From ecotourism to e-ecotourism: Exploring digital transformations for sustainable tourism development in Songkhla Province, Thailand

American Journal of Social Sciences and Humanities
Vol. 11, No. 2, 17-27, 2026
e-ISSN: 2226-4809/p-ISSN: 2304-6945

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ABSTRACT

This study examines the transition from traditional ecotourism to e-ecotourism in Songkhla Province, Southern Thailand, with a focus on the role of digital technologies in advancing sustainable tourism development. Using a qualitative systematic literature review (SLR) and thematic content analysis of 21 peer-reviewed studies from Scopus and Web of Science, the study addresses three questions: the current ecotourism landscape and its digital readiness, barriers to transitioning from traditional ecotourism to e-ecotourism, and how digital technologies contribute to sustainable tourism outcomes. Findings indicate that digitalization significantly enhances destination management, visitor education, and environmental conservation. Four key barriers constraining digital transformation are identified: limited digital literacy among local operators, insufficient financial resources for infrastructure development, inadequate digital infrastructure particularly in rural areas, and traditional mindsets resistant to technological change. A comprehensive conceptual framework linking digital transformation to three sustainable tourism development dimensions, including economic growth, socio-cultural preservation, and environmental conservation is developed, positioning e-ecotourism as an integrative mechanism for achieving sustainable outcomes. The study highlights e-ecotourism as a strategically necessary direction for Songkhla's future sustainable tourism development. Practical implications include targeted policy recommendations for government investment in digital infrastructure, comprehensive training programs for local operators and community members, and collaborative stakeholder engagement strategies designed to enable effective technology adoption while preserving community values and environmental integrity.

Keywords: *Destination management, Digital transformation, Ecotourism, E-ecotourism, Songkhla, Sustainable tourism development, Thailand.*

DOI: 10.55284/ajssh.v11i2.1849
Citation | Oak, N., Putri, O. W. S., & Liu, M. (2026). From ecotourism to e-ecotourism: Exploring digital transformations for sustainable tourism development in Songkhla Province, Thailand. *American Journal of Social Sciences and Humanities, 11*(2), 17–27.

Funding: This study received no specific financial support.
Institutional Review Board Statement: Not applicable.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
History: Received: 6 March 2026/ Revised: 30 April 2026/ Accepted: 3 June 2026/ Published: 12 June 2026
Publisher: Online Science Publishing

Highlights of this paper

- This study identifies four critical barriers to digital transformation in Songkhla's ecotourism sector: Limited digital literacy, insufficient financial resources, inadequate infrastructure, and resistance to technological change.
- A conceptual framework demonstrates how digital technologies such as mobile applications, artificial intelligence, AR/VR, and IoT sensors contribute to sustainable tourism development across economic, socio-cultural, and environmental dimensions.
- The research highlights e-ecotourism as a strategically necessary direction for Songkhla's future sustainable tourism development.

1. INTRODUCTION

Ecotourism has emerged as a significant approach to promoting sustainable development by balancing environmental conservation, economic growth, and social well-being (Firman et al., 2023). Unlike mass tourism, ecotourism emphasizes low environmental impact, responsible travel practices, and active participation of local communities. As global awareness of environmental degradation and climate change increases, ecotourism is increasingly viewed as a strategic tool for achieving sustainable economic development, particularly in resource-dependent and rural regions.

Technological innovation and digital transformation have recently begun to play a critical role in enhancing ecotourism practices by improving management efficiency, visitor experiences, and community engagement. The integration of information and communication technologies (ICT) into ecotourism has led to the emergence of e-ecotourism, which emphasizes the use of digital platforms, online systems, and smart technologies to support environmentally responsible tourism (Le & Nguyen, 2023). Despite growing digital activity globally, a substantial gap between ecotourism and e-ecotourism persists in many developing country contexts, including Thailand (Le & Nguyen, 2023).

