

Integrating Culture and Technology in Smart Tourism: A Case Study of Solo

***Pratita Rara Raina**

Institut Seni Indonesia Surakarta,
Indonesia

Roudlotul Jannati Rochnadia

Noorva Yudhitya
Institut Seni Indonesia Surakarta,
Indonesia

Priaji Iman Prakoso

Institut Seni Indonesia Surakarta,
Indonesia

***Corresponding author:**

Pratita Rara Raina, Institut Seni Surakarta,
Indonesia

✉ pratita.rara@isi-ska.ac.id

Article Info :

Article history:

Received: December 07, 2025

Revised: January 11, 2026

Accepted: February 18, 2026

Keywords:

business innovation; cultural
tourism; smart destination; smart
tourism ecosystem; Solo city

Abstract

Background: The development of smart tourism requires an integrated ecosystem framework that connects technology, governance, business, and visitor experience.

Objective: This study aims to develop a comprehensive Smart Tourism Ecosystem (STE) framework and examine its relevance to Solo City, Indonesia.

Methods: This study employed a qualitative, literature-based research design that combining a Systematic Literature Review (SLR) and a narrative review to established a comprehensive theoretical foundation while gaining deep contextual insight.

Results: The study identifies five key dimensions of the STE: Smart Technology, Smart Business Ecosystem, Smart Governance, Tourist Experience, and Smart Destination. The findings indicate that Solo has strong potential to develop as a culturally driven smart destination, supported by its creative economy, digital initiatives, and collaborative stakeholders.

Conclusion: While the proposed framework offers strategic insights, further empirical research is needed to assess local readiness and support sustainable smart tourism implementation in Indonesia.

To cite this article: Pratita R. R., Jannati R. R., Noorva Y., & Prakoso, P. I. (2026). Integrating culture and technology in smart tourism: A case study of Solo. *Journal of Business, Social and Technology*, 7(1), 1-17.

<https://doi.org/10.59261/jbt.v7i1.578>

INTRODUCTION

Over the past decade, digital transformation and connectivity have redefined how tourism systems evolve. The notion of being “smart” has emerged as a defining paradigm in this transition, referring not to a single technology but to an interconnected system of digital infrastructures—such as big data, IoT, sensor networks, and AI-driven analytics—that enable destinations to make data-informed and adaptive decisions (Gretzel et al., 2015; Höjer & Wangel, 2014). Within this context, smart tourism represents the application of these principles to the tourism domain, where real-time data, technological integration, and cross-sector collaboration come together to enhance efficiency, personalization, and sustainability.

In Indonesia, the relevance smart tourism has become increasingly evident as cities seek to balance rapid digitalization with cultural preservation. For example, initiatives in Jakarta and Bandung have integrated smart city platforms with tourism services, including digital information systems, e-ticketing, and data-driven urban management. Similarly, Yogyakarta has advanced smart tourism through digital promotion of cultural heritage and the integration of local creative industries into online marketplaces. These examples illustrate how developing-country destinations leverage technology to enhance visitor experiences while addressing infrastructural

limitations and governance challenges.

Within this national landscape, Surakarta (Solo) presents a distinctive case. Known for its strong Javanese cultural heritage, traditional arts, and creative economy, Solo faces the dual challenge of preserving intangible cultural assets while adapting to digital transformation. Limited technological infrastructure integration, varying levels of stakeholder digital readiness, and the need for coordinated governance mechanisms highlight the importance of a contextualized Smart Tourism Ecosystem framework. Therefore, examining smart tourism development in Solo is not only timely but also essential for understanding how mid-sized cultural cities in developing countries can implement smart principles in a sustainable and locally grounded manner.

However, as research on smart tourism continues to expand, many studies remain predominantly focused on technological adoption and infrastructure readiness, often overlooking the human, cultural, and business dimensions that ultimately define the quality and sustainability of smart destinations. Gretzel (2015) emphasizes that smart tourism should be understood not merely as a technological achievement but as a mindset—an approach to destination development that integrates data-driven innovation with cultural meaning and social participation.

Building on this perspective, the present study moves beyond technology-centric models that primarily assess digital infrastructure, platform efficiency, or data capability. It also extends prior business-oriented frameworks that focus mainly on value co-creation and competitiveness without sufficiently embedding governance structures and cultural context. Instead, this research proposes an integrative Smart Tourism Ecosystem framework that systematically connects five interdependent dimensions: technology, business ecosystem, governance, tourist experience, and destination identity.

The novelty of this study lies in positioning culture and stakeholder collaboration not as complementary elements, but as core components that shape how technology is designed, implemented, and sustained. By applying this integrative framework to Solo, the research demonstrates how a mid-sized cultural city in a developing country context can align digital transformation with heritage preservation, creative economy development, and participatory governance. In doing so, it contributes a more holistic and context-sensitive model of smart tourism that addresses gaps in prior studies focused narrowly on technological or economic performance indicators.

The business aspect of smart tourism is equally critical. The rise of digital platforms and AI-driven personalization has disrupted traditional tourism business models, shifting the focus toward co-creation, agility, and network-based innovation (Andrianto et al., 2022). Business Model Innovation enables tourism actors—ranging from small creative enterprises to destination management organizations—to leverage digital tools and collaborative networks to deliver more adaptive and meaningful experiences. This transition underscores the need for an ecosystem perspective that integrates technological efficiency with entrepreneurial creativity and local distinctiveness.

For cities such as Surakarta (Solo), this transformation is not merely strategic but urgent. The post-pandemic tourism landscape has become increasingly competitive, with destinations accelerating digital adoption to rebuild visitor confidence, improve service efficiency, and enhance personalized experiences. Without a structured smart tourism framework, Solo risks lagging behind other Indonesian destinations that are actively integrating digital systems into marketing, visitor management, and stakeholder coordination. Such delays could weaken its competitive position, reduce its visibility in digital tourism markets, and limit opportunities for local creative industries to scale through technology-enabled platforms.

Moreover, the absence of an integrated ecosystem approach may result in fragmented initiatives—where technology is adopted in isolation, businesses operate without coordinated data sharing, and cultural assets are promoted without strategic digital alignment. This fragmentation could undermine both economic resilience and cultural sustainability.

By proposing a Smart Tourism Ecosystem (STE) framework that aligns technological innovation with governance, business collaboration, and cultural identity, this research responds to the pressing need for resilient and adaptive tourism models. Beyond Solo, the framework offers

a scalable reference for other mid-sized cities in developing countries facing similar challenges: balancing modernization with heritage preservation while competing in an increasingly digital global tourism economy.

