BootLLCI		BootULCI
-1.386	0.024	0.012		0.003		0.052
0.281	0.022	0.010		0.003		0.044
1.281	0.021	0.010		0.003		0.045

Note. Developed by the authors.

Overall, the data support all the hypotheses, reflecting a moderated mediation model. The analyses performed indicate that: (1) as tourists show greater STT, they show a greater perception of destination image; (2) as tourists show greater STT, they show greater satisfaction; (3) destination image is positively related to satisfaction; (4) the relationship between STT and satisfaction is not unconditional but dependent on the degree of place dependence; (5) STT is an essential antecedent of e-WoM, either directly or indirectly, and part of its effects is modulated by the level of place dependence.

Discussion

This study confirms that STTs have a positive influence on e-WoM (H6), destination image (H1), and tourist satisfaction (H3). Previous studies have investigated the importance of e-WoM in smart tourism (Lin & Ryu, 2023;

Pang, 2021; Pourfakhimi et al., 2019; Rahimizhian et al., 2020). By contrast, this study shows a direct positive relationship between STTs and e-WoM (H6). Similar to the studies by Tavitiyaman et al. (2021a) and Tavitiyaman et al. (2021b), which confirmed a positive relationship between smart tourism applications and destination image, this study's findings revealed that STTs were significant antecedents of destination image (H1).

Although STTs and tourist satisfaction have been investigated in one model by prior studies (e.g., Azis et al., 2020; Pai et al., 2021; Y. Zhang et al., 2022), the present work is different from them by exploring the direct influence of STTs on tourist satisfaction, and the findings showed a positive relationship between these factors (H3). The aforementioned three hypotheses verify the significant role of STTs by addressing only the direct effects of STTs on their consequences, such as destination image, tourist satisfaction, and e-WoM.

Specifically, STTs play a crucial role in the formation of a favorable destination image by offering important information on time (Lee et al., 2018; Tavitiyaman et al., 2021b; Tavitiyaman et al., 2024). For instance, city guide applications, which provide information about museums, restaurants, parks, landmarks, and other tourist spots in the destination (Azis et al., 2020; Jeong & Shin, 2020), traffic-routing mobile applications, which provide information about a traffic-free route (Jeong & Shin, 2020; Tavitiyaman et al., 2021b; Tavitiyaman et al., 2024), and parking mobile applications for parking a car (Jeong & Shin, 2020) help tourists save time and achieve their expectations. In turn, these facilities may lead to tourist satisfaction and encourage visitors to recommend the destination to their relatives and friends (Azis et al., 2020). The findings of this research reveal that tourist satisfaction positively influences e-WoM (H4) and are similar to the prior studies (Lin & Ryu, 2023; Pang, 2021; Shafeeque & Azees, 2024).

When it comes to the indirect and moderated influences of STTs, unlike Kim (2018), who confirmed the multiple mediation effects of a destination image and overall satisfaction on the relationship between memorable tourism experiences and behavioral intentions, our research findings revealed that the influence of STTs on e-WoM is mediated by destination image and tourist satisfaction (H5). This implies that the positive relationship between STTs and destination image adds to tourist satisfaction, which usually leads to favorable e-WoM.

The present research, unlike previous studies (e.g., Isa et al., 2020; Ispas et al., 2021; Zhao et al., 2023), which investigated place dependence as a mediator or as a dependent or independent variable, examined the moderating effect of place dependence. The findings revealed that place dependence moderates the relationships between STTs and tourist satisfaction and between STTs and e-WoM (H7a and H7b). The results of the research show that the more highly dependent tourists are on the destination, the stronger the impact STTs have on tourist satisfaction and e-WoM. Destinations should improve infrastructure facilities, the quality of services, and their attractiveness, considering them crucial aspects that create the required conditions for tourists to enjoy their trip. For instance, destinations should ensure safety conditions to attract tourists when they are highly sensitive to the security of their private data. If the infrastructure of the destination fails to meet tourists' expectations concerning information safety, it can be less competitive and lose market share (Jeong & Shin, 2020). Moreover, STTs improve tourists' dependence on the destination by providing services that help visitors find the nearest hotels, restaurants, shopping centers, or other tourist spots in a faster and more reliable way.

Consequently, STT facilities at the destination enhance tourist satisfaction and encourage visitors to disseminate positive e-WoM by writing comments and sharing their experiences via photos and videos on social media. These results are consistent with prior studies (Jeong & Shin, 2020; Y. Zhang et al., 2022).

Our study makes a significant contribution to theoretical knowledge of STTs in the tourism industry. It analyzes the connections between STTs and the most important variables, i.e., destination image, tourist satisfaction, and e-WoM, and it also incorporates place dependence as a moderator. The inclusion of place dependence is also highly innovative because it introduces how individual and situational aspects related to a tourist destination can affect the effectiveness and perception of technology. Concerning the questions of how and when such effects can happen, the direct and indirect effects substantiated by the findings of this study provide the answer to the question of how such effects occur. The findings involving the moderating effect respond to the question of when such effects take place. Thus, by examining destination image and tourist satisfaction as mediators, the research explains the mechanism by which STT influences e-WoM and provides a better understanding of how customer engagement and satisfaction work. Lastly, regarding the moderating role of place dependence, discussing it as a moderator may assist in understanding the conditional impacts of STT, thereby implying that the influence of technology may vary significantly based on tourists' emotional and functional dependence on the destination.

