

The Current State of Smart Tourism in Da Nang City and a Proposed Model for Measuring Tourist Satisfaction via Destination Image, Perceived Smart Tourism Technologies, and Memorable Tourism Experiences

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Abstract

This paper examines the current state of smart tourism development in Da Nang City and proposes a model for measuring tourist satisfaction based on three key factors: destination image, perceived smart tourism technologies, and memorable tourism experiences. In addition to presenting the proposed model, the study synthesizes the challenges and obstacles encountered in the implementation of smart tourism technologies in Da Nang. The findings offer valuable insights that can serve as a foundation for future recommendations and strategic solutions to enhance smart tourism development in the city.

Keywords: *smart tourism technologies; tourist satisfaction; destination image; Memorable tourism experiences; Da Nang.*

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I. Introduction

In the Fourth Industrial Revolution context, technology is profoundly transforming various sectors, including tourism. The concept of *smart tourism* has emerged and developed as an inevitable trend aimed at enhancing service quality, promoting personalized experiences, and effectively supporting the management and sustainable development of the tourism industry. Globally, many cities have implemented smart tourism solutions as part of their broader smart city strategies, generating added value for both tourists and local communities.

In Vietnam, Da Nang City stands out as one of the pioneers in applying technology to smart tourism development. With a strategic vision to become a "smart city" by 2030, Da Nang has implemented a range of initiatives such as digital tourism maps, smart tourism information portals, public Wi-Fi systems, and integrated data platforms to support visitors. However, the actual effectiveness of these technological applications in enhancing tourist satisfaction remains an issue that requires systematic investigation and assessment.

Amid increasingly intense destination competition, understanding the factors influencing tourist satisfaction—including destination image, perceived impact of smart tourism technologies, and memorable tourism experiences—plays a critical role in enabling the city to refine its strategic approach. Although several studies have addressed these individual factors, there is still a lack of integrated models to evaluate their overall influence on tourist satisfaction within the context of smart tourism.

Moreover, international researchers have acknowledged the potential of smart technologies, predicting that tourists will increasingly engage with a broader range of such technologies. Studies by Jeong and Shin (2020), Pai (2021), and Huang et al. (2017) have demonstrated the perceived impact of smart tourism technologies on tourist satisfaction, with the framework proposed by Huang and colleagues being widely adopted. Additionally, tourists' memories and impressions of experiences facilitated by smart applications significantly shape their post-trip perceptions.

The primary objective of this paper is to explore the perceived influence of destination image and smart tourism technologies on tourist satisfaction in Da Nang, with memorable tourism experiences serving as a mediating factor. This study provides a critical foundation for the city to enhance its smart tourism initiatives and attract future visitors.

II. An Overview of Smart Tourism Implementation in Da Nang City

2.1. Smart Technology Applications in Tourism in Da Nang City

Da Nang City, with its strategic vision of becoming a leading smart city in Vietnam, has actively adopted cutting-edge technologies such as Artificial Intelligence (AI), Big Data, the Internet of Things (IoT), Virtual Reality (VR),

and Augmented Reality (AR) to develop smart tourism. These technological implementations aim to enhance tourist experiences and optimize tourism management. The following section presents key smart technology applications implemented, along with specific data and contextual information.

- Mobile Application "Danang FantastiCity":

Launched in 2017 by the Danang Tourism Promotion Center in collaboration with Gola Software Co., Ltd., the "Danang FantastiCity" mobile application integrates multiple features to assist travelers in planning their trips, searching for destinations, events, cuisine, and transportation. A notable feature is its offline map functionality, which allows users to access information without an internet connection. As of 2024, the application has recorded over 500,000 downloads, with an average of 18,000–20,000 monthly visits to the Danang Tourism Portal (danangfantasticity.com), ranking top in search results for the keyword "Da Nang tourism." The app supports multiple languages (Vietnamese, English), with Korean, Japanese, and Chinese under development to better serve international tourists.

