

This Smart Hotel is all about Sustainability! Impact of Perceived Compatibility, Perceived Enjoyment and Perceived Usefulness on Sustainable Travel Intention

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Citation: Riahi, I., Ouni, K., & Dekhil, F. (2025). This Smart Hotel is all about Sustainability! Impact of Perceived Compatibility, Perceived Enjoyment and Perceived Usefulness on Sustainable Travel Intention. *Journal of Cultural Analysis and Social Change*, 10(4), 171–179. <https://doi.org/10.64753/jcasc.v10i4.2792>

Published: December, 4, 2025

ABSTRACT

The advent of the Internet of Things (IoT) has engendered novel opportunities within the tourism industry. Smart hotels, which are defined by their reliance on IoT-driven technologies, have emerged as dynamic ecosystems that significantly enhance the overall travel experience. The purpose of this study is to examine the impact of perceived compatibility, perceived enjoyment and perceived usefulness of a smart hotel on sustainable travel intentions. A quantitative study was conducted with a sample of 250 tourists who are familiar with using smart applications. Structural Equation Modelling (SEM) was employed to analyse data, which confirmed all the causal relationships between the variables in the research model proposed.

Keywords: Smart hotel, Perceived Compatibility, Perceived Enjoyment, Perceived Usefulness, Sustainable Travel Intention.

INTRODUCTION

The pervasive influence of artificial intelligence (AI) technology is driving a fundamental transformation in industrial sectors and daily life. AI, which involves the simulation of human intelligence within machines, enables these systems to learn autonomously, reason, and make decisions. This technological advancement has profound implications for business operations, human behaviours and interactions across various fields (Mishra et al., 2024). Intelligence is defined as the advancement of multiple technologies in a concurrent and collaborative manner, rather than the development of a singular technology in isolation (Shen et al., 2020). Tourist destinations have undergone a transformation in the digital age. In the hospitality industry, customers now expect instant satisfaction, along with a deep understanding of their personal needs and desires. The advent of Industry 4.0 technologies has precipitated the development of sophisticated capabilities, which in turn optimize interactions with discrete systems. These technologies have the potential to enhance the tourism experience by creating new opportunities to personalize and tailor services. The potential for these technologies is to influence long-term user behaviour, thereby shaping their experience, is significant (Ionescu & Sărbu, 2024). The advent of the Internet of Things (IoT) has ushered in a new era of interconnectedness and intelligence within everyday objects, opening up new frontiers for the tourism sector. Smart destinations, characterised by their reliance on IoT-based technologies, have emerged as living ecosystems. These destinations have been shown to seamlessly integrate information, communication, and services, with the objective of enhancing the tourist experience (Farid et al., 2023). This development is reflected in the growing prevalence of smart technologies in industrial hospitality. It is noteworthy that hotels, as the fundamental pillars of the tourism industry, which are in need of technological innovations and improvements

to become "smart" (Yang et al., 2021). Indeed, some hotels now operate solely based on smart technologies, with no human employees involved in service delivery (Chang et al., 2022). Such hotels are designated as unmanned smart hotels.

The concept of the smart hotel represents a paradigm shift in the tourist experience, characterised by the integration of technology into all aspects of the guest's stay. At the core of this digital transformation, guests find themselves in a room where lighting, temperature, and entertainment systems respond to their preferences (Han et al., 2021). Likewise, IoT sensors detect the guest's movements and adjust the room's climate accordingly. The Internet of Things (IoT) facilitates the establishment of a personalised and responsive environment for each visitor, enabling the creation of a personalised and responsive cocoon. The integration of IoT-compatible devices, such as voice-activated assistants, further enhances guest experience by providing an intuitive interface for interacting with the environment, adding an extra level of comfort to their stay (Wynn et al., 2022).

Attractions equipped with the Internet of Things (IoT) contribute to sustainability efforts by optimising resource usage. Smart waste management systems, utilising sensors and connected devices, facilitate real-time monitoring of waste levels. The utilisation of such data has been shown to contribute to a reduction in operational costs and to minimise the environmental impact of tourism. In the event of an emergency, IoT systems can facilitate responsive procedures and ensure the safety of guests. However, the pervasive implementation of IoT in the tourism sector gives rise to concerns pertaining to data privacy. The collection of data on visitors, even for the purpose of enhancing the tourist experience, necessitates the implementation of robust privacy policies to maintain tourists' trust (Farid et al., 2023).