At the same time, culture remains a core driver of value within smart tourism ecosystems. In culturally rich destinations such as Solo, Central Java, heritage and creative industries play a central role in shaping identity and visitor engagement. The city's cultural tourism landscape—replete with Hadiningrat, Pura Mangkunegaran, Radya Pustaka Museum, Museum Batik Danar Hadi, and Kampung Wisata Baluwarti—demonstrates how heritage, craftsmanship, and digital storytelling can interact to strengthen destination authenticity and competitiveness. Yet despite these advancements, few studies have systematically linked cultural capital, governance structures, and technological innovation into an integrated Smart Tourism framework suitable for emerging creative cities like Solo.

The Smart Tourism Ecosystem (STE) framework proposed in this study provides not only a conceptual model but also a practical roadmap for implementation. For local governments, the framework highlights the need to develop integrated digital governance systems—such as centralized tourism data platforms, interoperable ticketing systems, and real-time visitor analytics—to improve coordination across agencies and cultural institutions. In the short term, policymakers can initiate cross-sector task forces that connect tourism offices, cultural heritage managers, ICT departments, and creative economy agencies to align digital initiatives with heritage preservation goals.

For businesses and creative entrepreneurs, the framework encourages collaborative digital platforms that enable co-promotion, shared data insights, and bundled cultural experiences. Small and medium-sized enterprises (SMEs), particularly in batik, performing arts, and culinary sectors, can leverage digital marketplaces and AI-driven marketing tools to expand reach while maintaining local distinctiveness.

For communities, especially those managing cultural villages and heritage neighborhoods, the STE framework promotes participatory governance and digital capacity building. Short-term actions may include digital literacy training, community-based content creation, and the use of storytelling platforms to amplify local narratives in global tourism networks.

By translating ecosystem principles into coordinated governance mechanisms, collaborative business models, and community empowerment strategies, the STE framework offers actionable guidance for transforming Solo into a smart, culturally grounded destination. At the same time, it provides a replicable model for other emerging creative cities in developing countries seeking to align technological innovation with cultural sustainability.

To address this gap, this study reframes smart tourism as an integrated ecosystem that unites five key dimensions which are Smart Technology, Smart Governance, Smart Experience, Smart Business Ecosystem, and Smart Destination into a coherent analytical model. The research employs a dual-method approach that combines a Systematic Literature Review (SLR) of 16 international articles to identify global theoretical foundations, and a Narrative Review of 42 additional studies to enrich and contextualize the framework. Through this synthesis, the study aims to construct a more comprehensive, culturally adaptive model of Smart Tourism Ecosystem (STE) that aligns digital innovation with governance, experience design, business transformation, and cultural identity.

This study extends the theoretical framework of smart tourism by emphasizing that digitalization alone cannot ensure sustainable destination development, as also noted by (Harrison et al., 2010). The ecosystem must involve collaborative governance and shared responsibility among stakeholders (Ansell & Gash, 2008). Practically, this perspective becomes relevant in the context of Solo City, where the number of domestic and international tourists continues to increase each year. The findings of this research can therefore help policymakers, tourism entrepreneurs, and local communities in Solo to design strategies that are digitally adaptive yet culturally grounded.

METHOD

This study employed a qualitative, literature-based research design that combining a Systematic Literature Review (SLR) and a narrative review to established a comprehensive theoretical foundation while gaining deep contextual insight. These complementary methods were selected to ensure both conceptual rigor and contextual sensitivity. To enhance robustness, the study applied thematic triangulation, systematically comparing and integrating findings from both review streams to strengthen analytical consistency and interpretive depth.

First, the Systematic Literature Review was conducted to identify global frameworks and key components of smart tourism development. Two academic databases—Scopus and ScienceDirect—were used, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol, as shown in Figure.1. The search keywords included: ("smart tourism") AND ("creative business" OR "cultural tourism"). Inclusion criteria were: (1) peer-reviewed journal articles, (2) published between 2015–2025, and (3) explicitly discussing smart tourism, creative business, and cultural tourism. Articles not meeting these criteria or lacking full-text access were excluded. After title, abstract, full text screening, the selected articles were coded and organized into a thematic matrix identifying recurring dimensions, conceptual frameworks, and implementation patterns.

Second, a narrative literature review was undertaken to enrich the discussion with broader theoretical and contextual perspectives not fully captured in the SLR. This stage included conceptual papers, scholarly books, and policy-related studies addressing cultural governance, innovation systems, and tourism development, particularly in Indonesia and comparable developing contexts. Unlike the SLR, this review was more flexible, enabling exploration of emerging concepts and locally grounded insights relevant to smart tourism ecosystems.

Data triangulation was conducted in three stages. First, initial themes derived from the SLR (e.g., technology infrastructure, governance mechanisms, business ecosystems, user experience, and destination competitiveness) were identified through open coding. Second, findings from the narrative review were mapped onto these preliminary themes to confirm, refine, or expand them. Where new dimensions emerged—such as cultural capital integration or participatory governance—these were critically compared with the SLR results to assess conceptual alignment. Third, axial coding was applied to examine relationships among themes, leading to the consolidation of core dimensions into an integrated ecosystem model.

All data were analyzed using thematic analysis involving coding, categorization, theme refinement, and cross-source comparison. This structured synthesis ensured transparency in how concepts were derived and integrated. The final outcome is a conceptual Smart Tourism Ecosystem model illustrating the dynamic interaction between technology, governance, culture, business innovation, and tourist experience, grounded in both global scholarship and contextual relevance.

RESULTS AND DISCUSSION

Result

Data Description or Result

A Systematic Literature Review (SLR) was employed to ensure that the understanding of Smart Tourism Ecosystems (STE) is grounded in evidence-based findings. Relevant studies were identified through searches across reputable academic databases and subsequently filtered using predefined inclusion and exclusion criteria. The final selection represents only the literature that demonstrates strong relevance to the research focus and contributes meaningful insights to the discourse on smart tourism. The following table presents a summary of these articles, outlining their key themes and main findings, as shown in Table: 1.

