Journal of STI Policy and Management, Volume 10(1), 2025, pp. 22- 38

STI POLICY AND MANAGEMENT

Journal homepage: http://www.stipmjournal.org

Examining the Effects of Smart Destination Management on Tourists' Satisfaction and Perceived Sustainability in Indonesia: A Structural Equation Model

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ARTICLE INFO

Article History:
Received : 05 April 2025
Revised : 02 June 2025
Accepted : 12 June 2025
Available online : 15 July 2025

Authorship Contribution:
The main author is Wahyu Khalik and herein after referred to as co-author

Keywords:
Smart Tourism,
Destination Management, Tourists',
Satisfaction,
Perceived Sustainability,
Digital Literacy.

ABSTRACT

This study examines the influence of smart destination management on tourists' satisfaction and perceived sustainability in six major destinations in Indonesia: Jakarta, Bandung, Yogyakarta, Malang, Bali, and Lombok. Using the Smart Tourism Destination (STD) framework, this study investigates the effects of smart tourism infrastructure, destination communication, and crowd management experience, with perceived destination accessibility as a mediator and tourists' digital literacy as a moderator. A total of 380 valid responses were collected through a structured survey and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show that the three core dimensions contribute significantly to enhance tourists' satisfaction, with perceived accessibility serving as key mediator. Tourists' satisfaction also strongly predicts perceived sustainability. Digital literacy moderates the smart services' effectiveness, highlighting the importance of individual readiness. Multi-Group Analysis (MGA) results reveal that crowd management has a significantly stronger impact in island-based destinations, suggesting the need for context-sensitive strategies. Theoretically, this study expands the STD framework by integrating individual and spatial dimensions. Practically, it offers insights for destination managers to invest in inclusive technologies, support digital literacy, and tailor approaches based on destination types. These findings support the development of smart and sustainable tourism, particularly in emerging economies like Indonesia.

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DOI: 10.14203/STIPM.2024.419

I. INTRODUCTION

The global tourism industry is experiencing a profound transformation, influenced by rapid advancements in digital technologies and the growing demand for more sustainable, efficient, and personalized travel experiences. In response to these changes, the concept of Smart Tourism Destinations (STDs) has gained increasing attention. This concept refers to tourism destinations that integrate information and communication technologies (ICTs) across infrastructure, services, and governance to enhance tourists' experiences and support sustainability goals (Boes et al., 2015; Goo et al., 2022; Jovicic, 2019). Smart destinations emphasize the comprehensive use of data, connectivity, and intelligent systems to optimize resource utilization, improve visitors' experiences, and promote inclusive development within the tourism ecosystem.

Based on this broader paradigm, smart destination management is then conceptualized as a more targeted operational approach. It refers specifically to how capable tourism managers and destination authorities in adopting digitally-driven strategies to manage visitors' experiences, coordinate services, deliver real-time information, and address practical challenges, such as overcrowding or accessibility. While holistic smart destination involves system-wide integration across multiple sectors, smart destination management focuses on the implementation of managerial practices that leverage digital tools to improve service delivery and enhance tourists' satisfaction (Boes et al., 2015; Jovicic, 2019). This study adopts the smart destination management perspective—rather than the holistic smart destination one—by focusing on three main management areas, namely smart tourism infrastructure, destination management communication, and crowd management experience.

Indonesia, as one of Southeast Asia's most dynamic and diverse tourism markets, has begun to implement smart tourism initiatives in several selected locations. Six prominent regions, namely Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok, represent major tourism hubs that blend cultural richness with growing digital innovation in destination management (Damanik et al., 2022). Despite various government-led projects aimed at enhancing infrastructure and connectivity, studies on how tourists perceive these digital enhancements remain limited. Moreover, little is still known about how these perceptions influence tourists' satisfaction with the destination and their views on its sustainability practices.

Previous studies on smart tourism often concentrated on the supply side by examining technological infrastructures, system readiness, or implementation processes (Boes et al., 2015; Damanik et al., 2022). However, these studies did not adequately explore the demand side, particularly concerning how tourists interact with—and evaluate—the usefulness of smart services. Additionally, there is still a lack of analysis on how perceived destination accessibility—defined as a tourists' ability to obtain information, navigate physical and digital environments, and access services—functions as a mediating factor. Another area that remains underexplored is the role of tourists' digital literacy in determining the effectiveness of smart destination features. Tourists' ability to understand and utilize digital services can influence the extent to which they benefit from smart tourism tools, especially in the context of developing countries.

Therefore, this study aims to address these research gaps by examining the impact of smart destination management on tourists' satisfaction and perceived sustainability in the six aforementioned major tourism destinations in Indonesia. This study introduces a comprehensive conceptual model that includes three core dimensions of smart destination management, namely smart tourism infrastructure, destination management communication, and crowd management experience, as direct predictors of tourists' satisfaction. The model also includes perceived destination accessibility as a mediating variable and tourists' digital literacy as a moderating variable.

By applying quantitative research design and analyzing responses from tourists who had first-hand experience in these destinations, this study provides a deeper understanding of how digital management practices influence visitors' satisfaction and perceived sustainability. It also extends theoretical insights on smart destination management by offering evidence from Indonesia, an emerging tourism economy where adoption in this realm is still developing.

II. ANALYTICAL FRAMEWORK

A. Smart Destination Management and Tourists' Satisfaction

Smart destination management (SDM) has emerged as a critical paradigm in the evolution of modern tourism, encompassing the strategic use of

digital technologies to enhance tourists' experiences, operational efficiency, and sustainability outcomes. Drawing from the foundational work of Baggio et al. (2020), a smart tourism destination integrates ICTs into the physical, social, and institutional environment of a destination. These digital systems enable more adaptive and responsive management approaches, creating dynamic environments where tourists can navigate efficiently, access real-time information, and engage meaningfully with local services.

Among the core pillars of smart destination management is the provision of smart tourism infrastructure, which includes Wi-Fi networks, mobile tourism applications, e-ticketing systems, interactive kiosks, and digital navigation tools (Sun et al., 2024). These services collectively facilitate seamless information flow, reduce searching costs, and personalize travel experiences. A study by Vien (2021) suggested that the presence and perceived quality of such digital infrastructure have a positive impact on tourists' satisfaction. When tourists can effortlessly obtain information, plan itineraries, and access services via digital tools, their experience becomes more convenient and enjoyable, leading to higher levels of satisfaction.

