

Decoding AI adoption in tourism: A multi-theoretical analysis based on a theory-in-use approach¹

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Abstract

Frame of the research: This study explores how artificial intelligence (AI) is perceived and applied in the tourism industry, using the theory-in-use (TIU) approach to analyse the gap between AI's theoretical potential and its practical implementation. Sociomateriality, service-dominant logic and affordance theory are combined to examine how tourism stakeholders incorporate AI into marketing, experience design, and organizational processes.

Methodology: We conduct an exploratory qualitative study based on a purposive sample of 16 semi-structured interviews with destination management organizations and service providers. The data are analysed thematically to identify patterns within the tourism ecosystem.

Results: The TIU analysis reveals three core findings. First, AI is performatively entangled with existing routines, producing sociomaterial configurations oriented toward stabilization rather than transformation. Second, managers use AI predominantly as a passive tool for operational optimization, a defensive operationalization that limits resource integration and co-creative value generation. Third, the actualization of affordances remains systematically constrained by literacy deficits, cultural resistance, and ecosystem fragmentation. These mechanisms are causally interconnected, and socio-material inertia shapes the managerial logics that drive these practices.

Research limits: Results are time-bound and context-specific, calling for longitudinal and cross-country studies.

Practical implications: Organizations should integrate co-creation outcomes alongside efficiency metrics in AI evaluation, develop managerial capabilities for multi-actor resource integration and pursue coordinated ecosystem-level action to reduce affordance under-actualization.

Originality of the paper: The study's originality lies in identifying the causal mechanisms that explain the gap between AI's theoretical potential and its practical enactment in tourism through an integrated TIU-based multi-theoretical lens.

Keywords: artificial intelligence; tourism experience management; theory-in-use; digital transformation; destination management

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1. Introduction

Artificial intelligence (AI) and related technological advances are transforming collaborative value creation among tourism ecosystem stakeholders, including public organizations, private operators, digital platforms, tourists and local communities (Lu *et al.*, 2019). The AI tourism market is projected to expand from \$2.95 billion in 2024 to \$13.38 billion by 2030, representing a compound annual growth rate of 28.7% (Research and Markets, 2024) and confirming tourism as a sector where AI is gaining significant momentum. In this context, AI-enabled technologies serve multifaceted roles in enhancing operational efficiency and delivering personalized tourist experiences (Gursoy, 2025; Samara *et al.*, 2020). Destination marketing organizations (DMOs) and tourism operators are key actors in destination governance and service delivery that are increasingly expected to leverage AI to manage tourist flows, optimize resource allocation (Tussyadiah, 2020), and deliver personalized services and real-time information, thereby enhancing visitor satisfaction and loyalty (Tussyadiah and Miller, 2019).

Research examining technology adoption within the tourism sector has experienced substantial growth in recent years. For example, Kong *et al.* (2023) highlighted a relevant increase in AI-related publications and citations within tourism and hospitality literature after 2018, with acceleration following the COVID-19 pandemic. Despite this progress, a gap persists between academic research on digital technologies and their practical implementation within the tourism industry (Law *et al.*, 2024) and destination management. This gap reflects broader digital transformation challenges facing tourism organizations (Brunetti *et al.*, 2020), including legacy infrastructure constraints, organizational inertia and the complexity of integrating emerging technologies into established service delivery models (Buhalis and Sinarta, 2019; Gretzel *et al.*, 2015).

While the extant literature thoroughly documents the functional capabilities of AI (Durmaz and Başer, 2023) and its impact on tourist experiences (e.g. Gursoy and Cai, 2025; Tussyadiah, 2020), the current understanding of the decision-making logics driving AI integration within destinations and among tourism providers remains limited. Tourism organizations often struggle to move beyond pilot projects and achieve scalable, systematic AI adoption due to resource constraints, skills gaps and uncertainty about return on investment (Buhalis *et al.*, 2019; Ivanov and Webster, 2019). Research-practice gap persists regarding how strategic actors within the tourism ecosystem can translate the theoretical potential of AI into actionable marketing strategies - that is, how they reconcile innovation imperatives with concrete operational constraints (Della Corte *et al.*, 2025; Shin and Perdue, 2022). To explore these gaps, this study adopted an integrated multi-theoretical perspective, combining sociomateriality, service-dominant logic (SDL) and affordance theory, interpreted through the theory-in-use (TIU) approach (Argyris and Schön, 1974; Zeithaml *et al.*, 2020), to analyse how DMOs and tourism operators perceive and enact AI in practice.

2. Theoretical Background

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AI's impact on tourism is a complex phenomenon characterized by heterogeneous adoption patterns (Tussyadiah, 2020). This heterogeneity requires a multi-theoretical lens to capture the technological, organizational and socio-cultural implications of AI integration in this sector. While prior studies have examined the adoption of digital technologies in tourism (Ivanov *et al.*, 2017; Kumar *et al.*, 2024), the specific mechanisms through which AI transforms value creation dynamics remain underexplored.

This study adopted a multi-theoretical perspective to address this gap, where the selected frameworks assume distinct and complementary analytical roles. Sociomateriality, SDL and affordance theory were employed as interpretive lenses, while TIU operated as a transversal perspective to uncover the managerial logics shaping AI adoption in practice. The concept of sociomateriality was used to describe how AI becomes embedded in organizational routines. SDL provided an evaluative lens to assess the depth of resource integration enabled by AI adoption. Affordance theory was used to explain why certain technological possibilities are actualized while others remain latent. Across these dimensions, TIU allowed the identification of the implicit managerial logics that guide decision-making, often diverging from both theoretical assumptions and stated strategic intentions.

