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A Multi-Level Analytical Framework for Smart Tourism Technologies: A Systematic Review of Decision-Relevant Mechanisms and Sustainable Outcomes (2015–2025)

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Abstract: This study examines Smart Tourism Technologies (STTs) as a structured, decision-relevant system within sustainability-oriented contexts, where multiple interacting factors shape tourism outcomes under conditions of complexity and uncertainty. A PRISMA-guided systematic review of 78 peer-reviewed studies (2015–2025) is conducted to synthesise how STTs-related attributes, multi-level mechanisms, and contextual conditions influence travel experience outcomes. The analysis organises existing literature into a multi-level framework that connects core technological dimensions with mediating and moderating mechanisms and broader contextual enablers. Within this structure, these elements jointly determine how cognitive, affective, behavioural, and well-being outcomes emerge across different tourism settings. The evidence indicates that STTs operate through interdependent processes rather than isolated technological effects, involving factors such as security, personalisation, technology readiness, perceived value, and digital well-being. These factors can be understood as implicit decision variables shaping experience quality, satisfaction, and sustainable behavioural responses. The review also identifies a gradual shift in the literature from technology adoption perspectives toward more integrated analytical interpretations that combine experience evaluation, sustainability considerations, and decision-relevant reasoning. By reorganising fragmented findings into a coherent analytical structure, the study provides a basis for further modelling, comparative evaluation, and structured decision analysis in sustainability-oriented tourism systems.

Keywords: Smart Tourism Technologies, Decision-oriented framework, Multi-level analysis, Sustainability evaluation, Experience-driven systems, Digital well-being, Systematic review

1 Introduction

Smart tourism technologies (STTs) have transformed tourism into an increasingly data-intensive and sustainability-relevant system, in which service provision, user interaction, and destination management are shaped by interconnected technological and behavioural factors [1, 2]. Central to this transformation are smart technologies, including the Internet of Things (IoT), big data analytics, mobile applications, immersive technologies, and Artificial Intelligence (AI), which enable travelers to access real-time information, personalized services, and engaging experiences [3–5]. STTs provide smart services such as navigation, itinerary planning, mobile payments, recommendations, and virtual tours, enabling seamless interaction between travelers and tourism service providers [6, 7]. Over the past decades, smart technologies have significantly changed tourists' behavior. As a result, smart tourism can be interpreted not merely as a technological trend but as a complex decision environment in which multiple attributes, user conditions, and contextual influences jointly determine tourism outcomes [8–10]. Scholars have identified the opportunities offered by smart technologies and expect that the prospects of STTs will be highly in demand in the near future [11, 12].

Across the pre-trip, on-site, and post-trip stages, STTs influence how tourism experiences are formed, evaluated, and translated into cognitive, emotional, and behavioural outcomes [7, 13]. Within this transformation, STTs enable co-created, data-driven, and digitally mediated experiences and support more sustainable tourism practices [14, 15]. Tourism experience in smart environments extends beyond service satisfaction and involves multiple outcome

dimensions, including emotional response, memory formation, engagement, and perceived quality of interaction [16–18]. Mobile technology supports this transformation by enabling data-driven services that enhance tourist experiences and contribute to sustainable and competitive tourism development [19]. Similarly, secure location-based services support smart transportation systems while protecting users' location privacy [20]. Social networking sites also encourage tourists to adopt sustainable and responsible behaviors across all stages of travel [13]. Research on digital technology adoption in sustainable tourism destinations is rapidly growing, with strong interdisciplinary collaboration and emerging research themes [21]. Moreover, travel experiences can improve emotional and mental well-being, influencing overall experience quality [22]. At the same time, the growing dependence on digital connectivity has introduced digital well-being as a critical evaluative concern, as technology-rich travel environments may generate both experiential value and psychological burden [23]. Accordingly, the effects of STTs cannot be understood through isolated technological features alone, but require structured interpretation of how service attributes, user characteristics, and contextual conditions interact across tourism settings.

Despite the rapid expansion of STTs research, existing studies remain fragmented across technology adoption, tourist experience, sustainability, and well-being perspectives, with limited effort to organise these strands into a structured analytical framework. In particular, prior research has rarely interpreted STTs as a system of decision-relevant components in which technological attributes, mediating mechanisms, and contextual conditions jointly shape tourism outcomes under complexity and uncertainty. This gap limits the analytical clarity of current smart tourism research and weakens its contribution to structured evaluation and future decision-support modelling. To address this limitation, the present study synthesises a decade of STTs literature (2015–2025) and develops a multi-level analytical framework that organises core technological dimensions, experience-shaping mechanisms, and sustainability-related outcomes into a coherent interpretive structure.

The present study is guided by the need to clarify how STTs can be analytically structured in relation to tourism experience formation and sustainability-oriented outcomes. To achieve this objective, the review addresses the following research questions:

RQ1: What are the key technological dimensions in contemporary smart tourism ecosystems?

RQ2: What multi-level mechanisms, including mediating, moderating, and contextual factors, shape STTs-enabled travel experiences?

RQ3: What types of tourism outcomes are generated through STTs across different contexts?

Overall, the study aims to systematically organise STTs-related dimensions, multi-level mechanisms, and contextual enablers into an integrated analytical framework that explains how tourism outcomes are formed in complex digital environments.

The remainder of the paper presents the review methodology, theoretical framing, thematic synthesis, analytical interpretation of decision-relevant mechanisms, research gaps, implications, and conclusion.