In addition to technological infrastructure, effective destination management communication also plays a vital role in shaping tourists' experiences. Communication in this context refers to the dissemination of timely, relevant, and accurate information through official tourism channels, digital platforms, and on-site signage. The ability of destination authorities to deliver real-time updates, such as event schedules, safety information, and transportation changes, can significantly enhance the visitors' experience, particularly within unfamiliar or dynamic environments. According to Tong and Chan (2022), effective digital communication fosters trust among visitors and reduces uncertainty, both of which contribute to their satisfaction.

Another critical but often overlooked aspect of smart destination management is how well a destination handles crowd management. In high-traffic tourism areas, especially in post-pandemic contexts, the ability to manage tourists' flows, minimize congestion, and ensure comfort is necessary to achieve visitors' satisfaction. Smart systems, such as digital ticketing, heat maps, and real-time visitors' flow monitoring tool, allow destination managers to control crowd density and optimize spatial planning. As noted by Al-Qurashi et al. (2023), inadequate crowd management can lead to dissatisfaction and safety concern, making this a key operational priority for destination managers. Thus, based on these theoretical reasonings, the following hypotheses are proposed:

H1: Perceived smart tourism infrastructure has a significant and positive effect on tourists' satisfaction.
H2: Destination management communication has a significant and positive effect on tourists' satisfaction.
H3: Crowd management experience has a significant and positive effect on tourists' satisfaction.

B. The Mediating Role of Perceived Destination Accessibility

Perceived destination accessibility is defined as the extent to which tourists believe they can easily access services, attractions, and navigation tools within a destination (Dumitrașcu et al., 2023; Vien, 2021). In smart destinations, accessibility does not merely means physical proximity, but also refers to informational access, technological usability, and infrastructural support. Tourists' perceived accessibility are influenced by the extent to which digital services and destination management tools help them navigate, locate key points of interest, and make informed decisions throughout their visit (Farishi et al., 2025; Fatihah et al., 2025; Yuli, 2024).

Several previous studies suggested that smart services, such as interactive mobile maps, integrated public transportation systems, and real-time traffic or crowd alerts, directly enhance the accessibility of a destination (D'Amico et al., 2022; Lin et al., 2022). Consequently, perceived accessibility can act as an intermediate mechanism through which smart destination attributes influence overall satisfaction. If tourists feel that a destination is easy to navigate and interact with, their satisfaction levels are likely to increase, even if they do not utilize all of the available smart services. Moreover, accessibility may bridge the gap between operational efficiency and subjective experience, allowing tourists to translate systemic improvements into meaningful outcomes. Thus, based on these theoretical reasonings, the following hypotheses are proposed:

H4: Perceived destination accessibility mediates the relationship between perceived smart tourism infrastructure and tourists' satisfaction.

H5: Perceived destination accessibility mediates the relationship between destination

management communication and tourists' satisfaction.

H6: Perceived destination accessibility mediates the relationship between crowd management experience and tourists' satisfaction.

C. Tourists' Satisfaction and Perceived Sustainability

Tourists' satisfaction remains one of the most studied constructs in many studies on tourism, representing the degree to which visitors' expectations are met or exceeded throughout their travel (Aminullah & Wusko, 2025; Dumitrașcu et al., 2023; Utama, 2024). It is widely viewed as a determining factor in tourism industry, since the satisfied tourists are more likely to revisit the destination, recommend it to other people, and contribute to positive destination image and branding (Shi et al., 2022). While satisfaction has been traditionally treated as an outcome, recent studies highlighted its role in shaping tourists' perceptions of destination sustainability.

Perceived sustainability refers to how tourists evaluate a destination's commitment to environmental preservation, social responsibility, and long-term viability (Han, 2021; Wang et al., 2021). When digital infrastructure and smart services contribute to better waste management, reduced congestion, and improved efficiency in resource utilization, tourists are more inclined to view the destination as sustainable. Furthermore, tourists who are satisfied with their experiences, especially those related to cleanliness, safety, and convenience, often interpret these factors as indicators of responsible and sustainable management practices (Rasoolimanesh et al., 2025). In this way, satisfaction serves as a psychological lens through which tourists interpret destination values in a broader scope. Thus, based on these theoretical reasonings, the following hypothesis is proposed:

H7: Tourists' satisfaction has a significant and positive effect on perceived sustainability.

D. The Moderating Role of Tourists' Digital Literacy

While smart destination features offer considerable potential, their effectiveness is contingent on the digital literacy of the tourists themselves. Digital literacy in this context refers to the tourists' capability to effectively and efficiently harness digital tools and technologies during their travel (Caldevilla-Domínguez et al., 2021; Ritonga, 2023; Xiong & Zhang, 2024). Tourists with high levels of digital literacy are better equipped to access real-time updates, navigate using mobile maps, utilize e-services, and adapt themselves to technology-based procedures. In contrast, tourists with lower levels of digital competence may feel overwhelmed, frustrated, or excluded, which can reduce the perceived value of smart tourism infrastructure.

Recent studies has emphasized that digital literacy was able to either amplify or dampen the effectiveness of smart tourism services (Anom et al., 2023; Marín Díaz et al., 2023). This suggests that individual capabilities interact with destination-level systems in producing the desired outcomes, such as satisfaction. Digitally literate tourists are more likely to view smart infrastructure and digital communication channels as helpful and empowering. They are also more likely to benefit from crowd management tools, such as real-time alerts or mobile ticketing systems. Thus, based on these theoretical reasonings, the following moderation hypotheses are proposed:

H8: Tourists' digital literacy moderates the relationship between perceived smart tourism infrastructure and tourists' satisfaction, such that the relationship is stronger for tourists with higher digital literacy.

H9: Tourists' digital literacy moderates the relationship between destination management communication and tourists' satisfaction, such that the relationship is stronger for tourists with higher digital literacy.

H10: Tourists' digital literacy moderates the relationship between crowd management experience and tourists' satisfaction, such that the relationship is stronger for tourists with higher digital literacy.