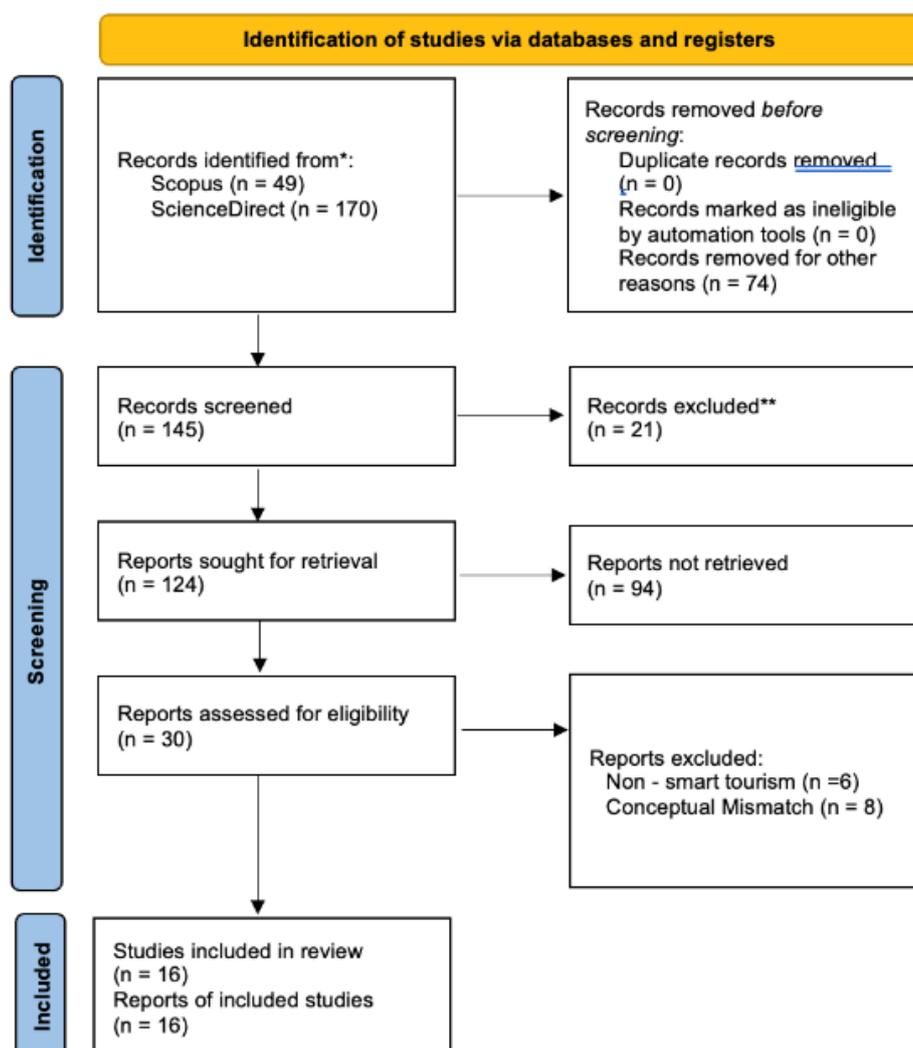


Figure 1. PRISMA flowchart
 [Data processed by the author (2025)]

Table 1. SLR Article Relevancies

Title	Author	Year	Journal	Database	Relevance
Using innovation and entrepreneurship for creating edge in service firms: A review of tourism and hospitality industry	Gagan Deep Sharma, Babak Taherid , Dariusz Cichone , Jaya Singh Pariharf , Aeshna Kharbana	(2024)	Journal of Innovation & Knowledge	Science Direct	This article identifies five key dimensions: Green Infrastructure for T&H, Sustainable Tourism Destination Development Management, and Digital Tourism Development. It validates that Digital Tourism Development is essential for recovery and growth. Furthermore, it links the need for Sustainable Entrepreneurship and Green Infrastructure to destination development, reinforcing the goal of sustainability within the STE.

Title	Author	Year	Journal	Dat aba se	Relevance
Analyzing the impact of digital technology on consumers' travel intentions	Yanan Tan, Guolian Jiang, Shaheem Sayed Merajuddin, Fang Zhao	(2025)	Journal of Innovation & Knowledge	Science Direct	It confirms that digital technology utilization, smartphone usage, significantly increases consumers' willingness to travel. Tourism marketing should optimize digital infrastructure and extend promotion beyond traditional platforms to social media (e.g., TikTok, Instagram).
Digital Strategies to a Local Cultural Tourism Development: Project e-Carnide	Maria Isabel Roque and Maria João Forte	(2017)	Tourism, Culture and Heritage in a Smart Economy	Scopus	This project seeks to enable the residents of Carnide, who possess a strong cultural heritage, to act as cultural mediators for visitors by conveying their memories and life narratives, enriched through digital documentation. The use of smart technology, mobile apps, in heritage data dissemination offers advantages such as accessibility and innovation.

[Data processed by the Author]

The analysis of sixteen articles obtained through the Systematic Literature Review indicates that the development of a Smart Tourism Ecosystem (STE) is shaped by an interplay of technological readiness, governance capacity, tourist experience design, cultural integration, and stakeholder participation—extending beyond a purely technological focus. Although each study approaches smart tourism from different methodological perspectives, their insights converge into five thematic pillars that explain how smart tourism ecosystem function. To enhance contextual relevance, each pillar is interpreted in relation to the development potential of Solo.

Pillar 1: Smart Technology

Technology functions as the backbone of smart tourism by enabling personalization, efficiency, and real-time responsiveness. The reviewed studies highlight AI-driven personalization immersive AR/VR cultural experiences, mobile platforms influencing travel decisions and sensor-based systems for visitor management (Kim et al., 2017; Portugal et al., 2025; Roque & Forte, 2017; Sharma et al., 2024; Verma et al., 2022).

In Solo's context, Smart Technology can be strategically integrated into the existing tourism infrastructure through the implementation of an integrated digital ticketing system that connects major cultural attractions such as Keraton Surakarta Hadiningrat and Pura Mangkunegaran, enabling seamless visitor access and improved data collection; the adoption of QR-based digital storytelling in museums and heritage areas like Radya Pustaka Museum to enrich interpretive experiences without compromising physical authenticity; the deployment of visitor flow monitoring systems in cultural villages such as Kampung Wisata Baluwarti to manage crowd density and prevent overcrowding during peak events; as well as the development of centralized data dashboards managed by the local tourism office to track tourist trends, preferences, and seasonal demand patterns for more responsive and evidence-based tourism management. These steps would allow Solo to move from isolated digital initiatives toward an integrated smart infrastructure.

Pillar 2: Smart Governance

While technology provides tools, governance provides direction. The literature emphasizes that successful smart tourism depends on institutional coordination, performance monitoring, and stakeholder alignment, integrates indicators and performance monitoring systems, and supports sustainability efforts through transparent communication (Mandić & Kennell, 2021; Marchi et al., 2023; Pasandideh et al., 2024). The integration of local government, tourism businesses, and communities into a symbiotic system demonstrates that successful digital transformation requires institutional capacity, not just technology (Yang & Ning, 2025). Monitoring systems using real-time sensor data show that governance decisions can now be data-driven instead of intuition-based (Zubiaga et al., 2019). These findings highlight that effective governance mechanisms are essential for sustaining technological innovation and ensuring accountability in tourism development.