Songkhla Province in Southern Thailand is rich in natural and cultural resources, including mountains, forests, paddy fields, lakes, rivers, and coastal wetlands, making it a region of considerable ecotourism potential (Chaiyakot & Visuthismajarn, 2012). Ecotourism activities include trekking, hiking, kayaking, bird watching, boating, cycling, and community-based activities such as fruit collection, weaving, and rice farming. Despite this potential, the province has yet to fully leverage digital technologies to sustainably promote and manage its ecotourism resources.

This study addresses three research questions (RQs).

- RQ1: How does the current ecotourism situation in Songkhla lead to the emerging implementation of e-ecotourism?
- RQ2: What are the restrictions in transforming traditional ecotourism into e-ecotourism in Songkhla Province?
- RQ3: How do digital technologies contribute to the promotion of ecotourism and sustainable tourism development in Songkhla Province?

Corresponding research objectives (ROs) are:

- RO1: To investigate the ecotourism scenario in Songkhla and link it to e-ecotourism in a practical context.
- RO2: To analyze the limitations to transforming from ecotourism to e-ecotourism in Songkhla Province.
- RO3: To investigate the role of digital technologies in promoting ecotourism and supporting sustainable tourism development in Songkhla Province.

2. LITERATURE REVIEW

2.1. Ecotourism

Ecotourism refers to responsible travel to natural areas that conserves the environment and sustains the well-being of local people (Mekhum, Songchan, & Pensap, 2020). It encompasses travel to destinations where flora, fauna, and cultural heritage are the primary attractions, enabling tourists to learn about local cultures and traditions while fostering appreciation for natural habitats (Tseng, Lin, Lin, Wu, & Sriphon, 2019). Ecotourism has grown substantially in Thailand as a sector linked to environmental conservation, economic development, and cultural exchange. Nearly 320 units of natural parks and protected areas, more than a thousand historical and cultural sites, and numerous destinations exist across urban and rural Thailand (Mekhum et al., 2020). Previous studies highlight that ecotourism contributes not only to environmental protection but also to the economic sustainability of local communities by creating employment opportunities, diversifying income sources, and encouraging the preservation of natural and cultural resources (Firman et al., 2023).

2.2. E-Ecotourism

The concept of e-ecotourism emerges from the blending of digital technologies with classical ecotourism practices. E-ecotourism refers to the integration of information technology with nature-based and sustainable tourism (Basheer, Hassan, Farooq, Ashraf, & Reshi, 2023). While traditional ecotourism focuses on nature and environmental activities, e-ecotourism depends on digital platforms, smart applications, and online information systems to deliver more interactive and educational travel experiences (Le & Nguyen, 2023). E-ecotourism transforms how travelers interact with destinations and service providers through digital tools such as the internet, mobile applications, and social media (Basheer et al., 2023). Social media platforms in particular have become integral to tourism promotion, enabling tourists to share experiences and driving destination awareness globally (ALmasoodi, Rahman, Basendwah, & ALfarra, 2023).

2.3. Digital Transformation in Tourism

Rapid advances in digital technologies have fundamentally changed tourism business operations, marketing strategies, and consumer behavior. Utilization of big data, artificial intelligence (AI), and smart tourism systems enables service providers to better understand customer preferences and improve management performance (Bekele & Raj, 2025). Digital platforms, including mobile apps, social media, and online travel agencies, allow tourism businesses to promote destinations and provide easy access to detailed information. From a sustainability perspective, digital transformation creates accessible, high-quality, and environmentally friendly tourism experiences (Zhong, Xie, & Lin, 2025), enabling improved planning strategies for sustainable tourism development (Wu, Xu, Zhao, Li, & Law, 2024).

2.4. Sustainable Tourism Development

Sustainable tourism development (STD) meets the needs of current tourists and host communities while protecting and enhancing opportunities for the future (Yang et al., 2023). It encompasses three main dimensions: economic, socio-cultural, and environmental. In the socio-cultural dimension, tourism serves as a bridge connecting people of diverse cultures, promoting mutual understanding and heritage preservation (Košić, Demirović, & Dragin, 2017). Community-based tourism (CBT) encourages economic development, protects cultural heritage, and supports environmental conservation, though limited governance capacity may restrict participation (Khuc et al., 2025). In the economic dimension, rural tourism generates positive effects for local communities, including job

creation, income diversification, and infrastructure development (Baloch et al., 2023). In the environmental dimension, conserving natural resources through sustainable tourism management reduces the ecological footprint of tourism activities (Anup, 2018; Jain & Saraswat, 2024).