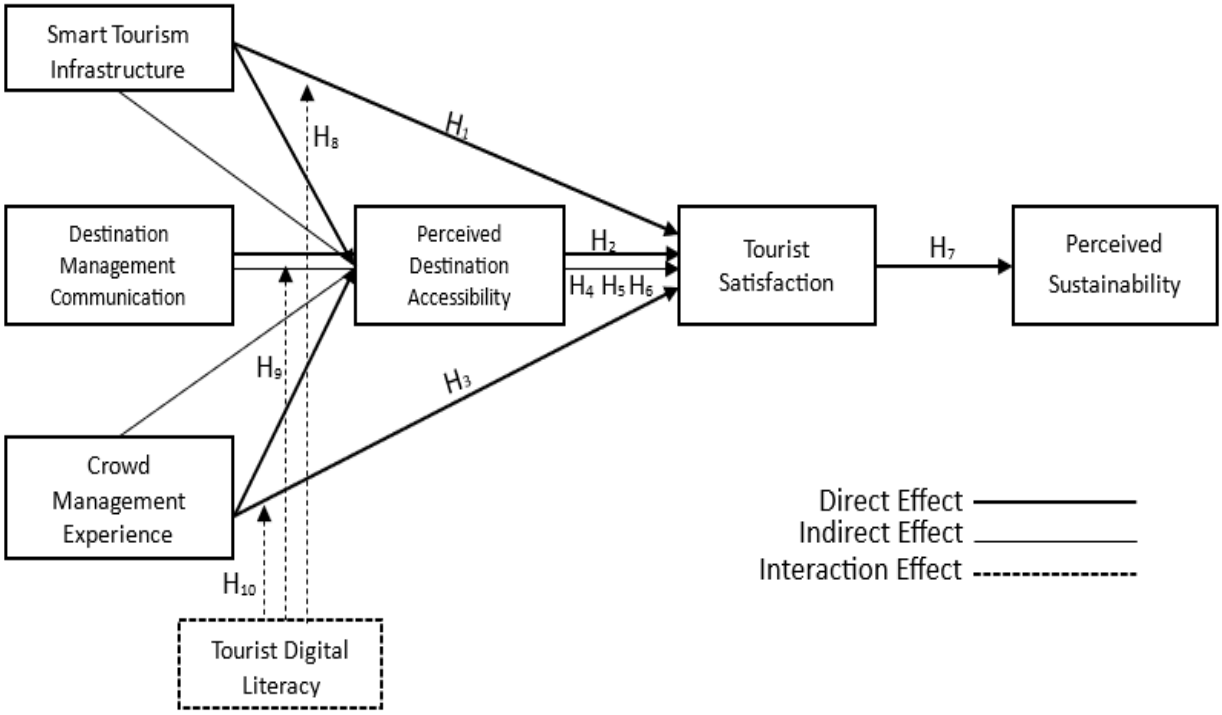

Figure 1. Conceptual Framework

III. METHODOLOGY

This study adopts a quantitative research design to investigate the impact of smart destination management on tourists' satisfaction and perceived sustainability in six prominent destinations in Indonesia: Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok. This method emphasizes a tourist-centered perspective by capturing individual perceptions of smart tourism services and management effectiveness.

The target population included both domestic and international tourists who have recently visited one of the selected destinations. The eligible respondents were determined using purposive sampling, targeting individuals who had utilized digital tourism services, such as mobile applications, digital signage, or e-ticketing systems. Data were collected using a structured self-administered questionnaire, which was distributed both in person and online to ensure broad and diverse respondent representation (January-March 2025).

Prior to the main survey, a pilot phase was conducted with 30 respondents to assess the clarity, relevance, and internal consistency of the measurement items. During the pilot phase, several items were removed due to low factor loadings and inadequate reliability. Only those items that met the psychometric standards were retained for the main survey. As a result, the final number of items in each construct reflected the outcomes of this validation process and represented the most reliable and contextually appropriate indicators for the Indonesian tourism setting.

The final dataset comprised 380 valid responses. All items were measured using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Seven constructs were examined in this study: smart tourism infrastructure, destination management communication, crowd management experience, perceived destination accessibility, tourists' satisfaction, perceived sustainability, and tourists' digital literacy. Each construct was evaluated using two to four validated items. Although several constructs included only two items, their inclusion was supported by strong empirical performance during the pilot phase and alignment with prior validated scales in the related literature. All retained items demonstrate high internal consistency, with Cronbach's alpha and composite reliability values exceeding 0.70 and Average Variance Extracted (AVE) values exceeding the threshold of 0.50, all of which align with Hair et al. (2024)'s recommendations.

To analyze the conceptual model, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed using SmartPLS 4.0 software. Convergent validity was assessed using reliability and validity assessments, consisting of Composite Reliability (CR), Cronbach's alpha,

and Average Variance Extracted (AVE). Meanwhile, discriminant validity was evaluated using the Fornell-Larcker criterion and the HTMT ratio.

Given the self-reported nature of the data, potential common method variance (CMV) was mitigated through both procedural and statistical strategies. Respondent anonymity was guaranteed, and item wording was designed to be neutral in order to minimize social desirability bias. Statistically, Harman's single-factor test and full collinearity diagnostics were conducted, with all variance inflation factor (VIF) values falling well below the recommended threshold of 3.3, indicating that CMV is not a concern in the model used in this study.

The model's fitness was assessed using the Goodness-of-Fit (GoF) index, while the model's explanatory strength was evaluated using R^2 values and effect sizes (f^2). These indicators were employed to confirm the robustness and explanatory power of the proposed structural model.

To explore spatial variations in smart tourism perceptions, the six destinations were grouped into two categories based on their tourism development context. Jakarta, Bandung, Yogyakarta, and Malang were categorized as urban destinations, taking into account their population density, infrastructure, and urban governance characteristics. Meanwhile, Bali and Lombok were categorized as island-based destinations, since tourism in these areas is largely nature-based and concentrated around coastal and resort settings. This classification was used to conduct a comparative analysis to examine whether the effects of smart destination management differ between urban and island-based environments.

Although this study was grounded in the Smart Tourism Destination (STD) framework due to its emphasis on system-level digital integration and destination-wide practices, alternative theoretical frameworks could also be relevant. Both the Technology Acceptance Model (TAM)—which highlights users' perceptions of a service's ease of use and usefulness, and the Expectancy-Disconfirmation Theory (EDT)—which links satisfaction to expectation-performance comparisons, could also offer useful perspectives. However, these two frameworks are more appropriate for studies focused on individual-level technological adoption. In contrast, the STD framework aligns with this study's objective of evaluating destination-level digital strategy and governance.