2 Methodology

This study adopts a Systematic Literature Review (SLR) guided by PRISMA 2020 to ensure methodological rigor, transparency, and reproducibility in synthesizing STTs research [24]. The review is designed not only to achieve systematic coverage of the literature but also to support the identification and organisation of key analytical elements, including technological attributes, experience-shaping mechanisms, and contextual conditions discussed across STTs-related studies. A structured multi-database search was conducted across Scopus, Dimensions, and Google Scholar, ensuring comprehensive and balanced coverage of the relevant literature [25, 26].

The review includes empirical, conceptual, theoretical, and case-based studies from both developed and emerging economies. These studies are organised across multiple domains, including tourism and hospitality management, information and communication technologies, transportation, logistics, supply chain systems, marketing, and commerce. Within these domains, the literature addresses topics such as digital transformation, intelligent transportation systems, tourist behavioural outcomes, and destination management strategies. This cross-disciplinary coverage enables the identification of recurring analytical elements and structural relationships within STTs-related research.

Literature searches for this review were conducted from June to December 2025. Following the PRISMA protocol, as illustrated in Figure 1, the initial search retrieved 2,800 records. After removing 500 duplicates, 2,300 titles and abstracts were screened, resulting in the exclusion of 2,100 irrelevant studies. Full-text assessment of 200 articles led to the removal of 122 studies due to non-peer-reviewed status, inaccessible full texts, or thematic irrelevance. Following this rigorous screening process, 78 studies published between 2015 and 2025 were selected for synthesis, representing both developed and emerging economies and encompassing empirical, conceptual, theoretical, and case-based research.

A database-specific Boolean keyword search was designed to capture studies on STTs and travel experience (Table 1). Searches in Scopus and Dimensions were conducted in title, abstract, and keyword fields, while Google Scholar searches were applied to full-text records due to platform limitations. Duplicate records were removed using manual verification.

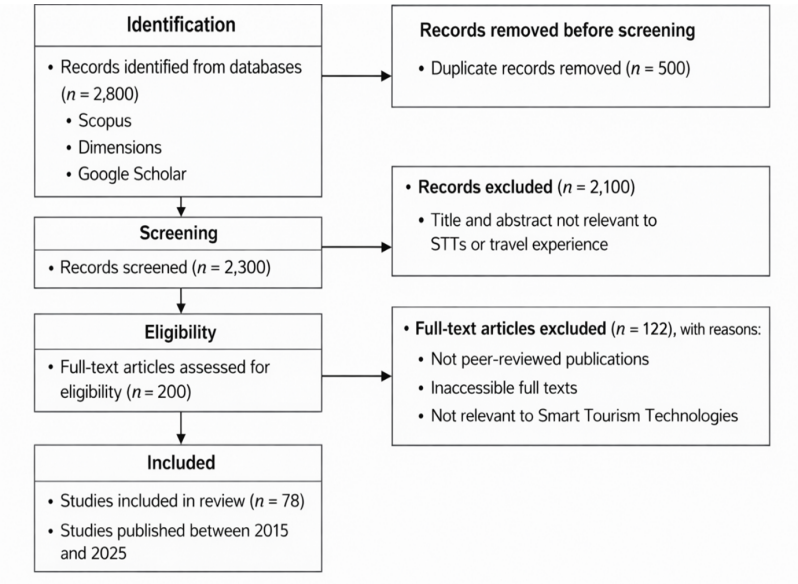

Figure 1. The review process at a glance: PRISMA 2020 flow diagram

This review applied predefined inclusion and exclusion criteria to ensure methodological rigor and thematic relevance. It included peer-reviewed, English-language studies published between 2015 and 2025 on STTs and travel experiences, while excluding non-peer-reviewed, inaccessible, or irrelevant studies (Table 2).

Table 1. Search strings, criteria, and search duration per database

Database	Boolean Search Strings	Searched by Criteria	Search Time-Frame
Scopus	(“STTs” OR “digital tourism” OR “AI” OR “AR” OR “VR” OR “mobile apps” OR “big data”) AND (“tourist experience” OR “travel experience” OR “memorable experience” OR “experience quality”)	Title, abstract, keywords	June-Dec 2025
Dimensions	(“STTs” OR “digital tourism” OR “AI” OR “AR” OR “VR” OR “mobile apps” OR “big data”) AND (“tourist experience” OR ”travel experience” OR ”memorable experience” OR ”experience quality”)	Title, abstract, keywords	June-Dec 2025
Google Scholar	(“STTs” OR “digital tourism” OR “AI” OR “AR” OR “VR” OR “mobile apps” OR “big data”) AND (“tourist experience” OR “travel experience” OR “memorable experience” OR “experience quality”)	Full text	June-Dec 2025

Note: STTs: Smart Tourism Technologies; AI: artificial intelligence

Table 2. Search strings, criteria, and search duration per database

Criteria	Description
Inclusion Criteria	
Publication type	Peer-reviewed journal articles and conference papers
Publication period	2015–2025
Research focus	STTs and/or travel experience
Context	Developed and emerging countries
Study design	Empirical, conceptual, theoretical, case-based, and review studies
Language	English
Exclusion Criteria	
Non-peer-reviewed sources	Reports, blogs, preprints, book chapters, essays
Accessibility	Incomplete or inaccessible full texts
Relevance	Studies not addressing STTs or tourism experience

Note: STTs: Smart Tourism Technologies

3 Theoretical Lens

STTs operate within a complex system in which technological attributes, user perceptions, and contextual conditions jointly shape tourism experience outcomes [10, 27]. From an analytical perspective, existing theoretical approaches can be interpreted as complementary mechanisms that explain how these interactions occur [28].

