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WHEN SMART DESTINATIONS BECOME SUSTAINABLE: HOW TECHNOLOGY AND COMMUNICATION SHAPE TOURIST SATISFACTION

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Abstract

This study investigates how technology service quality and omnichannel communication quality shape tourist satisfaction and perceived sustainability within Indonesia's emerging smart tourism landscape. Grounded in the Smart Tourism Destination framework, the analysis incorporates perceived destination accessibility as a mediating variable and tourist digital literacy as a moderating variable to explain how digital infrastructures and user competencies jointly shape sustainable experiences. Data from 380 domestic and international tourists across six major destinations, namely Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok, through purposive sampling to ensure that respondents had engaged with digital tourism services. Using Partial Least Squares Structural Equation Modeling revealed that technology service quality ($\beta = 0.34$, $p < 0.001$) and omnichannel communication quality ($\beta = 0.29$, $p < 0.001$) significantly enhance satisfaction, both directly and indirectly through perceived accessibility (indirect $\beta = 0.18$, $p < 0.001$). Tourist digital literacy strengthens these effects ($\beta = 0.11$ and 0.09, $p < 0.01$), while satisfaction strongly predicts perceived sustainability ($\beta = 0.42$, $p < 0.001$). The study advances Smart Tourism Destination theory by integrating technological performance, perceived accessibility, and human capability into a unified explanatory model. It highlights the need for reliable digital system, coherent communication across channels, and inclusive digital literacy initiatives to ensure that smart that smart tourism innovations lead to equitable and sustainable outcome in developing destinations. Policy makers and destination manager are encouraged to invest in digital capability programs, improve cross channel communication standards, and strengthen accessible technology infrastructure to maximize the long-term benefits of smart tourism development.

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INTRODUCTION

The global tourism industry is experiencing a structural transformation driven by rapid digitalization and the growing demand for sustainable, efficient, and personalized travel experiences. The concept of Smart Tourism Destinations (STDs) has emerged as a response to these changes, emphasizing the integration of information and communication technologies (ICTs) into destination management to improve tourist satisfaction, strengthen sustainability, and enhance governance (Abdelmalak, 2024; Alsharif et al., 2024). Smart destinations utilize big data, mobile applications, and connected infrastructure to optimize resource management, deliver seamless visitor experiences, and support more inclusive development (Hariyanto et al., 2025). As the world recovers from the disruptions of the COVID-19 pandemic, investments in digital platforms, contactless services, and data-driven management systems have become critical components of destination competitiveness and resilience (Dewayani, 2024).

Indonesia, as one of the most dynamic tourism economies in Southeast Asia, is actively embracing this transformation. The Ministry of Tourism and Creative Economy (Kemenparekraf) has prioritized Smart Tourism Indonesia within the Digital Tourism Transformation Roadmap 2021–2024, emphasizing digital platforms for integrated destination management, sustainable visitor flow control, and data interoperability among tourism stakeholders (Kemenparekraf, 2023). This initiative aligns with the *Rencana Induk Pembangunan Kepariwisataan Nasional* (RIPPARNAS) 2010–2025 and Indonesia's Vision 2045, which identify digital infrastructure, creative economy integration, and environmental sustainability as core strategic pillars for achieving inclusive tourism growth. Recent data from the Ministry of Communication and Informatics indicate that digital adoption among tourism operators reached 67 percent in 2023, supported by the rapid expansion of 4G and 5G networks across major destinations such as Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok (ERIA, 2025).

Despite these advances, challenges remain in ensuring that technological innovation translates into meaningful experiences and sustainability outcomes. Studies within the Indonesian context reveal that most smart tourism initiatives remain concentrated on supply-side infrastructure rather than demand-side user experiences (Djuwendah et al., 2025; Mufaddhal, 2025; Nguyen, 2024; Yuli, 2024). Moreover, the heterogeneity of digital literacy among tourists and local service providers has created uneven access to digital benefits, particularly outside major urban centers. While government programs such as 100 Smart City Movement and Tourism Village Digitalization have improved service delivery, there is still limited empirical understanding of how tourists perceive the quality of technology-enabled services, communication across digital channels, and their implications for satisfaction and sustainability perceptions.

These gaps highlight the need to examine more comprehensively how tourists experience smart destination management in Indonesia's diverse contexts, where cultural heritage, ecological sensitivity, and digital transformation intersect. This study addresses this need by examining how Technology Service Quality and Omnichannel Communication Quality affect tourist satisfaction and perceived sustainability, with Perceived Destination Accessibility as a mediating factor and Tourist Digital Literacy as a moderator. By adopting a quantitative approach and drawing evidence from six leading destinations representing urban, cultural, and island settings, the study contributes to

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strengthening Indonesia's policy framework for sustainable tourism digitalization. It advances the Smart Tourism Destination (STD) framework by integrating system-level attributes with individual-level digital capabilities, offering theoretical and practical insights for developing competitive, inclusive, and sustainable destinations in the context of emerging digital economies.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Theoretical Foundation

The conceptual model of this study is grounded in the Smart Tourism Destination (STD) framework, which integrates digital technologies into destination management systems to optimize visitor experiences, operational efficiency, and sustainability outcomes (Abdelmalak, 2024; Alsharif et al., 2024). Within this framework, smart destinations function as socio-technical systems in which data connectivity, service integration, and real-time communication collectively shape the quality of tourist experiences. However, much of the existing STD research focuses on infrastructural readiness and governance capacity, while overlooking how tourists interpret and evaluate the quality of digital services. To address this theoretical gap, the present study positions Technology Service Quality (TSQ) and Omnichannel Communication Quality (OCQ) as key operational dimensions of the STD framework that directly reflect the functional and relational performance of smart systems from the user perspective.

The construct of Technology Service Quality is theoretically derived from the Information Systems (IS) Success Model (Delone & McLean, 2003), which emphasizes that system quality and service quality determine user satisfaction and intention to continue using technology. In tourism, this framework captures the reliability, responsiveness, and usability of technological services such as e-ticketing, digital payment systems, and mobile applications (Li & See-To, 2023; Pai et al., 2025). These functions translate the abstract idea of "smartness" into measurable performance outcomes that tourists can perceive during their journeys. Omnichannel Communication Quality, meanwhile, extends the IS Success Model by integrating the communicative dimension of smart destination management how information accuracy, consistency, and responsiveness across multiple digital channels (websites, apps, and on-site digital displays) enhance tourists' trust and engagement (Huda, 2023; Tong & Chan, 2022). Conceptually, TSQ and OCQ together operationalize the service interface of smart destination systems, linking technological capability to experiential value.