The use of sustainable practices is crucial to achieving ecological balance. The practice of responsible tourism has been demonstrated to engender a positive effect on the well-being of local communities. This form of tourism has been shown to raise awareness among visitors regarding the political, environmental, and social facets of the destinations visited. In recent times, there has been a notable trend among hotels to enhance their sustainability efforts through the integration of smart technologies. The features of smart hotels have been shown to have a significant impact on the intention to visit. Beyond this, the smart hotel has the potential to encourage sustainable behaviour in tourists. A comprehensive review of the extant literature reveals a plethora of studies addressing sustainability and technological applications in the tourism sector. Yet, most of these scientific studies lack a comprehensive vision of a sustainable and smart hotel (Akel & Noyan, 2024).

Midden et al. (2008) explained the relationship between technology and sustainable consumer behaviour by relying on four distinct roles of technology: intermediary, amplifier, determinant, and promoter. A smart hotel can be defined as an accommodation operation that actively employs advanced technologies to interact with customers and deliver services while minimising labor. It is regarded as an innovative business model in the industrial hospitality (Ivanov et al., 2017).

The present article aims to evaluate the use of smart applications as tools for tourism marketing. In fact, the study seeks to ascertain the impact of perceived compatibility, perceived enjoyment, as well to perceived usefulness on the sustainable travel intention.

LITERATURE REVIEW

Smart Hotel

Recently, the hospitality industry has placed emphasis on the integration of novel technologies with the aim of providing visitors with travel experiences that are both convenient and distinctive. This strategic direction has been enriching the tourism experience and better satisfying the digital consumer (Jeong & Shin, 2020). The predominant interaction with tourism offerings occurs through smart technologies, such as chatbots (Fang et al., 2023). This paradigm shift within the industry has consequently led to the emergence of a novel form of tourism hospitality, which is known as the "smart hotel".

The notion of the smart hotel appeared around 2008 and has gained attention in recent years (Jin, 2018). This form of hospitality refers to a hotel equipped with a range of new information and communication technologies (Wu & Cheng, 2018) to provide tourists with a new intelligent experience (Xu, 2018).

The advent of global computer networks has enabled smart hotels to assume direct management of their technical systems and technological operations. These hotels have been found to integrate contemporary information technologies, including the Internet of Things (IoT), cloud computing, smart devices, and Big Data (Xu, 2018). The smart technologies increase the personalisation of the tourist experience (Lai & Hung, 2018). The smart hotel provides tourists with a variety of advanced technologies to solve human-related problems in this industry (Kaur et al., 2024).

The Internet of Things (IoT) is being used in smart hotels to improve the visitor experience of cultural and historical landmarks. One of the most important uses of IoT in tourism is the growth of smart museums. In the

past, museums used displays and signs to give information. But now, with the help of the Internet, they are changing to digital displays. Sensors and beacons, which are placed in the museum, can communicate with visitors' devices to give them real-time information about the exhibits they are viewing (Naramski, 2020). This technology helps visitors to understand historical contexts better and makes the experience more educational (Li & Jiang, 2023).

Leung (2019) posited that the concept of a 'smart hotel' is interpreted differently by various stakeholders. This diversity of interpretation can be attributed to the role of technology in shaping the tourism experience. But tourists are not familiar with smart hotels. Consequently, the definition and content of smart hotel services remain inconsistent and incomplete. It is therefore the conclusion of this study that the concept of the smart hotel is still in its infancy (Domanski, 2020; Yu & Hsu, 2024).

Smart Hotel and Sustainable Behaviour

It is evident that contemporary consumers are placing increasing emphasis on ethical attributes when selecting products or services. This has resulted in an increased demand for green products (Pop et al., 2020). In response to this behavioural shift, tourism hospitality providers that wish to remain competitive must consider the ecological concerns of tourists. It is incumbent upon industry professionals to develop sustainable actions and social responsibility initiatives.

Smart hospitality offers a wide range of benefits by co-creating sustainable value for every stakeholder in a destination's ecosystem. Tourists benefit from memorable and transformative experiences. Moreover, hotel owners enhance operational efficiency and customer service, ultimately leading to greater profitability. This, in turn, strengthens tourist engagement, loyalty, and satisfaction. The destination management organisations arise from international cooperation and increased coordination (Buhalis, 2020).

