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TOWARDS COMPREHENSIVE DIGITAL-ENVIRONMENTAL TOURISM FRAMEWORK: INTEGRATING TECHNOLOGY, PSYCHOLOGY, AND SUSTAINABILITY IN POST-DIGITAL ERA TOURISM

Nasir Abbas
Lecturer, College of Commerce, Government College University, Faisalabad.
Email: nasirabbas@gcuf.edu.pk
ORCID: https://orcid.org/0009-0000-1711-2963
Aisha Imtiaz
Assistant Professor, Government College Women University, Faisalabad, Punjab, Pakistan. Email: aisha.imtiaz@hotmail.com
Muhammad Adnan Afzal*
Lecturer, College of Commerce, Government College University Faisalabad, Pakistan. Corresponding Author Email: adnanafzal@gcuf.edu.pk
Shahid Munir
Lecturer, Department of Public Administration Government College University, Faisalabad. Email: shahidmunir@gcuf.edu.pk

Abstract

Purpose – This study addresses critical gaps in tourism literature by developing a comprehensive digital-environmental tourism framework that integrates technology adoption, psychological mediators, and sustainability outcomes to advance theoretical understanding and practical applications in post-digital era tourism. **Design/methodology/approach** – The research employs a systematic literature review and conceptual framework development methodology, synthesizing five core theoretical foundations: Theory of Planned Behavior, Technology Acceptance Model, Social Cognitive Theory, Environmental Psychology Theory, and Parasocial Interaction Theory. The framework integrates digital antecedents (social media marketing, E-WOM, influencer marketing, immersive technologies), psychological mediators (environmental consciousness, digital trust, place attachment, perceived authenticity), moderating factors (individual and contextual characteristics), and behavioral outcomes (sustainable tourism behavior, digital advocacy, long-term intentions). **Findings** – The framework identifies

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novel relationships between digital marketing strategies and environmental consciousness formation through psychological mediation pathways. Key findings reveal that digital platforms serve as powerful catalysts for environmental awareness development, with effectiveness moderated by individual characteristics and cultural contexts. The study proposes eight core propositions examining direct relationships, mediation effects, and moderation influences within the digital-environmental tourism nexus. **Practical implications –** The framework provides evidence-based guidance for tourism marketers developing sustainable digital strategies, destination managers implementing community-centered sustainability initiatives, and policymakers creating regulatory frameworks supporting digital-environmental tourism development. **Originality/value –** This research represents the first comprehensive integration of digital marketing and environmental psychology theories in tourism contexts, addressing fragmented literature streams while providing a multi-theoretical approach to understanding technology-mediated sustainable tourism behaviors in contemporary digital environments.

Keywords: digital tourism marketing, environmental consciousness, sustainable tourism behavior, social media marketing, technology acceptance, environmental psychology

Introduction and Background

Introduction to Digital Tourism Transformation: Evolution from Traditional to Digital Tourism Marketing

The tourism industry is undergoing profound digital transformation. Digital technologies have reshaped how travellers discover, plan, book, and experience journeys, shifting from traditional operations to digital ecosystems Jha, M. (2024). Before digitalization, tourism operated through physical travel agencies, printed materials, and telephone bookings, with travel professionals acting as gatekeepers. The traditional model followed a linear distribution

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chain from destinations through tour operators to consumers. The transformation began in 1996 with Expedia's launch, followed by Priceline in 1997, marking online travel agencies' emergence and enabling autonomous travel purchases (Elshaer et al., 2024). Digital transformation accelerated with social media, mobile technologies, and artificial intelligence. The World Economic Forum projects digitalization will generate US$305 billion of industry value by 2025, shifting US$100 billion to new competitors (World Economic Forum, 2017). The transformation evolved through stages of technological integration, customer experience enhancement, business model evolution, and operational optimization (Satiti & Udin, 2025).

Key Drivers of Digital Tourism Transformation

Technology Integration: Tourism enterprises use artificial intelligence, blockchain, virtual reality, and IoT to enhance customer experiences and optimize operations, enabling improved service quality and communication throughout the tourism value chain (Ku, 2025).

Platform Economy: The sharing economy transformed tourism through platforms like Airbnb and Uber, connecting travellers with local providers and transforming value creation while lowering market barriers (Pumaleque et al., 2021).

Data-Driven Personalization: Digital transformation enables collection and analysis of consumer data for personalized experiences. Companies must analyse customer information to meet tourist expectations.

The COVID-19 pandemic accelerated digital transformation in tourism, making virtual tourism and AI-powered services essential for business survival (Elshaer et al., 2024). The digital tourism landscape integrates online platforms, mobile applications, and virtual reality for marketing (Ku, 2025). Digital technologies promote eco-friendly practices through digital payments and stakeholder engagement. Digital transformation restructures industry relationships while advancing sustainability, aligning with SDGs (SDG Studies

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Review, 2024). This shift has democratized travel planning and reimagined tourism's operating principles Jha, M. (2024).

The Emergence of Environmental Consciousness in Tourism

Environmental consciousness within tourism represents a shift from economic-driven travel motivations to understanding tourism's environmental impacts. This transformation stems from awareness of climate change, environmental degradation, and sustainable development needs (Rahman et al., 2024). Environmental consciousness emerged because of the negative environmental consequences of tourism in the latter part of the 20th century. Tourism represents a "resource paradox" in which it requires ecological capital and is simultaneously dependent on environmental conservation (Baloch et al., 2023). The increase in tourism shows several environmental impacts, such as resource depletion and pollution; therefore, it is concluded that poorly balanced development between tourism and conservation may lead to adverse effects on climate change and biodiversity.

Sustainability Awareness and Tourist Behaviour

Environmental consciousness influences tourists' decision-making. Two previous independent studies found that tourists who are environmentally conscious show more sensitivity to environmental issues while travelling (Sanjaya et al., 2024). They will be more conscious and demand environmentally friendly services because of travelling to protected areas. Research indicates that improved sustainability perception leads to higher green purchase intentions (Baloch et al., 2023).

Integration of Environmental Education

Environmental education raises awareness, which in turn influences visiting intentions and converts environmental concerns into sustainable behaviours among tourists. Destination image and intention to visit ecotourism sites can be impacted by environmental awareness (Rahman et al., 2024), which has shown that environmentally friendly tourists prefer destinations in line with their values.

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The Role of Digital Platforms in Environmental Consciousness

Digital platforms have changed environmental awareness in tourism There is a significant connection between digital marketing and visitors' environmental attitudes, which cooperate with sustainable tourism promotion due to the development of innovation (Sanjaya et al., 2024). Marketing campaigns specifically affect tourists' environmentally sustainable behaviour and their choice of destination. Social media has raised environmental awareness and encouraged sustainable travel practices.

Ecotourism as Environmental Consciousness

Ecotourism embodies responsible travel that minimizes environmental impact while supporting conservation (Baloch et al., 2023). Key characteristics include:

- Low environmental impact behaviour
- Respect for local cultures and biodiversity
- Conservation support
- Benefits to local communities
- Local decision-making involvement
- Environmental education

Environmental consciousness impacts tourism through sustainable destination management (Baloch et al., 2023). Government authorities guide policy and conservation efforts, while responsible tourism standards remain essential. Implementation challenges persist in developing economies balancing economic and environmental priorities. Climate change has accelerated sustainable practices needs (Rahman et al., 2024). The COVID-19 pandemic transformed tourism toward sustainability and digital integration Jha, M. (2024), with AI chatbot adoption varying from 67% in China to 25% in Germany. Digital platforms enable eco-friendly practices through AI and blockchain. The pandemic prompted environmental impact reassessment, with destinations promoting green transition. Hotels invest in

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environmentally friendly technologies, while digital marketing influences eco-destination visits (Sanjaya et al., 2024). Post-pandemic tourism shifted toward sustainable alternatives, with content-focused trips and visiting friends emerging as popular activities. Travelers prioritize health, safety, environmental impacts, and authentic experiences.