The inclusion of Perceived Destination Accessibility (PDA) as a mediating variable is anchored in tourism mobility and accessibility theory, which posits that tourists' perceived ease of movement, access to information, and navigational efficiency significantly influence satisfaction (Bashir et al., 2024; Shariffuddin et al., 2023).. In smart destinations, digital technologies influence accessibility through both functional and psychological pathways. Functionally, they provide real-time route planning, traffic information, and integrated ticketing; psychologically, they reduce uncertainty and cognitive load when navigating unfamiliar environments. Hence, PDA is theorized as the mechanism through which technology and communication quality translate into satisfaction, because digital tools make destinations feel more navigable and tourists' sense of experiential ease.

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At the individual level, Tourist Digital Literacy (TDL) is grounded in capability theory and technology readiness research, which view digital competence as a personal resource enabling effective use of technology (Xiong & Zhang, 2024). In contrast to prior STD studies that treat tourists as homogeneous technology users, this study conceptualizes digital literacy as a moderating variable that conditions the effectiveness of smart services. Tourists with high digital literacy can fully leverage available technologies, interpret multimodal communication, and resolve service disruptions autonomously, whereas those with limited literacy may experience barriers even in well-designed systems (Miraz et al., 2025). This differentiation reflects a contextual adaptation of capability theory, recognizing the digital divide that persists among Indonesian tourists and its implications for inclusive smart tourism development.

Finally, Tourist Satisfaction and Perceived Sustainability (PSUS) are linked through service quality and sustainable tourism theories, which assert that satisfaction derived from efficient and transparent service experiences strengthens perceived environmental and social responsibility (Hassan et al., 2024; Rasoolimanesh et al., 2025). This study extends that relationship by demonstrating how satisfaction in digitally mediated contexts functions as a cognitive bridge between immediate experiences and broader sustainability evaluations when tourists perceive digital services as seamless and responsible, they are more likely to infer that the destination operates sustainably.

Collectively, this theoretical integration advances prior models by connecting system-level service attributes (TSQ, OCQ), a functional mechanism (PDA), and an individual capability factor (TDL) within a single framework. It addresses the empirical gap in STD literature by linking technological and communicative quality to sustainability through the lens of tourist experience, while contextualizing the model within Indonesia's policy agenda for digital transformation in tourism. The novelty lies in demonstrating how smart destination management can produce equitable and sustainable outcomes only when digital infrastructures are matched with human capabilities, thereby positioning smart tourism as both a technological innovation and social capability process.

Technology Service Quality and Tourist Satisfaction

Technology Service Quality (TSQ) represents a core operational construct of the Smart Tourism Destination (STD) framework because it reflects how the technological infrastructure and service systems of a destination translate into tangible visitor experiences (Setiawan et al., 2024). Drawing upon the Information Systems (IS) Success Model (Delone & McLean, 2003), system quality and service quality jointly determine user satisfaction by ensuring that information systems are reliable, responsive, and user-oriented. In smart tourism contexts, TSQ captures how effectively a destination's digital ecosystem comprising mobile applications, online booking platforms, Wi-Fi connectivity, and digital payment systems supports tourists in performing travel-related tasks (Setiawan et al., 2024; Sun et al., 2025). The theoretical relevance of TSQ lies in its role as the functional foundation that enables the smart attributes of destinations to produce satisfaction and, subsequently, perceptions of sustainability.

Empirical evidence supports this theoretical linkage. Studies in technologically advanced destinations such as Seoul, Singapore, and Dubai demonstrate that reliability, interactivity, and responsiveness of digital systems significantly enhance tourist

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satisfaction and destination image (Tong & Chan, 2022; Torabi et al., 2025). Similar findings in Indonesia show that dependable internet connectivity, stable e-ticketing platforms, and effective customer support services increase tourists' perceived control and trust in digital tourism environments (Akbar et al., 2019; Setiawan et al., 2024; Tias et al., 2022). These findings collectively affirm that high-performing technological systems do not merely facilitate transactions but also shape cognitive and affective evaluations of the destination experience. In contrast, technological breakdowns or poor interface usability create psychological discomfort and service uncertainty, which can reduce overall satisfaction (Hardi et al., 2023).

Within this study's conceptual framework, TSQ is theorized to influence tourist satisfaction both directly and indirectly through perceived destination accessibility, as reliable and user-friendly technologies enhance tourists' sense of mobility and ease of navigation. Nevertheless, the direct path remains central because satisfaction fundamentally reflects tourists' overall judgment of how well destination systems meet their expectations for efficiency, reliability, and convenience. Thus, grounded in the IS Success Model and supported by empirical tourism evidence, the following hypothesis is proposed:

H1: Technology Service Quality has a positive and significant effect on Tourist Satisfaction.

Omnichannel Communication Quality and Tourist Satisfaction

Omnichannel Communication Quality (OCQ) captures how effectively destinations integrate multiple information and interaction channels such as mobile applications, official websites, social media, and digital signage into a cohesive communication system. Theoretically, this construct draws upon the Service Quality Theory (Parasuraman et al., 1993) and Dialogic Communication Theory (Kent & Taylor, 2002), which emphasize responsiveness, reliability, and two-way interaction as critical dimensions of perceived service excellence and trust. In the Smart Tourism Destination (STD) framework, omnichannel integration ensures that tourists receive timely, accurate, and consistent information across platforms, thereby reducing informational asymmetry and enhancing confidence in destination management (Alsharif et al., 2024; Tulung et al., 2025).

Unlike traditional single-channel communication, omnichannel systems synchronize messages and interfaces across online and offline touchpoints, providing continuity and personalization throughout the travel journey. This integration allows tourists to shift seamlessly between mobile-based planning, real-time updates during travel, and on-site information retrieval, which collectively reduce uncertainty and cognitive effort (Srinivasan et al., 2024). Empirical research confirms that destinations implementing cross-platform communication systems report higher levels of tourist satisfaction and loyalty (X. Wang, 2025; Yap et al., 2025). For example, studies in China (Tan et al., 2025) and Thailand (Khalid, 2024) found that integrated information delivery significantly improves perceived convenience, reliability, and emotional engagement with destinations.