Table 1. Measurement Items of Each Construct

Construct	Item	Source
Smart Tourism Infrastructure	The destination provided reliable internet access in key tourist areas.	Adapted from Boes et al. (2015)
	I found mobile applications helpful for navigating and accessing services.	
Destination Management Communication	The destination managers communicated clearly through digital platforms.	Adapted from Akyurt & Demirdağ (2022) and Gato et al. (2022)
	I received timely and accurate travel information during my visit.	
	Digital communication tools enhanced my understanding of local offerings.	
Crowd Management Experience	Crowds were effectively managed in high-traffic tourist spots.	Adapted from Al-Qurashi et al. (2023)
	I experienced minimal delays or waiting owing to organized crowd control.	
Perceived Destination Accessibility	I could easily access attractions and facilities within the destination.	Adapted from Lin et al. (2022)
	Digital services helped me smoothly find and reach the desired locations.	
Tourists' Satisfaction	Overall, I am satisfied with my visit to this destination.	Adapted from Rasoolimanesh et al. (2025)
	The services provided met or exceeded my expectations.	
Perceived Sustainability	The destination demonstrated a clear commitment to sustainability.	Adapted from Wang et al. (2021)
	I observed environmentally friendly practices during my visit.	
	The destination appeared to be actively reducing its environmental impact.	
Tourists' Digital Literacy	I am confident in using digital tools for tourism-related activities.	Adapted from Anom et al. (2023)
	I can easily adapt myself to new travel technologies when needed.	
	I enjoy exploring destinations through digital platforms.	
	I often rely on apps and websites to enhance my travel experience.	

IV. RESULTS

A. Descriptive Statistics

Table 2 presents the demographic and behavioral profile of the 380 respondents surveyed across six major tourism destinations in Indonesia. The respondents' gender proportion was relatively balanced, with 52.1% of them were male and 47.9% were female. A significant proportion of respondents (37.6%) were within the 20 to 29-year-old age group, followed by those within the 30 to 39-year-old age group (26.8%), indicating a predominance of younger, digitally adept travelers. In terms of respondents' educational background, nearly half of them (45.5%) held a Bachelor's degree, while 17.6% completed postgraduate degree, reflecting a well-educated traveler profile. Regarding income levels, the majority of respondents (39.5%) reported earning between IDR 2–5 million per month, followed by 31.6% in the range of IDR 5–10 million, indicating a middle-income traveler profile. The survey also included both domestic (76.3%) and international (23.7%) tourists, ensuring a diverse representation of visitors' perspectives. The majority of respondents reported traveling with family (42.1%) and friends (34.7%), consistent with leisure-oriented travel patterns in Indonesia. Lastly, the distributed proportion of visited destinations is relatively even, with each location (Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok) accounting for approximately 15–17% of all responses, ensuring balanced regional representation.

Table 2. Respondents' Demographic Profile (N = 380)

Category	Subcategory	Frequency (n)	Percentage (%)
Gender	Male	198	52.1
	Female	182	47.9
Age Group (Years Old)	Under 20	25	6.6
	20–29	143	37.6
	30–39	102	26.8
	40–49	70	18.4
	50 and above	40	10.5
Educational Background	High school or below	78	20.5
	Diploma	62	16.3
	Bachelor's degree	173	45.5
	Master's degree or above	67	17.6
Monthly Income (IDR)	Below 2 million	42	11.1
	2–5 million	150	39.5
	5–10 million	120	31.6
	Above 10 million	68	17.9
Place of Residence	Domestic (Indonesia)	290	76.3
	International	90	23.7
Travel Companion	Solo	45	11.8
	With family	160	42.1
	With friends	132	34.7
	With tour group	43	11.3
Visited Destination	Yogyakarta	66	17.4
	Bandung	58	15.3
	Bali	64	16.8
	Jakarta	63	16.6
	Malang	64	16.8
	Lombok	65	17.1

Table 3. Descriptive Statistics of Each Construct

Construct	Item Amount	Mean	SD	Min	Max
Smart Tourism Infrastructure	2	5.62	1.03	2.50	7.00
Destination Management Communication	3	5.45	1.08	2.33	7.00
Crowd Management Experience	2	5.20	1.15	2.00	7.00
Perceived Destination Accessibility	2	5.55	1.02	2.50	7.00
Tourists' Satisfaction	2	5.70	0.95	3.00	7.00
Perceived Sustainability	3	5.40	1.10	2.00	7.00
Tourists' Digital Literacy	4	5.85	0.89	3.00	7.00

Table 3 summarizes the descriptive statistics of key constructs measured in this study using a seven-point Likert scale. All constructs show mean scores above 5.20, indicating generally positive perceptions across all respondents. The highest mean was resulted in Tourists' Digital Literacy (M = 5.85, SD = 0.89), suggesting that the majority of respondents felt confident and

capable in using technology to enhance their travel experiences.

Tourists' Satisfaction also show a high mean (M = 5.70, SD = 0.95), reflecting overall contentment with services and experiences at the destination. Likewise, Perceived Destination Accessibility (M = 5.55) and Smart Tourism Infrastructure (M = 5.62) are also rated favorably, highlighting tourists' recognition of digital tools and infrastructure as helpful.

Perceived Sustainability shows a slightly lower mean (M = 5.40), suggesting moderate perceptions regarding the destination's commitment to sustainability. The lowest mean was resulted in Crowd Management Experience (M = 5.20, SD = 1.15), indicating that several tourists may have experienced congestion or suboptimal crowd control in specific areas. Despite this, standard deviations of all constructs fall within the acceptable range, implying consistent responses without excessive variability.

These descriptive results offer a strong foundation for further structural analysis and suggest a favorable alignment between tourists' expectations and the digital and sustainable initiatives implemented in Indonesia's emerging smart destinations.

B. Measurement Model Assessment

Table 4 presents the measurement model assessment results, including outer loadings, internal consistency reliability (Cronbach's alpha and Composite Reliability), and convergent validity (AVE). The loading values of all items exceed the recommended threshold of 0.70 (Hair et al., 2024), indicating that each item strongly reflects its corresponding construct. Few items with loading values around 0.76 to 0.78 remain acceptable, provided that their corresponding AVE and CR values also exceed the recommended thresholds.

Cronbach's alpha values of all constructs range from 0.731 to 0.823, exceeding the benchmark of 0.70 and suggesting good internal consistency (Hair et al., 2024). Composite Reliability (CR) values of all constructs also exceed the threshold of 0.70, further confirming high construct reliability (Hair et al., 2024).