The tourism industry adapted through e-hospitality and technology for contactless operations. The shift from over-tourism to under-tourism requires regulations for socioeconomic impacts (Mahendru et al., 2024). Recovery focused on sustainable tourism based on circular economy. The research examines social media's influence on travel intentions and ecotourism behavior, with destination image mediating. This framework builds on the Theory of Planned Behavior with digital channels. The study integrates digital transformation with environmental consciousness. The research informs stakeholders about digital marketing strategies for sustainable tourism. Government authorities can use findings for environmental conservation policies. Digital marketing shapes ecotourism through destination image (Kilipiri et al., 2023). For Pakistan's tourism, this research guides digital promotion while addressing environmental concerns. The research addresses environmental challenges in Pakistan's destinations, particularly northern regions. Digital marketing can promote environmental awareness benefiting communities. The study's analysis establishes relationships between digital communication and tourism outcomes.

The contemporary tourism landscape faces unprecedented challenges requiring urgent attention. While digital technologies and environmental consciousness reshape tourism, three key problems need scholarly intervention. Research shows concerning fragmentation in understanding digital and sustainable tourism's intersection. Digital technologies in nature-based tourism lack strategic integration, leading to ineffective sustainable strategies (Hu et al., 2024). Smart tourism lacks specific identity and frameworks explaining ICT-tourism integration. Literature focuses on

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destination aspects over user perspectives, creating gaps in understanding digital innovations' influence on environmental stewardship (Ding & Wang, 2024). Evidence supporting technology's enhancement of smart sustainable models remains insufficient, shown by arbitrary ICT application (Khan et al., 2022).

The academic discourse lacks comprehensive frameworks explaining relationships between digital marketing, environmental consciousness, and tourist behaviour. Current approaches remain isolated within disciplines (De Moraes et al., 2024). Smart tourism's novelty creates theoretical inconsistencies. Existing frameworks inadequately address digital platforms' influence on environmental attitudes (Li et al., 2022). Theory of Planned Behaviour's integration with digital communication theories remains underexplored (Li, X. (2022).

Research Objectives

1. To develop an integrated conceptual framework that synthesizes theories from digital marketing, environmental psychology, and sustainable tourism to model the technology-psychology-sustainability nexus.
2. To identify and analyze the relationships between digital antecedents, psychological mediators, and sustainable behaviors, including the examination of direct, mediated, and moderated effects.
3. To propose a future research agenda focusing on priority areas for empirical testing, cross-cultural validation, emerging technologies, and methodological innovations in the field.
4. To provide actionable, evidence-based recommendations for key tourism stakeholders, including marketers, destination managers, and policymakers, to foster sustainable practices.
5. To advance academic knowledge by bridging theoretical gaps between digital marketing and environmental psychology and proposing a multi-level model for technology-mediated environmental behavior.

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6. To recommend innovative methodological approaches for digital-environmental tourism research, including integrated data collection, advanced analytics, and interdisciplinary validation techniques.
7. To demonstrate how digital tourism innovation can be strategically aligned with the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action, economic growth, and responsible consumption.
8. To provide evidence-based strategies that leverage the digital-environmental framework to support a resilient, sustainable, and inclusive post-pandemic tourism recovery.

Tourism research needs models integrating technology, psychology, and sustainability. Literature shows ignored sustainability development affects destinations (De Moraes et al., 2024). Research needs assessment of digital capabilities' impact on sustainable tourism (Ding & Wang, 2024). Limited understanding exists of environmental perception in digital tourism (Luong, 2025). Few studies explore cognitive-affective-conative theories in digital tourism Li, X. (2022). This research examines social media influence on travel intentions and ecotourism behaviour, with destination image mediating, connecting digital marketing and environmental psychology for developing economies like Pakistan.

Literature Review and Theoretical Foundation

Digital Tourism Literature Stream

Social Media Marketing in Tourism

Social media marketing has transformed tourism by enabling stakeholder engagement with travellers. The industry relies on content creators for information dissemination. Key components include entertainment, informativeness, interactivity, personalization, and credibility (Alghamdi & Wahid, 2024). Social media enables tourists to share authentic experiences (Mohamed, M, 2022). These platforms influence travel plans, with content correlating to destination visits (Sivakumar et al., 2024). User-generated

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content quality affects travel intentions through self-congruity and trust (Widiantoro et al., 2024). YouTube shapes tourist behaviour through travel vlogs across Arabian Gulf destinations. Facebook promotes hospitality businesses in emerging markets (Hossain et al., 2025). Generation Z relies heavily on online reviews for travel planning. Content creators influence tourism through credibility and entertainment (Sivakumar et al., 2024). Social media marketing enables destination management organizations to build brand images. Tourism businesses must create authentic content. Social media marketing faces challenges of technological change and information authenticity. Integration with sustainable tourism presents opportunities while risking overtourism. Tourism stakeholders must adapt strategies to leverage platforms while promoting sustainability.

Digital Word-of-Mouth (E-WOM)

Digital word-of-mouth (E-WOM) has transformed tourism information spread and travel decisions. On social networking sites (SNS), E-WOM involves sharing user-generated content and recommendations (Ngo et al., 2024). It serves as a channel for sharing experiences, with credibility impacting decisions. Users share viewpoints through media, enabling rapid information to spread. Research shows WOM-acquired consumers are twice as valuable, with E-WOM influence exceeding advertising (Ngo et al., 2024). Both positive and negative E-WOM affect purchase intentions. Studies show reviews and source credibility impact travel intentions (Rahman et al., 2024). E-WOM has expanded into religious tourism (Amir et al., 2024). Online travel agents benefit from E-WOM through reviewer expertise (Adisty et al., 2025). Millennial tourists account for 23% of global travel, contributing USD 400 billion in 2020 (Ngo et al., 2024). Information credibility influences usefulness and purchase intention. Information adoption is critical for online purchases. Research shows E-WOM influence on travel FOMO (Rahman et al., 2023). Tourism businesses can foster loyalty through credible influencers (Ngo et al., 2024). Destination organizations can use E-WOM insights for

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marketing. However, E-WOM faces challenges including platform evolution and information authenticity. The COVID-19 pandemic has increased reliance on E-WOM, as travellers depend on peer recommendations. Digital word-of-mouth has created new paradigms for tourism communication. Tourism stakeholders must remain adaptable while maintaining authenticity through effective E-WOM strategies.

Influencer Marketing Effectiveness

Influencer marketing has emerged as a powerful digital tourism strategy through social media personalities. Their effectiveness impacts followers' travel intentions, particularly among Generation Y and Z travelers (Mohamed, M, 2022). Source credibility determines marketing effectiveness, showing positive relationships with trust and travel intentions. Travel influencers' credibility and authenticity influence destination choice among millennials (Alrefai et al., 2024). Instagram travel influencers' credibility affects followers' trust, while content quality impacts follower responses (Mohamed, M, 2022). Parasocial relationships enhance marketing effectiveness through engagement (Alrefai et al., 2024). Instagram leads travel influencer marketing (Mohamed, M, 2022), with TikTok creating new opportunities (Serrano-Malebrán, 2025). Cultural factors affect effectiveness, as shown in Jordanian millennial studies. Traditional metrics include reach and conversion rates. Research uses structural equation modelling to understand influencer impact. Tourism businesses should select influencers aligned with target markets. Marketing effectiveness depends on credibility and authenticity, particularly affecting younger audiences' travel decisions.