Technology engagement theories, including TRA, TPB, and TAM, can be understood as behavioural decision mechanisms that explain how users respond to STTs attributes through perceived usefulness, ease of use, and behavioural intention [3, 29, 30]. Experience-based frameworks further extend this perspective by emphasising that tourism value emerges through emotional engagement, memory formation, and subjective evaluation processes rather than purely functional service delivery [4, 31, 32]. In addition, co-creation and service logic perspectives conceptualise tourism experiences as the result of continuous interaction among travellers, service providers, and digital platforms, highlighting the relational dynamics within STTs-enabled environments [27, 33]. Psychological and well-being theories, including PERMA, self-determination, and flow theory, introduce evaluative dimensions such as autonomy, competence, and intrinsic motivation, which influence both experiential outcomes and digital well-being [23, 34, 35].

These theoretical perspectives can be organised into a multi-level structure in which technological attributes, behavioural responses, and contextual conditions interact to determine tourism outcomes. Within this structure, mediating mechanisms such as perceived value, satisfaction, and memorable experience, together with moderating conditions such as security, trust, and user characteristics, shape the pathways through which STTs influence travel-related outcomes.

Based on this interpretation, Figure 2 synthesises these theoretical perspectives into an integrated analytical framework that organises STTs-related dimensions, multi-level mechanisms, and contextual enablers in a unified structure. As illustrated in Figure 2, STTs influence tourism systems not through isolated technological effects, but through interconnected mechanisms that shape cognitive, affective, behavioural, and well-being outcomes across different tourism contexts.

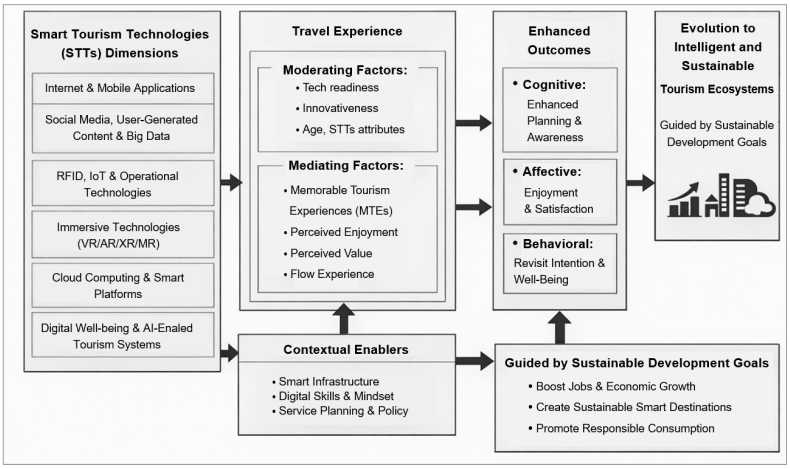

Figure 2. Multi-level Smart Tourism Technologies (STTs) experience framework: From smart technologies to intelligent sustainable tourism

4 Thematic Discussion

This review synthesizes diverse STTs scenarios by integrating fragmented themes into a holistic, multi-level STTs experience framework, illustrating the transition from smart technologies to intelligent sustainable tourism (Figure 2). The emergent themes identified through the review are organized into four areas: evaluation and dimensions of STTs, multi-level mechanisms shaping STTs-enabled travel experiences, STTs-enabled travel outcomes, and the evolution from smart technologies to intelligent sustainable tourism ecosystems.

4.1 Evaluation and Dimensions of Smart Tourism Technologies

STTs refer to the integration of advanced digital technologies into tourism systems to enhance personalization, memorability, and overall quality of travel experiences [3, 5, 36]. Conceptually, smart tourism emphasizes integrated and systematic travel management, optimizes resources and enables value co-creation among traveler, destinations, and service providers [37]. STTs are commonly characterized by four core attributes: informativeness, accessibility, interactivity, personalization and security [3, 38–41]. Informativeness reflects accuracy, relevance, and timeliness

of information; accessibility refers to ease of use and availability; interactivity enables two-way communication and support; and personalization tailors' content and services to individual preferences [3, 38]. Tourists are more likely to trust and engage with digital tourism services when they perceive that their personal information is secure, which enhances their overall travel experience [42].