The development of smart hospitality ecosystems in networked destinations is a key aspect of the industry's evolution. In order to capitalise on this, it is essential that hotels employ intelligent connectivity with all relevant stakeholders and the local community through smart networks. The local community is able to share information with the hotel and its visitors, such as local cuisine, regional products, upcoming cultural activities, and engage in value co-creation in a dynamic manner. The application of translation software facilitates direct interaction between local residents and tourists, thereby circumventing language-related barriers. Furthermore, the integration of smart hotel operations within the framework of destination and hospitality ecosystems can facilitate the establishment of sustainable and environmentally friendly environments (Buhalis et al., 2023).

The integration of the Internet of Things (IoT) in attractions also extends to improving operational efficiency. For instance, the implementation of smart lighting and air conditioning systems has been demonstrated to enhance the visitor experience. These systems are capable of adjusting lighting conditions and temperature based on factors such as the number of visitors, the time of day, or even individual preferences, thus creating a more comfortable and enjoyable environment (Soheilian et al., 2021). The use of IoT-enabled devices offers the opportunity to optimise hotel operations, transforming generic rooms into smart rooms where guests can autonomously manage their own settings (Eslerod et al., 2019).

Hotels are major consumers of energy and significant producers of carbon emissions (Warren et al., 2018). In this context, it is crucial to underscore the need for eco-friendly practices by adopting smart methods to reduce energy and water consumption, minimise carbon footprints, and reduce paper waste. The Internet of Things (IoT) has been identified as having the potential to significantly improve human health and well-being by detecting and monitoring health impacts across the spectrum of climate change. The IoT has been described as enabling the development of a systemic approach to human health and the ecosystem (Salam, 2020).

The concepts of sustainability and social responsibility are widely regarded as foundational principles of intelligent hospitality management. Consequently, customer's exhibit increased brand loyalty towards organisations that demonstrate responsibility towards environmental sustainability. Such responsibility is evidenced by the implementation of practices that reduce waste, facilitate recycling, and conserve energy. Furthermore, organisations that contribute to the betterment of their respective communities are also held in high regard by customers. It is imperative for tourism hospitality businesses to enhance their environmental performance. Smart hotels, in particular, have the potential to forge meaningful connections with their local communities, ensuring that their CSR actions contribute to sustainable development goals (Han et al., 2018).

RESEARCH HYPOTHESES

The extant literature demonstrates that human behaviour in relation to technology acceptance is complex and multifaceted, necessitating an integrated approach as opposed to reliance upon a solitary model. Indeed, integrated models provide a comprehensive and in-depth perspective on the underlying causal mechanisms of relationships, thus offering a complete understanding that single-model theories cannot provide (Thusi & Maduku, 2020). In this

regard, it is relevant to hypothesize that integrating TAM and IDT will provide a global and thorough view of the adoption of IoT-based technological innovations in smart hotels. The objective of this article is to examine the impact of perceived compatibility, perceived enjoyment, and perceived usefulness on the sustainable travel intention.

Perceived Compatibility And Perceived Enjoyment

It is reasonable to hypothesise that tourists will evaluate next-generation technologies based on their compatibility with their beliefs, ideas, and specific needs. When such technologies align with users' expectations, they are perceived more positively. Smart technologies are said to adequately meet users' preferences and lifestyles. This congruence not only fosters greater acceptance of technologies but also engenders a more pleasurable experience (Terrah et al., 2024). Few studies have examined the relationship between perceived compatibility and perceived enjoyment. Tan and Chou (2008) observed that the perceived compatibility of mobile information and entertainment services is positively related to the perception of playfulness. The concept of playfulness, as posited by Moon and Kim (2001), refers to the pleasure and psychological motivations associated with intrinsically interesting interactions. The following hypothesis is thus proposed in the context of IoT-based smart hotels; **H1:** *The perceived compatibility of smart hotels positively influences the perceived enjoyment of tourists.*

Perceived Compatibility and Perceived Usefulness

The degree of compatibility exhibited by a mobile application is positively correlated with the intention of its usage (Mehra et al., 2020). When a technology aligns with a user's specific travel style, it offers a seamless and personalised experience, increasing its perceived usefulness. In fact, compatible smart technologies reduce friction in the planning and execution of a tourism experience. Consequently, compatibility emerges as a pivotal element, serving as a conduit between the user's individual preferences and the added value of technologies in the tourism sector (Tiwari et al., 2024). The following hypothesis is thus proposed; **H2:** *The perceived compatibility of smart hotels positively influences the perceived usefulness.*