For Solo, Smart Governance can be operationalized by establishing a cross-sector smart tourism task force that brings together the tourism office, ICT department, cultural heritage authorities, universities, and business associations to foster coordinated policy implementation; developing a shared tourism data platform in which hotels, event organizers, transport providers, and cultural institutions contribute anonymized visitor data to support evidence-based decision-making; and introducing integrated performance indicators that combine digital readiness, sustainability metrics, and cultural preservation benchmarks to ensure balanced development. In this framework, local businesses play a crucial role not only as service providers but also as active data contributors and innovation partners, ensuring that governance decisions are grounded in real market dynamics and community needs rather than relying solely on top-down assumptions.

Pillar 3: Tourist Behavior

Smart tourism ultimately centers on visitor experience. The literature shows that digital tools influence emotional engagement, expectations, and revisit intention.

Emotional states such as joy, attachment, and satisfaction, particularly in heritage tourism could predict revisit intention and destination loyalty. AI-based smart services improve perceived convenience and experience outcomes, whereas digital platforms influence travel decisions and purchase intentions, especially among senior users (Kim et al., 2017; Sorcaru et al., 2025). Data mining studies show that digital information affects expectations more strongly than the on-site experience itself (Pai et al., 2022).

In Solo, enhancing the Tourist Experience can be achieved through the development of personalized itinerary recommendations via city tourism applications, enabling visitors to tailor their journeys according to interests and time availability; the creation of hybrid physical-digital cultural performances that incorporate interactive features to enrich engagement without diminishing authenticity; the provision of multilingual digital guides designed to better serve international cultural tourists; and the design of experience-based packages that integrate batik workshops, palace tours, and culinary heritage trails into cohesive thematic journeys. By strategically aligning technological innovation with Solo's cultural narrative, visitor satisfaction can be significantly enhanced while simultaneously strengthening destination loyalty and repeat visitation.

Pillar 4: Cultural Tourism

Technology alone does not create value; culture gives meaning to technological innovation. Studies demonstrate that digital interpretation enhances authenticity rather than replacing it.

Creative placemaking transforms cultural assets into engaging experiences, while immersive AR/VR enables visitors to learn through interaction rather than passive observation (Portugal et al., 2025; Richards, 2020). Digital storytelling platforms facilitate heritage interpretation and enrich local identity (Roque & Forte, 2017). Cultural ICT platforms introduce co-design and performance monitoring to preserve cultural value (Pasandideh et al., 2024).

Solo's strong cultural assets, such as Museum Batik Danar Hadi and its traditional batik industries, offer significant opportunities for the development of digital archives and virtual

exhibitions featuring rare batik motifs, the creation of community-based storytelling platforms that highlight the narratives and craftsmanship of local artisans, and the implementation of AR-enhanced heritage tours that explain the symbolic meanings behind rituals, architectural elements, and cultural practices. Through this strategic integration of technology and heritage, smart tourism initiatives can strengthen cultural preservation and appreciation, ensuring that innovation reinforces rather than commodifies Solo’s cultural identity.

Pillar 5: Stakeholder Participation

Sustainable smart tourism requires inclusive participation. The literature identifies digital literacy gaps, unequal access, and limited SME readiness as common barriers (Kim et al., 2017). Other studies highlight the role of co-design and SME involvement in improving digital readiness (Pasandideh et al., 2024). Community-led storytelling and participation suggest that resident engagement reinforces authenticity and strengthens destination identity (Roque & Forte, 2017).

In Solo, practical actions may include implementing digital training programs for batik SMEs and cultural entrepreneurs to enhance their technological capabilities, organizing community co-design workshops in the development of tourism applications to ensure user-centered and locally grounded solutions, initiating youth-led digital ambassador programs to actively promote cultural events through social media and digital platforms, and providing incentives for SMEs to adopt e-payment systems and online booking services to improve accessibility and competitiveness. Through these participatory mechanisms, technological transformation can be structured to benefit not only visitors through improved services and experiences but also local communities by strengthening economic resilience, digital inclusion, and cultural sustainability.

Overall, while the five pillars are theoretically derived from global scholarship, their application in Solo demonstrates concrete pathways for implementation. By systematically integrating Smart Technology, Governance, Experience Design, Cultural Capital, and Stakeholder Participation, Solo can transition from fragmented digital initiatives toward a coordinated Smart Tourism Ecosystem—strengthening competitiveness while preserving its cultural authenticity. From the pillars above, the conceptual framework of STE could be drawn as bellow:

Table 2. SLR Article Analysis

STE Pillars	Key Variables
Smart Technology	AI, AR/VR, mobile apps, immersive tech, digital platforms, monitoring sensors
Smart Governance	Smart governance, KPI monitoring, co-design, sustainability reporting, destination management
Tourist Behavior	Emotional engagement, expectation, behavioral intention, satisfaction
Cultural Tourism	Cultural experience, digital storytelling, creative placemaking, heritage interpretation, ICT for cultural tourism
Stakeholder Participation	Community involvement, SME readiness, digital literacy, market segmentation

[Data processed by the Author]

Although the SLR reveals strong theoretical and empirical insights, the 16 articles do not provide a holistic integration model that connects technology, culture, and innovative business. The articles focus on isolated perspectives, some articles emphasize technological readiness, and others examine digital visitor experience, and several explore cultural tourism transformation. Yet none of them present a holistic approach connecting these dimensions into one unified model. This fragmentation indicates that the current global discourse on smart tourism remains conceptually rich but lacks integrative synthesis, especially when contextualized within cultural tourism settings and business integration.

To address this gap and strengthen the conceptual foundation of the research, a narrative literature review was conducted using a broader and more flexible search strategy across databases beyond Scopus and ScienceDirect, including Google Scholar, Taylor & Francis Online, Springer, and Emerald, and Routledge. A total of 42 articles were identified and reviewed based on relevance to the components of Smart Tourism Ecosystem, which includes technology, cultural and creative tourism, and business model innovation. Unlike the SLR, which applies strict inclusion criteria and procedural traceability through PRISMA, the narrative review allows deeper exploration of theoretical discussions and contextual insights that do not always appear in indexed journals but substantially contribute to model development.

Table 3. Narrative Article Relevancies

Title	Author	Year	Journal	Datab ase	Relevance
Does smart tourism technology matter? Lessons from three smart tourism cities in South Korea	Taehyee Um & Namho Chung	(2021)	Asia Pacific Journal of Tourism Research	Routledge	Destination components (6 A's: attractions, accessibility, amenities, available packages, activities, and ancillary services) to combine services and technology at the destination
Redefining the concept of smart tourism in tourism and hospitality	Liu	(2024)	Anatolia: An International Journal of Tourism and Hospitality Research	Routledge	Technology as infrastructure; as a ubiquitous tour information service, then evolved into a technology-involved and tourist-centered tourism experience.
Tourism cloud management system: the impact of smart tourism	Fang Yin, Xiong Yin, Jincheng Zhou, Xinli Zhang, Ruihua Zhang, Ebuka Ibeke	(2022)	Journal of Cloud Computing: Advances, Systems and Applications	Springer	STD is a generic architecture derived from smart city principles, incorporating sustainability and competitiveness as its foundation, and aims to revolutionize tourism management.