Technology Acceptance in Tourism

Technology acceptance in tourism is crucial for digital transformation, based on frameworks like Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), which explain how perceived usefulness, ease of use, and external factors influence adoption (Hidayat & Franksiska, 2022). Mobile applications and social media marketing are key

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constructs in tourism technology acceptance. Tourism's digital transformation has evolved to Tourism 5.0 (Jha, M. (2024), focusing on technological integration, customer experience, and operational optimization. Technology adoption includes mobile applications, social media, virtual reality, augmented reality, and wearable devices. Market data shows growth in tourism technology investments, with regional adoption varying significantly. Technology acceptance depends on information quality, source credibility, ease of use, and self-efficacy. Digital transformation is driven by operational efficiency and competitive advantage. Technologies like virtual reality, AI, and data analytics offer immersive experiences and personalized services. The COVID-19 pandemic accelerated adoption, making digital tools essential. Mobile applications provide booking and navigation services, while AI enables chatbots for customer support. Future acceptance requires addressing barriers while balancing innovation with authentic experiences. Understanding acceptance factors provides insights for effective strategies, with ongoing research essential for integrating innovations with sustainability goals.

Environmental Tourism Literature Stream

Sustainable tourism balances current needs while protecting future opportunities through environmental, socio-cultural, and economic measures. It involves responsible travel that conserves environments and supports, differing from ecotourism as sustainable practices span all sectors. Environmental sustainability minimizes impacts through energy efficiency and waste reduction. Slovenia demonstrates these practices with 60% forested territory and nature reserves. Sustainable tourism protects cultural heritage through community participation. Economic sustainability creates community benefits through local sourcing. Digital technology supports sustainable tourism through marketing and ecological assessment. Climate change research focuses on biodiversity preservation. The accommodation sector implements practices through energy efficiency programs. Sustainable tourism requires monitoring systems to inform management strategies.

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International certification systems establish standards, with Global Sustainable Tourism Council providing criteria. Future practices will integrate technologies including electric vehicles. International cooperation will address climate change and biodiversity challenges. Practices must align with UN Sustainable Development Goals while meeting local needs.

Ecotourism Behavior Determinants

Ecotourism behavior determinants influence tourists' environmentally responsible travel decisions. Understanding these determinants promotes sustainable tourism and conservation. Research shows behavior is influenced by individual, social, and contextual factors (Le et al., 2025). The Theory of Planned Behavior and Social Learning Theory explain how individual characteristics shape sustainable practices. Environmental consciousness and travel motivations determine ecotourism behavior. Subjective norms affect ecological conservation through social pressure. Natural environment influences pro-environment behavior through self-attitude. Destination characteristics depend on attraction, services, and infrastructure. Cultural heritage preservation promotes conservation while attracting tourists. Service quality and infrastructure shape sustainable practices. Infrastructure enables pro-environmental behavior. Perceived behavioral control reflects tourists' environmental responsibility beliefs. Risk perception and trust in destination management affect ecotourism engagement. Studies show factors influence behavior through emotional responses. Understanding these determinants impacts management and policy. Destination managers can enhance ecotourism through service quality and education. Future research should examine technology's role in promoting responsible tourism while supporting conservation.

Environmental Consciousness and Travel

Environmental consciousness in travel reflects growing awareness and demand for sustainable tourism (Khan et al., 2024). Research shows environmental consciousness drives green travel behaviour, particularly

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among Generation Z (Khan et al., 2024). By 2025, 84% of travellers prioritize sustainability. Environmental consciousness influences behaviour through psychological mechanisms, with stimulus-organism-response theory showing direct pathways (Wang et al., 2025). Despite high awareness, gaps exist between consciousness and sustainable travel behaviour. While 92% consider sustainable travel, only 56.9% practice it, with 21% willing to pay more (Trip.com Group, 2024). Gen Z shows price sensitivity, with 53.6% citing environmental factors. APAC and Latin American travellers prioritize environmental factors more than EMEA and North American travellers. Cultural context affects environmental consciousness, with collectivistic cultures showing stronger social influence Li, X. (2022). Environmentally aware tourists choose destinations aligned with their values (Sanjaya et al., 2024). Digital platforms influence environmental consciousness and eco-destination choices (Sanjaya et al., 2024). Tourism businesses can leverage this by highlighting sustainability features. Destination management organizations can develop sustainable products and protective policies. Environmental consciousness continues evolving, driven by climate change evidence. While progress exists in promoting sustainable travel, challenges remain in translating consciousness into behaviour. Understanding psychological mechanisms is essential for developing effective sustainable tourism strategies.

Green Marketing in Tourism

Green marketing in tourism integrates environmental sustainability with strategic marketing for responsible travel, emphasizing environmental protection and community empowerment. Green marketing develops tourism products minimizing environmental impact while benefiting destinations (Karina et al., 2025). Research shows green marketing promotes eco-friendly services through authentic sustainability messaging. Green product development creates low-impact, authentic experiences. Research indicates green products affect sustainable tourism through marketing (Yudawisastra et

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al., 2023). Development includes eco-friendly accommodations and community experiences. Hotels use energy-efficient technologies to attract sustainability-minded guests. Green promotion communicates environmental benefits through transparent messaging (Mulyanto et al., 2023). Digital platforms reach conscious travelers through targeted content. Green marketing requires pricing reflecting sustainable practices while remaining accessible. Research shows correlation between green marketing strategies and tourist visit intentions ($\beta = 0.867$, $p < 0.001$). Green marketing encourages pro-environmental behaviors (Karina et al., 2025) and educates about environmental impacts. Digital platforms showcase initiatives through social media, demonstrating sustainable practices through visual content and influencer marketing.

Climate Change and Tourism Adaptation

Climate change and tourism adaptation requires strategic responses addressing vulnerabilities. Tourism destinations face challenges affecting supply and demand from thermal stress (Njoroge, et al., 2015). Destination vulnerability depends on climate exposure, tourism sensitivity, and adaptive capacity (Pogačar et al., 2025). Climate impacts include rising seas, extreme weather, and temperature shifts, affecting coastal areas through erosion (Ofremu et al., 2025). Mediterranean tourism faces challenges from heatwaves, with temperature increases reducing arrivals and revenue (Ofremu et al., 2025). Mountain regions experience decreased snow cover impacting winter tourism (Pogačar et al., 2025). Tourism stakeholders adopt adaptation approaches with mitigation efforts. Cities enhance facilities for high temperatures while improved transportation increases resilience (Ofremu et al., 2025). Destinations implement diversification to reduce climate dependencies. Scandinavian countries demonstrate sustainable tourism, while Portugal and Greece lead in green accommodations. Digital platforms enable environmental monitoring. Businesses implement adaptation through infrastructure modifications (Becken, 2005).

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Psychological Mediators Literature Stream

Consumer Behavior in Digital Environments

Digital technologies have transformed consumer behavior in tourism through psychological pathways. The Stimulus-Organism-Response framework explains how digital stimuli affect behavior, with customer engagement mediating content's transformation into travel intentions (Alsheyab & Omar, 2025). Psychological mechanisms include cognitive, affective, and behavioral components shaping responses to marketing stimuli. AI and recommendation systems influence consumer attitudes through perceived novelty (Chen et al., 2024). Digital experiences affect tourist intentions through memory formation.

Environmental Psychology Theories

Environmental psychology theories explain tourist behavior through psychological processes. Environmental knowledge affects environmental commitment and behavior Dam, T. C. (2025). Environmental restrictiveness theory links perceived restoration to pro-environmental behavior (Zhou et al., 2023). Environmental factors influence behavior through pathways mediated by psychological factors (Wang et al., 2025). Presence while browsing destination information corresponds to pro-environmental intentions through eco-guilt (Chen et al., 2024).