Practically, our results provide knowledge to destination marketers and tourism managers. The identified impacts of STT in improving destination image and tourist satisfaction prove the relevance of investing in technology that augments the tourist experience. First, strategic use of technology: tourism operators should invest in technology that improves tourist experience, including mobile applications with real-time and location-based features and augmented-reality capabilities that can enhance the physical experience. Second, enhancing tourist engagement: According to our research, more interactivity and personalization through the use of STT can result in improved tourist satisfaction and positive e-WoM. Managers should pay attention to technologies that will help achieve such results to promote the image and appeal of their destination. Lastly, keeping up with tourist expectations: the role of place dependence emphasizes the necessity for destinations to comprehend and address the unique features and demands of their target audiences. An example could be destinations that promote outdoor activities, which could look into technology that improves the natural experience.

Simultaneously, cultural centers may invest in virtual tours or augmented-reality experiences that enhance historical value.

Moreover, the findings of our study can inform tourism development policy. By recognizing the importance of STT in tourism experiences and expectations, policymakers can better channel their resources toward the development of technology to facilitate economic gains without compromising the attractiveness of the destination.

CONCLUSIONS

The results of this analysis show that STT and destination image are predictive factors of tourist satisfaction, whereas STT is a potential antecedent of destination image. Moreover, STTs have direct and indirect influences on e-WoM, considering destination image and satisfaction as mediators, with tourist satisfaction as a major predictive factor of e-WoM. One of the main contributions of the study was the examination of the moderating role played by place dependence in the model. The findings showed that place dependence moderates the relationships between STTs and e-WoM and between STTs and tourist satisfaction. Based on the findings, these relationships are stronger when tourists are highly place-dependent. Although the direct and indirect relationships in the model formulated by the authors provided similar results to previous research, the present study is distinguished by the fact that it examines the constructs specified above within one model. It analyzes the mediating effects of destination image and tourist satisfaction and the moderating role of place dependence. Overall, the questions regarding how and when the specified influences take place can be addressed based on the findings of the present research, which confirmed that (1) the influences of STTs on the specified variables are significant and positive, and (2) they may be more effective when visitors are highly dependent on the place. As regards implications, the research adds to the literature by providing valuable information on the crucial role of STTs in attaining a desirable destination image, satisfying tourists, and inspiring them to disseminate positive e-WoM. In addition, it offers valuable managerial implications to destination marketers and managers on how to enhance destination image and tourist satisfaction with the assistance of STTs and build their online reputation via positive e-WoM.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study had some limitations that should be addressed in future research. First, it was conducted only with tourists who traveled to one country. Another lim-itation is related to the risk of common method variance when using the same source of information to measure all the variables in the model. Additionally, the study's cross-sectional design means that causality cannot be confirmed. Moreover, this study did not include other variables that may be significant predictors of the chosen variables in the proposed model, such as technology readiness. In addition to overcoming the previous limitations, further research is needed to investigate the effects of related variables on STTs and e-WoM (e.g., memorable tourism experiences, tourist engagement, and destination familiarity), considering their potential mediating and moderating influences.

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APPENDIX 1

Table A1. Research constructs and measurement scale.

Variable	Measurement items	Supporting studies
Informativeness	STTs provide me with useful information about the travel destination(s) and the trip. STTs are helpful for evaluating the destination(s) and the trip. STTs enable me to complete my trip with the detailed information provided. STTs enable me to minimize my worries about my trip.	Huang et al. (2017); Jeong and Shin (2020); Pai et al. (2020); Lee et al. (2018)
Accessibility	I can use tourism STTs anytime and anywhere. I can easily use STTs. I can easily find STTs. I can search without a complicated sign-up process at tourism.	Huang et al. (2017); Jeong and Shin (2020); Pai et al. (2020); Lee et al. (2018)
Interactivity	I can find many other travelers' questions and answers on tourism websites and apps. STTs that I use are highly responsive to me. STTs that I use are interactive. It is easy to share tourism information content on tourism websites and apps.	Huang et al. (2017); Jeong and Shin (2020); Pai et al. (2020); Lee et al. (2018))
Personalization	STTs allow me to receive tailored information. STTs provide me with easy-to-follow paths and links. I can interact with STTs to get personalized information. The tourism information provided by STTs meets my needs.	Huang et al. (2017); Jeong and Shin (2020); Pai et al. (2020); Lee et al. (2018)
Security	Smart tourism technologies protect my personal and sensitive information. Smart tourism technologies respect my privacy and the safety of my transactions. Smart tourism technologies are trustworthy and reliable.	Huang et al. (2017); Pai et al. (2020); No and Kim (2015)
Destination image	People in this place are friendly. This place offers suitable accommodation. This place is a safe city. This place has beautiful natural scenery. This place is an interesting city.	Jalilvand et al. (2012); Abbasi et al. (2021)
Place attachment Place dependence	Visiting Khiva is more important to me than visiting any other place. I enjoy visiting Khiva more than any other place in this country. I would not trade any other place in this country for the type of experience I have in Khiva.	Xu and Zhang (2016); Kim et al. (2016)
e-WoM	My friends on social media network often ask my advice about new destinations. I spend a lot of time talking with my friends on social media about places to visit. My friends usually give me good advice on where to go during vacations.	Kakirala and Singh (2020)
Tourist satisfaction	During my Khiva travel, I feel that this trip has enriched my life. I am really glad I had this trip. During my Khiva travel, I accomplished the purpose of the vacation. During my Khiva travel, it was rewarding to me in many ways. I feel much better after this trip. During my Khiva travel, I was satisfied with the travel experience. It is a wise choice for me to travel to Khiva.	Pai et al. (2021)

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