[Data processed by the Author]

Based on the narrative review presented above, five key variables consistently emerge across the literature. These variables represent the core elements of the STE and reflect how all variables interact within a tourism environment. To deepen the understanding of their roles and relationships, each of these main variables is further elaborated into more detailed sub-variables. The following section discusses these variables and their derivative components, demonstrating how they collectively shape the structure of the STE.

Table 4. Narrative Article Analysis

Main Variables	Sub - Variables	Context	Articles Resource
Smart Technology	Technical foundation	The existence and quality of the underlying infrastructure that supports ST, including ubiquitous mobile connectedness, sensors, IoT, cloud computing, free Wi-Fi, and NFC.	(Liu et al., 2024); (Türkcan, 2024)
	Smart Tourism Technology (STT)	The use of smart technologies that are accessible to tourists, such as: AI, VR/AR (Virtual/Augmented Reality), Chatbots, Mobile Apps (e.g., e-payment, e-ticketing, navigation, recommender systems), and Smart Traffic/Security Systems.	(Baran & Karaca, 2024; Chuang, 2023; Tavitiyaman et al., 2021; Wang et al., 2022)
	Data Analytics	Capacity to collect, analyse, integrate, and leverage big data (user-generated content, sensor data, real-time data) to support decision-making, demand forecasting, and service personalization.	(Gretzel et al., 2015; Mehraliyev et al., 2020)
	Digital Accessibility	Ease for tourists to obtain, access and use online tourism information.	(Özköse et al., 2023)
Smart Destination Attributes	Smart Attractiveness	The quality of attractions, activities and tourism products is enriched with technology, and includes aspects of cultural heritage and creativity.	(Akbar et al., 2024; Arsita & Ahmadi, 2024; Maharani, 2022; Rahmawati et al., 2023)
	Smart Accessibility	The quality of physical access to the destination (public transportation, parking, infrastructure) is smart and makes it easy for all types of tourists, including people with disabilities.	(Gretzel et al., 2015; Um & Chung, 2021)
	Amenities & Ancillary Services	The quality of accommodation, food (diet), ancillary services, and other facilities are integrated in STE.	(Gretzel et al., 2015; Özköse et al., 2023)
	Digitalization Readiness	The level of city readiness in adopting digital technology comprehensively (besides basic infrastructure), which influences the implementation of STC.	(Baggio et al., 2020; Safika et al., 2025)
	STT Attributes	Tourist perceptions of technology attributes: Informativeness (data quality/credibility), Accessibility (ease of use), Interaction (real-time feedback), and Personalization (customized services).	(Liu et al., 2024)
Smart Experience	User Experience	Technology-mediated, co-created, data-driven, and context-aware experiences enhanced through personalization and real-time monitoring.	(Del Vecchio et al., 2018; Mehraliyev et al., 2020; Özköse et al., 2023; Tavitiyaman et al., 2021)
	Satisfaction	Tourist satisfaction with smart services	(Lee et al., 2018)

Main Variables	Sub - Variables	Context	Articles Resource
		and destination services, which influences overall satisfaction.	
	Behavioural Intentions	Tourists' intention to revisit, recommend the destination (word of mouth), or demonstrate pro-sustainability behaviour.	(Baran & Karaca, 2024)
Smart Business Ecosystem	Value Co-creation	The level of dynamic interconnection between different stakeholder (tourists, residents, suppliers, government, platforms, etc.) to share information, exchange resources, and create shared value.	(Akbar et al., 2024; Gretzel et al., 2015)
	Innovative Business	The ability of tourism businesses to digitize their core processes and adopt flexible and open business models driven by data and intelligent technology.	(Baggio et al., 2020; Del Vecchio et al., 2018; Gretzel et al., 2015)
	Human Capital	Availability of talent and skilled workforce in technology and tourism is required for destination innovation and management.	(Widiyanto & Supriyanto, 2023)
Smart Governance	Smart Governance	The role of the government/DMO as a strategic promoter, top designer, regulator, and leader in formulating policies/regulations and facilitating collaboration.	(Baggio et al., 2020; Mehraliyev et al., 2020; Wang et al., 2022)
	Sustainability	The level of STE's ability to support long-term development, including reducing overtourism, preserving cultural heritage, economic balance, and community/resident empowerment.	(Maharani, 2022; Rodrigues et al., 2023; Susilowati et al., 2025)
	Security & Trust	Regulations and systems that guarantee tourist data security, privacy, and build trust between tourists and systems/stakeholders.	(Ramadhani et al., 2024)

[Data processed by the Author]

The synthesis of findings from both the Systematic Literature Review (SLR) and the Narrative Review establishes a comprehensive framework of the STE that reflects the dynamic interconnection between technology, governance, tourist experience, cultural tourism, business innovation, and stakeholder participation. This framework aims to describe how smart tourism can evolve from fragmented digital initiatives into an integrated, data-driven, and culturally grounded ecosystem.

Discussion

The SLR, based on 16 global articles, identified five fundamental pillars: Smart Technology, Smart Governance, Tourist Behaviour, Cultural Tourism, and Stakeholder Participation. These pillars describe the essential structure of a global smart tourism system. The Narrative Review, based on 42 complementary articles, expands and operationalizes these pillars into applicable dimensions for implementation and evaluation. Together, they form a coherent STE framework consisting of five dimensions.

Smart Technology

Both reviews confirm that technological readiness determines how destinations collect, analyze, and utilize information to provide intelligent and adaptive tourism services. The integration of digital infrastructure (IoT, sensors, cloud computing, Wi-Fi, NFC) ensures ubiquitous connectivity, while smart tourism technologies (STT) enhance personalization, accessibility, and real-time interaction (Baran & Karaca, 2024; Liu et al., 2024; Türkcan, 2024).

Data analytics forms a critical layer, enabling destinations to analyze user-generated content and behavioral data for evidence-based decision-making (Mehraliyev et al., 2020). Moreover, digital accessibility ensures inclusive participation across diverse tourist segments (Özköse et al., 2023).

In Surakarta (Solo), although digital initiatives are growing, integration remains fragmented. Many SMEs lack advanced data capabilities, and interoperability between systems (hotels, attractions, transport) is limited. Digital literacy gaps among small cultural entrepreneurs may also hinder full adoption of IoT-based or data-driven systems. Without coordinated infrastructure investment and technical training, smart technology risks becoming symbolic rather than transformative.

Smart Business Ecosystem

Both reviews indicate that smart tourism destinations function as interconnected ecosystems involving governments, communities, private sectors, and digital platforms (Akbar et al., 2024; Gretzel et al., 2015). This ecosystem fosters co-creation and shared resource utilization.