Destination Image Formation

Digital technologies influence destination image formation through user-generated content (Lin et al., 2024). Psychological processes combine cognitive and affective components to create destination perceptions. Digital content marketing shapes destination images through attention mechanisms, with content quality affecting travel intentions (Khan et al., 2022).

Trust and Authenticity in Digital Communications

Trust and authenticity mediate digital communications and tourist behavior. Perceived authenticity influences trust formation and patronage intentions. Brand authenticity dimensions affect consumer behavior through trust. Platform characteristics influence trust perceptions.

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Place Attachment and Emotional Connections

Place attachment mediates digital communications through emotional connections. Digital engagement influences attachment through vicarious experience. Cultural factors moderate attachment formation, while environmental features evoke emotional responses affecting pro-environmental behaviors.

Theoretical Foundations

Core Theories

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), is a widely applied framework in tourism research for understanding behavioral intentions. Bibliometric analysis shows TPB literature has evolved significantly (1985-2024), particularly in tourism applications (Naskar et al., 2025). TPB's premise that behavioral intentions form through attitudes, subjective norms, and perceived behavioral control has been validated in tourism contexts. Studies show TPB maintains strong predictive power in tourism behaviors, with attitude being the strongest predictor of intentions (Zhang et al., 2025). The theory's application in digital tourism has proven valuable for understanding technology-mediated travel decisions. Research shows TPB's effectiveness increases when integrated with constructs like environmental consciousness and digital trust (Li, 2024). Studies demonstrate TPB effectively predicts ecotourism behavior, with environmental attitudes strongly predicting sustainable travel intentions (Erfanian et al., 2024). The theory's adaptability to cultural variations makes it suitable for cross-cultural tourism research.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), introduced by Davis (1989), is the predominant framework for understanding technology adoption in tourism. Recent reviews from 2020-2025 show TAM applications have expanded, particularly in mobile applications and social media marketing (El Archi &

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Benbba, 2023). TAM's core constructs—perceived usefulness and ease of use—remain key predictors of technology acceptance in tourism. Modern TAM applications incorporate external variables like trust, system quality, perceived enjoyment, and technological self-efficacy to enhance explanatory power in tourism contexts. These variables provide understanding of user interactions with digital tourism platforms. Combining TAM with the Technology-Organization-Environment (TOE) framework offers comprehensive insights into technology adoption in tourism enterprises, especially for virtual reality tourism (Tran & Van Hanh, 2025). Research shows perceived usefulness has stronger influence on adoption than ease of use, indicating tourism stakeholders prioritize functionality over simplicity. Studies reveal TAM's predictive power varies across technologies and user groups, with Generation Z showing distinct acceptance patterns (Trinh et al., 2023). The model effectively predicts adoption of tourism apps, virtual reality systems, and social media platforms across cultural contexts.

Social Cognitive Theory

Social Cognitive Theory (SCT), developed by Bandura (2004), has gained prominence in tourism research for understanding how individual cognition, social influence, and environmental factors shape tourist behavior. SCT provides a framework for exploring environmental behaviors in tourism contexts, particularly where social learning and modeling are crucial. The theory's core constructs—self-efficacy, outcome expectations, observational learning, and social influence—explain environmental behaviors among tourists. Research in forest ecotourism contexts shows SCT can explain 59% of behavioral intention and 27% of actual environmentally friendly behaviors (Erfanian et al., 2024). The theory's reciprocal determinism provides insights for understanding digital tourism behaviors, with social influence and others' behaviors emerging as key determinants of behavioral intentions. SCT's application in digital tourism reveals the importance of observational learning through social media platforms, demonstrating how tourists learn sustainable

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behaviors by observing others through digital channels. The theory's focus on self-efficacy shows how digital platforms enhance tourists' confidence in sustainable behaviors.

Environmental Psychology Theory

Environmental Psychology Theory provides theoretical foundations for understanding tourist behavior in environments, particularly for sustainable tourism and ecotourism. Research shows environmental psychology principles explain how environmental factors influence tourist cognition, emotion, and behavior through psychological processes. The cognitive-affective-conative (CAC) framework has proven valuable for tourism research. Studies show environmental knowledge (cognitive factors) influence environmental commitment (affective factors), which impact pro-environmental behavior (conative factors) in tourism contexts Dam, T. C. (2025). Environmental restorativeness theory has emerged as a significant component in tourism applications. Natural environments provide psychological restoration benefits that enhance tourists' environmental consciousness and promote sustainable behaviors (Zhou et al., 2023). Research demonstrates that stronger presence when browsing destination environmental information corresponds to enhanced pro-environmental intentions, mediated by eco-guilt and empathy with nature (Chen et al., 2024). This shows how digital representations of environments can influence environmental behaviors.

Parasocial Interaction Theory

Parasocial Interaction Theory, developed to understand media consumption, explains how individuals form one-sided emotional relationships with media figures that influence behavior and decision-making. Research shows parasocial interactions are crucial in tourism marketing through social media influencers. Studies indicate that tourists' parasocial relationships with travel influencers affect destination attitudes and visit intentions, mediated by credibility and authenticity (Guo et al., 2022). The integration of this theory with tourism research reveals how digital marketing creates emotional

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connections beyond commercial relationships. Research shows source credibility influences parasocial relationships, which affect destination attitudes and visit intentions (Guo et al., 2022). The theory now extends to live streaming, virtual reality, and interactive platforms, with parasocial relationships developing through social media, virtual tours, and content creation (Huang et al., 2025).