Sociomateriality

Sociomateriality examines how social and material elements interact and co-constitute each other in complex environments from an organizational theory standpoint (Orlikowski, 2007; Orlikowski and Scott, 2008). Organizational reality thus emerges from the ongoing entanglement between humans and technologies, which are conceived as mutually constitutive rather than as separately interacting entities. This perspective is well-suited to understanding how digital technologies reshape organizational practice (Leonardi and Barley, 2010), especially in tourism, where digital platforms and AI-powered systems reconfigure relationships among destinations, service providers and tourists throughout the entire service provision process (Borges-Tiago and Avelar, 2025; Frisch *et al.*, 2019). Physical and digital elements accordingly function within smart tourism ecosystems as co-constitutive dimensions of the service environment (Buhalis *et al.*, 2019). This constitutive entanglement shapes how AI is perceived and enacted within the tourism ecosystem. As Meske and Junglas (2021) have demonstrated, the interplay of technological capabilities, user competencies and organizational context generates varied uses, such that the same AI-powered recommendation system can differ dramatically in its outcomes depending on users' technological literacy, cultural background and circumstances (Zhang *et al.*, 2021). AI can actively reconfigure experiences by weaving together physical and digital touchpoints (Neuhofer *et al.*, 2014), ultimately catalysing new forms of value co-creation between human and non-human actors in the tourism ecosystem (Tussyadiah, 2020). In this study, sociomateriality was used to

examine how AI becomes embedded in routines and day-to-day practices as an integral component of organizational processes.

Service-Dominant Logic and Value Co-Creation

SDL positions value as co-created through the integration of resources among multiple actors within service ecosystems, which shifts analytical attention to relational processes (Vargo and Lusch, 2004). In this framework, the boundary between production and consumption is inherently permeable, as guests participate in value creation through their interactions with service providers, physical environments and technology interfaces (Shaw *et al.*, 2011). This dynamic is particularly salient in tourism, where destinations, operators, the local community and tourists continuously co-generate experiential value (Cabiddu *et al.*, 2013).

Within this framework, tourism organizations must strategically manage value co-creation by facilitating resource integration across diverse stakeholders, particularly given that tourists bring their own competencies, knowledge and expectations into service encounters (Cabiddu *et al.*, 2013). Digital channels have amplified these dynamics, and introduced new consumption patterns and service configurations that progressively reconfigure how, when and where value is co-created across the tourism ecosystem (Luceri *et al.*, 2023). SDL consolidates resource integration as the foundational mechanism of value co-creation (Vargo and Lusch, 2016). From this perspective, AI is a platform through which heterogeneous resources - including tourist preferences, destination knowledge, service provider competencies and real-time contextual data - are dynamically integrated to generate emergent value configurations (Akaka and Vargo, 2014; Buhalis *et al.*, 2019; Huang and Rust, 2021; Lin *et al.*, 2025). This reconceptualization shifts the analytical attention from the properties of the technology itself towards the quality and depth of the resource integration processes it enables. In this study, SDL was employed to examine how AI mediates resource integration among tourism actors, as well as whether its adoption advances relational, multi-actor co-creation processes.

Affordance Theory

Affordance theory, originally described by Gibson (1979) and extended to technology by Leonardi (2011), posits that a technology's material properties interact with users and social context, thus enabling or constraining actions. This proves particularly suited to examining why AI implementations in the tourism sector generate very different results depending on organizational context and user capabilities (Florido-Benítez and del Alcázar Martínez, 2024). Self-service check-in systems or data analytics platforms, for example, generate action possibilities only when users recognize their value, possess adequate digital competencies and operate within supportive infrastructural conditions. Limited digital literacy, app fragmentation and infrastructure gaps constitute relational constraints that systematically inhibit the actualization of AI affordances across tourism contexts (Chen *et al.*, 2024; Leonardi, 2011).

A theoretically significant distinction within affordance theory concerns the gap between potential and actualized affordances. While technological systems contain a range of action possibilities, these are only realized when actors perceive them as relevant to their goals and possess the competencies and material conditions required to engage with them (Leonardi, 2011; Meske and Junglas, 2021). In tourism ecosystems, this actualization gap is compounded by a further dimension that individual-level analyses tend to overlook - namely, the fragmentation of technological infrastructures across destination stakeholders. When each attraction, accommodation provider or transport operator deploys proprietary digital systems with limited interoperability, the threshold for affordance actualization rises in ways that cannot be attributed to a deficit in any single actor's competence. Co-creation failures of this kind are emergent properties of the ecosystem rather than individual adoption barriers, and the analysis of such failures requires a level of observation that extends beyond the dyadic user-technology relationship (Chen *et al.*, 2024; Sustacha *et al.*, 2023). In this study, affordance theory was employed to examine which potential affordances of AI are actualized by tourism providers and which remain latent, with a focus on the organizational, infrastructural and competence-related conditions that mediate this actualization.

Integrating the Frameworks: Towards a TIU Approach

This study adopted an integrated multi-theoretical framework to analyse AI adoption in the tourism sector. Sociomateriality (Orlikowski, 2007; Orlikowski and Scott, 2008) was employed to describe how AI becomes entangled with organizational routines in tourism contexts, revealing how social and material elements co-constitute daily practices. SDL (Vargo and Lusch, 2004, 2016) provided the interpretive lens for assessing the quality of resource integration processes and examining the extent to which AI adoption actualizes the co-creative potential of tourism service ecosystems (Akaka and Vargo, 2014; Buhalis *et al.*, 2019; Lin *et al.*, 2025). Affordance theory (Gibson, 1979) was used to explain the relational conditions that determine why specific AI applications are actualized while others remain latent, while considering how technological properties interact with user competencies and material infrastructure to enable or constrain particular uses (Chen *et al.*, 2024; Meske and Junglas, 2021). Following the use of these theoretical lenses, TIU (Argyris and Schön, 1974; Zeithaml *et al.*, 2020) was applied to uncover the actual managerial decision-making logics generating the observed outcomes and explain why managers' practical behaviours diverge systematically from the co-creative logic that SDL identifies as central to value generation (Errichiello and Micera, 2021; Kaur *et al.*, 2024).