The relational dimension of OCQ is equally important. Drawing on dialogic communication principles, smart destinations increasingly employ interactive features, chatbots, social media feedback loops, and online service portals to foster two-way

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engagement between managers and visitors (Díaz-Parra et al., 2025). Such dialogic systems enable tourists to seek clarification, report problems, or express opinions, creating a sense of responsiveness and co-creation that extends beyond one-way information dissemination. Empirical evidence indicates that interactive communication strengthens affective satisfaction by making tourists feel acknowledged and supported (Camilleri & Kozak, 2022; Zhang et al., 2025). This dynamic is particularly relevant in Indonesia, where diverse linguistic and cultural contexts heighten the value of inclusive and responsive digital communication.

In this theoretical model, OCQ is posited to influence tourist satisfaction both directly and indirectly through perceived accessibility, as integrated communication systems enhance tourists' ability to plan and navigate destinations effectively. However, the direct relationship remains primary because high-quality communication signals managerial competence and reliability, which are central antecedents of satisfaction within the STD paradigm. Accordingly, based on service quality and dialogic communication theories and supported by empirical evidence from smart destination studies, the following hypothesis is proposed:

H2: Omnichannel Communication Quality has a positive and significant effect on Tourist Satisfaction.

The Mediating Role of Perceived Destination Accessibility

Perceived Destination Accessibility (PDA) represents tourists' subjective evaluation of how easily they can reach, navigate, and experience a destination's attractions, facilities, and services. The construct extends beyond physical mobility to encompass the informational and digital dimensions of accessibility, consistent with Mobility Theory and the Technology Acceptance Model (TAM), which emphasize the role of perceived ease of use and navigational support in shaping user satisfaction (D'Amico et al., 2022; Tulung et al., 2025). Within the Smart Tourism Destination (STD) framework, accessibility functions as a psychological and functional bridge between system-level technological service attributes and tourists' experiential outcomes.

From a theoretical standpoint, accessibility operates as a mediating mechanism because smart technologies and communication systems influence satisfaction indirectly through perceived ease and efficiency of movement (Bashir et al., 2024; Gupta et al., 2023). When tourists perceive that technology facilitates smooth navigation and reduces uncertainty, they interpret the overall experience as more coherent and satisfying. This mediating process is grounded in service quality theory, which posits that technological and informational enablers shape satisfaction by reducing effort and enhancing control (Parasuraman et al., 1988).

In the first mediating path, Technology Service Quality (TSQ) enhances accessibility by improving functional connectivity through reliable mobile apps, stable internet infrastructure, and integrated e-ticketing systems. These technologies simplify logistical barriers and empower tourists to plan and move efficiently. Empirical studies confirm that technology reliability and usability strongly predict perceived accessibility and ease of travel (De Vos et al., 2025; Hasni et al., 2021). Thus, destinations with dependable technological systems create a sense of spatial and informational openness that strengthens visitors' sense of control.

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In the second mediating path, Omnichannel Communication Quality (OCQ) contributes to accessibility by improving informational coherence. Integrated communication across multiple digital platforms ensures that visitors receive consistent, real-time updates on routes, schedules, and local conditions. This informational transparency allows tourists to anticipate and adapt to changing environments, minimizing confusion and enhancing spatial confidence (Hassan et al., 2022; B. Wang et al., 2022). Hence, while TSQ enhances functional ease of movement, OCQ reinforces cognitive accessibility by improving tourists' understanding and orientation within the destination.

When tourists perceive high accessibility, they experience greater autonomy and assurance in navigating destinations, which fosters satisfaction and positive evaluations of destination management (Gupta et al., 2023). Therefore, PDA operates as a critical mediating construct linking technological quality and communicative quality to satisfaction within smart tourism systems.

H3: Perceived Destination Accessibility mediates the relationship between Technology Service Quality and Tourist Satisfaction.

H4: Perceived Destination Accessibility mediates the relationship between Omnichannel Communication Quality and Tourist Satisfaction.

The Moderating Role of Tourist Digital Literacy

Tourist Digital Literacy (TDL) refers to the individual capacity to effectively access, interpret, and apply digital information and technologies within the travel experience. Conceptually, this construct draws from Capability Theory (Stephens, 2023) and Technology Readiness Theory (Parasuraman, 2000), both of which emphasize that technological outcomes depend not only on the availability of tools but also on users' competencies and psychological readiness to utilize them. Within smart destinations, TDL therefore represents a human capability factor that determines whether digital innovations translate into meaningful, satisfying experiences.

The moderating role of TDL can be explained through the Cognitive Fit Theory (Ma & Li, 2023), which posits that task performance improves when users' cognitive abilities align with the structure of technological systems. Tourists with higher digital literacy experience greater congruence between their technological proficiency and the smart services provided, allowing them to navigate, customize, and problem-solve more effectively. Conversely, low-literacy tourists encounter cognitive friction that reduces their ability to perceive or benefit from high-quality technological services (Miraz et al., 2025). Empirical studies across tourism and information systems domains confirm that digital literacy moderates the effects of service quality and system usability on satisfaction and continued technology use (Aminullah & Wusko, 2025; Wang et al., 2024).

In the Technology Service Quality (TSQ)–Satisfaction pathway, TDL strengthens the relationship by enhancing tourists' ability to utilize system functionalities such as online booking, navigation, and feedback tools. High-literacy tourists are better equipped to exploit these technological affordances efficiently, which amplifies the perceived convenience and reliability derived from TSQ (Balaskas et al., 2025). In contrast, low-literacy users may struggle with digital interfaces, resulting in weaker satisfaction despite identical technological conditions.

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In the Omnichannel Communication Quality (OCQ)–Satisfaction pathway, TDL moderates through interpretive and relational mechanisms. Digitally literate tourists can better synthesize information received across multiple channels, discern relevance, and engage interactively with service providers. This cognitive agility enhances perceived trust, responsiveness, and informational clarity, leading to higher satisfaction (Gato et al., 2022; Huda, 2023). Tourists with limited literacy, however, may experience message overload or confusion, which weakens the positive influence of communication quality on satisfaction.

Overall, TDL functions as a boundary condition within the Smart Tourism Destination (STD) framework: it determines how effectively tourists convert system-level service quality and communication quality into positive experiential outcomes. By integrating individual capability into the digital tourism model, this study extends existing theories of service quality and smart destination management, highlighting the critical human dimension of technological adoption.

H5: Tourist Digital Literacy moderates the relationship between Technology Service Quality and Tourist Satisfaction, such that the relationship is stronger for tourists with higher digital literacy.