Innovative business models emerge through platform-based services, creative content monetization, and smart hospitality systems. Human capital becomes central, requiring expertise in data analysis, digital management, and experience design (Widiyanto & Supriyanto, 2023). However, these innovations depend on enabling governance structures that promote collaboration and resource exchange.

Solo's economy is strongly supported by batik artisans, heritage performers, and small-scale creative enterprises. While culturally rich, many operate traditionally and may face barriers in adopting e-commerce, smart payment systems, or data analytics. Resistance to change, limited capital, and uneven technological readiness could slow ecosystem integration. Strengthening mentorship programs, digital incubation hubs, and SME incentives will be critical for sustainable transformation.

Smart Governance

Governance regulates how technology and stakeholders are orchestrated toward sustainability goals. The literature highlights the strategic role of governments and DMOs as regulators, facilitators, and network leaders (Del Chiappa & Baggio, 2015; Wang et al., 2022). Smart governance includes institutionalized monitoring systems and data-driven decision-making, supported by trust, cybersecurity, and privacy protections (Pasandideh et al., 2024; Ramadhani et al., 2024). Sustainability policies form the ethical foundation of smart governance, preserving heritage, reducing overtourism, and empowering residents (Maharani, 2022; Rodrigues et al., 2023).

Although collaboration between local agencies and BPS shows improving data governance, inter-agency coordination may still face bureaucratic silos. Establishing a centralized tourism intelligence system requires regulatory clarity, budget allocation, and technical expertise. Additionally, balancing commercialization with cultural preservation presents governance dilemmas, particularly in heritage zones.

Tourism Experience

Technology enhances emotional engagement rather than replacing human interaction. Tourist experience in smart destinations is characterized by informativeness, accessibility, interaction, and personalization (Corrêa & Gosling, 2021; Liu et al., 2024). These attributes influence satisfaction and behavioral intentions such as revisit motivation and sustainable conduct (Baran & Karaca, 2024; Lee et al., 2018). By emphasizing co-creation and data-driven

insights, destinations can align technological efficiency with emotional and cultural authenticity.

Solo’s strong brand identity “Solo, The Spirit of Java”—offers rich experiential value. However, over-digitalization could risk commodifying sacred traditions or reducing cultural depth to surface-level digital content. Ensuring that AR/VR, mobile apps, and digital storytelling remain culturally sensitive and community-approved is essential to maintaining authenticity.

Smart Destinations

This dimension integrates smart attractiveness, accessibility, ancillary services, and digital readiness with cultural experience, digital storytelling, creative placemaking, and ICT-enabled heritage interpretation (Gretzel et al., 2015; Özköse et al., 2023; Pasandideh et al., 2024; Portugal et al., 2025; Roque & Forte, 2017). For instance, digital art installations or QR-based storytelling at heritage sites can extend cultural engagement while fostering local creative entrepreneurship.

This means that a Smart Destination is not only about digital systems or data management, but also about how technology supports cultural expression and community involvement. For example, digital storytelling can be used to share local heritage stories through online platforms, while smart accessibility ensures that both local and international visitors can experience these cultural attractions easily and comfortably. In the same way, creative placemaking supported by digital tools can help local artists and cultural communities to co-create tourism experiences

A Smart Destination is therefore not defined solely by digital systems but by how technology amplifies cultural expression and strengthens community participation (Pasandideh et al., 2024; Portugal et al., 2025; Richards, 2020; Roque & Forte, 2017). The synthesis of these insights results in an integrative framework (Table 5) that conceptualizes the dynamic interaction between digital infrastructure, governance, cultural heritage, and innovation capacity.

The application of the STE framework in Solo demonstrates promising foundations in digital recognition and governance structure. However, implementation feasibility depends on addressing three structural challenges: 1) Digital Literacy Gap – SMEs and cultural communities require structured capacity-building programs. 2) Institutional Coordination – Cross-sector data sharing and long-term funding mechanisms must be institutionalized. 3) Cultural Sensitivity in Digitalization – Technological innovation must align with local wisdom and community consent.

Without addressing these constraints, the STE framework risks partial implementation. Conversely, if integration across technology, governance, business, culture, and community participation is achieved, Solo can strengthen not only tourism competitiveness but also cultural sustainability and inclusive economic development. Thus, the STE framework provides not merely an aspirational model, but a structured pathway—conditional upon institutional commitment, community empowerment, and balanced digital transformation.

Table 5. Synthesis of STE Framework

Dimensions	Contexts
Smart Technology	Digital Infrastructure
Smart Business Ecosystem	Value Creation & Innovative business model
Smart Governance	Regulation & Sustainability
Tourism Experience	Co-created experience
Smart Destinations	Communicating cultural expression

[Data processed by the Author]

In applying the integrated STE framework, Surakarta (Solo) presents a favorable environment across the five dimensions: Smart Technology, Smart Business Ecosystem, Smart Governance, Tourism Experience, and Smart Destination.

The city has demonstrated progress in digital connectivity and tourism performance, reflected in increasing hotel occupancy rates and national recognition through the Smart City Award 2024. Its strong creative economy—particularly batik, heritage crafts, and cultural performances indicates a solid foundation for developing a collaborative smart business ecosystem (Widiyanto & Supriyanto, 2023).

Institutional coordination between local government and statistical agencies further suggests growing data governance capacity, while the city's cultural identity, branded as "Solo, The Spirit of Java", provides a strong experiential anchor for smart tourism innovation.

These conditions indicate that Solo possesses structural readiness to implement the STE framework. However, a deeper and more systematic operationalization of each dimension is required to ensure balanced integration between technology, governance, business innovation, and cultural sustainability. The following section elaborates this application in greater detail.

CONCLUSION

This study concludes that the development of a Smart Tourism Ecosystem (STE) requires an integrated framework connecting technology, innovative business models, governance, tourist experience, and destination readiness into a cohesive system. Based on the synthesis of 16 articles from the Systematic Literature Review and 42 articles from the Narrative Review, five major dimensions were identified: Smart Technology, Smart Business Ecosystem, Smart Governance, Tourist Experience, and Smart Destination. These interrelated dimensions demonstrate that digital transformation in tourism extends beyond technological adoption; it requires alignment among institutions, businesses, communities, and cultural values to create shared and sustainable value.

When contextualized in Surakarta (Solo), the framework indicates that the city possesses a strong foundation for smart tourism development. Solo's cultural heritage assets—such as Keraton Surakarta Hadiningrat and Pura Mangkunegaran—its vibrant creative economy, and its growing digital initiatives reflect key principles of the STE model. With strategic coordination, Solo can integrate technology with cultural storytelling, heritage preservation, and participatory tourism to enhance visitor experience while empowering local communities.