- Chatbot "Danang FantastiCity":

Da Nang is one of the first two cities in Southeast Asia, along with Singapore, to deploy an AI-powered tourism chatbot. Introduced in November 2017 during the APEC summit, the Danang Department of Tourism developed the chatbot in collaboration with Hekate Technology JSC. Integrated into the Facebook Messenger platform enables 24/7 information retrieval regarding attractions, weather, public restrooms, ATMs, and tourism events. Within the first six months of pilot implementation, the chatbot facilitated 121,347 interactions (averaging 674 per day) from 9,737 users across 12 countries. As of 2024, it has been upgraded to include real-time event notifications and promotional e-coupons, enhancing tourist-business engagement.

- "inDanang App":

Released in 2023 by a local technology startup, the "inDanang App" emphasizes transparent tourism information and authentic local experiences. It allows users to access gastronomy, accommodation, and recreational activities updates while enabling businesses to manage location details, create events, and collect customer feedback. During a four-month trial, the app recorded approximately 12,000 downloads and attracted 1,000 regular users, including numerous international visitors. The app has received positive feedback from travel agencies for its data integration capabilities with the Department of Tourism and Industry and Trade. However, it continues to face challenges in standardizing information content.

- "Danang Smart City" Application:

Deployed at the end of 2020 by the Danang Department of Information and Communications, the "Danang Smart City" application is a "super app" designed to serve both residents and tourists. The tourism sector provides access to electronic epidemiological maps, tourism sites, parking locations, public toilets, and bus routes. During the COVID-19 prevention phase, QR Code ticketing was used for visitor tracking. Additionally, users can view traffic camera feeds from key roads, although the number of available cameras remains limited. According to Mr. Nguyen Van Quoc, Director of the Danang Public Service Information Center, the long-term objective is to consolidate all public and tourism services into a unified platform, reducing the need for multiple standalone applications.

- VR/AR Technology at Tourist Attractions:

The Danang Museum, officially opened on April 1, 2025, exemplifies the application of modern technologies in tourism. It utilizes VR and AR technologies to recreate local history and culture through interactive exhibits, attracting over 10,000 visitors in 2023. Similarly, AR technology has been implemented at the Marble Mountains to provide contextual information on caves and relics, offering a more immersive visitor experience. These applications enhance tourist engagement and promote the city's cultural heritage.

- IoT-Based Smart Management Systems:

Approximately 30% of 4- and 5-star hotels in Da Nang—equating to over 100 establishments—have adopted smart management systems based on IoT. These systems include voice-controlled room features, personalized services through customer data analysis, and optimized operational efficiency. For instance, the Furama International Convention Center began trialing AI-powered service robots in October 2024, which serve an average of 50 guests per day, helping to reduce staff workload while improving service quality.

- Public Wi-Fi and Digital Infrastructure:

Da Nang has installed over 200 free public Wi-Fi access points across major tourist locations such as My Khe Beach, Dragon Bridge, and the city center, ensuring seamless connectivity for visitors. This digital infrastructure serves as a foundational element for the deployment of smart tourism applications. Additionally, the city is

developing a smart transportation system using BIM-GIS, AI, and Digital Twin technologies to manage tourist traffic flow more efficiently, particularly at high-density destinations.

2.2. Opportunities and Challenges in Applying Smart Technologies to Tourism in Da Nang

a. Opportunities

- **Developed Technological Infrastructure:**

Da Nang's extensive fiber-optic network and widespread availability of free Wi-Fi across the city create favorable conditions for deploying smart tourism applications, including interactive maps, virtual tour guides, and QR code-based electronic payment systems.

- **Digital Promotion Potential:**

According to the Da Nang Department of Tourism (2017), approximately 93% of international tourists access travel information via the Internet and social media platforms. This highlights the significant potential of digital platforms in attracting and engaging tourists.