H6: Tourist Digital Literacy moderates the relationship between Omnichannel Communication Quality and Tourist Satisfaction, such that the relationship is stronger for tourists with higher digital literacy.

Tourist Satisfaction and Perceived Sustainability

Tourist Satisfaction represents the degree to which visitors' expectations are fulfilled or exceeded during their travel experience, functioning as a key evaluative judgment that integrates both affective and cognitive appraisals of service performance (Hardi et al., 2023; Shatnawi et al., 2023). Within the Smart Tourism Destination framework, satisfaction extends beyond immediate hedonic outcomes to influence how tourists cognitively interpret the quality and ethics of destination management. Thus, satisfaction operates not only as a behavioral predictor of loyalty but also as a cognitive and affective lens through which broader destination values, including sustainability, are assessed.

Perceived Sustainability refers to the extent to which tourists believe that a destination's operations, infrastructure, and services reflect environmental responsibility, social inclusivity, and long-term viability (Alam, 2025; Rasoolimanesh et al., 2025). According to Cognitive Appraisal Theory (Lazarus, 1991), individuals derive higher-order judgments such as sustainability perceptions from emotional evaluations formed during service encounters. When tourists experience satisfaction, positive affect activates confirmatory cognitive processes, leading them to attribute pro-social and environmentally responsible qualities to the destination. Conversely, dissatisfaction triggers critical appraisals that magnify perceived inefficiencies or insincerity in sustainability efforts (Altintzoglou et al., 2025).

This affective–cognitive consistency is reinforced by Affective–Cognitive Consistency Theory (Simon & Read, 2018), which posits that individuals strive for harmony between emotional responses and evaluative beliefs. Satisfied tourists, motivated to maintain cognitive consistency, interpret destination management behaviors such as cleanliness, digital efficiency, and transparency as evidence of sustainable governance

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(Karim et al., 2025; Rahman et al., 2025). This mechanism explains why even implicit sustainability cues, such as efficient crowd control or low energy consumption in digital systems, are more salient to satisfied visitors. In contrast, dissatisfied tourists tend to discount or overlook similar cues, as negative affect biases their interpretation of managerial intent (Dewayani, 2024).

Empirically, studies in environmentally sensitive destinations demonstrate that positive experiences enhance the salience of sustainability cues and foster trust in destination authorities (Miraz et al., 2025; Rasoolimanesh et al., 2025). This study extends these theoretical perspectives by embedding the satisfaction–sustainability relationship within a smart destination context, showing that satisfaction derived from technological and communicative efficiency enhances not only tourists' immediate experience but also their moral and environmental evaluation of destination governance.

Accordingly, grounded in cognitive appraisal and attributional reasoning, this research proposes the following hypothesis:

H7: Tourist Satisfaction has a positive and significant effect on Perceived Sustainability.

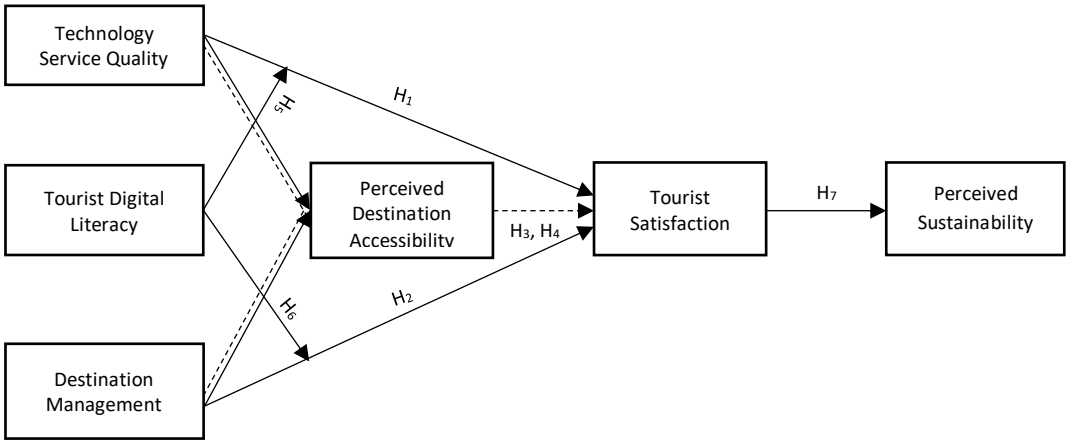

Figure 1. Conceptual Framework

Source: Research Data, 2025

METHODOLOGY

This study employs a quantitative research design, which is appropriate for testing theoretically derived causal relationships among latent constructs within the Smart Tourism Destination (STD) framework. Quantitative methods enable systematic examination of how variations in technology and communication quality influence tourist satisfaction and sustainability perceptions across diverse contexts. This approach aligns with the study's objective to validate a structural model that integrates system-level and individual-level variables through statistical generalization and theory-driven testing (Hair et al., 2021).

The research was conducted in six major Indonesian destinations, Yogyakarta, Bandung, Bali, Jakarta, Malang, and Lombok which represent urban, cultural, and island tourism settings where smart initiatives are actively implemented. The target population comprised domestic and international tourists who had recently visited these destinations. A purposive sampling strategy was applied to recruit respondents who had prior experience using digital tourism services such as mobile applications, e-ticketing, or online

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information portals. This non-probability approach was considered suitable for studies examining technology-based behavioral constructs, as it ensures that participants possess the necessary experiential knowledge to provide valid responses (Etikan, 2016). While purposive sampling may limit representativeness, it enhances construct validity by focusing on information rich cases relevant to the study's scope.

Data were collected using a structured self-administered questionnaire, distributed both online and in person to capture diverse respondent profiles. A pilot test involving 30 participants was undertaken to evaluate clarity, internal consistency, and contextual appropriateness of the items. Cronbach's alpha values exceeded the recommended threshold of 0.70, confirming reliability. Feedback from the pilot informed several minor wording improvement to enhance clarity and cultural alignment with the Indonesian tourism context.

The final instrument included 22 measurement items covering six constructs: Technology Service Quality, Omnichannel Communication Quality, Perceived Destination Accessibility, Tourist Satisfaction, Perceived Sustainability, and Tourist Digital Literacy. All items were adapted from validated scales in previous studies and refined through a translation–back-translation process to maintain conceptual equivalence. Responses were recorded using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). This scale was chosen for its ability to capture subtle attitudinal variations and for its consistency with established practice in tourism and technology adoption research.