Digital-Environmental Tourism

Conceptual Framework Development

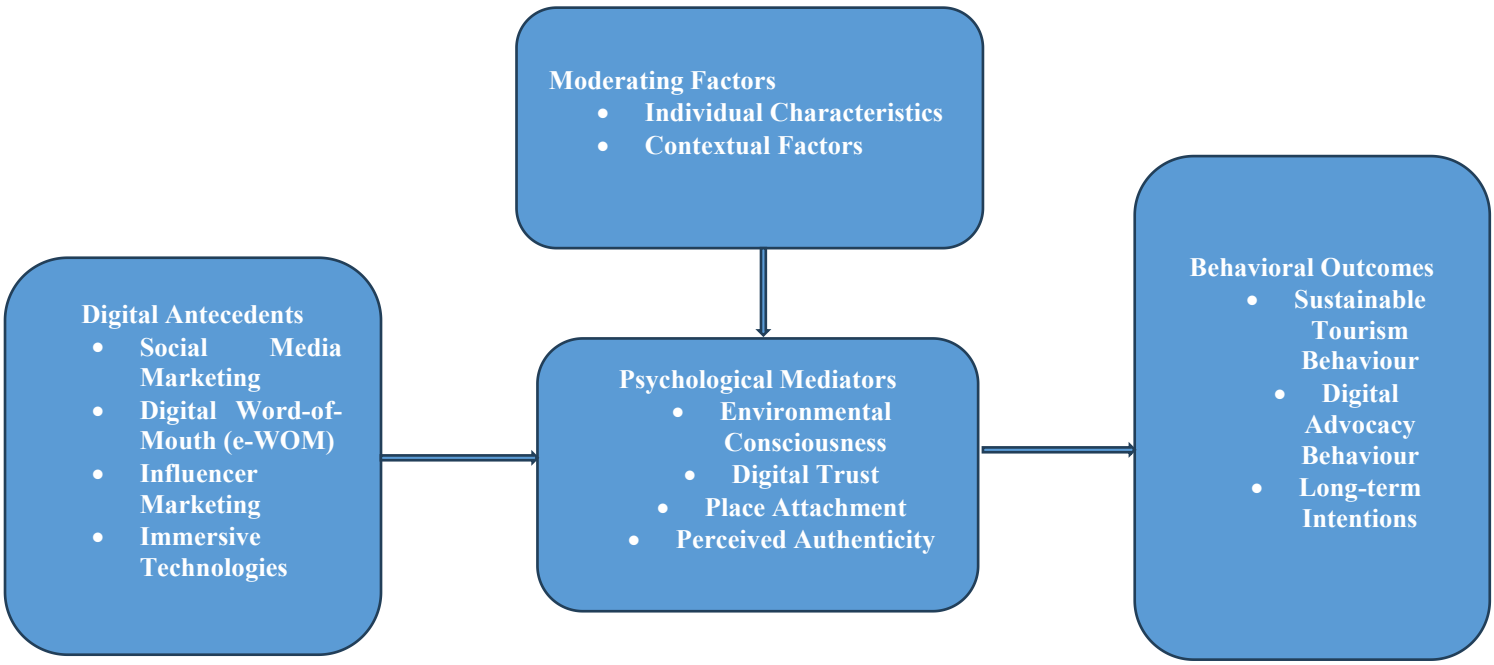

Figure-01 Digital-Environmental Tourism

Framework Components Identification

Digital Antecedents

Social Media Marketing

The visual nature of Instagram makes the social media channel one that is a strong fit in tourism marketing (Alghamdi & Wahid, 2024). This made it a platform with the roles of entertainment, informativeness, interactive experience, personalization, and an institution itself regarding the credibility

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of its media. Poor quality and poor engaging content are one of the reasons greater than 90% of all social media marketing does not work for most tourism businesses. The current study links high-quality content contributions and their impact on destination image perceptions and travel intentions, which are mediated by engagement behaviours.

Digital Word-of-Mouth (E-WOM)

Source credibility significantly influences E-WOM effectiveness. Research shows that information credibility positively affects usefulness, adoption, and purchase intention (Ngo et al., 2024). When consumers trust E-WOM sources and content, it increases confidence. Message characteristics impact E-WOM persuasiveness. Findings show that positive reviews, negative reviews, source credibility, and quality influence travel plans (Rahman et al., 2024). Research with 302 respondents shows message characteristics shape travel decisions. Transmission occurs through social networking sites, online travel agents, and mobile applications, enabling real-time information exchange about travel experiences.

Influencer Marketing

Influencer authenticity is the key factor determining marketing effectiveness in tourism. Research shows that perceived authenticity has the highest influence on destination choice intentions, surpassing recommendations and engagement (Alrefai et al., 2024). Authenticity manifests through genuine experiences, honest opinions, and transparent disclosure of commercial relationships. Parasocial relationships between influencers and followers enhance marketing effectiveness by creating emotional connections that increase persuasive power. Source credibility influences these relationships, which affect destination attitude and visit intentions (Guo et al., 2022). Demographic and cultural alignment between influencers and audiences moderates marketing effectiveness.

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Immersive Technologies

Virtual reality has transformed tourism marketing by enhancing emotional engagement and visit intentions. Research shows VR influences travelers' perceptions through immersive experiences, enriching interactions with virtual environments (Istiqlal et al., 2024). Studies with 412 tourists indicate VR boosts tourism by overcoming travel barriers. Augmented reality offers differentiated experiences and improves tourism value chains. A literature review from 2010 to 2024 highlights nine AR benefits, including enhanced engagement and behavioral intentions (Jalilvand & Ghasemi, 2024). Interactive digital platforms enable real-time, personalized experiences, bridging physical and digital tourism. Research links interactivity, vividness, and information content to perceived usefulness in mobile AR applications.

Psychological Mediators

Environmental Consciousness

Environmental knowledge positively affects environmental commitment, attitude, and travelers' pro-environmental behavior in tourism. Studies using cognitive-affective-conative theory show that environmental knowledge forms a cognitive base for affective and behavioral responses Dam, T. C. (2025). Environmental concern drives sustainable tourism behaviors and mediates between environmental awareness and pro-environmental intentions. Pro-environmental attitudes predict sustainable tourism behavior, significantly influencing ecotourism behavior and destination choice (Zhang et al., 2025).

Digital Trust

Platform trust influences technology acceptance in digital tourism contexts. Research shows that perceived trustworthiness enhances user engagement with tourism technologies (Ngo et al., 2024). Source credibility affects information adoption and behavioral outcomes, while information reliability impacts user confidence and decision-making, leading to platform loyalty.

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Place Attachment

Emotional connections to destinations form through direct experience and digital platforms, particularly social media. Research shows tourists engaging with destination content develop stronger emotional bonds affecting behavioral intentions. Functional attachments represent practical bonds based on destination attributes meeting traveler needs. Social bonds with local communities and travelers develop through digital platforms, enhancing place attachment through social engagement.

Perceived Authenticity

Content authenticity influences trust and behavior in digital tourism. Perceived authenticity positively affects trust and patronage through credibility assessment (Alsharif et al., 2024). Authentic experience is the fourth and final level of tourism, engaging tourists in feelings of emotion. Cultural Authenticity reflects local practices and impacts destination attraction and tourist behaviour.

Moderating Factors

Individual Characteristics

This affects the efficacy of digital marketing, as Gen Z has unique technology adoption tendencies that differ from other demographic patients (Trinh et al., 2023). There is an interaction effect of environmental values on the relationship between digital communication and sustainable tourism behaviour, as environmentally concerned populations respond favourably to sustainability messaging. The impact of digital marketing also depends on the experience of tourists, where experienced travellers show different patterns of responses than novice ones. In tourism, environmental consciousness and digital marketing effectiveness are generally moderated by the effect of age, income, and culture on both demographics

Contextual Factors

The degree of social norm influence varies depending on the cultural context which can determine doctoral marketing effectiveness and sustainable

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inbound tourism behaviour (Luong, 2025). Economic conditions moderate the sustainability of tourism participation, in addition to the impact of environmental consciousness. In digital marketing, ease of access is entwined with platform usage behavioural patterns because they are determined by technological infrastructure. Digital marketing environment: This is designed through regulations and rules that policy frameworks in sustainable tourism.

Behavioral Outcomes

Sustainable Tourism Behavior

Actions towards environmental conservation show environmental awareness and digital marketing influence. The results of a study revealed that environmentally conscious tourists perform conservation behaviours while travelling (Baloch et al., 2023). This is an investment in the localised economy of a favela, because as its name indicates, femi culture is just that. Educational engagement: Participation in learning activities that develop an understanding of sustainability and conservation.

Digital Advocacy Behaviour

Consuming content means happy travellers consuming experiences from digital platforms for word-of-mouth marketing. The former spurs network-wide sustainable tourism, and the latter provides general ratings that guide travellers.

Long-term Intentions

The intentions of repeating visitors indicate a high satisfaction rate among travellers and their commitment to sustainable destinations. A dedication to protecting the environment beyond travel experiences. Greater emulation of tourism habits in daily life combines environmentally friendly living practices.

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Framework Relationships and Propositions

Direct Relationships

Proposition 1: Digital Marketing Antecedents Positively Influence Psychological Mediators

Digital green marketing influences tourists' environmental beliefs through social media platforms. Electronic word-of-mouth affects trust formation and behavioral intentions (Ngo et al., 2024). Digital content quality affects place attachment as tourists develop emotional connections. Influencer marketing operates through perceived authenticity, affecting destination choice intentions (Alrefai et al., 2024).