- **Supportive Digital Transformation Policies:**

The local government has introduced supportive policies to build a real-time tourism database and foster international cooperation with technology partners. These efforts are intended to enhance tourism management capabilities and increase the city's competitiveness in the digital economy.

b. Challenges

- **High Investment Costs:**

Implementing digital data systems and cybersecurity solutions requires substantial financial investment, posing challenges especially for small and medium-sized enterprises (SMEs) operating in the tourism sector.

- **Human Resource Limitations:**

The tourism workforce in Da Nang exhibits inconsistent quality, with noticeable gaps in digital literacy and foreign language proficiency. Only approximately 29.73% of small vendors in similar tourist zones have adopted e-commerce practices, indicating low technological readiness.

- **Data Security and Privacy:**

The application of digital technologies in tourism necessitates significant investment in cybersecurity infrastructure and strict adherence to regulations governing the protection of tourists' data.

- **Limited Multilingual Support:**

Many existing smart applications have yet to incorporate sufficient multilingual capabilities, which restricts accessibility for international tourists, particularly from emerging markets such as India and Muslim-majority countries, thereby limiting potential market expansion.

III. Proposed Research Model on Tourist Satisfaction in Da Nang City Based on the Relationship among Perceived Smart Tourism Technologies, Memorable Tourism Experience, and Destination Image

3.1 Smart Tourism Technologies (STTs)

a. Smart Tourism

The concept of "smart tourism" emerged due to the Fourth Industrial Revolution, particularly due to the rapid advancement of information and communication technologies (ICTs). These developments have created diverse and innovative products for the tourism industry. Smart tourism can be understood as a model built upon an ICT infrastructure in which data integration systems are synchronized, ensuring real-time interaction among three key stakeholders: tourism authorities, enterprises, and tourists. The ultimate goal is to create optimal value, benefits, and services.

The idea of smart tourism originates from the development of smart cities and is conceptualized as a tourism platform that integrates tourism resources with ICT systems to provide satisfactory information and tourism services, leveraging mobile communication technologies (Zhang et al., 2012). Smart tourism is characterized by intensive information sharing and value co-creation (Gretzel et al., 2015), and focuses on systems that support individual tourists through all-encompassing technologies (Li et al., 2016). The service-oriented principle has been proposed as a guiding vision for smart tourism development.

Smart tourism comprises multiple layers and components supported by ICT infrastructure. While various definitions converge on the application of ICT in tourism development, smart tourism emphasizes collecting, integrating, and utilizing data obtained from infrastructure and end-user devices. This facilitates a more personalized and enhanced travel experience. In essence, smart tourism transforms data and information into actionable knowledge that benefits destinations, residents, and tourists alike.

b. Smart Tourism Technologies (STTs)

Smart tourism technologies (STTs) represent the integration of information technology and artificial intelligence (AI) to enhance and optimize the tourism experience for travelers while also improving the management of

tourism operations. These technologies aim to establish a more convenient, intelligent, and visitor-friendly tourism environment, while enabling tourism organizations and local governments to manage tourism resources more effectively.

STTs encompass several key components, including:

- **Mobile Applications:** These allow tourists to access information about destinations, plan itineraries, book accommodations and tickets, and receive personalized travel guidance based on location and data-driven recommendations.
- **Artificial Intelligence (AI):** AI can generate customized experiences by suggesting activities, destinations, dining options, and even virtual tour guide services tailored to individual preferences and schedules.
- **Internet of Things (IoT):** Smart sensors and information management systems can monitor visitor flow, enhance resource efficiency at tourist sites, and provide a safer, more comfortable visitor experience.
- **Virtual Reality (VR) and Augmented Reality (AR):** These technologies offer virtual previews of destinations or enhance on-site engagement by overlaying digital content on real-world environments.
- **Big Data and Analytics:** These tools help tourism organizations better understand visitor behavior, forecast demand, and identify emerging trends in the tourism industry.

Overall, STTs aim to foster a smart, engaging, and seamless tourism environment that not only elevates the tourist experience but also supports the sustainable development and efficient management of tourism destinations.