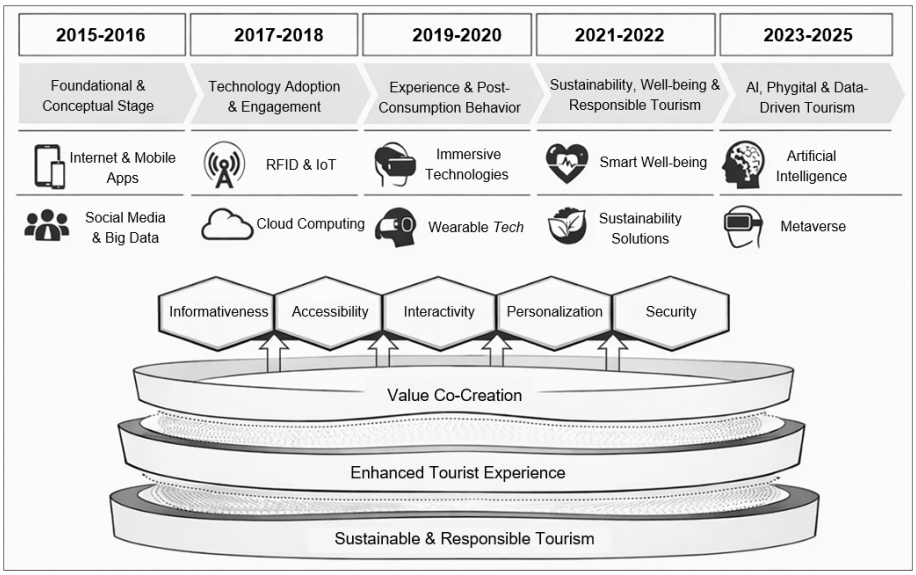

Figure 3. The evolution and dimensions of Smart Tourism Technologies (STTs): foundation to AI driven feature

STTs have evolved across different stages (Figure 3). First, early research focused on the internet, mobile apps, and social media for information sharing and social integration [17, 43–45]. Second, operational technologies like RFID, IoT, and cloud computing improved backend efficiency and destination management [1, 6, 20]. Third, emerging studies emphasize smart well-being, digital balance, wearable tech, and phygital experiences [22, 23, 46]. Finally, recent research highlights AI, the metaverse, and immersive technologies for personalized, predictive, and engaging tourism [2, 10, 47, 48]. Overall, STTs are shifting from access-driven tools to well-being-oriented and data driven ecosystems.

This review examines 78 STTs-focused studies published between 2015-2025, extracted from global research databases. This timeline-based SLR allows observation of thematic evolution, and digital emerging trends (Table 3).

4.2 Multi-Level Mechanisms Shaping Smart Tourism Technologies Enabled Travel Experiences

STT experiences operate through multilevel mechanisms, including moderators, mediators, and contextual enablers. As summarized in Table 4, prior literature demonstrates how these mechanisms shape tourist experiences and behavioral outcomes.

The impact of STTs on tourist experiences depends on several factors. Moderators like security and privacy concerns, technology readiness, growth mindset, emotional arousal, and place dependence shape how STTs attributes translate into experiences. At the same time, mediating mechanisms, such as perceived value, trust in technology, memorable experiences, user competence, and self-gratification, explain how these tools lead to satisfaction, loyalty, and future behaviors. Beyond individual factors, the broader digital environment plays a crucial role. Elements like digital well-being, online media engagement, authenticity, digital detox, and social media induced travel anxiety further influence outcomes. Together, these insights show that STTs do not produce direct effects. Instead, Tourists' experiences and behaviors result from the mix of psychology, personal traits, and context.

4.3 Smart Tourism Technologies Enabled Travel Outcome

Cognitive, affective, and behavioral outcomes are the three aspects of response; these outcomes represent what a person thinks (cognitive), feels (affective), and does (behavioral) following an experience [29]. The cognitive outcomes refer to changes in knowledge, intellect, thoughts, and beliefs [29]; affective outcomes concern feelings, emotions, attitudes, and values [71] and behavioral outcomes are observable actions, reactions, or skills, that occur as a result of cognitive appraisals and affective states [30].

The reviewed literature reveals that STTs shape travel experiences through interlinked cognitive, affective, behavioral and wellbeing outcomes, reinforcing the view of smart tourism as an experience-driven and outcome-oriented ecosystem (Table 5).

Table 3. Evolution of Smart Tourism Technologies (STTs) 2015–2025

Timeline	Thematic Evolution	STTs Dimensions and Key Supporting Studies
2015–2016	Foundational and conceptual stage	• Earlier studies established the foundation for the development of smart tourism [36]. • Social context mobile (SoCoMo) marketing is considered an empowering factor for value co-creation in travel and tourism [43]. • STTs collect and use real-time data, enabling dynamic personalization [49]. • Smart tourism destinations are defined as an ecosystem-based approach grounded in service-dominant (S-D) logic, where stakeholders collaboratively co-create personalized tourism experiences through smart technologies [27]. • Social media acts as a data source for the effective management of smart tourism destinations [44]. • Smart tourism destination competitiveness combines traditional concepts of comparative advantage and competitive advantage, core resources and attractors, and destination management factors [50]. • Smart destinations exploit human-computer cloud technologies to enhance the quality of tourist experiences [51].
2017–2018	Technology adoption and engagement	• STTs attributes promote both explorative and exploitative use, while users' security and privacy concerns negatively affect adoption [3]. • Smart tourism dynamic responsive systems enhance tourist engagement [52]. • Advances in mobile technology are expected to enhance consumer experiences and increase the competitiveness and sustainability of tourism destinations [19]. • Online travel reviews and big data reveal that electronic word-of-mouth significantly shapes tourist destination image and supports smart tourism insights [45]. • STTs experiences and destination value directly influence tourists' happiness [39]. • Perceived benefits increase travelers' smart device use, while perceived risks vary according to technology readiness [53].
2019–2020	Experience and post consumption behavior	• STTs attributes (informativeness, interactivity, and personalization) enhance experience, satisfaction, and revisit intention; security and privacy moderate their impact [5]. • Mobile and online technologies are integral to tourist behavior and shape personalized physical experiences in rural smart tourism contexts [54]. • STTs experience increases satisfaction, happiness, and revisit intention [55]. • Social networking sites encourage sustainable tourist behavior across all travel stages [13].
2021–2022	Sustainability, well-being and responsible tourism	• Digital well-being introduces new responsibilities for destinations, platforms, and tourists in smart tourism [23]. • Social media communication enhances value co-creation, online experience, and customer well-being [14]. • Smart tourism research has evolved from ICT adoption toward experience, sustainability, and destination management [56]. • Perceived STTs experiences increase satisfaction and revisit intention [4]. • Smart tourism leverages ICT-driven innovations to enhance sustainability, resource management, and competitiveness [57]. • STTs improve tourists' experiences and overall satisfaction [58]. • Balancing novelty-seeking and technology-related concerns improves travel satisfaction (both transactional and experiential) [59]. • Travel vlogs influence tourist behavior through engagement and informational value [17].
2023–2025	AI, phygital, and data-driven tourism	• Residential tourism clusters shape how smart destinations create memorable tourism experiences [5]. • Technostress creators adversely affect outcomes and information system usage across contexts [60]. • Information overload on social media contributes to anxiety, reducing travel intention [61]. • Gamified STTs enhance engagement and enrich visitors' experiences at destinations [62]. • Tourist experiences in smart city landscapes are driven by multiple interacting smart tourism factors, where different configurations jointly produce high experiential value [10]. • AI-powered smart tourism reflects a paradigm shift toward intelligent, data-driven, and adaptive tourism ecosystems [2].