Regarding convergent validity, AVE values of all constructs surpass 0.50, ranging from 0.648 to 0.825. These findings suggest that more than 50% of the items' variance is explained by their corresponding constructs, thus meeting the criterion for adequate convergent validity (Fornell & Larcker, 1981). Overall, these results confirm that the measurement model is both reliable and valid.

Table 5 displays discriminant validity of each construct based on the Fornell–Larcker criterion, which requires that the square root of AVE value for each construct (displayed in bold diagonally) to be greater than its correlation with all other constructs (off-diagonal values). This condition has been satisfied across all constructs. For instance, the square root of AVE for Tourists' Satisfaction (0.91) is greater than its correlation with all other constructs (e.g., 0.70 with Perceived Destination Accessibility and 0.72 with Perceived Sustainability). Similarly, the diagonal value for Smart Tourism Infrastructure (0.85) is higher than its correlation with all other constructs. These results confirm that all constructs are empirically distinct from each other, thus establishing strong discriminant validity in accordance with Fornell and Larcker (1981)'s criterion.

Table 6 presents the HTMT ratio values of each construct, which compared to the Fornell–Larcker criterion, offer a more robust assessment of discriminant validity. According to Hair et al. (2024), HTMT ratio values should be below 0.90 (liberal threshold) or preferably 0.85 (conservative threshold) to confirm discriminant validity.

In this study, HTMT values of all constructs fall below 0.85, ranging from 0.62 to 0.78. For example, the HTMT value between Smart Tourism Infrastructure and Tourists' Satisfaction is 0.70, and that of between Tourists' Satisfaction and Perceived Sustainability is 0.76, both fall within the acceptable range. Thus, all of these HTMT values support the conclusion that the constructs are conceptually distinct from each other.

In summary, the measurement model demonstrates high reliability, satisfactory convergent validity, and strong discriminant validity, confirming that the latent constructs used are both statistically suitable and conceptually independent.

Table 4. Reliability and Convergent Validity of the Measurement Model

Construct	Item Code	Loading	Cronbach's Alpha	CR	AVE
Smart Tourism Infrastructure	STI1	0.82	0.731	0.843	0.722
	STI2	0.84			
Destination Management Communication	DMC1	0.78	0.791	0.867	0.686
	DMC2	0.81			
	DMC3	0.76			
Crowd Management Experience	CME1	0.83	0.752	0.864	0.761
	CME2	0.87			
Perceived Destination Accessibility	PDA1	0.85	0.741	0.854	0.747
	PDA2	0.83			
Tourists' Satisfaction	TSAT1	0.88	0.823	0.905	0.825
	TSAT2	0.91			
Perceived Sustainability	PSUS1	0.80	0.778	0.860	0.673
	PSUS2	0.78			
	PSUS3	0.82			
Tourists' Digital Literacy	TDL1	0.79	0.812	0.880	0.648
	TDL2	0.82			
	TDL3	0.77			
	TDL4	0.81			

Table 5. Discriminant Validity of Each Construct based on the Fornell–Larcker Criterion

Construct	STI	DMC	CME	PDA	TSAT	PSUS	TDL
Smart Tourism Infrastructure (STI)	**0.85**						
Destination Management Communication (DMC)	0.62	**0.83**					
Crowd Management Experience (CME)	0.59	0.63	**0.87**				
Perceived Destination Accessibility (PDA)	0.66	0.68	0.67	**0.86**			
Tourists' Satisfaction (TSAT)	0.64	0.66	0.61	0.70	**0.91**		
Perceived Sustainability (PSUS)	0.57	0.60	0.58	0.65	0.72	**0.82**	
Tourists' Digital Literacy (TDL)	0.61	0.63	0.60	0.68	0.65	0.61	**0.80**

Table 6. Discriminant Validity of Each Construct based on the HTMT Ratio

Construct	STI	DMC	CME	PDA	TSAT	PSUS	TDL
STI	—	0.71	0.66	0.74	0.70	0.63	0.67
DMC		—	0.69	0.76	0.73	0.67	0.69
CME			—	0.73	0.67	0.62	0.66
PDA				—	0.78	0.70	0.73
TSAT					—	0.76	0.70
PSUS						—	0.68
TDL							—

Table 7. Collinearity Statistics of Each Construct based on VIF Values for Common Method Bias Assessment

Construct	Item Code	VIF Value
Smart Tourism Infrastructure	STI1	2.05
	STI2	2.18
Destination Management Communication	DMC1	2.45
	DMC2	2.39
	DMC3	2.41
Crowd Management Experience	CME1	2.20
	CME2	2.28
Perceived Destination Accessibility	PDA1	2.30
	PDA2	2.34
Tourists' Satisfaction	TSAT1	2.11
	TSAT2	2.16
Perceived Sustainability	PSUS1	2.09
	PSUS2	2.14
	PSUS3	2.22
Tourists' Digital Literacy	TDL1	2.47
	TDL2	2.52
	TDL3	2.38
	TDL4	2.44

C. Common Method Bias

To mitigate the potential impact of common method variance (CMV), several procedural remedies were employed during the survey design and data collection process. First, respondents were assured of their anonymity and confidentiality, reducing evaluation apprehension and social desirability bias (Hair et al., 2024). Second, the questionnaire incorporated varied item phrasing and introduced psychological separation between predictor and criterion variables to minimize consistency bias. Third, constructs were assessed using validated multi-item scales adapted from prior studies, which further reduced the likelihood of CMV caused by poor scale development or item ambiguity.

Two statistical approaches were used to assess the presence of CMV: Harman's single-factor test and full collinearity assessment. In Harman's single-factor test, all items from the measurement model were put into an exploratory factor analysis (EFA) without rotation. The unrotated solution indicates that the first factor accounts for 32.7% of the total variance, well below the commonly accepted threshold of 50%. This result suggests that no single factor dominates the variance in the dataset, indicating that CMV is not a serious concern (Hair et al., 2024).

According to Hair et al. (2024), full collinearity VIF values below 3.3 suggest both vertical and lateral multicollinearity and by extension, CMV is unlikely to bias the results. As shown in Table 7, VIF values of all items range from 2.05 to 2.52, which are well within the acceptable range. This confirms that multicollinearity is not present, thereby supporting the conclusion that CMV is not a threat to the validity of the structural model.