The integration of these perspectives enables a layered analytical progression, from the situated practices through which AI becomes embedded in organizational routines, to the assessment of whether these enactments advance resource integration as the co-creative foundation of tourism service ecosystems, to the relational conditions that determine which affordances are actualized. TIU operates across all three layers, and brings to the surface the implicit managerial logics that shape each

dimension of AI adoption in practice. Against this backdrop, this study examined how tourism managers perceive and enact AI in practice, with a focus on the managerial logics that shape its use and their implications for resource integration and value co-creation. To structure the analysis, the remainder of this paper is organized as follows: after introducing the theoretical background, we provide the details of the research methodology, present and discuss the main findings, and conclude with theoretical and managerial implications, as well as limitations and directions for future research.

3. Methodology

This qualitative exploratory study adopted a TIU approach (Argyris and Schön, 1974), which is a suitable methodological tool to uncover the implicit managerial logics that shape emerging phenomena in applied marketing (Möller *et al.*, 2020). Sixteen semi-structured interviews were conducted with tourism operators and DMO managers (DMOs, hospitality, travel intermediaries, heritage sites managers and airport tourism technology providers) chosen through purposive sampling (Patton, 2002), prioritizing smart destinations and tourism actors active or interested in using AI technologies, including virtual assistants, robots, predictive algorithms, virtual or augmented reality (VR/AR), and recommendation platforms (see Appendix A). The sample size was defined according to the principle of information power (Malterud *et al.*, 2016), and 16 cases were considered sufficient to ensure analytical depth, given the alignment between the sample and research objectives. The interviews were conducted in two phases, with an initial round in early 2023 and a subsequent one between late 2024 and early 2025, allowing for the refinement and validation of emerging themes. Interviews lasted 45-60 minutes, were conducted online in the participants' native language and followed a flexible semi-structured protocol. The interviews investigated both the specific technologies currently in use or under exploration, and their strategic relevance for experience design and service delivery. Participants were asked to reflect on the perceived functionalities and benefits of adopted technologies, barriers to adoption, managerial implications, and processes of value creation.

The analytical process adhered to the coding approach developed by Saldana (2021) and involved an initial independent coding by two researchers to ensure intercoder reliability and minimize interpretive bias. This was followed by collaborative theme development, refinement and validation through consensus-building discussions. Codes were then interpreted in relation to the sociomateriality, SDL and affordance theory frameworks, allowing theoretical insights to emerge through an iterative dialogue between data and theory. Within this framework, TIU was operationalized by systematically distinguishing between managers' espoused theories - the strategic intentions and objectives declared regarding AI adoption - and their TIUs, inferred through the thematic analysis of descriptions of actual practices, decision-making routines and operational priorities that emerged across the interviews. All ethical considerations were addressed and communicated to participants,

ensuring anonymity, informed consent and secure management of direct quotations (Wiles, 2012).

4. Findings and Discussion

The analysis identified four primary topics, which were further articulated into 10 themes and 32 sub-themes (Table 1). The insights that emerged from the analysis highlight how tourism practitioners conceptualize AI supporting both experiential personalization and operational optimization.

Beyond this descriptive classification, the findings revealed a set of underlying mechanisms that cut across the identified themes. First, a sociomaterial inertia mechanism highlighted how existing practices tend to absorb AI without substantial reconfiguration. Second, a defensive operationalization mechanism emerged, whereby AI is primarily adopted to stabilize and optimize existing routines rather than to transform them. Third, an affordance under-actualization mechanism explained why several AI functionalities remain latent due to limited user capabilities, fragmented technological systems and organizational constraints. These mechanisms provide a deeper explanatory layer that connects the thematic structure to the managerial logics shaping AI enactment.

*Tab. 1: Perceived Applications and Barriers of AI in Tourism:
Perspective of DMOs and Tourism Operators*

Topic/ Theme	Sub-theme
1. AI-driven experience	
AI-enabled data-driven marketing	CRM systems; Data analytics
AI-driven personalization	Image modification; Chatbots, Geolocation; Customer support; Edutainment; Enhanced storytelling - Narrative and immersive tools for engagement
2. Operational efficiency	
AI-driven Service Automation and Infrastructure Optimization	Check-in kiosks; Payment simplification; App functionality, and Modular construction; Cleaning automation; Economic sustainability - Reducing operating costs and providing service sustainability
3. Traveler journey management	
Pre-travel	Personalized travel planning; Information access and trip organization; Expectation management
During-travel	Real-time info and orientation; Personalized recommendations; On-site assistance; Cultural heritage preservation—managing tourist flows, enhancing the destination engagement
Post-travel	Maintaining connection; Experience recalls and reinforcement
4. Barriers and resistance	
User-related barriers	Age and digital literacy; Perceived utility; Information overload, and User acceptance
Cultural factors	Resistance to change; Payment preferences
Technology-related issues	App fragmentation, Connectivity issues, Device limitations
Adoption challenges	Awareness and communication gaps

Source: Authors' elaboration

From a marketing perspective, AI enables the development of highly personalized and immersive tourism experiences through sophisticated data analytics, interactive technological tools and engaging digital narratives that enhance visitor engagement. These enabling technologies strengthen tourists' emotional connections with destinations, while also facilitating sophisticated visitor profiling and significantly improving the ability of tourism organizations to manage the entire customer journey through relational and interactive approaches while enhancing the industry's customer relationship management practices.

From a managerial perspective, AI adoption is strongly associated with enhanced operational and infrastructural efficiencies. It yields substantial impacts on service automation capabilities, economic sustainability metrics and strategic management of tourism flows throughout destination ecosystems. Respondents evaluated AI-enabled technologies primarily based on their demonstrated ability to rationalize resource allocation, standardize operational processes and maintain consistent service quality standards even within highly complex and variable tourism contexts. These assessments reflect sociomaterial entanglements, resource integration dynamics and affordance actualization processes that shaped subsequent analysis, which examines these findings through the three theoretical lenses identified in this study. The empirical findings reveal how AI-based technologies become deeply integrated into complex sociomaterial practices (Table 2), progressively reconfiguring tourism ecosystems through dynamic, multidirectional interactions between social actors and material technological elements.