Table 4. Multi-level mechanisms and Smart Tourism Technologies (STTs) enabled travel experiences

Multi-Level Mechanisms	Key Findings
Moderators	Security and privacy moderate the relationship between STTs attributes and tourists' memorable experiences at smart tourism destinations [42]. Technology readiness moderates the relationship between AR satisfaction and destination loyalty [63]. Age moderates trust formation, with perceived ease of use being particularly important for elderly users [64]. Switching costs influence satisfaction-driven loyalty and word-of-mouth intentions [65]. STTs act as moderators by enhancing novelty and reducing worries, improving both transaction and travel satisfaction [59]. Growth mindset strengthens the relationship between perceived benefits and psychological well-being [22]. Place dependence strengthens the impact of STTs on tourist satisfaction and electronic word-of-mouth [66]. Emotional arousal strengthens the effects of STTs attributes on memorable tourism experiences [41].
Mediators	Travel experience satisfaction mediates the relationship between STTs use, happiness, and revisit intentions [56]. Trust in technology mediates the relationship between perceived ease of use and behavioral intention to adopt tourism apps [64]. Perceived value mediates the effects of informativeness, interactivity, and accessibility on satisfaction, revisit intention, and willingness to pay [58]. Memorable tourism experiences mediate the relationship between STTs and loyalty [16]. Memorable experiences partially mediate the relationship between STTs and tourists' hedonic and eudaimonic well-being [18]. User competence mediates the relationship between STTs attributes and memorable experiences in smart rural destinations [67]. Satisfaction mediates the relationship between technology characteristics and repeat-visit intentions [68]. Self-gratification mediates the relationship between satisfaction and happiness [8]. Destination image and satisfaction mediate the effects of STTs on electronic word of mouth [66].
Contextual Enablers	Digital well-being introduces new responsibilities for destinations, platforms, and tourists within smart tourism ecosystems [23]. Online travel media influence tourist well-being through cognitive, emotional, and behavioral mechanisms [12]. Tourist involvement, authenticity, and destination image enhance satisfaction in Chinese heritage tourism contexts [69]. TikTok short-video characteristics and flow experience significantly influence tourists' behavioral intentions [70]. Digital detox and technology-free tourism practices support well-being as alternatives to technology-intensive travel [46]. Idealized tourism content and information overload on social media can induce travel anxiety, reducing travel intention [61].

Table 5. Types of Smart Tourism Technologies (STTs) outcomes, key insights and supporting studies

Types of STTs Outcomes	Key Insights	Supporting Studies
Cognitive	STTs enhance trip planning and decision-making through real-time information (flight status, weather, traffic, crowd levels, safety alerts); improve navigation, destination understanding, and delivery of personalized intelligent services.	[2, 3, 10, 38, 39, 44, 72]
Affective	STTs enhance satisfaction, happiness, and emotional engagement through interactivity, personalization, security, gamification, and immersive technologies; foster memorable experiences, hedonic pleasure, and eudaimonic well-being.	[8, 12, 22, 39, 42, 46, 56, 58]
Behavioral	Positive experiences drive revisit intentions, loyalty, and word-of-mouth recommendations; mediated by satisfaction, perceived value, and memorable experiences.	[4, 16, 42]
Well-being	STTs enhance life satisfaction, technology-life balance, and digital well-being; however, excessive connectivity may lead to technostress, information overload, and digital anxiety, underscoring the need for human-centered and ethical design.	[12, 18, 22, 23, 46, 61, 73, 74]

The review pointed out that recent literature goes beyond the cognitive, affective and behavioral perspective. Well-being is now viewed as a broader life outcome, reflecting overall quality of life, life satisfaction, and a healthy balance between technology use and daily life [23, 46]. Unintended or unmindful technology use can cause digital challenges such as technostress, information overload, and digital anxiety [61, 74]. This highlights the need for human-centered and ethical STTs design. Promoting digital well-being and mindful technology use is an important

direction for sustainable and responsible smart tourism.