D. Structural Model Assessment

Table 8 presents the structural model assessment results, including path coefficients (β), t-values, p-values, and the significance of each hypothesis. All 10 hypotheses (H1 to H10) are supported at conventional significance levels ($p < 0.05$), confirming the robustness of the model.

All three core dimensions with direct effects, namely Smart Tourism Infrastructure ($\beta = 0.210$, $p < 0.001$), Destination Management Communication ($\beta = 0.180$, $p = 0.004$), and Crowd Management Experience ($\beta = 0.165$, $p = 0.008$), show significant and positive effects on Tourists' Satisfaction, supporting H1 to H3. These results suggest that digital infrastructure, effective communication, and proactive management of visitors' flow directly enhance tourists' overall experiences.

The mediating role of Perceived Destination Accessibility is also supported. Indirect effects from Smart Tourism Infrastructure (H4), Destination Management Communication (H5), and Crowd Management Experience (H6) to Tourists' Satisfaction through Perceived Destination Accessibility are all declared significant. This indicates that ease of movement and digital access serve as key mechanisms linking managerial practices to enhanced visitors' satisfaction.

Furthermore, Tourists' Satisfaction significantly influences Perceived Sustainability ($\beta = 0.483$, $p < 0.001$), supporting H7. This finding confirms that satisfied tourists are more likely to view the destination as environmentally and socially responsible.

Lastly, Tourists' Digital Literacy significantly moderates the relationships between the three core dimensions and Tourists' Satisfaction, with interaction effects ranging from $\beta = 0.087$ to 0.105, supporting H8 to H10. These results assert that tourists with higher digital literacy derive more values from smart tourism services, reinforcing the importance of digital readiness in enhancing service impact.

Table 8. Structural Model's Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	Coefficient	t-Value	p-Value	Conclusion
H1	STI → Tourists' Satisfaction	0.210	3.52	0.000	Supported
H2	DMC → Tourists' Satisfaction	0.180	2.94	0.004	Supported
H3	CME → Tourists' Satisfaction	0.165	2.68	0.008	Supported
H4	STI → PDA → Tourists' Satisfaction (Indirect)	0.108	2.75	0.006	Supported
H5	DMC → PDA → Tourists' Satisfaction (Indirect)	0.116	2.94	0.004	Supported
H6	CME → PDA → Tourists' Satisfaction (Indirect)	0.122	3.06	0.002	Supported
H7	Tourists' Satisfaction → Perceived Sustainability	0.483	7.89	0.000	Supported
H8	TDL × STI → Tourists' Satisfaction	0.105	2.42	0.016	Supported (Moderation)
H9	TDL × DMC → Tourists' Satisfaction	0.098	2.11	0.035	Supported (Moderation)
H10	TDL × CME → Tourists' Satisfaction	0.087	1.98	0.048	Supported (Moderation)

Table 9. Goodness-of-Fit (GoF) Index

Measure	Value	Threshold	Interpretation
Average AVE	0.720	> 0.50	Satisfactory convergent validity
Average R^2 (endogenous vars)	0.605	—	Substantial explanatory power
GoF = √(AVE × R^2)	0.659	> 0.36 (large)	Large GoF – strong model fit

Table 9 shows the Goodness-of-Fit (GoF) value of the structural model, calculated as the geometric mean of average AVE and average R^2 values. The resulting GoF value (0.659) exceeds the threshold of 0.36 for a large effect size (Hair et al. 2024), indicating a strong overall model's fitness. This result affirms that the model demonstrates substantial explanatory power and reliability across both measurement and structural dimensions.

Table 10. Coefficient of Determination (R^2)

Endogenous Construct	R^2 Value	Interpretation
Tourists' Satisfaction	0.624	Substantial (Hair et al., 2024)
Perceived Sustainability	0.409	Moderate
Perceived Destination Accessibility	0.538	Moderate to substantial

As shown in Table 10, the R^2 value of Tourists' Satisfaction is 0.624, indicating that 62.4% of its variance is attributed to the combined effects of Smart Tourism Infrastructure, Destination Management Communication, Crowd Management Experience, and Perceived Destination Accessibility. According to Hair et al. (2024), this value is considered substantial.

The R^2 value of Perceived Destination Accessibility is 0.538 and that of Perceived Sustainability is 0.409, both reflecting moderate to substantial explanatory capacity. These values support the model's predictive strength in capturing core outcomes within the smart tourism context.

Table 11. Effect Size (f^2)

Path	f^2 Value	Effect Size
STI → Tourists' Satisfaction	0.045	Small
DMC → Tourists' Satisfaction	0.036	Small
CME → Tourists' Satisfaction	0.029	Small
PDA → Tourists' Satisfaction	0.132	Medium
Tourists' Satisfaction → Perceived Sustainability	0.297	Large

As shown in Table 11, all three direct effects, namely Smart Tourism Infrastructure ($f^2 = 0.045$), Destination Management Communication ($f^2 = 0.036$), and Crowd Management Experience ($f^2 = 0.029$), exhibit small effect sizes on Tourists' Satisfaction. Although statistically revealed as small, these effects are practically meaningful, especially within complex behavioral models where multiple dimensions interact to shape experiences. In real-world destination management, even small improvements in digital infrastructure, communication strategies, or crowd control measures can lead to incremental but valuable gains in tourists' satisfaction, particularly when implemented at scale across multiple tourism destinations.

Perceived Destination Accessibility demonstrates a moderate effect size ($f^2 = 0.132$) on Tourists' Satisfaction, underscoring its role as a key mechanism through which smart management practices translate into satisfaction. This finding also asserts the central role of navigability and service accessibility in shaping the perceived success of smart tourism implementations.

The largest effect is shown between Tourists' Satisfaction and Perceived Sustainability ($f^2 = 0.297$), indicating that tourists who are satisfied with their experiences are significantly more likely to perceive the destination as

environmentally responsible. This finding reinforces the strategic value of enhancing satisfaction, not only to encourage return visits, but also to strengthen perceived sustainability among visitors. Collectively, these results indicate that while the direct effects of individual smart tourism components may be statistically small or moderate, their cumulative and mediated impacts are practically significant. This provides meaningful insights for policymakers and destination managers seeking to design inclusive, technology-driven tourism systems that contribute to both visitors' satisfaction and long-term sustainability.

E. Multi-Group Analysis

The Multi-Group Analysis (MGA) results presented in Table 12 provide insights of how the effects of smart destination management differ between urban and island-based destinations in Indonesia.