Tab. 2: Sociomateriality

Service Delivery			
Sub-Theme	Description	Sample Quote	Quote ID
AI-Human interactions	Conversational AI interfaces transform the ontology of customer service, creating a new approach to service provision and influencing human-machine interactions.	"We are trying to understand, for example, if through products like ChatGPT, we can automate 90% of customer requests through chat."	7
Physical practices optimization	The constitutive entanglement of routine hospitality practices with technological agents.	"Various routine guest service requests within hotels can be automated: from extra pillows and wake-up calls to taxi bookings and inquiries about museum partnerships."	3
Cultural-Technology Interactions			
Visual reconfiguration	AI systems actively participate in constituting new tourism realities, and destinations become fluid rather than fixed as a physical location.	"We are planning to explore AI systems that could take visual inputs, such as photos of the two towers, and reconstruct or remodel them according to different artistic styles and formats tailored to various target audience profiles and interests."	5
Cultural persistence	Technological and cultural elements become mutually constitutive, creating new forms of existence for historical artifacts that are neither purely digital nor physical.	"Maintaining museums and cultural venues is financially difficult from an economic point of view, but through these technologies, we can make places usable that would otherwise be inaccessible now or soon."	6
Socio-Cultural Adoption Dynamics			
Organizational inertia	The relationship between technological implementation and organizational practices.	"After several years of evaluation, we are now equipped with a CRM that allows us, even in an automated way, to send communications, emails, and newsletters in all the various phases, let's say."	15
Culturally embedded routines	The regional performativity of practices demonstrates how seemingly "technical" functions are related to social routines.	"[...] I realize that, for example, in Italy at a cultural level, the fact of paying in cash is different from London."	8
Ecosystem challenges	Technology adoption manifests as a reconfiguring of established relations between different players across the destination.	"I see more difficulty in making them use it... so maybe... we need an effort of greater information when the tourist arrives at the destination to give him immediately what's available in the city and the tools he can use."	9

Source: Authors' elaboration

The first thematic cluster demonstrates how AI technologies, particularly self-service systems and sophisticated digital assistants, generate new forms of participation modalities within established service processes, thus reconfiguring traditional service encounter structures. This finding aligns with the theoretical contributions of Orlikowski and Scott (2008) and emphasize how socio-technological relations generate constitutive entanglements that fundamentally redefine service practices themselves rather than merely augmenting existing processes. At the same time, studies such as Bulchand-Gidumal *et al.* (2024) have emphasized how the integration of self-service technologies positively affects operational efficiency and perceptions by creating new forms of user interaction. The perceived utility and familiarity of AI-powered conversational interfaces, including voice assistants, further conditions the extent to which these technologies are integrated into service interactions (Patrizi *et al.*, 2021).

The second thematic cluster, culture-technology interactions, highlights how AI modifies, reinterprets and reconfigures cultural heritage experiences, thus demonstrating the constitutive role of these technologies in constructing and maintaining smart tourism destinations as dynamic, evolving entities (Gretzel and Koo, 2021). This evidence also extends the work by Femenia-Serra and Neuhofer (2018) on immersive technologies in cultural tourism contexts by highlighting the transformative potential of sophisticated digital platforms to fundamentally redefine how visitors perceive, engage with and derive meaning from artistic and cultural heritage assets.

The third thematic cluster reveals how socio-cultural dynamics shape the conditions under which AI is absorbed into organizational routines. Organizational inertia emerged as a key mechanism through which existing practices tend to incorporate AI incrementally rather than through transformation, thus confirming the sociomaterial perspective that technology adoption is mediated by the inertia of established routines and cultural norms (Orlikowski, 2007). Culturally embedded practices (e.g. regionally specific payment preferences) further demonstrate how seemingly technical choices are inseparable from social and cultural contexts, which reinforces the constitutive entanglement between material and social elements. At the ecosystem level, coordination failures among destination stakeholders compound these dynamics by generating adoption barriers that exceed individual organizational constraints and require the collective reconfiguration of sociomaterial arrangements (Tuomi and Tussyadiah, 2020). This sociomaterial inertia is reflected in the managerial logics observed in this study, whereby managers tended towards defensive operationalization as the dominant mode of AI integration.

These findings about AI integration are consistent with those of other studies analysing tourism practices. The sociomaterial perspective reveals how digital systems become inextricably woven into the daily operational fabric of tourism organizations (Borges-Tiago and Avelar, 2025; Tuomi and Tussyadiah, 2020) to create inseparable entanglements between technological affordances and human practices (Orlikowski and Scott, 2008). This hybridization is evident in multiple dimensions, including conversational AI interfaces in customer service interactions (Alharbi *et*

al., 2026), robot integration in hospitality routines (Cheong *et al.*, 2026) and AR systems for physical heritage sites and their digital representations (Femenia-Serra and Neuhofer, 2018).

These hybrid configurations cannot be understood through a purely technological lens that privileges material affordances, nor through a purely social lens that overlooks material constraints. Rather, they emerge from the dynamic, ongoing processes of negotiation and adaptation through which tourism stakeholders remake the sociomaterial texture of tourism experiences. In this sense, AI adoption in tourism is an ongoing performative process through which technology and social structures reciprocally shape each other, often generating outcomes that diverge from initial strategic intentions (Chowdhury *et al.*, 2022; Keller *et al.*, 2019). Building on these sociomaterial dynamics, Table 3 illustrates how AI supports resource integration processes and enables new forms of value co-creation across the tourism ecosystem.