Perceived Enjoyment and Sustainable Travel Intention

Perceived enjoyment has been incorporated into the modified Technology Acceptance Model (TAM) to analyse the influence of this attitudinal factor, in conjunction with functional variables (such as perceived usefulness), on hotel customers' behavioural intention to adopt AI-based technologies. Hedonic perceptions, such as perceived enjoyment, have been identified as a crucial factor in users' behavioural intentions (Chen et al., 2019). Therefore, it is reasonable to predict that higher perceived enjoyment induced by technology will stimulate tourists' travel intentions and desire to experience. The experience of pleasure through smart technologies has been shown to positively influence travel intentions (Yin et al., 2022). The enhancement of tourist destinations' attractiveness, through the provision of immersive and enjoyable experiences facilitated by these technologies, has the potential to encourage visitors to adopt more sustainable travel behaviours (Ying et al., 2022; Hoang et al., 2023). The following hypothesis is thus proposed; **H3:** *The hypothesis is that perceived enjoyment within a smart hotel will positively influence the sustainable travel intention.*

Perceived Usefulness and Sustainable Travel Intention

Users are naturally drawn to applications that enhance convenience and efficiency. When an intelligent application is perceived as genuinely beneficial in addressing users' travel-related requirements, it significantly promotes its adoption, as users are assured it will enhance their experience. Perceived usefulness thus becomes a critical condition influencing user intentions (Tiwari et al., 2024). The integration of advanced technologies exerts a substantial influence on tourists' experiences. The cognitive perceptions and emotional responses of tourists to these smart technologies have been shown to directly affect their decision making process. In effect, the way in which users perceive the usability of smart technologies affects their future choices regarding destinations, activities or services. The dynamic interplay between tourists and smart technologies has been shown to influence their behaviours and decisions throughout their tourism experience (Liu et al., 2022). The following hypothesis is thus proposed; **H4:** *The sustainable travel intention is positively influenced by perceived usefulness.*

Perceived Compatibility and Sustainable Travel Intention

One of the primary objectives of this study is to explore the significance of the perceived compatibility attribute, as derived from the Innovation Diffusion Theory (IDT), within the context of smart hotels. The IDT is predicated on five fundamental parameters that characterise the adoption of a novel innovation, with perceived compatibility frequently cited as a major predictor of behavioural intention to adopt the innovation. Existing literature provides substantial evidence that attests to the crucial and determining role of perceived compatibility in the technology adoption process. A high level of perceived compatibility has been shown to result in the

development of a stronger behavioural intention to adopt smart technology (Faqih, 2020). In light of the aforementioned considerations, the following hypothesis is proposed; **H5: Perceived compatibility positively influences the sustainable travel intention.**

METHODOLOGY

The objective of the article is to examine the impact of perceived compatibility, perceived enjoyment, and perceived usefulness on the sustainable travel intention. In this case, a quantitative study was conducted, encompassing 250 tourists of diverse nationalities who are well-versed in the utilisation of smart applications. The questionnaire was disseminated through travel groups on the social media platforms Facebook and Instagram. The survey was conducted over a period from 3 January 2025 to 10 February 2025. The present study builds upon earlier research, drawing inspiration from the work of Faqih (2020) in assessing perceived compatibility, the measurement scale of Manis & Choi (2019) in examining perceived usefulness, the measurement scale of Praveena & Thomas (2014) in testing perceived enjoyment, and the measurement scale of Rahimizhian et al. (2020) in studying the variable of sustainable travel intention. The details of our sample will be presented in Table 1 below:

Table 1: Sample Details.

Characteristics	Details	Percentages
Gender	Men	38%
	Women	62 %
Age	18-24 years	30%
	25-34 years	33 %
	35-49 years	36%
	50-64 years	1%
Nationality	Belgian nationality	34%
	Swiss nationality	25%
	French nationality	24%
	Tunisian nationality	17%
Occupations	Intermediate profession	58%
	Student	25 %
	Employee	14 %
	Pensioner	3%

RESULTS

Results of the Exploratory Analyses

All KMO values are greater than 0.5, providing strong evidence for the existence of an acceptable factor solution. The Bartlett's test is significant at the 5% risk level. Regarding the quality of representation, it is considered adequate when it exceeds 0.5. The items are grouped under each variable with an Eigenvalue greater than 1. To verify reliability at the exploratory level, the Cronbach's alpha coefficients (α) are above 0.7. This finding indicates that the reliability of each variable in the conceptual model has been substantiated. The results of the exploratory analyses are presented in the following Table 2:

Table 2. Results of the Exploratory Analyses.