Among the direct effects, Crowd Management Experience → Tourists' Satisfaction show a statistically significant difference ($p = 0.045$), with the effect being stronger in island-based destinations ($\beta = 0.208$) compared to that of urban ones ($\beta = 0.123$). This suggests that in island contexts, where visitors' density and environmental sensitivity are often more pronounced, effective crowd control plays a more critical role in shaping visitors' satisfaction. While the other two direct effects (Smart Tourism Infrastructure and Destination Management Communication) also show higher coefficients in island-based destinations, the differences with urban ones are not statistically significant at 5% level.

Table 12. Multi-Group Analysis Results

Path	Urban	Island-Based	Difference	p-Value	Significant Difference
Direct Effects					
STI → Tourists' Satisfaction	0.178	0.268	0.090	0.084	No
DMC → Tourists' Satisfaction	0.144	0.225	0.081	0.067	No
CME → Tourists' Satisfaction	0.123	0.208	0.085	0.045	**Yes**
PDA → Tourists' Satisfaction	0.221	0.301	0.080	0.078	No
TS → PS	0.470	0.502	0.032	0.265	No
Indirect (Mediated) Effects					
STI → PDA → Tourists' Satisfaction	0.097	0.128	0.031	0.103	No
DMC → PDA → Tourists' Satisfaction	0.105	0.135	0.030	0.115	No
CME → PDA → Tourists' Satisfaction	0.112	0.145	0.033	0.091	No
Moderating Effects					
TDL × STI → Tourists' Satisfaction	0.099	0.124	0.025	0.318	No
TDL × DMC → Tourists' Satisfaction	0.085	0.112	0.027	0.226	No
TDL × CME → Tourists' Satisfaction	0.070	0.108	0.038	0.051	Marginal

For indirect effects, none of the mediated paths through Perceived Destination Accessibility show significant differences between the two destination groups. However, island-based destinations consistently show slightly higher coefficients, indicating that tourists in these areas may benefit more from navigational ease and digital support when accessing key attractions and services.

Regarding moderating effects, the interaction between Tourists' Digital Literacy and Crowd Management Experience approaches significance ($p = 0.051$), suggesting that tourists with higher digital literacy may derive more values from smart crowd management tools in island destinations. However, the other moderating paths did not reveal significant differences between the two destination groups.

Overall, the MGA results reveal that island-based destinations tend to benefit more from smart tourism strategies related to crowd control and accessibility, while urban destinations may face more complex infrastructure or behavioral challenges. These spatial differences underline the importance of context-sensitive approaches in implementing smart destination management practices across different tourism environments.

V. DISCUSSION

This study examines the influence of smart destination management on tourists' satisfaction and perceived sustainability in six major tourism destinations in Indonesia. The results confirm that all three direct effects, namely smart tourism infrastructure, destination management communication, and crowd management experience, contribute positively to tourists' satisfaction. These findings are consistent with both Guo et al. (2023) and Zollo et al. (2022)'s findings, which highlighted the role of digital technologies in enhancing convenience, responsiveness, and the overall quality of visitors' experiences.

The significant effect of smart tourism infrastructure on tourists' satisfaction supports Torabi et al. (2022)'s findings, who found that mobile applications, digital maps, and real-time services increase tourists' engagement and enhance perceived values. Similarly, the role of destination communication aligns with Liu and Zheng (2023)'s findings, who demonstrated that timely and transparent digital information builds trust among visitors and reduces uncertainty during travel. The impact of crowd management is also evident in this study, reinforcing arguments from Gazzawe and Albahar (2024) and Khan and Ivan (2023), who emphasized the role of smart technologies in controlling visitors' flow. To strengthen these strategies, crowd management practices should align with the concept of carrying capacity, which refers to the maximum visitor number a site can accommodate without harming environmental quality or diminishing the tourists' experience. This suggested approach is also in line with Indonesia's National Tourism Development Master Plan (*Ripparnas*) 2010–2025, which emphasizes visitor capacity control and destination sustainability as national priorities (Haribudiman et al., 2023).

A key contribution of this study lies in identifying perceived destination accessibility as a significant mediating variable. This supports Dumitrașcu et al. (2023)'s findings, who noted that ease of movement within a destination contributes directly to tourists' satisfaction. In the context of smart tourism, accessibility refers not only to physical mobility, but also to digital access to relevant information and services. However, such access is not universally experienced. In many cases, travelers with limited digital skills or without reliable internet access, especially those from rural areas or low-income groups, face barriers to fully benefiting from smart services. In fact, it is considered essential that accessibility in tourism destinations also accommodates the needs of people with disabilities. This means smart destinations should prioritize inclusive infrastructure and digital design, integrating universal access principles to ensure that all visitors, regardless of their physical ability or digital competence, can engage fully within the tourism environment. Indonesia's Digital Transformation Strategy for the Tourism Sector 2020–2024 echoes this notion, encouraging inclusive design and bridging regional technology gaps (Ministry of Tourism and Creative Economy, 2020).

Another important finding of this study is that tourists' satisfaction strongly predicts perceived sustainability. This supports both Mathew et al. (2024) and Rasoolimanesh et al. (2025)'s findings, who suggested that when tourists are satisfied with their travel experiences, they are more likely to view the destination as environmentally responsible and socially sustainable. In this context, sustainability refers to not merely environmental preservation, but also the ethical use and long-term viability of digital systems. Sustainable digitalization involves the use of energy-efficient technologies, protection of users' data, and alignment with globally recognized sustainability standards, such as those promoted by the Global Sustainable Tourism Council. These ideas also align with Indonesia's commitment to the Sustainable Development Goals (SDGs), as incorporated in its Master Plan for Sustainable Tourism Development (Leontinus, 2022), which promotes environmentally friendly and technology-integrated tourism growth.

The moderating role of tourists' digital literacy is another novel contribution of this study. It is evident that tourists with higher digital literacy derive more benefit from smart tourism services, confirming Anom et al. (2023)'s findings. However, this also reveals important equity concerns, since it is possible for tourists and local stakeholders who lack digital skills or access to smartphones and the internet to be unintentionally excluded from many smart tourism experiences. This gap in digital readiness, if not addressed, risks reinforcing the existing socio-economic disparities and limiting the inclusiveness of digital transformation in tourism. Thus, to promote equitable access to digital services, it is crucial to implement two things: consider systemic barriers that limit participation and develop inclusive strategies that accommodate digitally excluded populations.