Tab. 3: SDL

Service Delivery			
Sub-Theme	Description	Sample Quote	Quote ID
AI-Human interactions	Conversational AI interfaces transform the ontology of customer service, creating a new approach to service provision and influencing human-machine interactions.	"We are trying to understand, for example, if through products like ChatGPT, we can automate 90% of customer requests through chat."	7
Physical practices optimization	The constitutive entanglement of routine hospitality practices with technological agents.	"Various routine guest service requests within hotels can be automated: from extra pillows and wake-up calls to taxi bookings and inquiries about museum partnerships."	3
Cultural-Technology Interactions			
Visual reconfiguration	AI systems actively participate in constituting new tourism realities, and destinations become fluid rather than fixed as a physical location.	"We are planning to explore AI systems that could take visual inputs, such as photos of the two towers, and reconstruct or remodel them according to different artistic styles and formats tailored to various target audience profiles and interests."	5
Cultural persistence	Technological and cultural elements become mutually constitutive, creating new forms of existence for historical artifacts that are neither purely digital nor physical.	"Maintaining museums and cultural venues is financially difficult from an economic point of view, but through these technologies, we can make places usable that would otherwise be inaccessible now or soon."	6
Socio-Cultural Adoption Dynamics			
Organizational inertia	The relationship between technological implementation and organizational practices.	"After several years of evaluation, we are now equipped with a CRM that allows us, even in an automated way, to send communications, emails, and newsletters in all the various phases, let's say."	15
Culturally embedded routines	The regional performativity of practices demonstrates how seemingly "technical" functions are related to social routines.	"[...] I realize that, for example, in Italy at a cultural level, the fact of paying in cash is different from London."	8
Ecosystem challenges	Technology adoption manifests as a reconfiguring of established relations between different players across the destination.	"I see more difficulty in making them use it... so maybe... we need an effort of greater information when the tourist arrives at the destination to give him immediately what's available in the city and the tools he can use."	9

Source: Authors' elaboration

Resource integration emerged as a fundamental explanatory mechanism elucidating how sophisticated AI systems enable the strategic integration of technological, informational and human resources to co-create meaningful, contextually relevant travel experiences. For instance, technologies can generate context-specific recommendations by relying on a tourist's physical location in combination with data gathered and assessed using AI. Similarly, AI-driven customization mechanisms use tourists' historical behaviours and stated preferences, which enables these mechanisms to co-create tailored experiences throughout the tourists' journey. These technologies demonstrate how AI can connect and enrich human and technological resources, thus highlighting SDL's emphasis on all actors as resource integrators within the tourism ecosystem. While SDL conceptualizes AI as an active platform for resource integration, the TIU analysis revealed that managers predominantly treat it as a passive tool for operational optimization, thus limiting the depth of co-creative value generation that SDL envisions. These managerial logics appear to influence how AI possibilities are perceived and enacted in practice, ultimately limiting affordance actualization to those functions that align with existing operational priorities.

These findings suggest that AI-mediated interactions progressively blur the temporal and functional boundaries separating the traditionally understood phases of travel - that is, pre-trip, on-site and post-trip (Manser Payne *et al.*, 2021; Neuhofer *et al.*, 2014). In the AI-mediated interactions, the phases of the traditional tourist journey merge into overlapping cycles of planning, engagement, reflection and re-engagement. Pre-trip planning activities enabled by AI-powered recommendation engines and predictive analytics continue iteratively throughout the journey as conditions change and tourist preferences evolve in real-time. On-site experiences are continuously enriched through retrospective reflection and forward-looking anticipation, which are mediated through mobile applications and social platforms. Finally, post-trip engagement becomes recursive as AI systems prompt new travel planning based on historical preferences, thereby collapsing the temporal distance between the conclusion of one journey and the inception of the next (Huang and Rust, 2021; Mariani and Wamba, 2020).

This recursive architecture reflects a fundamental shift in how value is created and co-created within tourism ecosystems. Rather than value accumulation occurring sequentially across distinct phases, value emerges continuously through cyclic processes of learning, adaptation and mutual constitution between tourists, service providers and AI systems. Tourists move from passive consumers of pre-determined experiences to active participants in the continuous co-creation and refinement of their travel narratives. AI systems transition from passive information repositories to active agents that anticipate, suggest and learn from evolving tourist preferences. Finally, tourism organizations shift from phase-based segmentation of customer interactions towards holistic, longitudinal relationship management that spans multiple journeys and timeframes (Buhalis *et al.*, 2019; Li *et al.*, 2021).

Affordance theory reveals how action possibilities and constraints emerge from the interplay between technological features, user capabilities and material contexts, further unpacking the relational nature of AI's influence across the tourism ecosystem (see Table 4).