To move from conceptual design to practical implementation, several actionable steps are recommended. First, pilot projects could be initiated in selected heritage zones to test integrated digital ticketing, visitor flow monitoring, or augmented reality storytelling systems. Second, partnerships between the local government, universities, and creative SMEs could be established to experiment with AI-based tourism marketing, data-sharing platforms, or smart event management systems. Third, capacity-building programs focusing on digital literacy and data governance should be implemented to ensure inclusive participation among local businesses and community groups.

Future research should extend this study through empirical validation. Field-based case studies, stakeholder interviews, and participatory action research in Solo would help assess institutional readiness, digital maturity, and community engagement levels. Longitudinal studies could evaluate the effectiveness of pilot smart tourism initiatives over time. Comparative studies involving other mid-sized cultural cities in Indonesia or similar developing-country contexts would also enhance the adaptability and scalability of the STE framework.

Although this research is limited to literature-based synthesis, it provides a strategic and adaptable foundation. By combining empirical testing, collaborative experimentation, and cross-city comparison, the Smart Tourism Ecosystem framework can evolve from a conceptual model into a practical roadmap—not only for Solo but also for other emerging cultural destinations seeking resilient and culturally grounded digital transformation.

ACKNOWLEDGEMENT

The author would like to express sincere gratitude to the Institute for Research and Community Service (LPPM), Institut Seni Indonesia Surakarta, for the support and facilitation that made this study possible. This research was funded through the 2025 Research Grant (DIPA) of Institut Seni Indonesia Surakarta.

AUTHOR CONTRIBUTION STATEMENT

Pratita Rara Raina was responsible for the conceptualization, methodology, data analysis, and writing of the original draft and its review. Roudlotul Jannati Rochnadia Noorva Yudhitya contributed to the literature review, methodology, data collection, and editing of the manuscript. Priaji Iman Prakoso handled data collection, analysis, interpretation, and manuscript editing. All authors approved the final manuscript and are accountable for its content.

REFERENCES

- Akbar, P. N. G., Auliya, A., Pranita, D., & Oktadiana, H. (2024). The readiness assessment of Jakarta as a smart tourism city. *Cogent Social Sciences*, 10(1), 2364386. <https://doi.org/10.1080/23311886.2024.2364386>
- Andrianto, T., Koseoglu, M. A., & King, B. (2022). A business model innovation process for tourism: findings from a literature review. *Tourism Recreation Research*, 47(5-6), 583-590. <https://doi.org/10.1080/02508281.2021.1878654>
- Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, 18(4), 543-571. <https://doi.org/10.1093/jopart/mum032>
- Arsita, N. C., & Ahmadi, M. A. (2024). The Development Of Tourism Sector As A Strategy To Increase Local Revenue Surakarta. *JURNAL BENGAWAN SOLO: PUSAT KAJIAN PENELITIAN DAN PENGEMBANGAN DAERAH KOTA SURAKARTA Учредители: Lembaga Pengkajian Dan Pengembangan Sumberdaya Pembangunan (LPPSP)*, 3(2), 107-121.
- Baggio, R., Micera, R., & Del Chiappa, G. (2020). Smart tourism destinations: a critical reflection. *Journal of Hospitality and Tourism Technology*, 11(3), 407-423. <https://doi.org/10.1108/JHTT-01-2019-0011>
- Baran, Z., & Karaca, S. (2024). Factors affecting customer experience, attitude, and repurchase intention on smart tourism applications. *Current Issues in Tourism*, 1-19. <https://doi.org/10.1080/13683500.2024.2440809>
- Chuang, C.-M. (2023). The conceptualization of smart tourism service platforms on tourist value co-creation behaviours: An integrative perspective of smart tourism services. *Humanities and Social Sciences Communications*, 10(1), 367. <https://doi.org/10.1057/s41599-023-01867-9>
- Corrêa, S. C. H., & Gosling, M. de S. (2021). Travelers' perception of smart tourism experiences in smart tourism destinations. *Tourism Planning & Development*, 18(4), 415-434. <https://doi.org/10.1080/21568316.2020.1798689>
- Del Chiappa, G., & Baggio, R. (2015). Knowledge transfer in smart tourism destinations: Analyzing the effects of a network structure. *Journal of Destination Marketing & Management*, 4(3), 145-150. <https://doi.org/10.1016/j.jdmm.2015.02.001>
- Del Vecchio, P., Mele, G., Ndou, V., & Secundo, G. (2018). Creating value from social big data: Implications for smart tourism destinations. *Information Processing & Management*, 54(5), 847-860. <https://doi.org/10.1016/j.ipm.2017.10.006>
- Gretzel, U., Werthner, H., Koo, C., & Lamsfus, C. (2015). Conceptual foundations for understanding smart tourism ecosystems. *Computers in Human Behavior*, 50, 558-563. <https://doi.org/10.1016/j.chb.2015.03.043>
- Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. *IBM Journal of Research and Development*, 54(4), 1-16. <https://doi.org/10.1147/JRD.2010.2048257>
- Höjer, M., & Wangel, J. (2014). Smart sustainable cities: definition and challenges. In *ICT innovations for sustainability* (pp. 333-349). Springer. https://doi.org/10.1007/978-3-319-09228-7_20
- Kim, M. J., Lee, C.-K., & Bonn, M. (2017). Obtaining a better understanding about travel-related purchase intentions among senior users of mobile social network sites. *International Journal of Information Management*, 37(5), 484-496. <https://doi.org/10.1016/j.ijinfomgt.2017.04.006>