To mitigate this gap, destination managers and policymakers should implement multi-level digital inclusion policies. At the visitor level, offline alternatives (such as printed maps or audio guides), simplified mobile interfaces, and multilingual support can improve service usability. More importantly, at the community level, governments should invest in digital literacy programs that specifically target rural communities, small tourism operators, youth, and the elderly. These programs could include workshops hosted by tourism boards, digital skills training at local schools, and initiatives by community tourism centers to support local businesses in adopting digital tools. Such programs not only aim to enhance digital inclusion, but also to empower local communities

to participate more actively and innovatively in tourism development. Smart Tourism Roadmap established by the Ministry of Tourism and Creative Economy also reinforces this vision by emphasizing the role of community-based training and SME digital empowerment as the pillars of equitable transformation.

A further contribution of this study is the comparative examination of urban and island-based destinations using Multi-Group Analysis. The results reveal spatial differences in how smart destination practices influence tourists' satisfaction. Specifically, the impact of crowd management experience on tourists' satisfaction is significantly stronger in island-based destinations compared to that of urban ones. This may reflect the heightened ecological sensitivity of island environments, the clustering of tourism activity in concentrated areas, and the predominance of leisure-based tourism in coastal zones. While other paths, such as smart tourism infrastructure and perceived destination accessibility, also show slightly higher effects in island destinations, the differences with the urban ones are not statistically significant. These findings underscore the need for context-sensitive planning in smart tourism implementation, especially in geographically diverse regions like Indonesia.

In summary, this study has contributed to the existing literature by offering a comprehensive and spatially nuanced view of how smart destination management, digital readiness, and perceived accessibility influence tourists' satisfaction and perceived sustainability. Through both aggregate and comparative analyses, this study has offered practical and theoretical insights for developing smart tourism in a way that balances innovation with inclusion. The findings highlight the promise of smart tourism in enhancing visitors' experiences while also revealing the importance of addressing digital inequalities to ensure equitable access to digital services for all related stakeholders. For this reason, improving community-level's digital literacy and removing access barriers to digital services are the essential strategies to guide the smart tourism evolution from convenience-oriented management to equity and sustainability-oriented ones.

Implications

This study has offered important implications, both theoretically and practically, in the domain of smart destination management and sustainable tourism development.

From a theoretical perspective, this study has advanced the Smart Tourism Destination (STD) framework by empirically validating how smart destination attributes, namely perceived smart tourism infrastructure, destination management communication, and crowd management experience, affect tourists' satisfaction and perceived sustainability. This relationship was further clarified by the mediating role of perceived destination accessibility, which emphasizes the significance of enabling tourists to navigate and interact with destinations, both physically and digitally. Additionally, the integration of tourists' digital literacy as a moderating factor highlights the critical role of individual capabilities in shaping the effectiveness of smart tourism strategies. These findings have contributed to a growing body of literature that aims to connect system-level innovation with user-level engagement, particularly to develop tourism markets in emerging economies, such as Indonesia, by shifting the strategies into more digitally-driven. Furthermore, the inclusion of spatial comparison through urban and island-based groupings has provided a valuable analytical lens for understanding how contextual differences influence the outcomes of smart tourism initiatives.

From a practical standpoint, this study has provided several actionable guidances for tourism destination managers, policymakers, and tourism stakeholders operating in diverse tourism settings. First, investment in foundational digital infrastructure, such as high-speed internet, interactive signage, mobile applications, and real-time communication platforms, remains essential for improving visitors' satisfaction. Second, crowd management should be elevated as a strategic priority, especially in island-based destinations where congestion due to tourists' flows can lead to environmental degradation and visitors' dissatisfaction. As a solution, innovative technologies, such as predictive analytic tools, heat mapping, and digital booking platforms, can help regulate visitors' flows while maintaining alignment with local carrying capacity thresholds.

Third, perceived destination accessibility must be addressed through both digital and physical planning. This includes designing user-friendly mobile tools, offering multilingual support, and ensuring infrastructure accessibility for people with disabilities. Fourth, the findings on digital literacy suggest that smart services should go hand in hand with educational supports. For instance, destination authorities can implement digital onboarding campaigns for travelers and

collaborate with local communities to promote grassroots awareness of digital tourism tools.

Finally, the MGA results emphasize the importance of context-sensitive strategies. For urban destinations, where infrastructure is often more complex and diversified, emphasis should be placed on system integration and service interoperability. On the other hand, for island-based destinations, which are ecologically more sensitive due to tourists' highly concentrated flows, crowd control and visitors' experience management must be handled with precision.

Taken together, these implications reinforce the notion that successful implementation of smart tourism strategies necessitates not merely technological adoption, but also inclusive design, capacity building, equitable access to digital services, and adaptive spatial planning. Only by integrating these elements can tourism destinations foster smart environments that are not only technologically advanced, but also sustainable, inclusive, and resilient.

VI. CONCLUSION

This study concludes that smart destination management plays a significant role in enhancing tourists' satisfaction and perceived sustainability in Indonesian tourism context. By examining six major tourism destinations, this study has confirmed that perceived smart tourism infrastructure, destination management communication, and crowd management experience contribute to tourists' satisfaction, both directly and indirectly, through perceived destination accessibility. Tourists' satisfaction, in turn, significantly influences perceived sustainability, indicating that positive visitors' experiences shape views on a destination's environmental and social responsibility. The moderating role of tourists' digital literacy reveals that individual digital readiness enhances the benefits of smart tourism services. Moreover, the MGA results highlight spatial variations, with crowd management showing a significantly stronger effect on island-based destinations compared to that of urban ones.

This study has made several theoretical and practical contributions, but it is not without several limitations. First, the use of cross-sectional data restricted the possibility to draw causal inferences. Second, although spatial grouping was employed, other contextual variables, such as destination size, policy support, or environmental sensitivity, were not examined. Third, this study focused exclusively on tourists' perceptions, omitting managerial or residents' perspectives that could provide a more comprehensive understanding of the dynamics of smart tourism destination.

For this reason, future studies should consider longitudinal or mixed method approaches to explore how smart tourism practices evolve over time. Several suggested methods comprise expanding the framework to include multiple stakeholder perspectives and testing the smart tourism management model in other emerging economies, since these approaches would enhance the generalizability and offer deeper insights of sustainable smart tourism development.

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