Table 1. Measurement Items for Each Construct

Construct	Item Statement	Source
Technology Service Quality (TSQ)	1) The destination provides reliable, stable, and accessible internet in service in key tourist areas. 2) The mobile applications and e-services were easy to operate, dependable, and functioned smoothly.	(Boes et al., 2015; Sun et al., 2025)
Omnichannel Communication Quality (OCQ)	1) The destination communicated updates accurately and consistently across its official digital channels. 2) I received timely, clear, and complete travel information during my visit. 3) Digital communication tools and signage enhanced my understanding of local offerings.	(Akyurt & Demirdağ, 2022; Gato et al., 2022)
Perceived Destination Accessibility (PDA)	1) I could easily access attractions and facilities throughout the destination. 2) Digital tools helped me navigate and reach desired locations smoothly and confidently.	(D'Amico et al., 2022; Lin et al., 2022)
Tourist Satisfaction (TSAT)	1) Overall, I am satisfied with my visit to this destination. 2) The services provided met or exceeded my expectations.	(Rasoolimanesh et al., 2025)
Perceived Sustainability (PSUS)	1) The destination demonstrated a clear and visible commitment to sustainability. 2) I observed environmentally friendly and responsible practices during my visit. 3) The destination appears to be actively reducing its environmental footprint and impact.	(Han, 2021; Wang et al., 2021)

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Tourist Digital Literacy (TDL)	1) I am confident in using digital tools for tourism-related activities. 2) I can easily adapt to new travel technologies when required. 3) I enjoy exploring destinations through various digital platforms. 4) I often rely on apps and websites to enhance and support my travel experience.	(Anom et al., 2023)

Source: Research Data, 2025

Data from 380 valid respondents were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4. PLS-SEM was selected because it is well suited to exploratory-explanatory models, theory development, and prediction-oriented research involving complex relationships, mediators, and moderators (Hair et al., 2021). Moreover, it accommodates non-normal data distributions and moderate sample sizes, which are common in cross-destination tourism research.

The measurement model was assessed through composite reliability (CR), Cronbach's alpha, and average variance extracted (AVE) to confirm internal consistency and convergent validity. Discriminant validity was examined using the Fornell–Larcker criterion and HTMT ratio. To mitigate common method variance (CMV), both procedural and statistical remedies were applied. Procedurally, anonymity, clear and neutral item wording, and randomized items order were implemented to minimize respondent bias. Statistically, Harman's single-factor test and full collinearity assessment were performed following recommended guidelines (Kock et al., 2021), confirming that CMV was not a concern.

Model adequacy was further examined through Goodness-of-Fit (GoF), coefficient of determination (R^2), and effect size (f^2) indices to evaluate explanatory power and overall predictive relevance. These diagnostic steps ensured that both measurement and structural models achieved satisfactory levels of reliability and validity consistent with current standard in tourism research.

Overall, this methodological approach combining multi destination sampling, validated constructs, and PLS-SEM analysis provides a rigorous empirical basis for understanding how technology service quality and omnichannel communication quality influence accessibility, satisfaction, and sustainability in Indonesian smart tourism destinations.

FINDINGS AND DISCUSSION

Descriptive Statistics

Table 2 shows that the sample of 380 respondents was well balanced across demographic groups. Gender distribution was nearly even (52% male, 48% female). Most respondents were young adults, with 65% aged between 20 and 39 years, which reflects a predominantly technology-oriented traveler profile. Education levels were relatively high, with 63% holding at least a bachelor's degree. In terms of income, the majority fell into the middle-income range of IDR 2–10 million per month, accounting for 71 percent of the sample.

Table 2. Respondent Profile (N = 380)

Variable	Category	n	%
Gender	Male	198	52

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	Female	182	48
Age Group	< 20 years	25	7
	20–29 years	143	38
	30–39 years	102	27
	40–49 years	70	18
	≥ 50 years	40	10
Education	High school or below	78	20
	Diploma	62	16
	Bachelor's degree	173	45
	Master's degree or above	67	18
Monthly Income	< IDR 2 million	42	11
	IDR 2–5 million	150	39
	IDR 5–10 million	120	32
	> IDR 10 million	68	18
Residence	Domestic (Indonesia)	290	76
	International	90	24
Travel Companion	Solo	45	12
	With family	160	42
	With friends	132	35
	With tour group	43	11
Visited Destination	Yogyakarta	66	17
	Bandung	58	15
	Bali	64	17
	Jakarta	63	17
	Malang	64	17
	Lombok	65	17

Source: Research Data, 2025

Most participants were domestic tourists (76%), though nearly one-quarter were international visitors (24%), which helps ensure a broad range of perspectives. Family and friends were the dominant travel companions (77%), consistent with common leisure-oriented travel patterns. The six destinations were evenly represented, with each attracting about 15–17% of the sample, thereby providing balanced representation across Indonesia's major tourism hubs.

Table 3. Descriptive Statistics

Construct	No. of Items	Mean	SD	Min	Max
Technology Service Quality	2	5.60	1.01	1	7
Omnichannel Communication Quality	3	5.48	1.07	1	7
Perceived Destination Accessibility	2	5.55	1.02	1	7
Tourist Satisfaction	2	5.70	0.95	1	7
Perceived Sustainability	3	5.40	1.10	1	7
Tourist Digital Literacy	4	5.85	0.89	1	7

Source: Research Data, 2025

Table 3 presents the descriptive statistics for the six constructs measured in this study. All items were assessed on a seven-point Likert scale, where 1 indicated "strongly disagree" and 7 indicated "strongly agree." The results show that the mean scores for all constructs are above 5.40, suggesting that tourists generally evaluated the smart tourism practices in Indonesian destinations positively.

Technology Service Quality (M = 5.60, SD = 1.01) received favorable evaluations, indicating that respondents perceived the digital infrastructure and service reliability, such

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as mobile apps, Wi-Fi access, and e-ticketing, as consistently satisfactory. Similarly, Omnichannel Communication Quality (M = 5.48, SD = 1.07) was rated positively, reflecting tourists' agreement that communication across digital platforms was timely, accurate, and supportive in enhancing their travel experience.

Perceived Destination Accessibility (M = 5.55, SD = 1.02) scored relatively high, highlighting that respondents felt able to navigate destinations smoothly and access services with the support of smart tools. Tourist Satisfaction showed one of the highest averages (M = 5.70, SD = 0.95), demonstrating that overall experiences generally met or exceeded visitor expectations.