Proposition 2: Psychological Mediators Positively Influence Sustainable Tourism Behaviors

Psychological mediators drive sustainable behaviors. Environmental consciousness influences ecotourism behavior through knowledge and commitment Dam, T. C. (2025). Cognitive factors shape affective responses, impacting behavioral outcomes. Digital trust promotes responsible travel choices (Zhang et al., 2025). Place attachment drives environmental stewardship, while perceived authenticity creates commitment to environmental protection (Alsharif et al., 2024).

Proposition 3: Digital Antecedents Have Direct Effects on Behavioral Outcomes

Digital marketing directly influences sustainable tourism behaviors. Social media facilitates environmental behavior through social learning Jha, M. (2024). Electronic word-of-mouth increases sustainable behavior adoption (Rahman et al., 2024). Immersive technologies enable environmental education for behavior change (Istiqlal et al., 2024).

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Mediation Effects

Proposition 4: Psychological Factors Mediate Digital Antecedents and Behavioral Outcomes

Psychological mediators link digital marketing to sustainable behaviors. Environmental consciousness mediates between digital marketing and ecotourism behavior (Sanjaya et al., 2024). Trust enables sustainable tourism choices (Ngo et al., 2024). Place attachment mediates between digital marketing and community support. Customer engagement influences travel intentions through intricate social media interactions which shape perspectives over time.

Proposition 5: Multiple Mediators Create Complex Pathways

Multiple psychological constructs operate simultaneously, creating complex pathways. Digital marketing sways behaviour through environmental mindfulness, trustworthiness, and attachment to place (Wang et al., 2025). Effects cascade where digital precursors impact primary mediating factors, then secondary mediating factors, before ultimately affecting behaviours. Social platforms influence ecological awareness and location-rootedness, encouraging sustainable practices Li, X. (2022).

Moderation Effects

Proposition 6: Individual Characteristics Moderate Digital Influence

Individual traits variably affect the efficacy of digital marketing in sustainable tourism behaviour. For those born digital, technology approval and environmental consciousness differ distinctly, such as in Generation Z (Trinh et al., 2023). Environmental values moderate digital influence, as individuals with stronger environmental values respond better to sustainability marketing (Luong, 2025). Travel experience level alters how digital communications shape actions, with seasoned voyagers reacting differently than novices.

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Proposition 7: Contextual Factors Moderate Psychological Mediators

Contextual factors influence psychological mediators in sustainable tourism behaviors. Economic conditions affect travelers' sustainable practices and moderate environmental consciousness-behavior relationships. Technological infrastructure determines digital marketing effectiveness, affecting platform usage Jha, M. (2024). The regulatory environment shapes mediator operations through policy frameworks.

Proposition 8: Cultural Context Moderates Framework Relationships

Cultural context moderate's framework relationships, showing variations in digital marketing effectiveness and psychological mediator operations. Collectivistic cultures demonstrate stronger social norm influence on environmental consciousness than individualistic cultures (Luong, 2025). Cross-cultural research shows relationships between digital antecedents, mediators, and outcomes vary across cultures, with environmental consciousness, trust, and place attachment showing cultural specificity.

Framework Validation Approach

Expert Panel Validation Method

The framework validation uses expert panel evaluation with specialists in digital marketing, environmental psychology, and sustainable tourism. Panels include tourism academics, digital marketing practitioners, and sustainability experts. Validation uses criteria for theoretical coherence, practical applicability, and empirical validity. Experts assess framework components using instruments measuring construct clarity, relationships, and feasibility. The process combines quantitative ratings and qualitative feedback for comprehensive evaluation.

Delphi Technique for Consensus Building

The Delphi technique builds consensus among expert panel members through iterative evaluation rounds. The process involves expert assessments,

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anonymous feedback sharing, and group discussion. Rounds continue until consensus is reached on framework elements, with statistical measures like coefficient of variation ensuring agreement assessment.

Case Study Applications

Framework validation uses case studies across diverse geographical and cultural contexts, examining applicability in different tourism destinations and technological environments. Research sites span emerging and developed economies to assess universality. Mixed methods approach combines quantitative testing with stakeholder interviews and observations. Comparative analysis identifies framework strengths and requires adaptations.

Cross-Cultural Validity Considerations

Cross-cultural validation ensures framework applicability across diverse tourism markets. The validation process examines cultural equivalence of constructs and measurement invariance. Research incorporates Western and non-Western contexts for validity assessment. Cultural validation examines construct meaning, relationship patterns, and behavioral outcomes across cultural groups, identifying necessary adaptations while maintaining theoretical coherence.

Theoretical Contributions and Implications

Theoretical Contributions

Integration of Fragmented Literature Streams

This study integrates fragmented literature across digital marketing, environmental psychology, and sustainable tourism domains. The framework addresses gaps in smart tourism research that lacks specific identity and conceptual frameworks (Ding & Wang, 2024). It synthesizes theoretical perspectives including Planned Behavior, Technology Acceptance, Social Cognitive, Environmental Psychology, and Parasocial Interaction theories. Research shows sustainability development has been ignored, affecting national destinations (De Moraes et al., 2024). This framework assesses how

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digital capabilities affect sustainable tourism performance while incorporating multi-level sustainability perspectives.

Novel Relationships Identification

The study reveals unexplored links between digital marketing antecedents and environmental consciousness through psychological mediators. Digital green marketing campaigns influence tourists' environmental beliefs and behaviors via social media platforms (Sanjaya et al., 2024). The multidimensional framework examines how digital platforms shape sustainable tourism practices beyond conventional strategies. Studies have shown that digital advertising moulds eco-conscious conduct through environmental care, reliability, and place attachment avenues, generating helpful collaborations (Wang et al., 2025).

Multi-Level Analysis Framework

The structure provides a multilevel review exploring singular, organizational, and communal elements in digital-ecological tourism relationships. This viewpoint addresses the constraints of only level investigations that miss intricate interactions between personal, technological, and situational variables Jha, M. (2024). The structure combines micro-level mental and macro-level environmental factors while addressing key stakeholders such as businesses, areas, administrators, and travellers (Luong, 2025).

Cross-Disciplinary Synthesis

This analysis connects tourism reports, environmental science, technology, and behavioural brain research to address sustainability challenges in tourism (Li et al., 2022). The structure demonstrates how environmental psychology insights enhance the understanding of technology-mediated behaviours in tourism contexts. The amalgamation of diverse hypothetical viewpoints is crucial for addressing environmental and technological difficulties. The structure provides a template for rigorous cross-disciplinary examination addressing useful sustainability concerns.

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Practical Implications

For Tourism Marketers

Digital Marketing Strategy: The framework provides guidance for optimising digital marketing approaches to cultivate sustainable tourist conduct. Social media marketing campaigns that emphasise entertainment, usefulness, engagement, personalisation, and believability serve as key promotional factors (Alghamdi & Wahid, 2024). These insights aid in developing plans that endorse destination and environmental awareness.

Content Formation: Exploration illustrates that authentic digital material affects trust-building and behavioural results. Content creators should focus on environmental benefits, community support, and educational facets that improve destination appeal and sustainability consciousness.

Influencer Cooperation: Research indicates that influencers' perceived genuineness most strongly impacts destination selection, with credibility affecting trust formation (Alrefai et al., 2024). Marketers should partner with influencers who exhibit genuine environmental dedication.

Sustainability Communication: Digital green advertising campaigns positively sway tourists' environmental behaviour and intentions to revisit eco-destinations (Sanjaya et al., 2024).

For Destination Managers

Sustainable Tourism Advancement: The framework provides guidance for incorporating digital technologies into sustainable tourism strategies. Digital transformation can support Sustainable Development Goals through environmental sustainability, economic growth, and cultural preservation Jha, M. (2024). Managers can leverage digital platforms to promote sustainable practices and support local communities.