Tab. 4: Affordance Theory

Sub-Theme	Description	Sample Quote	Quote ID
AI-Enabled Actions			
Self-service activities	The ability for guests to independently complete arrival processes without staff intervention, enabled by digital kiosk interfaces and mobile applications.	"[...] an app, allowing customers to register, check in, scan passports, and generate digital room keys directly from their smartphones."	11
Autonomous maintenance possibilities	The ability of hotel staff to delegate routine tasks to robotic systems, freeing human resources for more complex service interactions.	"We are testing robots for cleaning common areas, especially the floor."	12
Space accessibility affordances	The ability of cultural institutions to make previously inaccessible spaces available to visitors through technological mediation, overcoming physical or economic constraints.	"Another thing for us as an institution is to be able to make accessible places that otherwise could not be, also for reasons of economic sustainability. Today, even keeping a museum open is difficult."	9
AI-Enabled Data management			
Customer insight	The ability of tourism industry managers to visualize and access customer preference patterns that would otherwise remain invisible is enabled by CRM systems.	"We have a CRM system that allows us to direct the service of editorial products and commercial products to the end user, but it is in an initial phase of development."	7
Visitor behavior perception	The ability of destination managers to perceive patterns in tourist interests through analytics interfaces.	"The system, integrated with Google Analytics, provides real-time data on visitor interactions with digital signage, including the geographical origin of users and which monuments generate the most interest."	9
Targeted communication possibilities	The ability to direct promotional content to specific audience segments based on algorithmic matching.	"The second aspect concerns advertising, where we are experimenting and will continue to experiment throughout 2023 with a series of programmatic campaigns."	2
User-Dependent Constraints			
Age-related perception barriers	The ability of older tourists to perceive and actualize technological affordances due to unfamiliarity with digital interfaces.	"We typically engage with an older demographic who possess greater financial resources. These tourists tend to interact more extensively with our services due to their specific needs and requirements."	7
Value recognition constraints	The limited ability of users to perceive the utility of technological features when the afforded actions don't align with their perceived needs.	"Even at 25 years old, I don't always see the value in similar technology. It's not always about using it because it's entertaining."	2
Attention allocation limitations	The constrained ability of tourists to engage meaningfully with both physical and digital environments simultaneously, creating competing affordances.	"Technology often overloads our experiences; we interact with people while simultaneously checking our smartphones or documenting moments through photographs. It frequently leads to a deterioration rather than an enhancement of the actual experience."	7
Material Constraints			
Interoperability limitations	The ability of tourists to move between different attraction experiences is due to fragmented technological ecosystems requiring multiple applications.	"The fragmentation of tourism applications is problematic. When each museum or site demands its own app, users become overwhelmed before they even begin exploring."	7
Connectivity-dependent affordances	The contingent nature of digital service affordances that disappear in environments lacking adequate network infrastructure.	"[...] There I wondered, 'Who developed the app and didn't think that maybe the customer doesn't always have the connection available?'"	8
Device-dependent action possibilities	The conditional availability of technological affordances that exist only for users with specific types of devices creates uneven access to digital experiences.	"[...] We can launch new services, but our clients don't have the latest generation phones."	10

Source: Authors' elaboration

The first thematic cluster encompasses the range of potential actions that emerge specifically when diverse users engage with AI technologies within contextually situated tourism environments. Self-service affordances, for instance, emerge at the intersection of digital interfaces and guest independence, thus enabling tourists to perform tasks previously mediated by staff. Similarly, autonomous maintenance possibilities represent affordances that emerge for hospitality operators and could allow human resources to be redirected towards high-value interactions. These findings align with Leonardi's (2011) conceptualization of affordances as relational possibilities that arise between technological features and tourists' practices.

The second thematic cluster, AI-enabled data management, represents distinct action possibilities that emerge from technological systems' ability to make patterns and relationships intelligible to users. This evidence is in line with other studies (Chen *et al.*, 2024) in which it emerged that AI extends traditional conceptions of affordances as enablers into the domain of data-driven decision-making. The third thematic cluster comprehensively addresses the various constraints that emerge directly from the inherent material properties and technological limitations of AI systems deployed in tourism contexts. Similarly, connectivity-dependent affordances highlight how digital action possibilities are contingent upon the availability of infrastructure and disappear entirely in areas lacking adequate connectivity.

The threshold for actualization of AI affordances increases in a non-linear activity within fragmented technological ecosystems, which generates ecosystem-level co-creation failures that cannot be reduced to or explained by individual-level adoption barriers (Chen *et al.*, 2024; Leonardi, 2011). This insight represents a critical expansion of affordance theory towards recognizing system-level phenomena that emerge from the aggregate effects of technological fragmentation, infrastructure gaps and coordination failures among ecosystem actors. Traditional affordance theory, as applied to tourism, typically operates at the dyadic level to examine how individual users perceive and actualize technological possibilities given their competencies, goals and immediate material contexts (Florido-Benítez and del Alcázar Martínez, 2024). However, empirical evidence from tourism ecosystems suggests that ecosystem-level fragmentation creates emergent constraints that exceed the sum of individual barriers. For instance, when each attraction develops its own proprietary service application (e.g. an app), the need to navigate fragmented applications increases tourists' cognitive load and interface learning demands. This fragmentation undermines the design principles that Norman (1999) identified as central to effective affordance perception - namely clarity, consistency and intuitive interaction between users and technological interfaces. The realization of AI affordances in offering seamless and continuous personalization across the entire destination experience is thus systematically inhibited as a result of this fragmentation (Meske and Junglas, 2021).

These ecosystem-level phenomena necessitate a reorientation of how tourism organizations approach AI adoption. Rather than viewing AI integration as an individual organizational problem that can be solved

through technology selection, staff training and user interface design, an ecosystem perspective suggests that substantial portions of AI's transformative potential remain unrealizable through individual action. To realize these affordances, there must be coordinated action across ecosystem stakeholders - including DMOs, individual tourism operators, technology providers and regulatory bodies - to establish interoperability standards, infrastructure investments and data governance frameworks that permit seamless integration across the tourism value chain (Sustacha *et al.*, 2023).

The TIU analysis revealed that managers' actual decision-making logics systematically constrain the resource integration processes that SDL identifies as the foundation of value co-creation (Vargo and Lusch, 2004, 2016). This occurs through pragmatic navigation of the organizational constraints, skills deficits and uncertainty that characterize the contemporary tourism industry. Managers in this study applied AI through low-integration logics that prioritized the optimization of existing processes and cost reduction, thereby limiting the depth and quality of resource integration that transformative co-creation would require (Buhalis *et al.*, 2019). These findings suggest that the gap between the potential and the actual use of AI stems primarily from the managerial logics that guide its enactment. AI tends to be embedded within existing routines in ways that stabilize current practices, thereby constraining its transformative potential within the tourism ecosystem.

5. Conclusions

This study examined how DMOs and tourism operators perceive and apply AI in practice. The results revealed a systematic divergence between AI's theoretical potential and its practical implementation. Three underlying mechanisms appeared to account for this divergence: sociomaterial inertia, defensive operationalization and under-actualized affordances. These mechanisms, analysed through the integrated theoretical lenses of sociomateriality, SDL and affordance theory and interpreted via TIU, are discussed below.