3. METHODOLOGY

3.1. Research Design

This study employs a qualitative research design based on a systematic literature review (SLR) combined with documentary analysis. A qualitative methodology was selected as it is well-suited to exploring complex socio-technological phenomena, particularly the conceptual and contextual dimensions of ecotourism transformation (Wu et al., 2024; Yang et al., 2023). The SLR framework enables rigorous, transparent, and reproducible synthesis of existing scholarly knowledge pertaining to ecotourism, digital transformation, and sustainable tourism development.

3.2. Data Sources and Search Strategy

The literature search was conducted using Scopus and Web of Science (WoS), selected for their comprehensive coverage of peer-reviewed journals in tourism, environmental studies, information technology, and sustainable development (Basheer et al., 2023; Bekele & Raj, 2025). Secondary sources, including Google Scholar, were consulted for regionally specific studies. Search terms included: "ecotourism", "e-ecotourism", "digital transformation", "sustainable tourism", "Songkhla", "Southern Thailand", "smart tourism", "community-based tourism", and "digital technology tourism", limited to publications from 2002 to 2025. The initial search yielded over 300 potentially relevant documents, subsequently refined through multi-stage screening.

3.3. Inclusion and Exclusion Criteria

Studies were included if they: (1) were published in English in peer-reviewed journals or conference proceedings indexed in Scopus or WoS; (2) addressed themes relevant to ecotourism, e-tourism, digital transformation in tourism, sustainable tourism, or CBT; (3) were published between 2002 and 2025; and (4) provided sufficient empirical, theoretical, or conceptual contributions. Studies were excluded if they: (1) were non-peer-reviewed sources; (2) focused on tourism sectors unrelated to nature-based or sustainable tourism; (3) were duplicates; or (4) lacked methodological transparency. Table 1 summarizes these criteria.

Table 1. Inclusion and exclusion criteria in the research.

Category	Inclusion Criteria	Exclusion Criteria
Language	Written in English	Other languages
Publication Source	Peer-reviewed journals or conference proceedings indexed in Scopus or WoS	Non-peer-reviewed sources (opinion pieces, news articles, blog posts)
Thematic Relevance	Addressed themes of ecotourism, e-tourism, digital transformation, sustainable tourism, or CBT	Studies focused exclusively on tourism sectors unrelated to nature-based or sustainable tourism
Publication Period	Published between 2002 and 2025	Duplicate studies identified across multiple databases
Academic Rigor	Provided empirical, theoretical, or conceptual contributions relevant to the RQs	Lacked sufficient methodological transparency or academic rigor

3.4. Screening and Selection

The screening process followed PRISMA 2020 guidelines Page et al. (2021) in four stages: (1) Identification, records from Scopus (342) and WoS compiled (257), duplicates removed (32); (2) Screening, titles and abstracts assessed against criteria; (3) Eligibility, full-text articles retrieved and evaluated for substantive relevance and methodological quality, 567 articles remain; (4) Inclusion, studies meeting all criteria retained for final synthesis. A total of 21 studies were selected. The details are shown in Figure 1.