3.2 Perceived STTs and Memorable Tourism Experiences

3.2.1. Perceived STTs

According to studies such as C.D. Huang et al (2017), M. Jeong and H. Shin (2020) STTs are typically characterized by four main attributes: accessibility, Informativeness, interactivity, and personalization.

a. Accessibility

Jeong and Shin (2020) define accessibility as the ease with which tourists can access and utilize information provided at destinations through various STTs. High accessibility facilitates information search, saving tourists both time and effort, thereby increasing satisfaction with their tourism experience. Moreover, accessibility contributes to co-creative experiences and significantly predicts memorable tourism experiences.

b. Informativeness

The Informativeness of STTs refers to the quality and reliability of information provided at tourism destinations. As noted by Kim, Lee, and Hiemstra (2004), Informativeness is closely associated with tourists' perception of a destination. When STTs offer accurate, comprehensive, and trustworthy information, tourists are more likely to explore destinations, enhancing their overall tourism experience.

c. Interactivity

Interactivity in STTs relates to these technologies' immediate responsiveness and proactive communication features. Tourists can easily access information about attractions, food, and accommodations, and request additional details as needed. High interactivity encourages tourists to engage more deeply with STTs and contributes to building comprehensive tourist databases, allowing managers to analyze the behavior of different tourist segments.

d. Personalization

Personalization is defined as the ability of STTs to deliver specific and tailored information that meets the individual needs of tourists. According to Ha and Stoel (2009), personalization helps tourists save time and costs during information searches, while enabling service providers to optimize tourist experiences and improve satisfaction. Moreover, tourists are more likely to use STTs—such as hotel booking websites—to tailor their trips by selecting options best aligned with their personal preferences.

3.2.2. The Relationship Between Perceived STTs and Memorable Tourism Experiences (MTEs)

The relationship between memory and experience is not novel and has been widely explored in prior studies. As Kim (2010) synthesized, three primary groups of factors influencing human memory have been consistently identified. First, emotionally charged events tend to be remembered more vividly; the stronger the emotional intensity, the higher the likelihood of retention. Second, the process of cognitive appraisal—defined as the semantic evaluation of a situation or event—serves as a post-processing mechanism that enhances memory recall by enriching and detailing initial impressions. Third, unusual or distinctive events are generally more likely to be retained in memory than routine or ordinary occurrences.

Building upon this foundation, Kim, Tung, and Ritchie argue that Memorable Tourism Experiences (MTEs) are selectively constructed based on tourists' subjective evaluations of their travel experiences. Kim et al. (2012) introduced the concept of MTEs, which has since been widely adopted and builds upon prior research in the field. Accordingly, in this paper, MTEs are conceptualized following Kim et al.'s (2012) definition: "A

memorable tourism experience is one that is positively remembered and recalled after the event has occurred.” As such, MTEs can vary greatly in intensity and form across individuals, and are subject to change over time. By nature, tourism experiences are highly personalized, as each visitor engages with and perceives smart tourism destinations, supported by Smart Tourism Technologies (STTs), in unique ways. Even when engaging in the same types of activities at the same destination, tourists’ memories and evaluations of the experience may differ depending on their personal perceptions and emotional responses (J.-H. Kim, 2018). Applying STTs may play a crucial role in enhancing tourists’ memory of their experiences by facilitating access to relevant information and promoting interactive engagement with available tourism resources at smart destinations.

Based on the aforementioned theoretical relationships, this study proposes the following hypotheses:

- **H1a:** *The accessibility of STTs is positively associated with tourists’ memorable experiences at smart tourism destinations.*
- **H1b:** *The informativeness of STTs is positively associated with tourists’ memorable experiences at smart tourism destinations.*
- **H1c:** *The interactivity of STTs is positively associated with tourists’ memorable experiences at smart tourism destinations.*
- **H1d:** *The personalization of STTs is positively associated with tourists’ memorable experiences at smart tourism destinations.*