The analysis revealed a convergence among the three theoretical frameworks that guided this research. The findings indicated that AI is transforming the tourism ecosystem across multiple interconnected dimensions. The sociomateriality perspective demonstrated how AI can become an integral part of the industry's practices by creating a deep entanglement between social and material elements that reshape the foundational dynamics of the tourism experience. Technology and social practices co-constitute each other, which generates hybrid configurations where the digital and the physical become increasingly seamless. From the SDL perspective, AI functions as a significant enabler of emerging dynamics of value co-creation. This entails a substantive reconfiguration of how different resources are integrated and mobilized in the tourism experience. AI enables iterative adaptation to the evolving needs of travellers, thus generating value propositions that respond dynamically to the changing contexts of the travel experience.

The application of affordance theory revealed how the same AI technologies generate different possibilities for action depending on the relationship between technological features, user capabilities and material contexts. The findings demonstrated that the actualization of AI affordances is, however, systematically constrained by digital literacy gaps, cultural resistance and infrastructural fragmentation, ultimately producing ecosystem-level co-creation failures that exceed individual adoption barriers. Notably, discrepancies emerged between the theoretical potential of AI and its practical implementation. The decision logics actually guiding tourism managers often diverged significantly from stated intentions or available technical possibilities. This dissonance reveals how AI adoption in tourism is a complex process that is influenced by the organizational, cultural and contextual factors that shape operational decision-making. Tourism managers' TIUs reflect the pragmatic trade-offs between technological innovation and the realities of the industry, thus creating a more nuanced and gradual picture of AI adoption than the more transformative trajectories frequently explored in the literature.

Theoretical Implications

This study advances the theoretical understanding of AI adoption in tourism by moving beyond descriptive applications towards the identification of the underlying mechanisms that could explain the gap between AI's potential and its practical enactment. By integrating sociomateriality, SDL and affordance theory through the TIU lens, the findings suggest that this gap emerges from the interaction between managerial logics, sociomaterial practices and the (non-)actualization of technological affordances. These interactions operate through three interconnected mechanisms. Sociomaterial inertia stabilizes organizational practices, thus shaping the managerial logics that emerge in context. These logics manifest as defensive operationalization, the dominant TIU identified in this study, whereby managers recognize and actualize only those AI possibilities that reinforce existing routines, which results in the under-actualization of affordances. The cumulative outcome is a constraint on the depth of resource integration that limits the co-creative potential SDL identifies as central to value generation. These three mechanisms provide the integrative theoretical structure across the four contributions developed below.

First, the results of this research underscore the value of a sociomateriality perspective (Orlikowski, 2007; Orlikowski and Scott, 2008) for understanding AI implementation, as revealed through the TIU lens. The challenges encountered by providers, such as difficulties integrating CRM systems effectively or overcoming resistance to change even for basic communication automation, exemplify the deep entanglement of AI technology with existing organizational practices, social structures and material arrangements. The findings show that AI adoption is a performative process (Tuomi and Tussyadiah, 2020) where technology and social context mutually shape each other in ways that lead to emergent and sometimes unexpected outcomes. The managerial TIU observed in the context of AI implementation reflects this complex negotiation between

technological possibilities and the inertia embedded within the existing sociomaterial fabric of tourism organizations (Tussyadiah, 2020).

Second, this research contributes to SDL (Vargo and Lusch, 2016) by empirically demonstrating how AI's potential for deep resource integration that dynamically combines tourist preferences, destination knowledge and real-time contextual data to generate co-creative value configurations (Akaka and Vargo, 2014; Buhalis *et al.*, 2019) remains largely unrealized in practice. Managers' TIUs lead them to deploy AI primarily for operational efficiency and standardization, including automated check-ins, cleaning robots and simplified payments, which limits resource integration to shallow, transactional exchanges, thus falling short of the relational, transformative co-creation SDL envisions (Manser Payne *et al.*, 2021). The findings advance SDL by establishing managerial logic as a conditional variable of resource integration. AI's co-creative potential is realized only when managerial logics align with relational, multi-actor value creation goals. When such alignment is absent, as this study shows is predominantly the case, resource integration remains shallow and co-creative potential is systematically unrealized. Hybrid architectures of service delivery (Wirtz *et al.*, 2018) further necessitate a refinement of SDL to account for co-creation mediated by human-AI interactions in blended environments.

Third, this study extends affordance theory (Gibson, 1979; Leonardi, 2011) in the context of AI in tourism. While AI has numerous potential affordances for action such as enhanced personalization, predictive analytics and seamless journey management, the present findings highlight a significant gap between these potential affordances and those achieved by tourism providers. The identified barriers - including user-related factors (digital literacy, perceived utility, information overload), cultural resistance and technology-related issues (application fragmentation and connectivity) - act as powerful constraints on the perception and actualization of affordance (Meske and Junglas, 2021).

Applying TIU helps explain why certain affordances remain latent or underutilized and reveals that managers' and tourists' practical reasoning, which is shaped by existing routines, skills and cultural norms, mediates their engagement with AI's capabilities (Florido-Benítez and del Alcázar Martínez, 2024). These findings extend affordance theory beyond its traditional dyadic focus in examining how individual users perceive and actualize technological possibilities (Leonardi, 2011) towards an ecosystem-level conceptualization in which the actualization of affordances is conditioned by the collective interoperability of technological infrastructures across destination stakeholders (Chen *et al.*, 2024; Sustacha *et al.*, 2023).

Finally, this study advances the application of TIU (Argyris and Schön, 1974; Zeithaml *et al.*, 2020) as an analytical framework for investigating the persistent research-practice gap in technology adoption within tourism (Law *et al.*, 2024; Shin and Perdue, 2022). By focusing on the modes of thinking and decision-making processes that underpin managers' actual behaviours, TIU allows for a deeper understanding of why AI implementation unfolds the way it does and, it thus helps to reveal the practical logics, assumptions and compromises that often diverge from

espoused strategies or the technology's documented potential. It highlights the critical role of managerial logics in translating abstract technological possibilities into concrete organizational realities within the tourism ecosystem.