Digital Infrastructure Planning: This study offers insights into developing infrastructure that encourages tourism and conservation. Exploration emphasises the harmonisation of digital technology with

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sustainable destinations through stakeholder collaboration. Planning should prioritise environmental monitoring and sustainable tourism promotion.

Community Participation Strategies: Digital platforms can boost community involvement in tourism development. Research indicates that community engagement impacts environmental conduct, with economic benefits linked to protective behaviours. These platforms facilitate community participation in tourism planning processes.

Environmental Protection Integration: Digital technologies aid destination environmental administration. Platforms can promote eco-friendly practices, environmental education, and conservation efforts while maintaining their economic viability.

For Policymakers

Regulatory Framework Development: Regulatory frameworks aim to balance innovation and sustainability requirements. Strong regulations enforce standards and support digital transformation. Policymakers use research insights to develop supportive yet protective policies.

Sustainable Tourism Policies: Sustainable tourism policies leverage technology to benefit the environment and communities. The government plays a role through incentives and requirements that foster low-impact tourism. Digital tools open opportunities when policies enable their ethical use.

Digital Literacy Programs: Digital literacy programs address the gaps that slow the adoption of sustainable solutions. Research shows that education strengthens participation in green initiatives. Policymakers create learning opportunities to increase skills and environmental understanding.

Environmental Awareness Campaigns: Campaigns spread awareness of threats to natural places using engaging online content. When people care about the consequences of their actions, behavioural changes are more likely to occur. Digital platforms enhance the understanding of the interconnectedness and consequences of individual choices.

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Societal Implications

Environmental Conservation Promotion

The framework demonstrates how technology can help visitors care for natural places. Research has connected environmental values to conduct in tourism activities. Digital experiences that contribute to teaching respect for fragile ecosystems reach a broad audience Dam, T. C. (2025). Digital-environmental tourism frameworks contribute to global conservation efforts through scalable environmental education campaigns reaching diverse audiences. Authentic communication works against misleading messaging while promoting real conservation success.

Community Development Support

The study also shows how digital tools support community welfare. Evidence indicates that ecotourism can enrich local lives and economies when conducted respectfully. Online spaces give local people a voice in decisions that affect them while ensuring that benefits are shared and traditions are preserved. The framework empowers populations to shape sustainable outcomes in their tourism.

Cultural Preservation

Digital technologies can both protect cultural heritage for future generations to experience as well as support sustainable tourism development in local communities. Studies have shown that immersing oneself in the rich cultural atmosphere of a destination stimulates environmental awareness and influences visitors to adopt more conservation-minded behaviours during their travels and after they return home (Wang et al., 2025). Authentically representing traditions through digital platforms creates new economic opportunities to preserve cultural practices that may otherwise disappear.

Sustainable Lifestyle Encouragement

The framework aims to encourage the adoption of more sustainable lifestyles through tourism experiences that enhance environmental consciousness. Research has found that travelling to destinations in an environmentally

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conscious manner and learning about indigenous conservation efforts can extend environmental awareness to influence daily practices even after returning from vacation Li, X. (2022). By focusing on experiencing authentic environmental preservation practices firsthand, it contributes to cultivating lifelong environmentally committed citizens who are more likely to participate in ongoing conservation efforts in their communities.

Future Research Agenda

Empirical Testing Priorities

Large-Scale Quantitative Studies

Future research should focus heavily on large-scale quantitative analyses to validate this digital-environmental framework across diverse situations. Studies will require extensive empirical testing involving over one thousand individuals for statistical power and broad relevance, as suggested by Jha, M. (2024). Large investigations deliver robust proof while allowing complex analyses, such as structural equation modelling and its sequential variants. Advanced techniques such as PLS-SEM and PLSc demand significant sample sizes to untangle mediating influences, (Ngo et al., 2024). Multiple waves of data collection should be used to track fluctuations in digital promotion effectiveness and environmental awareness over time.

Longitudinal Behaviour Tracking

Longitudinal research necessitates innovative designs that observe tourists' eco-consciousness, technology adoption, and sustainable behaviours throughout various experiences, as recommended by Zhang et al. (2025). Prior work indicates that behavioural changes regarding sustainability require prolonged monitoring. Hence, mobile sensing, social platforms, and action tracking may document real-time shifts in environmental awareness, clarifying causality and consistency as people engage in digital-environmental relationships.

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Cross-Cultural Validation Studies

Confirming its applicability across contexts remains pivotal for establishing the universality of this framework. According to (Luong, 2025) cultural differences moderate the development of digital marketing and eco-awareness, with group-oriented societies reacting differently from individualistic communities. Studies must consider the applicability of Western and non-Western regions, industrialised and developing economies, and urban and rural populations. Research emphasises testing measurement equivalence across societies, blending quantitative assessment with qualitative adaptation to comprehend the influence of local values.

Mixed-Methods Approaches

Future studies should prioritise blended methodologies that combine quantitative testing with qualitative comprehension of psychological mechanisms. Mixed designs offer thorough perspectives by aligning quantitative relationships with qualitative explanations of processes, as advised by Wang et al. (2025). These investigations should sequentially use exploratory qualitative insights to guide the quantitative development. Contemporary analysis should incorporate digital ethnography and online observations to capture authentic digital tourism behaviour.

Emerging Technology Integration

Artificial Intelligence Applications

Integrating AI into digital environmental tourism research presents opportunities to advance theory and practice. AI technologies enhance eco-consciousness through customised sustainability advice, predictive modelling, and destination administration systems, as noted by Jha, M. (2024). Future studies should examine how AI-powered promotion affects environmental awareness through personalised content and prediction algorithms. Studies could analyse AI chatbots that promote sustainable tourism or recommendation systems for eco-friendly travel. Key concerns include

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understanding user acceptance of AI sustainability communication and its impact on environmental awareness.

Blockchain in Sustainable Tourism

Blockchain enhances Traceability and Transparency in Sustainable Tourism. All stakeholders can be brought together using blockchain technology. Future research: How does blockchain impact tourists' trust in sustainability claims and verification of their impacts (Economics and Tourism Research, 2025ledger). This includes examinations of blockchain's relevance to sustainability credentials, carbon offset programs, and community investments. The most important factors are knowing the blockchain or verified information about tourist decisions and environmental awareness. Seamless synergy with digital marketing can enhance the credibility of sustainability communication systems through blockchain technology integration.

Internet of Things (IoT) Implications

IoT technologies enable real-time environmental monitoring and intelligent destination management. Research should examine how IoT sensors influence environmental consciousness through feedback systems and management platforms (Ding & Wang, 2024). Studies should investigate psychological impacts of IoT-mediated awareness systems on sustainable tourism behaviors. Key priorities include privacy concerns in IoT sustainability monitoring, effectiveness of environmental feedback, and IoT data integration for personalized sustainability promotion.

Metaverse Tourism Experiences

Metaverse technologies, virtual tourism, and environmental education create new paradigms for research on how virtual reality nature travel affects green perception, destination image, and travel behaviour (Istiqlal et al., 2024). Research is needed to explore the efficacy of immersive virtual environments in encouraging sustainable tourism and to study transfer behaviour from a virtual-to-physical interface. Among its key priorities are exploring metaverse

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tourism as an alternative to physical travel, investigating the impact of virtual environmental education, and considering how metaverse platforms can be integrated with digital marketing to transition towards green tourism.