Variables	Items	Extractions	Eigenvalue	KMO	Bartlett's Sig	Cronbach's Alpha
Perceived compatibility	PC_1	0,964	3,794	0,769	0,000	0,986
	PC_2	0,952				
	PC_3	0,952				
	PC_4	0,926				
Perceived enjoyment	PE_1	0,923	3,923	0,869	0,000	0,926
	PE_2	0,862				
	PE_3	0,864				
	PE_4	0,885				
	PE_5	0,889				
Perceived usefulness	PU_1	0,884	3,461	0,755	0,000	0,887
	PU_2	0,892				
	PU_3	0,892				

Sustainable travel intention	PU_4	0,924	2,546	0,742	0,000	0,911
	PU_5	0,933				
	STI_1	0,883				
	STI_2	0,809				
	STI_3	0,854				

Results of the Confirmatory Analyses

As posted by Fornell and Larcker (1981), the reliability of latent variables is assessed by Joreskog's Rho, which must exceed the threshold of 0.7. The validity of a measurement scale is indicative of its capacity to closely approximate and explain the phenomenon under study. Indeed, convergent validity must be greater than 0.5. The ensuing table 3 illustrates that the measurement model for each variable in the conceptual model is both reliable and validated.

Table 3. Reliability and Validity Check of the Model Variables.

	Rho of Joreskog	pvc
Perceived compatibility	0,982	0,932
Perceived enjoyment	0,934	0,746
Perceived usefulness	0,883	0,721
Sustainable travel intention	0,912	0,776

Results of the Structural Analysis

The following table 4 presents the tests of the causal links between perceived compatibility, perceived enjoyment, perceived usefulness and sustainable travel intention.

Table 4. Significance of Causal Links.

Liens	Estimate	CR	P	Hypothesis Status
Perceived compatibility ---> Perceived enjoyment	0,546	10,866	0,000	Accepted
Perceived compatibility ---> Perceived usefulness	0,326	5,902	0,000	Accepted
Perceived enjoyment ---> Sustainable travel intention	0,100	1,499	0,013	Accepted
Perceived usefulness ---> Sustainable travel intention	0,263	4,435	0,000	Accepted
Perceived compatibility ---> Sustainable travel intention	0,240	3,441	0,000	Accepted

The structural model will be presented in Figure 1 below:

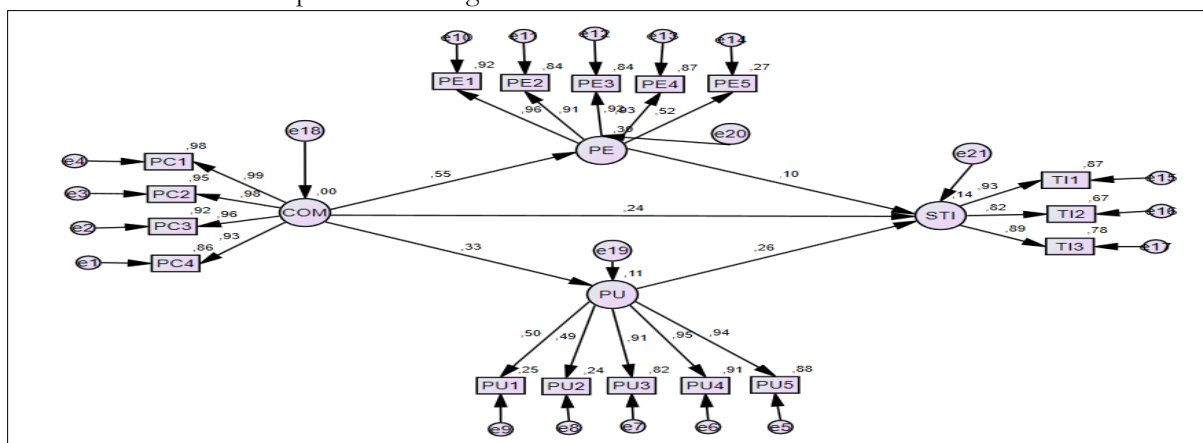


Figure 1. The Research Structural Model.