4.4 From Smart Technologies to Intelligent Sustainable Tourism Ecosystems

Existing literature demonstrates a clear evolution in the conceptualization and application of STTs. Rather than merely expanding in volume, STTs research has undergone a qualitative transformation. STTs have transformed from technological tools to experience systems and, ultimately, to intelligent and sustainable tourism ecosystems. Early studies primarily focused on the foundations and adoption of smart technologies, emphasizing ICT infrastructure, mobile tourism, and online travel planning [36, 38, 43, 50]. During this phase, technology was largely viewed as a functional support tool for tourism services.

Subsequent research shifted toward the experience and smart destination era, examining how STTs enable personalized experiences, enhance tourist satisfaction, and influence behavioral outcomes such as revisit intention [3, 39, 42, 56]. Technology thus evolved from a functional tool into an experience enabler.

More recent studies emphasize tourists' mindful use of STTs to support digital well-being during travel experiences [22, 23, 46]. The concept of phygital tourism further integrates physical and digital environments to create seamless and context-aware experiences [75, 76]. Contemporary research also highlights the emergence of intelligent, responsible, and sustainable tourism driven by artificial intelligence, extended reality, and the Internet of Things [2, 73]. These technologies contribute to sustainability by improving resource efficiency and reducing environmental impacts [21]. STTs further support the achievement of key sustainable development goals (SDGs). Digital tourism platforms promote sustainable and inclusive economic participation [77], smart tourism destinations enhance urban sustainability [1, 72], and intelligent systems encourage efficient resource use and responsible tourist behavior [6].

As a result, intelligent and sustainable tourism ecosystems are emerging in which technology, tourist experiences, behavior, and sustainability jointly shape tourism outcomes that benefit both visitors and destinations. Within this transformation, Smart Tourism 2.0 represents a new paradigm where AI-driven systems, gamification, blockchain, digital twins, and metaverse technologies reshape tourism interactions and enable "better-than-real" experiences [2, 62]. Overall, STTs operate within a socio-technical ecosystem in which technology, user behavior, experience, and sustainability interact to co-create tourism value.

5 Decision Analysis Approaches in Smart Tourism Technologies Research

The studies in Table 6 show the evolution of decision analytical approaches in STTs research from 2015 to 2025. Early research focused on usability and content quality. Recent studies emphasize AI-driven, personalized, and well-being-oriented frameworks. This reflects the shift of STTs into digital ecosystems that support meaningful travel experiences.

A key observation from the reviewed studies is that most empirical research on STTs adopts behavioral decision-analysis approaches rather than classical optimization models. It is observed that Structural Equation Modeling (SEM) is the most commonly used method to examine relationships between smart tourism service attributes and travel experience outcomes. These models allow researchers to analyze multiple interconnected variables simultaneously, such as informativeness, accessibility, interactivity, and personalization. Previous studies have used SEM to explain how STTs attributes shape tourists' engagement, satisfaction, and loyalty [3, 39, 42, 56].

Another important research stream focuses on technology adoption and decision-support models, often grounded in the Technology Acceptance Model (TAM) and smart tourism ecosystems. These studies demonstrate how digital tools assist tourists in planning and navigating trips through real-time information and contextual recommendations. For example, mobile information services improve travel planning efficiency [38], while location-aware platforms enhance destination interaction [44]. Recent research extends these models by incorporating AI-driven recommendation systems and predictive analytics, enabling personalized services and real-time decision support [2, 10].

A third emerging direction examines experiential and well-being outcomes of STTs. Current literature shows smart technologies influence emotional engagement, happiness, and overall quality of life. Digital well-being introduces new responsibilities for destinations, platforms, and tourists in smart tourism [23]. Social media communication further enhances value co-creation, online experiences, and customer well-being [14]. Online travel media shape tourists' well-being through cognitive, emotional, and behavioral mechanisms [12], while STTs more broadly have positive effects on psychological well-being [22] and perceived well-being outcomes [18]. Digital detox and technology-free tourism practices offer alternatives to intensive technology use, supporting well-being [46]. Finally, research on extended reality (XR) consumer experiences emphasizes technology and immersive experiences, though attention to consumer welfare remains limited [73]. Together, these studies underscore that STTs can enhance both experiential satisfaction and broader well-being, highlighting the need for responsible and human-centered technology design.

Overall, STTs research has evolved from examining adoption and functional decision-making toward understanding experiential, psychological, and well-being outcomes. The trend toward AI-powered, personalized, and

ecosystem-oriented solutions reflects the growing emphasis on responsible, engaging, and sustainable smart tourism.