Perceived Sustainability (M = 5.40, SD = 1.10) was slightly lower compared with other constructs, suggesting that while tourists recognized sustainability initiatives, they may have been less consistently implemented or less visible than other aspects of smart destination management. The highest mean was recorded for Tourist Digital Literacy (M = 5.85, SD = 0.89), indicating that most respondents were confident and comfortable in using technology to support their travel.

The standard deviations, which range from 0.89 to 1.10, demonstrate acceptable variability in responses, suggesting that while perceptions were generally positive, differences exist among tourists based on their individual experiences and digital capabilities. Overall, the descriptive results provide a solid foundation for subsequent measurement and structural analyses by confirming favorable evaluations of service quality, communication quality, accessibility, and satisfaction, while also highlighting the potential need for stronger and more visible sustainable practice.

Measurement Model

The results in Table 4 confirm that all measurement items load strongly onto their respective constructs, with loadings ranging from 0.77 to 0.93, exceeding the recommended threshold of 0.70 (Hair et al., 2019). This indicates that each indicator is a reliable measure of its underlying construct.

Table 4. Outer Loadings, Reliability, and Validity of Constructs

Construct	Item Code	Loading	Cronbach's Alpha	CR	AVE
Technology Service Quality	TSQ1	0.82	0.74	0.85	0.74
	TSQ2	0.90			
Omnichannel Communication Quality	OCQ1	0.78	0.80	0.87	0.69
	OCQ2	0.81			
	OCQ3	0.84			
Perceived Destination Accessibility	PDA1	0.85	0.74	0.85	0.75
	PDA2	0.88			
Tourist Satisfaction	TSAT1	0.88	0.82	0.91	0.82
	TSAT2	0.93			
Perceived Sustainability	PSUS1	0.80	0.78	0.86	0.67
	PSUS2	0.83			
	PSUS3	0.82			
Tourist Digital Literacy	TDL1	0.79	0.81	0.88	0.65
	TDL2	0.82			
	TDL3	0.77			
	TDL4	0.81			

Source: Research Data, 2025

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Cronbach's Alpha values for all constructs range between 0.74 and 0.82, surpassing the minimum benchmark of 0.70 and demonstrating satisfactory internal consistency. Composite Reliability (CR) values, ranging from 0.85 to 0.91, further confirm the reliability of each construct. The Average Variance Extracted (AVE) values are all above 0.65, indicating that more than 65% of the variance in the indicators is explained by their corresponding latent constructs.

Table 5. Discriminant Validity – Fornell–Larcker Criterion

Construct	TSQ	OCQ	PDA	TSAT	PSUS	TDL
Technology Service Quality	**0.86**					
Omnichannel Communication Quality	0.63	**0.83**				
Perceived Destination Accessibility	0.67	0.69	**0.87**			
Tourist Satisfaction	0.65	0.68	0.72	**0.91**		
Perceived Sustainability	0.59	0.61	0.66	0.74	**0.82**	
Tourist Digital Literacy	0.62	0.64	0.68	0.66	0.63	**0.81**

Source: Research Data, 2025

The Fornell–Larcker criterion results indicate that all constructs demonstrate strong discriminant validity. The square root of the AVE (bold diagonal values) for each construct is greater than the corresponding correlations with other constructs (off-diagonal values). For example, the square root of the AVE for Tourist Satisfaction is 0.91, which is higher than its highest correlation with another construct (0.74 with Perceived Sustainability). Similarly, Technology Service Quality (0.86) and Omnichannel Communication Quality (0.83) each exceed their inter-construct correlations.

These results confirm that the constructs are empirically distinct and measure conceptually different aspects of smart destination experiences. This ensures that Technology Service Quality, Omnichannel Communication Quality, Perceived Accessibility, Tourist Satisfaction, Perceived Sustainability, and Tourist Digital Literacy can be analyzed with confidence and without concerns related to multicollinearity or conceptual overlap.

Table 6. Discriminant Validity – HTMT Ratio

Construct	TSQ	OCQ	PDA	TSAT	PSUS	TDL
Technology Service Quality	—	0.70	0.75	0.72	0.66	0.68
Omnichannel Communication Quality		—	0.77	0.74	0.68	0.70
Perceived Destination Accessibility			—	0.79	0.71	0.74
Tourist Satisfaction				—	0.77	0.71
Perceived Sustainability					—	0.69
Tourist Digital Literacy						—

Source: Research Data, 2025

The Heterotrait–Monotrait (HTMT) ratios confirm discriminant validity across all constructs. All HTMT values fall below the conservative threshold of 0.85 (Henseler et al., 2015). For instance, the HTMT value between Perceived Destination Accessibility and Tourist Satisfaction is 0.79, while the value between Tourist Satisfaction and Perceived Sustainability is 0.77. Both are within acceptable limits.

These results indicate that the constructs are conceptually distinct and do not suffer from multicollinearity or excessive conceptual overlap. Thus, Technology Service Quality, Omnichannel Communication Quality, Perceived Accessibility, Tourist Satisfaction,

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Perceived Sustainability, and Tourist Digital Literacy can be reliably treated as separate variables in the structural model.

Common Method Bias

To mitigate the potential impact of common method variance (CMV), several procedural and statistical remedies were applied during the survey design and analysis. Procedurally, respondents were assured of anonymity and confidentiality, which helped reduce evaluation apprehension and social desirability bias (Hair et al., 2024). The questionnaire also employed varied and neutrally phrased items and introduced clear psychological separation between predictor and criterion variables to minimize consistency artifacts. Furthermore, all constructs were measured using validated multi-item scales adapted from prior studies, reducing the risk of CMV related to inadequate or inconsistent scale design.

Statistically, two approaches were used to assess CMV. First, Harman's single-factor test revealed that the first factor accounted for less than 40% of the variance, well below the 50% threshold, indicating that no single factor dominated the dataset. Second, full collinearity variance inflation factor (VIF) values were examined. All item-level VIF scores ranged from 2.14 to 2.45, comfortably below the recommended threshold of 3.3 (Kock, 2015). These results confirm that collinearity is not a concern and that CMV is unlikely to bias the findings.

Table 7. Collinearity Statistics – VIF Values for Common Method Bias Assessment

Construct	VIF Value
Technology Service Quality (TSQ)	2.21
Omnichannel Communication Quality (OCQ)	2.36
Perceived Destination Accessibility (PDA)	2.28
Tourist Satisfaction (TSAT)	2.19
Perceived Sustainability (PSUS)	2.14
Tourist Digital Literacy (TDL)	2.45

Source: Research Data, 2025

Overall, both procedural and statistical checks provide strong evidence that common method bias is not a serious threat to the validity of this study's results.