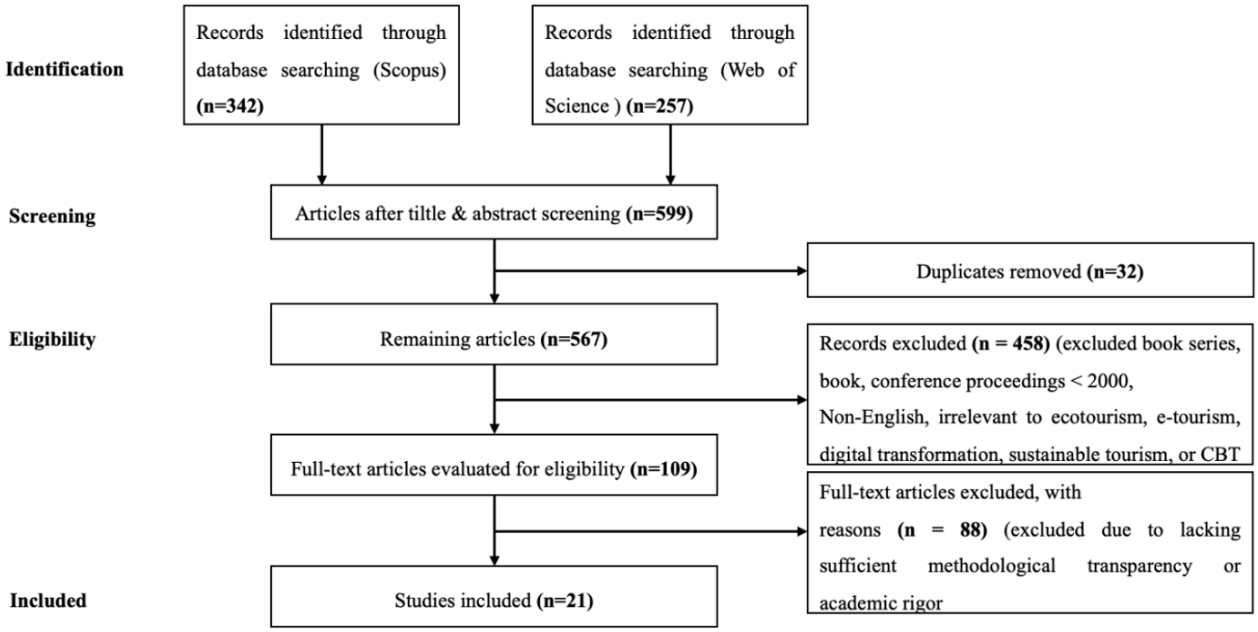

Figure 1. The screening process followed the PRISMA 2020 guidelines.

3.5. Data Analysis

Selected studies were analyzed through thematic content analysis, systematically coding and categorizing key findings according to three themes: (1) current ecotourism state and challenges in Songkhla; (2) barriers and enablers of digital transformation in ecotourism; and (3) the role of digital technologies in promoting sustainable tourism. Secondary data from government tourism reports, regional statistics, and institutional publications were incorporated to contextualize findings within Songkhla Province (Chaiyakot & Visuthismajarn, 2012; Mekhum et al., 2020).

3.6. Conceptual Framework

Drawing on synthesized literature, a conceptual framework was developed illustrating pathways through which digital transformation supports STD outcomes across three dimensions: economic growth, socio-cultural preservation, and environmental conservation. As shown in Figure 2, the framework positions e-ecotourism as an integrative mechanism linking digital technologies (mobile applications, GIS, AI, AR/VR, IoT sensors, social media) with STD outcomes. This integrates theoretical positions from e-ecotourism scholarship (Le & Nguyen, 2023), digital tourism transformation (Bekele & Raj, 2025; Zhong et al., 2025), and sustainable development principles (Baloch et al., 2023; Yang et al., 2023).