- Lee, H., Lee, J., Chung, N., & Koo, C. (2018). Tourists' happiness: are there smart tourism technology effects? *Asia Pacific Journal of Tourism Research*, 23(5), 486–501. <https://doi.org/10.1080/10941665.2018.1468344>
- Liu, J., Hall, C. M., Zhu, C., & Ting Pong Cheng, V. (2024). Redefining the concept of smart tourism in tourism and hospitality. *Anatolia*, 35(3), 566–578. <https://doi.org/10.1080/13032917.2023.2282712>
- Maharani, N. A. (2022). Kebijakan Pariwisata Berbasis Komunitas Di Kota Surakarta. *Journal of Politic and Government Studies*, 11(2), 366–384.
- Mandić, A., & Kennell, J. (2021). Smart governance for heritage tourism destinations: Contextual factors and destination management organization perspectives. *Tourism Management Perspectives*, 39, 100862. <https://doi.org/10.1016/j.tmp.2021.100862>
- Marchi, V., Marasco, A., & Apicerni, V. (2023). Sustainability communication of tourism cities: A text mining approach. *Cities*, 143, 104590. <https://doi.org/10.1016/j.cities.2023.104590>
- Mehraliyev, F., Chan, I. C. C., Choi, Y., Koseoglu, M. A., & Law, R. (2020). A state-of-the-art review of smart tourism research. *Journal of Travel & Tourism Marketing*, 37(1), 78–91. <https://doi.org/10.1080/10548408.2020.1712309>
- Özköse, H., Uyar Oğuz, H., & Aslan, A. (2023). Scientific mapping of smart tourism: a content analysis study. *Asia Pacific Journal of Tourism Research*, 28(9), 923–948. <https://doi.org/10.1080/10941665.2023.2283601>
- Pai, C.-H., Xu, S., Jin, J., & Shang, Y. (2022). Value evaluation of cultural tourism tourists' psychological expectation based on machine learning data mining. *Frontiers in Psychology*, 13, 943071. <https://doi.org/10.3389/fpsyg.2022.943071>
- Pasandideh, S., Raiyani, K., Lerones, P. M., Ahmed, S., Pereira, P., Barrientos, F. J., & Martins, J. (2024). Co-Designing in Cultural Tourism: TExTOUR ICT Services and Performance Monitoring System. *Heritage*, 7(11), 6151–6172. <https://doi.org/10.3390/heritage7110289>
- Portugal, C., Vaz, D., Dias, M. S., Trocado, P., Prata, A., & Abreu, F. B. e. (2025). Enhancing the Visitor Experience with Immersive Technologies and Gaming: The Monserrate Use Case. In *Smart Life and Smart Life Engineering: Current State and Future Vision* (pp. 273–291). Springer. https://doi.org/10.1007/978-3-031-75887-4_13
- Rahmawati, E. D., Admadianto, H. N., Fadila, S., & Baaq, S. H. (2023). Smart Tourism Technology Dan Kepuasan Wisatawan Untuk Berkunjung Kembali Di Wisata Heritage Kota Surakarta. *Journal Management*, 22(1).
- Ramadhani, M., Rohmah, W., & Harjono, B. (2024). Peran hukum dalam pengembangan pariwisata di Kota Surakarta: Kajian kebijakan pemerintah. *Jurnal Bengawan Solo: Pusat Kajian Penelitian Dan Pengembangan Daerah Kota Surakarta*, 3(1), 96–107. <https://doi.org/10.58684/jbs.v3i1.53>
- Richards, G. (2020). Designing creative places: The role of creative tourism. *Annals of Tourism Research*, 85, 102922. <https://doi.org/10.1016/j.annals.2020.102922>
- Rodrigues, V., Eusébio, C., & Breda, Z. (2023). Enhancing sustainable development through tourism digitalisation: a systematic literature review. *Information Technology & Tourism*, 25(1), 13–45. <https://doi.org/10.1007/s40558-022-00241-w>
- Roque, M. I., & Forte, M. J. (2017). Digital strategies to a local cultural tourism development: Project e-Carnide. *Tourism, Culture and Heritage in a Smart Economy: Third International Conference IACuDiT, Athens 2016*, 365–383. https://doi.org/10.1007/978-3-319-47732-9_24
- Safika, S., Arsyad, A. W., Sary, K. A., & Boer, K. M. (2025). Indonesia Virtual Tour Sebagai Media Komunikasi Digital Untuk Mempromosikan Pariwisata Indonesia. *Jurnal Media Informatika*, 6(2), 941–946. <https://doi.org/10.55338/jumin.v6i2.5239>
- Sharma, G. D., Taheri, B., Cichon, D., Parihar, J. S., & Kharbanda, A. (2024). Using innovation and entrepreneurship for creating edge in service firms: A review research of tourism and hospitality industry. *Journal of Innovation & Knowledge*, 9(4), 100572. <https://doi.org/10.1016/j.jik.2024.100572>
- Sorcaru, I. A., Muntean, M.-C., Manea, L.-D., & Nistor, R. (2025). Voice assistants in the tourism

- customer journey: From knowledge and decision-making to ecotourism loyalty in family vacations. *Journal of Innovation & Knowledge*, 10(6), 100833. <https://doi.org/10.1016/j.jik.2025.100833>
- Susilowati, A. P. E., Rachmawati, R., & Rijanta, R. (2025). Smart village concept in Indonesia: ICT as determining factor. *Heliyon*, 11(1). <https://doi.org/10.1016/j.heliyon.2025.e41657>
- Tan, Y., Jiang, G., Merajuddin, S. S., & Zhao, F. (2025). Analyzing the impact of digital technology on consumers' travel intentions. *Journal of Innovation & Knowledge*, 10(2), 100685.
- Tavitiyaman, P., Qu, H., Tsang, W. L., & Lam, C. R. (2021). Smart tourism application and destination image: Mediating role of theory of mind (ToM). *Asia Pacific Journal of Tourism Research*, 26(8), 905–920. <https://doi.org/10.1080/10941665.2021.1928252>
- Türkcan, B. (2024). Sustainable urban tourism from the perspectives of overtourism and smart tourism: A systematic literature review. *Journal of Travel and Tourism Research*, 25(25), 112–156.
- Um, T., & Chung, N. (2021). Does smart tourism technology matter? Lessons from three smart tourism cities in South Korea. *Asia Pacific Journal of Tourism Research*, 26(4), 396–414.
- Verma, S., Warriar, L., Bolia, B., & Mehta, S. (2022). Past, present, and future of virtual tourism-a literature review. *International Journal of Information Management Data Insights*, 2(2), 100085. <https://doi.org/10.1016/j.jjime.2022.100085>
- Wang, X., Zhen, F., Tang, J., Shen, L., & Liu, D. (2022). Applications, experiences, and challenges of smart tourism development in China. *Journal of Urban Technology*, 29(4), 101–126. <https://doi.org/10.1080/10630732.2021.1879605>
- Widiyanto, H., & Supriyanto, A. E. (2023). *Strategi pengembangan pariwisata berkelanjutan berbasis warisan budaya di Kota Surakarta*. <https://doi.org/10.58684/jbs.v2i2.60>
- Yang, L., & Ning, W. (2025). Mechanisms and effects of the sustainable integration of digital-driven rural cultural tourism from the perspective of symbiosis. *Sustainable Futures*, 10, 100867. <https://doi.org/10.1016/j.sftr.2025.100867>
- Yin, F., Yin, X., Zhou, J., Zhang, X., Zhang, R., Ibeke, E., Iwendi, M. G., & Shah, M. (2022). Tourism cloud management system: the impact of smart tourism. *Journal of Cloud Computing*, 11(1), 37.
- Zubiaga, M., Izgara, J. L., Gandini, A., Alonso, I., & Saralegui, U. (2019). Towards smarter management of overtourism in historic centres through visitor-flow monitoring. *Sustainability*, 11(24), 7254. <https://doi.org/10.3390/SU11247254>