Table 6. Decision analytical approaches in STTs research

Study	Decision/Analytical Model	Decision Criteria/Variables	Decision Context	Key Contribution
[38]	Technology adoption analysis with comparative evaluation of online tourism platforms	Website attributes: accessibility, security, trust, interaction, personalization; online information sources	Travel planning and consumption	Classified online tourism information sources and identified key website attributes influencing tourists' evaluation and decision-making
[44]	Decision-support modeling for smart tourism infrastructure	Smart infrastructure, tourism experience	Smart destination management	Demonstrated how STTs assist tourists in interpreting and navigating destinations
[3]	Exploration-exploitation adoption analysis using SEM	STTs attributes, use type, security/privacy, travel satisfaction	Travel planning	Showed that STTs enhance both transactional and experiential travel satisfaction
[39]	Behavioral and experiential evaluation using SEM	STTs attributes, destination value, perceived experience, motivational values, tourist happiness	Tourist experience evaluation	Demonstrated the joint effects of STTs attributes and destination value on tourist happiness
[42]	SEM-based analysis of experience-driven behavior	Informativeness, interactivity, personalization, security/privacy, satisfaction, revisit intention	Smart tourism experience evaluation	Identified key STTs attributes influencing satisfaction and revisit intention, with moderating effects of security and privacy
[56]	SEM assessment of STTs experiences and travel outcomes	STTs experience, travel satisfaction, tourist happiness, revisit intention	Tourist experiences with STTs	Confirmed the relationships among STTs experience, satisfaction, happiness, and revisit intention
[4]	Behavioral intention modeling using SEM	Perceived STTs experience, travel confidence, travel enjoyment, travel satisfaction, revisit intention	Travel experience and revisit intention	Showed that perceived STTs experience positively influences travel experience, which in turn affects revisit intention
[23]	Experiential and well-being framework analysis	Digital well-being philosophy, acceptance–avoidance approach, policy adoption	Digital well-being in tourism	Introduced a digital well-being continuum to guide policy, stakeholder roles, and service design
[12]	Well-being assessment framework linking technology affordances to virtual experience	Modality, agency, interactivity, navigability, contextual moderators, psychological well-being	Digital tourism and virtual experiences	Proposed a framework linking technology features with virtual experiences and psychological well-being
[59]	Ambidexterity analysis of STTs impacts using SEM	Novelty seeking, tourist worries, transaction satisfaction, experience satisfaction	Travel planning and destination experience	Showed that STTs simultaneously enhance novelty and reduce uncertainty to improve satisfaction

Study	Decision / Analytical Model	Decision Criteria / Variables	Decision Context	Key Contribution
[58]	Regression-based behavioral and experience modeling	Accessibility, interactivity, perceived value, satisfaction, behavioral intentions	Visitor attractions and smart experiences	Demonstrated that smart technology attributes improve satisfaction and behavioral outcomes
[22]	SEM analysis of STTs factors on psychological well-being	Automation, security/privacy, information accuracy, personalization, perceived benefits, growth mindset	Smart tourism experience design	Linked STTs factors to tourists' psychological well-being through perceived benefits
[18]	Well-being evaluation of STTs	Life satisfaction, technology–life balance	Smart tourism well-being	Expanded STTs outcomes toward broader quality-of-life impacts
[46]	Digital detox and well-being analysis across the full tourism experience	Immersive technologies, digital detox tools, entire travel phase	Tourism digitalization	Highlighted how technology impacts travelers' psychological and social well-being
[10]	Comparative analysis of smart city tourism technologies	Usability, intelligence, ecology, interactivity, cultural factors, tourist experience	Smart city tourism	Showed that synergistic configurations of usability and ecological factors improve the tourist experience
[2]	AI-driven experiential evaluation in next-generation smart tourism	AI assistants, immersive environments	Next-generation smart tourism	Demonstrated that AI and immersive technologies drive personalization and engagement

6 Smart Tourism Technologies in Different Country Contexts

Research on STTs spans diverse countries, reflecting differences in technological maturity and tourism ecosystems. Developmental studies have provided global conceptual frameworks for understanding STTs-related systems [2, 28, 36, 43].

In technologically advanced contexts, STTs research tends to emphasise experience personalisation, smart technology trends (e.g., gamified STTs and smart devices), and destination competitiveness [43, 49, 62]. In contrast, studies in China have focused on social-aware place identification, secure location-based services, and sustainability-oriented adoption processes [20, 56]. Research in emerging economies, including Malaysia, Indonesia, Vietnam, Iran, and Thailand, has explored value co-creation, gamification, and the integration of STTs within smart city environments [14, 41]. European studies, particularly in Spain, France, and Norway, have highlighted issues related to digital well-being, online engagement, and rural smart tourism experiences [45, 54].

These findings suggest that STTs-related attributes and mechanisms do not operate uniformly across contexts, but are shaped by variations in infrastructure availability, digital literacy, and tourism development priorities. In particular, technological maturity and institutional conditions influence how STTs attributes are translated into behavioural and experiential outcomes. Moreover, while developed countries lead in advanced STTs adoption, emerging economies are increasingly exploring their potential. For example, recent research in Bangladesh indicates that STTs can influence tourists' psychological well-being within evolving digital environments [22].

Overall, the cross-country evidence indicates that STTs should be interpreted as context-dependent systems, in which similar technological components may produce different outcomes under varying socio-technical conditions.

7 Research Gaps and Future Directions in STTs Research

Despite the rapid growth of STTs research, existing studies exhibit several analytical limitations that constrain both theoretical development and practical interpretation. These limitations are not only related to data availability or application scope, but also reflect the way STTs-related systems are conceptualised and analysed.

Geographical scope: Most studies have concentrated on technologically advanced regions such as North America, Europe, and East Asia, where digital readiness, infrastructure maturity, and governance conditions are relatively stable. As a result, existing frameworks are often implicitly based on high-capacity systems and may not adequately

capture variations in less-developed or transitional contexts. This creates limitations in the generalisability of STTs-related analytical structures, particularly in explaining how technological attributes and behavioural mechanisms operate under different infrastructural and cultural conditions.

Multi-disciplinary integration: Current research largely emphasises STTs attributes and their direct relationships with satisfaction and loyalty outcomes. While recent studies have begun to incorporate emerging dimensions such as technostress, social media–induced anxiety, digital well-being, and sustainability-related behaviours, these elements are often treated in isolation. There remains limited integration of these dimensions into a coherent analytical structure that explains how multiple mechanisms interact within STTs-enabled systems.