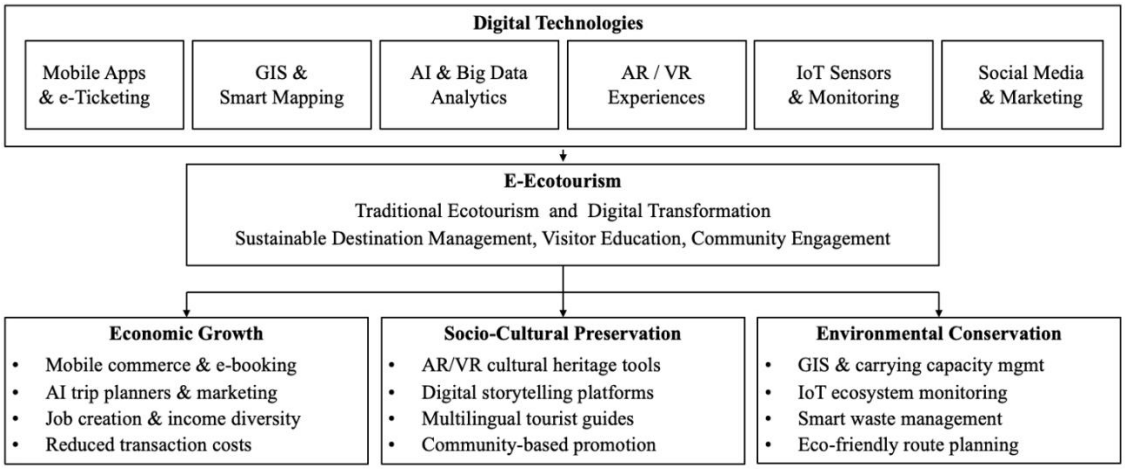

Figure 2. Conceptual framework of digital transformation to e-ecotourism and STD outcomes.

.**Source:** Authors' own elaboration based on Le and Nguyen (2023); Bekele and Raj (2025); Baloch et al. (2023) and Yang et al. (2023).

4. RESULTS AND DISCUSSION

Table 2 presents the 21 studies selected for thematic analysis with verified information for all entries, cross-checked against the original reference list.

Table 2. Summary of selected studies (N = 21).

Study	Purpose	Method	Participants / Setting	Analysis
Chaiyakot and Visuthismajarn (2012)	Determine a pattern of rural tourism that harmonizes with the Songkhla Lake Basin (SLB) resources in Southern Thailand	Quantitative	400 samples, Songkhla Lake Basin, Thailand	Survey, group discussions, questionnaires
Košić et al. (2017)	Investigate residents' attitudes toward the social, economic and environmental impact and benefits of rural tourism activities	Quantitative approach	254 samples, Serbia	Survey questionnaire
Anup (2018)	Examine tourism's role in environmental conservation and how tourism activity can support ecosystem management	Qualitative approach	Literature-based	Systematic literature review
Aly, Yuliawan, Noviyanti, Firdaus, and Prasetyo (2019)	Analyze and identify obstacles that facilitate and may influence the policy legislation process for rural tourism	Qualitative approach	Government stakeholders, East Java Province, Indonesia	Interviews, questionnaires
Ollivaud and Haxton (2019)	Assess how Indonesia can make the most of tourism to promote sustainable regional development	Qualitative approach	National tourism sector, Indonesia (OECD Working Paper No. 1535)	Policy analysis
Tseng et al. (2019)	Investigate ecotourism development in Thailand using fuzzy set theory and DEMATEL to identify value of attractions	Mixed methods	Ecotourism destinations, Thailand	Fuzzy set theory, DEMATEL, linguistic preferences
Mekhum et al. (2020)	Establish links between knowledge sharing, ICT, and ecotourism performance mediated by tourist attraction and digital management system	Quantitative approach	Employees of ecotourism provider companies, Ranong Province,	Questionnaires, dropdown technique