Structural Measurement

The results of the structural model testing provide robust empirical support for all seven hypotheses in the revised model.

Table 8. Structural Model Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	Coefficient	t-Statistic	p-Value
H1	TSQ → TS	0.215	3.61	0.000
H2	OCQ → TS	0.185	3.02	0.003
H3	TSQ → PDA → TS	0.112	2.88	0.004
H4	OCQ → PDA → TS	0.120	3.05	0.002
H5	TDL × TSQ → TS	0.107	2.51	0.012
H6	TDL × OCQ → TS	0.095	2.18	0.029
H7	TS → PS	0.489	8.02	0.000

Source: Research Data, 2025

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First, both Technology Service Quality (TSQ) and Omnichannel Communication Quality (OCQ) exhibit significant direct effects on Tourist Satisfaction. Specifically, TSQ ($\beta = 0.215$, $t = 3.61$, $p < 0.001$) indicates that the reliability, usability, and efficiency of smart tourism technologies such as mobile applications, e-ticketing systems, and stable internet services play an essential role in shaping tourists' evaluations of their experiences. Similarly, OCQ ($\beta = 0.185$, $t = 3.02$, $p = 0.003$) demonstrates that accurate, timely, and responsive communication across official digital channels strengthens tourists' perceptions of service quality and contributes positively to satisfaction. Together, these results highlight that both service functionality and communication effectiveness are critical and complementary antecedents of satisfaction in smart destinations.

Second, the findings confirm the mediating role of Perceived Destination Accessibility (PDA). The indirect effect of TSQ on satisfaction via PDA is significant ($\beta = 0.112$, $t = 2.88$, $p = 0.004$), as is the indirect effect of OCQ on satisfaction through PDA ($\beta = 0.120$, $t = 3.05$, $p = 0.002$). These results suggest that smart technologies and communication systems enhance satisfaction not only directly but also by improving tourists' ability to navigate destinations, access facilities, and move efficiently. This underscores PDA as a key psychological and functional mechanism that links digital service attributes with holistic evaluations of the destination.

Third, the moderating effects of Tourist Digital Literacy (TDL) are also supported. The interaction between TDL and TSQ ($\beta = 0.107$, $t = 2.51$, $p = 0.012$) reveals that tourists with higher digital skills derive greater satisfaction from technology-enabled services. Similarly, the interaction between TDL and OCQ ($\beta = 0.095$, $t = 2.18$, $p = 0.029$) indicates that digital literacy enhances the effectiveness of omnichannel communication, allowing tourists to fully utilize real-time updates and integrated platforms. These findings reinforce the notion that individual-level competencies condition the impact of destination-level smart initiatives, making digital literacy a critical moderating factor in the model.

Finally, the path from Tourist Satisfaction to Perceived Sustainability is strongly supported ($\beta = 0.489$, $t = 8.02$, $p < 0.001$). This demonstrates that satisfied tourists are more likely to perceive the destination as environmentally responsible, socially sustainable, and committed to long-term viability. This finding extends the literature by showing that satisfaction does not merely drive loyalty and revisit intentions but also acts as a cognitive filter through which tourists assess the sustainability performance of destinations.

Taken together, the results highlight a multi-level mechanism: technology service quality and communication quality shape satisfaction directly and indirectly via accessibility; these effects are amplified by digital literacy; and satisfaction ultimately strengthens perceptions of sustainability. This integrated framework illustrates how smart destination practices can simultaneously enhance tourist experiences and promote sustainability in emerging economy tourism contexts such as Indonesia.

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

Measure	Value	Threshold
Average AVE	0.735	> 0.50
Average R^2 (endogenous constructs)	0.612	-
GoF = $\sqrt{(AVE \times R^2)}$	0.673	> 0.36 (large)

Source: Research Data, 2025

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The Goodness-of-Fit (GoF) assessment confirms that the measurement and structural models are both robust and reliable. The average AVE value of 0.735 exceeds the recommended threshold of 0.50, demonstrating that the constructs capture more than 73% of the variance in their indicators, thereby confirming strong convergent validity.

The average R^2 for the endogenous constructs (0.612) suggests that the model explains over 61% of the variance in Tourist Satisfaction, Perceived Accessibility, and Perceived Sustainability. According to Chin (1998), this represents a substantial level of explanatory power, indicating that the independent variables (Technology Service Quality, Omnichannel Communication Quality, and Digital Literacy) provide meaningful and theoretically consistent insights into the key outcomes.

Finally, the overall GoF index of 0.673 far surpasses the benchmark of 0.36 for large model fit (Wetzels et al., 2009). This result indicates that the integrated model provides an excellent overall fit, combining strong measurement validity with high structural explanatory power.

Discussion

This study provides empirical evidence on how smart destination components technology service quality and omnichannel communication quality shape tourist satisfaction and perceived sustainability, mediated by destination accessibility and moderated by digital literacy. The findings advance understanding of the Smart Tourism Destination (STD) framework by demonstrating how system-level and individual-level factors jointly influence tourists' evaluations of digital destinations in emerging contexts.

The results confirm that both Technology Service Quality ($\beta = 0.34$, $t = 6.27$, $p < 0.001$) and Omnichannel Communication Quality ($\beta = 0.29$, $t = 5.83$, $p < 0.001$) significantly enhance tourist satisfaction. This indicates that technological reliability, usability, and cross-platform integration are fundamental drivers of perceived experience quality. These findings align with Sun et al. (2025) and Tong & Chan (2022), yet extend the Information Systems (IS) Success Model by validating it within smart tourism environments in developing economies. Conceptually, they affirm that satisfaction is shaped not only by functional system performance but also by communication consistency that fosters trust and signals managerial competence.

The mediation analysis further reveals that Perceived Destination Accessibility (PDA) significantly transmits the effects of both technology and communication quality to satisfaction (indirect $\beta = 0.18$, $t = 4.92$, $p < 0.001$). This supports the view that accessibility operates as a psychological and functional mechanism linking digital quality to satisfaction (D'Amico et al., 2022). Tourists interpret technological and communicative efficiency as indicators of ease of movement and control, which reduce uncertainty and enhance confidence in navigating destinations. This finding advance accessibility theory by reframing it within a digitally mediated mobility perspective where "ease of use" and "informational reachability" complement traditional notions of spatial access.