Contextual Extensions

Crisis Tourism Management

The journey to integrate digitalisation and sustainability into crisis-resilient tourism systems was highlighted during the COVID-19 pandemic. Further studies should investigate digital-environmental frameworks for disaster management and tourism recovery at the destination (Rahman et al., 2024). Future research should examine the role of digital platforms in crisis communication and environmental protection during tourism disruptions. These extra priorities cover understanding environmental awareness during crises, digital marketing strategies for green tourism recovery, and creating a template balanced between maintaining environmental conservation while developing economic recovery frameworks.

Climate Change Adaptation

Integrated digital-environmental tourism adaptation and mitigation approaches to climate change Future research should study how digital AM supports climate-resilient tourism, environmental knowledge, and community adaptation (Ofremu et al., 2025). Research on how digital platforms can be used for climate education and sustainable behaviour in destinations at risk is, therefore, needed.

Post-Pandemic Recovery

Consumer behaviour, technology, and sustainability trends Research should analyse whether and how experiences with the pandemic have also affected environmental awareness and interest in more sustainable forms of tourism. Top-level focus areas will be to follow how behaviours change post-pandemic and implement strategies that link digital transformation with sustainability outcomes.

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Emerging Market Applications

The challenges provided by emerging markets make these digital-environmental tourism frameworks unique. Studying the cultural and technological influences on framework effectiveness in emerging economies, more specifically, these are signals that you might be interested in learning more about mobile-first strategies, building sustainable communities of practice, or iteratively deploying resource-tested technologies. It should focus on the cultural adaptation of digital marketing, community-centred interventions, and scalable solutions for resource-limited settings.

Methodological Innovations

Big Data Analytics Applications

Digital data from tourism can track innovation by analysing the connections between the digital environment and environmental tourism. Future studies should investigate social media engagement, environmentally sustainable activities, and tourism behaviour between generations in big data analytics research Jha, M. (2024). Insight: Optimal use of sentiment analysis, network analysis, and predictive modelling to assess marketing efficiency and behavioural trends. Highlights: Automation tools for sustainability analysis, predictive models of environmental consciousness, and real-time data on digital-environmental tourism interaction.

Machine Learning Approaches

In environmental tourism, machine learning technologies can recognise patterns, predict behaviour, and create individualised interventions in virtual environments. In the future, research should adopt supervised and unsupervised algorithms to explore ecological awareness drivers and sustainable tourist behaviours (Ngo et al., 2024). Deep Learning for pattern recognition of tourism data & Reinforcement Learning for interventions (use-cases / studies) Many actions are on the table to help create some of these models, including a framework for sustainability recommendations, a

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measure of environmental consciousness, or even possible AI-driven marketing strategies for sustainable tourism.

Social Network Analysis

Social network analysis reveals how environmental consciousness and sustainable tourism behaviors spread through digital networks. Research should use network analysis to understand influence patterns and information diffusion related to sustainable tourism Li, X. (2022). Studies should examine how network structure affects environmental consciousness while identifying key influencers. Priorities include mapping influence networks, understanding viral mechanisms for environmental awareness, and developing network-based strategies to promote sustainable tourism behaviors.

Behavioural Experimentation

Experimental approaches in digital environmental tourism contexts evaluate causal relationships and intervention effectiveness through testing. Studies should utilise a variety of testing methods, such as randomised controlled trials, field experiments, and A/B testing, to examine assorted intervention strategies. Researchers must employ A/B testing to compare digital marketing variations, controlled trials to gauge different education programs, and field experiments to explore distinctive behaviour promotion techniques. Key research aims involve experimenting with digital marketing messages to determine effective methods for raising environmental awareness, assessing diverse sustainable behaviour initiatives to discern impactful solutions, and utilising controlled trials to recognise formative mechanisms within digital tourism that influence green conduct.

Limitations and Conclusion

Framework Limitations

Theoretical Scope Boundaries

The digital-environmental tourism framework operates within theoretical boundaries that potentially omit crucial psychological and institutional factors influencing digital-environmental tourism relationships. The framework

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integrates five core theories (Theory of Planned Behavior, Technology Acceptance Model, Social Cognitive Theory, Environmental Psychology Theory, and Parasocial Interaction Theory), potentially missing some psychological and behavioral mechanisms influencing digital-environmental tourism relationships (Naskar et al., 2025). While integrating five core theories illuminates individual processes, the framework risks underestimating the organizational capabilities and policy support that shape technology and environmental adoption. Future refinement should consider multilevel theoretical integration to provide a more holistic understanding. Research shows that organizational capabilities and institutional support moderate technology-environment relationships in tourism contexts Jha, M. (2024). Future refinements should consider multi-level theoretical integration.

Contextual Limitations

The framework's development, primarily based on Western and Asian market research, may have limited applicability across diverse global contexts. Cultural variations in technology adoption, environmental consciousness, and tourism behavior require context-specific adaptations (Luong, 2025). The collectivist-individualist dimension affects social media use and environmental behavior adoption. Economic development levels impact digital infrastructure and environmental priorities, limiting framework application in developing nations. Resource constraints and limited technological access may alter the proposed relationships. The framework assumes baseline conditions of digital literacy and tourism infrastructure that aren't universal.

Temporal Considerations

Given the rapid evolution of technologies, temporal qualifications influence the framework. Emerging technologies such as AI, blockchain, and metaverses are reshaping marketing and travel in complex ways beyond current theories (Ding & Wang, 2024). Environmental awareness shows temporal dynamics influenced by climate crises and policy shifts, which alter the proposed

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relationships (Ofremu et al., 2025). Longitudinal studies will be needed to understand the framework's temporal stability.

Measurement Challenges

The framework incorporates environmental awareness, digital trustworthiness, place attachment, and perceived authenticity, which present testing difficulties. Studies indicate debates regarding the quantification of these mental constructs, with tools providing varying outcomes (Ngo et al., 2024). Measuring technology-enabled environmental behaviour in tourism generates methodological obstacles. Cross-cultural dimension equivalence is a key restriction because the meanings of constructs may differ across societies. Investigations have demonstrated that environmental consciousness and tourism behaviour constructs necessitate validation across cultures (Wang et al., 2025).

Conclusion

The digital-ecological tourism structure integrates theories explaining how digital technologies impact environmental awareness and sustainable tourism actions. It combines theoretical insights into a design covering digital antecedents, psychological intermediaries, moderating factors, and behavioural outcomes. This study connects fragmented literature while analysing technology-psychology-sustainability relationships in tourism, demonstrating how digital platforms catalyse environmental awareness and sustainable behaviour. The structure incorporates digital marketing and environmental psychology in tourism, addressing metatheoretical approaches to sustainability. This reveals the connection between digital strategies and environmental consciousness through psychological intermediaries. Practically, it guides tourism stakeholders in employing digital technologies for sustainability, helping advertisers develop genuine environmental strategies, and destination administrators create supporting digital infrastructure. Policymakers can use this to establish regulatory frameworks that ensure real benefits.

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While large-scale quantitative modelling is important for validating the elements of the framework across diverse settings, qualitative exploration of lived experiences should not be overlooked. Cross-cultural collaboration and long-term evaluation can provide a nuanced understanding of how factors intertwine and whether envisaged outcomes come to fruition. Meanwhile, a blended investigation incorporating mixed data sources can offer a multifaceted perspective on how inner workings may manifest differently amid varying conditions. As technologies, environmental values, and cultural worldviews continuously change, tourism exploration in digital realms demands consideration of such evolution. Researchers must consider artificial intelligence, distributed ledgers, and interconnected devices while prioritising user privacy and equitable access. For the framework to have a genuine impact, fostering real improvement in the natural environment rather than just digital participation is key. The framework's success depends on facilitating genuine environmental benefits rather than digital engagement. As tourism faces sustainability challenges, the framework offers a pathway for leveraging digital innovation, requiring research effort, industry commitment, and policy support.

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