Research design: Most empirical studies rely on cross-sectional data, focusing on single-stage observations of user behaviour and experience outcomes. This restricts the ability to analyse dynamic processes, such as how STTs usage, behavioural responses, and well-being outcomes evolve over time or across different phases of travel. As a result, the temporal dimension of outcome formation remains underexplored.

Policy and business impact: Existing studies predominantly focus on individual-level behavioural outcomes, with relatively limited attention to system-level implications, including organisational performance, destination-level dynamics, and financial outcomes. This creates a gap in understanding how STTs-related mechanisms scale from individual experience to broader system performance and strategic decision contexts.

Overall, these limitations indicate that current STTs research remains fragmented in its analytical structure, with insufficient integration across attributes, mechanisms, and outcomes. Addressing these gaps requires a more systematic approach to modelling the interactions among technological, behavioural, and contextual components within smart tourism systems.

8 Implications

This systematic review synthesizes a decade of research (2015–2025) on STTs and organises existing studies into a multi-level analytical structure. The findings show that STTs can be interpreted as experience-oriented systems in which technological attributes, mediating and moderating mechanisms, and contextual conditions jointly shape tourism outcomes across the travel journey. The analysis also clarifies how these elements have evolved over time and how they are linked to cognitive, affective, behavioural, and well-being outcomes.

The evidence indicates that the effectiveness of STTs cannot be attributed to technological features alone, but depends on how these features interact with user characteristics, service configurations, and contextual conditions. In this sense, elements such as infrastructure availability, digital skills, system usability, and trust function as critical variables influencing how STTs-related mechanisms translate into observable outcomes. Similarly, advanced technologies, including AI, play a role in shaping experience formation across different travel phases, particularly when combined with user preferences and situational factors. These patterns suggest that STTs should be interpreted as system-level configurations rather than isolated tools.

STTs are also associated with broader sustainability-oriented developments in tourism systems. The integration of digital technologies contributes to economic activity, service coordination, and tourism-related employment, as reflected in prior studies [7, 28, 43, 67]. At the same time, STTs support the development of data-informed governance and destination management practices [21], including the integration of tourism systems with smart city infrastructures and mobility solutions [6, 48]. These processes influence how tourism systems operate in relation to resource use, environmental impact, and urban development.

In addition, STTs are linked to changes in consumption patterns and user behaviour, including the emergence of digital well-being, digital detox practices, and technology-related psychological responses [22, 23, 46]. While these developments highlight the potential of STTs to support more sustainable and balanced tourism systems, they also reveal challenges such as technostress and information overload, which may affect user experience and behavioural outcomes [60]. Overall, the findings indicate that STTs-related outcomes emerge from the interaction between technological, behavioural, and contextual elements, and therefore require analysis within an integrated system perspective.

9 Conclusion

This study synthesises a decade of research on STTs and interprets them as a structured system in which technological attributes, behavioural mechanisms, and contextual conditions jointly shape tourism outcomes. Rather than treating STTs as isolated tools, the analysis organises existing evidence into a multi-level framework that explains how experience formation emerges across different stages of the travel journey.

The findings indicate that the effects of STTs are not determined by technological innovation alone, but depend on how technological attributes interact with user characteristics, service configurations, and contextual environments. In this process, mediating and moderating mechanisms play a central role in translating technological features into cognitive, affective, behavioural, and well-being outcomes. This interpretation highlights the importance of analysing STTs as an integrated system rather than as a set of independent components.

At the same time, the review identifies several limitations related to data scope and the pace of technological development. The focus on English-language, peer-reviewed publications may restrict the representation of emerging practices, while rapid advancements in artificial intelligence, immersive technologies, and phygital systems suggest that empirical evidence may not fully capture ongoing changes in smart tourism environments.

Overall, the study indicates that STTs-related outcomes emerge from the interaction between technological, behavioural, and contextual elements. Understanding these interactions requires a systematic analytical approach that considers both the structure of STTs systems and the conditions under which they operate.

Author Contributions

Conceptualization: M.A., R.S., and I.H.; methodology: M.A. and I.H.; software: M.A. and R.S.; validation: M.A., R.S., and I.H.; formal analysis: M.A.; investigation & data curation: M.A. and R.S; writing – original draft preparation: M.A.; writing – review & editing: R.S. and I.H. All authors have read and agreed to the published version of the manuscript.

Data Availability

The data supporting the findings of this study are derived from published literature and are available within the article and its referenced sources.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

Declaration on the Use of Generative AI and AI-assisted Technologies

Generative AI and AI-assisted technologies were used solely to support language refinement and grammatical editing during the preparation of this manuscript.

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List of Abbreviations

STTs	Smart Tourism Technologies
MTEs	Memorable Travel Experiences
RFID	Radio Frequency Identification
IoT	Internet of Things
AI	Artificial Intelligence
VR	Virtual Reality
AR	Augmented Reality
XR	Extended Reality
MR	Mixed Reality
SDGs	Sustainable Development Goals
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
TRA	Fluid (pure water)
TPB	Theory of Planned Behavior
TAM	Technology Acceptance Model
SEM	Structural Equation Modeling
PERMA	Positive Emotion, Engagement, Relationships, Meaning, and Accomplishment