			Thailand	
Sihabutr and Nonthapot (2021)	Study effects of economic factors on sustainable community-based tourism and identify indicators of success in Upper Northeast Thailand	Quantitative approach	400 samples, Upper Northeast Thailand	Questionnaires
ALmasoodi et al. (2023)	Explore digital transformation plans while emphasizing emerging quality dimensions and associated consequences in tourism services	Quantitative approach	315 samples, Babylon City, Iraq	Questionnaires
Baloch et al. (2023)	Investigate the relationship between tourism development and environmental suitability to propose a framework for sustainable ecotourism	Quantitative approach	650 samples	Questionnaires
Basheer et al. (2023)	Evaluate e-tourism through bibliometric analysis and data mapping of emerging research trends and materials	Quantitative approach	Scopus and Web of Science databases	Bibliometric analysis
Firman et al. (2023)	Investigate the impact of eco-product innovation, eco-process innovation, eco-organizational innovation, ecotourism policies, and social media on sustainable tourism development	Quantitative approach	Tourism sector firms, Indonesia	Questionnaires, structural equation modeling
Le and Nguyen (2023)	Conduct bibliometric analysis of ecotourism research literature for the period 2002–2022 using VOSviewer software	Quantitative approach	1,693 publications, Scopus database	VOSviewer bibliometric analysis
Yang et al. (2023)	Evaluate current research levels and provide guidelines for future research on sustainable tourism	Qualitative approach	Literature-based	Systematic literature review
Jain and Saraswat (2024)	Analyze the role of technology in environmental conservation and awareness-raising	Qualitative approach	Literature-based	Systematic literature review
Polukhina, Sheresheva, Napolskikh, and Lezhnin (2024)	Examine the perspective on the development of regional tourism ecosystems as pillars of sustainable development during economic crisis	Mixed methods	Tourism stakeholders, Russia	Delphi method, mathematical and statistical analysis
Wu et al. (2024)	Reveal future implications of digital intelligence and smart development in the context of tourism	Qualitative approach	278 key publications	Systematic literature review
Bekele and Raj (2025)	Provide a bibliometric review of digitalization and digital transformation research in the tourism industry and devise future research agendas	Mixed methods	Tourism digitalization literature (Scopus, WoS)	Systematic literature review, bibliometric analysis
Khuc et al. (2025)	Investigate young tourists' perceptions of and financial contributions to community-based tourism associated with cultural preservation	Quantitative approach	275 samples, Vietnam	Contingent valuation method (CVM), interval regression model
Zhong et al. (2025)	Explore how factor endowment, digital transformation, and institutional quality influence high-quality tourism economic development	Mixed methods	30 Chinese provinces	Panel regression, fuzzy-set Qualitative Comparative Analysis (fsQCA)
Page et al. (2021)	Present the updated PRISMA 2020 statement as a guideline for reporting systematic reviews	Methodological approach	PRISMA guideline development group	Consensus-based methodology

Note: Included as the methodological reference for the PRISMA-guided screening protocol.

Source: Page et al. (2021).

4.1. Current Ecotourism Situation in Songkhla and Emerging E-Ecotourism

The thematic analysis reveals that ecotourism in Songkhla Province remains predominantly traditional, relying on face-to-face guided tours, physical promotional materials, and informal word-of-mouth marketing. Digital marketing has begun to emerge through social media, where content about Songkhla tourist destinations increasingly appears as visitors share reviews and recommendations, enhancing the province's image (ALmasoodi et al., 2023). However, a significant implementation gap persists between this incipient digital activity and a fully realized e-ecotourism model.

Key heritage sites, including Songkhla Old Town, Songkhla National Park, and Songkhla Zoo, provide a strong ecotourism foundation, yet the digital infrastructure supporting visitor information, navigation, and experience enhancement remains underdeveloped. Hotels and accommodations have increasingly adopted online booking systems, and online ride-hailing services are available; however, these developments alone do not constitute e-ecotourism, as comprehensive digital integration across visitor engagement, destination management, and environmental conservation is still lacking (Mekhum et al., 2020).

Studies reviewed indicate that successful e-ecotourism implementation requires not merely digitizing existing services but fundamentally rethinking destination management through technology (Bekele & Raj, 2025). Songkhla's growing tourism profile, particularly among Malaysian and regional visitors, provides a timely opportunity to invest in digital transformation to strengthen its competitive positioning as a sustainable tourism destination.

4.2. Barriers to Digital Transformation in Songkhla's Ecotourism Sector

The literature synthesis identifies four principal barriers to transitioning from traditional ecotourism to e-ecotourism in Songkhla Province. First, limited digital literacy among local community members and small tourism operators constrains adoption of digital tools. Studies in comparable Southeast Asian contexts confirm that digital skill gaps among tourism SMEs significantly impede platform adoption (Firman et al., 2023). Second, insufficient financial resources represent a structural barrier, as digital infrastructure development and staff training require sustained investment beyond the capacity of many small community-based operators (Aly et al., 2019).