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Managerial Implications

These findings also have practical implications for DMOs and tourism operators. First, countering sociomaterial inertia requires organizations to actively disrupt the embedded routines that stabilize low-level AI use, where organizational capacity allows. The evidence suggests that CRM systems, chatbots and check-in automation are predominantly absorbed into existing workflows without reconfiguring the underlying service logic. Organizations should evaluate AI adoption in ways that integrate operational efficiency metrics with dimensions related to experience quality, tourist engagement and resource integration across the tourism ecosystem.

Second, countering defensive operationalization requires expanding managerial logics beyond efficiency optimization to incorporate co-creation outcomes as an equally legitimate dimension of AI performance evaluation. This expansion demands investment in managerial development programmes that build both technical competencies and the relational and strategic capabilities needed to recognize AI as a platform for multi-actor value creation. Transparent data governance policies are a further prerequisite, as the depth of resource integration that SDL envisions depends on the willingness of ecosystem actors to share preference data, behavioural patterns and contextual information. This condition remains non-trivial given competitive dynamics and regulatory constraints among destination stakeholders.

Third, reducing the under-actualization of affordances requires coordinated action at the ecosystem level. The evidence demonstrates that app fragmentation, connectivity gaps and device limitations systematically prevent the actualization of AI affordances across destination contexts. DMOs are particularly well positioned to facilitate interoperability standards among attractions, accommodation providers and transport operators, particularly in destination systems with strong governance capacity and institutional legitimacy. This would reduce the cognitive and technical burden on tourists otherwise forced to navigate fragmented digital environments. Balancing AI-mediated interactions with human touchpoints remains essential to preserve the personalized quality that distinguishes tourism experiences, particularly for user segments where the perceived utility of technology remains low.

Limitations and Future Research Directions

While this study provides insights into the integration of AI within the tourism industry, some limitations must be acknowledged. The research focused on AI's role within the Italian tourism context, which is shaped by specific cultural, regulatory and economic characteristics. This means that the generalization of the findings to the broader Italian tourism sector, as well as to other international settings, remains beyond the scope of the

data collected. The study pursued analytical generalization, with the aim of offering theoretical insights grounded in qualitative analysis (Patton, 2002). A further limitation concerns the study's cross-sectional design. AI adoption is inherently dynamic and examining it at a single point in time constrains the understanding of how managerial logics and technology integration evolve over time.

These constraints highlight several avenues for future research. Longitudinal studies are essential to track the evolution of AI adoption over time to examine how initial experimentation matures into embedded practices, how barriers are gradually overcome or reinforced, and how value co-creation dynamics transform as both organizations and tourists gain experience with AI technologies. Second, there is a clear need for comparative, cross-regional or cross-national studies to validate and expand upon these findings in diverse tourism systems with varying levels of digital infrastructure, regulatory frameworks and cultural orientations towards technology. Third, future research should examine whether the mechanisms identified in this study operate across different organizational contexts, as well as whether organizational size and digital maturity moderate their intensity. Finally, future studies should broaden the stakeholder base to include developers, policymakers and user communities, thereby enriching the understanding of ecosystem-wide dynamics.

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Appendix

Appendix A. List of interviewees

Fabiola Sfodera
Alessio Di Leo
 Decoding AI Adoption
 in Tourism: A Multi-
 Theoretical Analysis
 Based on a Theory-in-Use
 Approach

Id	Job Role	Sector	Technology used	Geographic Location
1	Senior Marketing Director and Communication manager	Hospitality (Hotel industry)	Programmatic advertising; Chatbot; AI search or recommendation systems; Augmented Reality; Self-service and check-in with facial recognition system	Multiple locations across Italy
2	Global Key Account Manager	Tourist services (Online travel agency)	Recommendation systems based on collaborative filtering; Interface Adoption via Machine Learning; Online self-services check in; Chatbot	Multiple locations across Italy
3	Technical and operational director and museum associate	Cultural Heritage (Museum)	Video mapping; Gaming interaction; Virtual Reality; Virtual Sommelier; Metaverse (in development)	Southern Italy
4	Owner and technical director	Tourist services (Travel agency)	Chatbot	Multiple locations across Italy
5	Senior Digital Advisor	Tourist Services (Air Transport)	AI Prediction and Prognosis Systems; Robot; Intelligence app (in development); Augmented reality	Central Italy
6	Marketing Manager	Hospitality (Hotel industry)	Chatbot; Programmatic advertising; Self-service check-in kiosk with facial recognition system; Robot	Multiple locations across Italy
7	Communication manager and web editor	DMO	Chatbot; AI-enabled CRM system; Programmatic Advertising; Location-based web apps; AI profiling systems	Northern Italy
8	Global e-commerce Director	Hospitality (Hotel industry)	Self-service check in with facial recognition; Chatbot; App intelligence; Customer profiling system; Robot for professional services	Central Italy
9	Communication and tourism promotion manager	Destination	Virtual tour guide; AI simultaneous translator; Augmented Reality; Metaverse (in development)	Central Italy
10	Global Crisis specialist	Hospitality (Hotel industry)	Self-service check-in with facial recognition system; Chatbot; Customer profiling system with AI; Robots for professional services	Central Italy
11	Communication Manager	Destination	Chatbot; AI simultaneous translator	Northern Italy
12	CEO	Tourist services (Software development)	Metaverse; AI-enabled CRM system; Generative AI system	Multiple locations across Italy
13	Technology Supplier Manager	Hospitality (Hotel industry)	Robot; Relational AI Booking System	Multiple locations across Italy
14	Social Media Manager	DMO	Chatbot (in development); AI system recommendation	Northern Italy
15	Cultural curator	Cultural Heritage	Augmented Reality; Virtual Reality; Mixed Reality	Southern Italy
16	Digital Field Marketing manager	Hospitality (Hotel industry)	AI search and recommendation system; Voice assistant; Robot concierge; Self-service check-in kiosk	Central Italy

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