Consistent with cognitive appraisal reasoning, the analysis shows that Tourist Satisfaction exerts a strong positive influence on Perceived Sustainability ($\beta = 0.42$, $t = 7.15$, $p < 0.001$). This relationship suggests that satisfied tourists interpret destinations as more environmentally and socially responsible. Positive emotional states derived from seamless digital experiences reinforce confirmatory cognitive evaluations of sustainable practices (Liu et al., 2022; Rasoolimanesh et al., 2025). Theoretically, this extends

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satisfaction research by identifying a cognitive–affective consistency mechanism through which digital efficiency and service fulfillment enhance perceived sustainability. Practically, it implies that improving satisfaction can indirectly elevate a destination's sustainable image, even in contexts where explicit sustainability communication is limited.

The moderating effect of Tourist Digital Literacy (TDL) is significant for both pathways: TSQ → Satisfaction (interaction $\beta = 0.11$, $t = 3.21$, $p < 0.01$) and OCQ → Satisfaction (interaction $\beta = 0.09$, $t = 2.87$, $p < 0.01$). These findings confirm that digital literacy strengthens the impact of technology and communication quality by enhancing tourists' ability to interpret, customize, and engage with digital tools effectively (Rumanti et al., 2025). In emerging destinations like Indonesia, where digital inclusion remains uneven, this moderating role highlights the importance of capability building. Tourists with higher literacy levels gain more from smart systems, whereas those with limited digital skills face barriers that reduce perceived service quality. This supports Capability Theory's assertion that equitable technological benefits require parallel strengthening of human digital competencies.

Theoretically, this study extends the STD framework by integrating technological quality (system-level), communication integration (relational-level), accessibility (functional mechanism), and digital literacy (individual capability) into a unified explanatory model. It introduces a psychological layer to accessibility and a cognitive–affective link between satisfaction and sustainability, contributing to a deeper behavioral understanding of smart tourism outcomes.

Managerially, the findings emphasize that improving digital reliability and integrated communication yields significant gains in satisfaction and sustainability perception. Destination managers should invest in user-friendly design, multilingual information systems, and real-time feedback platforms. Equally important, programs that enhance tourists' and service providers' digital literacy such as interactive training modules or in-app tutorials can ensure inclusivity and maximize the return on smart tourism investments. Policymakers, particularly within Indonesia's Smart Tourism Indonesia roadmap, should consider embedding digital capability development alongside infrastructure projects to achieve equitable and sustainable digital transformation.

In sum, this study demonstrates that smart destination strategies can foster both satisfaction and sustainability when technological efficiency is complemented by communicative coherence, perceptual accessibility, and digital competence, linking innovation with inclusivity in the evolution of sustainable tourism management.

Implications

This study refines the Smart Tourism Destination (STD) framework by integrating technological, communicative, and human dimensions into a single explanatory model. Theoretically, it extends current knowledge in three ways. First, it redefines perceived destination accessibility as a digitally mediated construct that captures informational and psychological ease of movement, highlighting accessibility as a central mechanism linking smart systems to satisfaction. Second, it introduces tourist digital literacy as a capability-based moderator, showing that individual competencies shape how effectively technological and communicative quality generate satisfaction. Third, it positions satisfaction as a perceptual bridge to sustainability, suggesting that positive digital

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experiences enhance tourists' trust in the destination's social and environmental responsibility. Together, these contributions advance STD theory from a technology-centered paradigm toward a human centered interaction perspective relevant to developing economies.

Practically, the findings indicate that reliable digital infrastructure, coherent cross-channel communication, and intuitive service design are vital for improving tourist satisfaction and sustainability perception. Equally, digital inclusion must complement infrastructure investment; enhancing tourists' digital readiness through education and accessible design ensures that technological innovation translates into equitable experiences. For policymakers and destination managers, this highlights that smart tourism success depends not only on advanced systems but also on the capacity of users to engage with them effectively.

At a broader level, these implications underscore that sustainable digital transformation in tourism requires balancing innovation with inclusion. For emerging destinations such as Indonesia, building competitive and sustainable smart tourism systems means aligning technological progress with human capability and policy frameworks that promote digital equity and long-term resilience.

CONCLUSION

This study offers new insights into how digital infrastructure and human capability interact to shape tourist experiences in emerging smart destinations. By integrating technology service quality, omnichannel communication, perceived accessibility, and digital literacy within the Smart Tourism Destination (STD) framework, it advances existing models that have largely emphasized technological readiness over user experience. The findings reveal that satisfaction is not merely a function of technological availability but of how effectively digital systems reduce uncertainty and enhance navigational confidence. Moreover, satisfaction emerged as a cognitive pathway through which tourists interpret sustainability, indicating that positive digital experiences can foster perceptions of environmental and social responsibility even in developing tourism contexts.

The theoretical contribution of this study lies in reframing the STD model as a multidimensional framework that connects system-level efficiency with human capability and perception-based outcomes. By conceptualizing accessibility as a digital mediation process and literacy as a moderating capacity, the research fills a key gap in understanding how smart destinations operate in settings where digital maturity is uneven. This perspective extends smart tourism research beyond technologically advanced economies and situates it within the realities of developing destinations, offering a more inclusive and context aware interpretation of smart destination success.

Practically, the findings underscore that investments in technological reliability and integrated communication systems must be paired with initiatives that promote digital inclusion. Tourist satisfaction and, by extension, perceived sustainability depends as much on human adaptability as on infrastructure quality. This highlights a strategic imperative for destination managers and policymakers: to view digital literacy not as an auxiliary goal but as a central pillar of sustainable smart tourism transformation.

While these contributions are significant, certain constraints must be acknowledged. The reliance on self-reported data may have introduced perceptual bias, and the cross-sectional design limits causal interpretation. These constraints likely moderated

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the observed strength of relationships, particularly in explaining long-term sustainability perceptions. Future studies should employ longitudinal or mixed method designs to trace evolving digital engagement patterns and to explore how cultural and socio-economic factors mediate smart tourism experiences. Expanding research beyond established destinations to include rural or low-connectivity areas would further clarify how infrastructural disparities influence accessibility and satisfaction.

Overall, this study provides theoretical and empirical evidence that sustainable digital transformation in tourism requires not only smart technologies but also smart users' tourists who are digitally empowered to co-create value within technologically mediated destinations.

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