3.3. The Relationship Between Destination Image and Tourist Satisfaction

Destination image refers to the mental perception of tourists based on various sources of information. While there are multiple approaches to constructing and evaluating destination image, scholars have yet to reach a consensus on its definition, mainly due to the fact that most empirical studies rely heavily on factor analysis. Moreover, the measurement scales used in previous research often consist of complex and multifaceted constructs (Coban, 2012). A review of the literature reveals that key components contributing to the formation of a destination’s image include intrinsic characteristics, accessibility, cultural resources, and security factors widely acknowledged as essential in strengthening a destination’s appeal. The cognitive image reflects tourists’ beliefs, knowledge, and perceptions about a destination, including their evaluation of local residents and ongoing events. In contrast, the affective image represents tourists’ emotional responses—what they like or dislike about a destination. According to Coban (2012), emotional impressions, such as beliefs, thoughts, and feelings, are closely linked to the cognitive dimension, suggesting a strong interplay between rational evaluation and emotional experience in shaping destination image.

Variations in destination image are largely attributable to the uniqueness of a place, including its cultural features and both natural and man-made environments. Fredericks and Salter (1995) argue that image is a key element of the overall customer value package, alongside price, product quality, service quality, and innovation—factors that collectively influence customer loyalty. Similarly, Eskildsen et al. (2004) conclude that destination image significantly shapes perceived value, tourist satisfaction, and loyalty. Therefore, in highly competitive tourism markets, a favorable destination image is viewed as a critical asset in maintaining market position and attracting repeat visitors.

Based on this discussion, the following hypothesis is proposed:

- H2:** *Destination image has a positive relationship with tourist satisfaction.*

3.4. The Relationship Between Memorable Tourism Experiences and Tourist Satisfaction

Tourist satisfaction is widely regarded as the outcome of an evaluative process involving both functional and emotional components. According to Pai et al. (2021), tourist satisfaction can be defined as a traveler’s overall emotional assessment of their experience at a destination. Customer satisfaction plays a pivotal role in the tourism and service industries, as high-quality services can consistently meet tourists’ expectations and enhance their overall experience. When service providers deliver elements such as quality, comfort, and relevance, tourists tend to develop positive emotions and attitudes toward the trip itself and the destination’s image (Lee et al., 2018).

Due to the experiential nature of tourism, tourists’ perceptions and responses to Smart Tourism Technologies (STTs) can vary significantly, resulting in highly personalized travel experiences. Even when participating in the same activities at a specific destination, tourists’ memories and evaluations of those experiences remain subjective and distinct. As destinations increasingly adopt smart technologies, the development and integration of STTs to support the creation of meaningful and memorable experiences has become a critical factor (Jeong & Shin, 2020).

Shin et al. (2021) examined the influence of STTs and tourists’ technology readiness on satisfaction and subsequent behavioral intentions. Their findings suggest that satisfaction reflects an individual’s positive perception of the quality of the product or service experienced, which is consistent with established consumer behavior theories. Within the context of technology acceptance, satisfaction is often considered a central construct,

indicating users' favorable reactions toward the adopted technology. Furthermore, studies by Abubakar et al. (2017) and Jeong and Shin (2020) have demonstrated that satisfaction serves as a mediating factor in the relationship between tourism experiences and future behavioral intentions, such as revisit intention and electronic word-of-mouth (eWOM) communication.

Based on the above discussion, the following hypothesis is proposed:

H3: *Memorable tourism experiences have a positive impact on tourist satisfaction.*

3.5. Proposed Research Model

The construction of a research model for measuring tourist satisfaction in Da Nang is based on tourists' perceptions of Smart Tourism Technologies (STTs) and their Memorable Tourism Experiences (MTEs). This model is proposed concerning the conceptual framework that Kim et al. (2012) developed, along with insights drawn from several preceding studies. In this model, memorable tourism experiences are posited to mediate the relationship between perceived smart tourism technologies and tourist satisfaction.

This research aims to explore not only the direct effects of STT attributes (i.e., accessibility, informativeness, interactivity, and personalization) on tourist satisfaction but also their indirect effects through the mediating role of MTEs. By investigating these pathways, the model seeks to provide a deeper understanding of how technological perceptions influence satisfaction in the context of a smart tourism destination.