DISCUSSION

The aim of this study is to examine the impact of perceived compatibility, perceived enjoyment, and perceived usefulness on sustainable travel intention. A quantitative study was conducted, encompassing 250 tourists from

diverse nationalities. Following the presentation of the empirical results, a comparison with existing theory is imperative. The initial research hypothesis was formulated to examine the relationship between perceived compatibility and perceived enjoyment. The hypothesis was found to be validated. Perceived compatibility can indeed trigger a sense of enjoyment during a digital experience. The utilisation of digital applications is enhanced when they align with users' travel preferences, which increases the likelihood of adoption (Xavier et al., 2024). The second hypothesis was confirmed, showing that perceived compatibility has a positive effect on perceived usefulness. The ease of use of a smart application is a crucial element that enhances perceived usefulness. Consequently, when users find the travel application intuitive and easy to use, they are more likely to view it as an accessible tool, which facilitates its adoption (Tiwarei et al., 2024). The third hypothesis was confirmed. The hypothesis posited that perceived enjoyment exerts a positive influence on sustainable travel intention. As posited by Camilleri et al. (2023), users are more inclined to adopt applications in the context of their travel experience when these applications effectively fulfil their purpose while offering a significant time and effort saving. In addition, the perceived enjoyment associated with using smart applications plays a key role in increasing user engagement (Soltani Nejad et al., 2024). It is reasonable to predict that higher perceived enjoyment, driven by technology, will stimulate tourists' travel intentions and their desire to experience the trip. Our empirical results confirm the fourth hypothesis, highlighting the significant relationship between perceived usefulness and sustainable travel intentions. Eco-friendly hotels, offering environmentally-friendly programmes, convey an image of sustainability and encourage tourists to adopt responsible purchasing behaviours. The dynamic interaction between tourists and smart technologies has also been shown to significantly influence their behaviour and decisions throughout the travel experience (Liu et al., 2022). The fifth hypothesis was also validated. A high level of perceived compatibility has been shown to be associated with the emergence of a stronger behavioural intention to adopt smart technologies (Faqih, 2020).

CONCLUSION

Fotiadis and Castaneda (2024) mentioned that perceived compatibility, defined as the alignment of applications with users' behaviours and preferences, is a pivotal factor in the adoption of such applications. Furthermore, the perceived enjoyment experienced by users in the course of interacting with these applications has been shown to motivate them to seek out more enjoyable and eco-conscious travel experiences. Finally, perceived usefulness ensures that these applications effectively address practical needs when planning sustainable trips, thereby reinforcing the intention to travel responsibly. The interplay of these three factors is thus critical in fostering sustainable behaviours among tourists.

Theoretical and practical implications: Intelligent systems have been shown to enhance operational efficiency and innovation, thereby contributing to the achievement of sustainable development goals within the hospitality industry. While a significant number of studies have examined green and smart hotels, few have delved into the analysis of sustainable practices in these establishments, considering both environmental and technological dimensions (Akel & Noyan, 2024).

Furthermore, smart hotels are regarded as a pioneering business model within the hospitality industry, setting them apart from their competitors by offering substantial benefits through the integration of state-of-the-art technologies. In the context of mounting concerns pertaining to climate change and the progressive advancement of smart technologies, organisations in emerging economies find themselves increasingly compelled to adopt eco-friendly practices, cultivate, and operationalise their STARA capabilities to enhance the efficiency of their profits and bolster their environmental sustainability. This evolution positions the smart hotel as a novel manifestation of the tourism industry's sustainability paradigm. However, the utilisation of smart services by tourists is contingent upon their ease of use and the willingness to pay for their use. Consequently, it falls upon tourism management to consider the economic viability of such smart services when conceptualising smart tourism experiences.

Limitations and future research directions: Our research has some limits. We chose the participants using convenience sampling. Generation Z (born in 2001 or later) is often called "Digital Natives" because they grew up in a time when information and technology were developing fast. This generation will be the main target market for smart hospitality and tourism. In the future, we should research which smart devices this generation expects and then use these technologies to create smart hotels and tourist attractions.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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