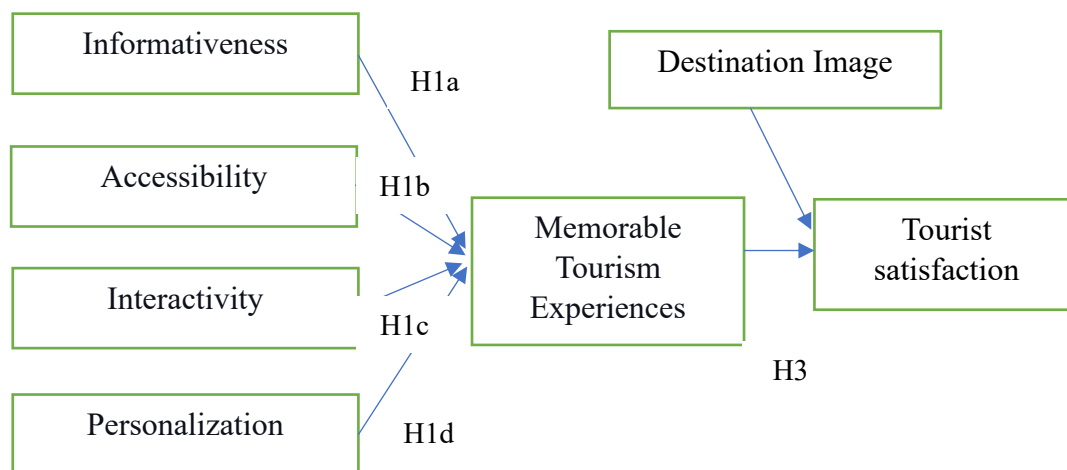


Figure 1. Proposed Research Model

IV. Conclusion

In the context of rapid technological advancement and the digital transformation trend, smart tourism has emerged as an inevitable direction, contributing to enhancing service quality and overall tourist experience. Da Nang City—recognized as one of Vietnam's pioneering destinations in adopting smart tourism solutions—has made significant progress by implementing tourism information portals, digital maps, integrated data systems, and various tourist-supporting utilities. However, the transition toward a brilliant tourism model continues to face several challenges, particularly in the synchronization of technological systems and relevant stakeholders' awareness and implementation capacity.

The findings of this study propose a model for measuring tourist satisfaction based on three key components: destination image, perceived smart tourism technologies (STTs), and memorable tourism experiences (MTEs). This model offers a more comprehensive understanding of the factors influencing tourist satisfaction in a smart tourism context and provides practical implications for policymakers, tourism managers, and service providers in formulating appropriate strategies to improve service quality and strengthen destination competitiveness.

Based on the research outcomes, this paper recommends that Da Nang City continue investing in developing smart tourism infrastructure, intensify destination image communication efforts, and focus on designing personalized, creative, and memorable tourism experiences. In doing so, smart tourism will not merely function as a supporting tool but will become a core platform in promoting tourist satisfaction, loyalty, and positive word-of-mouth in the digital era.

While this study offers a general overview of the current state of smart tourism in Da Nang and presents a model for evaluating tourist satisfaction, several limitations remain that future research should address.

First, this study primarily analyzes the relationships between three core variables—destination image, perceptions of smart tourism technologies, and memorable tourism experiences—about tourist satisfaction. However, it does not explore potential mediating variables such as trust in technology, revisit intention, or

electronic word-of-mouth (eWOM). Future studies could extend the model by incorporating such mediators or moderators to gain deeper insights into tourist behavior within smart tourism environments.

Second, the research was conducted solely in Da Nang—a representative destination. To enhance the generalizability and comparative value of the findings, future research should consider cross-destination analyses, both within Vietnam (e.g., Hue, Hoi An, Ho Chi Minh City, Hanoi) and across Southeast Asia, to draw context-specific lessons and develop tailored implementation strategies.

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