Third, inadequate digital infrastructure, particularly unreliable internet connectivity in rural areas, limits the practical deployment of smart tourism systems. Mekhum et al. (2020) identify ICT access as a critical mediating factor in ecotourism performance in Thai provincial contexts. Fourth, traditional mindsets and risk aversion among some community stakeholders present a social barrier. Local operators who perceive current income as adequate may resist technological change, particularly fearing displacement by automated systems. Addressing this requires participatory engagement strategies framing technology as an enabler rather than a replacement (Khuc et al., 2025).

4.3. Role of Digital Technologies in Sustainable Tourism Development

The thematic analysis demonstrates that digital technologies contribute to all three STD dimensions in Songkhla's ecotourism context. In the economic dimension, mobile applications and e-ticketing systems enable tourists to book access to Songkhla Zoo, museums, and national parks, reducing transaction costs and extending market reach (Wu et al., 2024). AI-powered trip planners can recommend low-impact routes and redistribute visitor flows to reduce overtourism while increasing economic benefits for peripheral communities.

In the socio-cultural dimension, digital storytelling tools and augmented reality (AR) applications enable deeper engagement with Songkhla's cultural heritage, including the architecture of Songkhla Old Town, the traditional Nora dance, and Muslim community practices. Online tourist guide services supplement traditional

guides for independent travelers, and social media feedback mechanisms provide real-time visitor insights for destination managers (ALmasoodi et al., 2023).

In the environmental dimension, geographic information system (GIS) mapping supports sustainable route planning by visualizing carrying capacities and monitoring visitor flows in the mangrove areas of the Songkhla Lake Basin (Baloch et al., 2023). Internet of Things (IoT) sensor networks can monitor water quality, pollution levels, and ecosystem health indicators. Smart waste management systems can reduce plastic pollution in coastal tourism zones. The adoption of electric vehicles among tourism operators represents an early indicator of technology-driven emission reduction (Sihabutr & Nonthapot, 2021).

5. CONCLUSIONS

This study examined the transition from ecotourism to e-ecotourism in Songkhla Province, Thailand, through a systematic review of 21 peer-reviewed studies. Three principal conclusions emerge from the analysis.

First, Songkhla possesses substantial ecotourism resources but remains at an early stage of digital integration. The province's growing tourism profile provides a favorable basis for systematic digital transformation, but concerted investment and coordination among government, local communities, and private operators are required.

Second, four barriers constrain digital transformation: limited digital literacy, insufficient financial resources, inadequate digital infrastructure, and traditional mindsets resistant to change. Addressing these barriers demands targeted policy interventions, including digital skills training, subsidized infrastructure investment, and participatory stakeholder engagement.

Third, digital technologies offer significant potential contributions across all three STD dimensions. In the economic dimension, mobile commerce and AI-driven marketing can expand market reach. In the socio-cultural dimension, AR applications and digital storytelling can deepen cultural engagement and support heritage preservation. In the environmental dimension, GIS, IoT monitoring, and smart waste management systems can strengthen ecological stewardship.

Future research should include primary data collection through surveys and interviews with tourism stakeholders in Songkhla, followed by pilot implementation of selected digital technologies in defined areas such as Songkhla Old Town and Songkhla Lake Basin. Comparative analysis with digitally advanced Thai destinations such as Chiang Mai and Phuket could further inform best-practice transfer strategies.

6. RECOMMENDATIONS

For government and tourism authorities: Implement digital tourism platforms incorporating smart visitor management and AI-based trip planners. Invest in digital infrastructure and internet connectivity in rural Songkhla ecotourism zones. Establish regulatory frameworks limiting visitor numbers and promoting eco-friendly behavior in sensitive natural areas.

For local communities and business operators: Adopt digital tools, including online booking systems and social media marketing platforms. Participate in digital literacy and digital marketing training programs. Leverage digital storytelling to promote authentic cultural experiences and build stronger connections between visitors and local heritage.

For technology developers and researchers: Design user-friendly, multilingual tourism applications incorporating AI-based planning, AR cultural experiences, and real-time environmental monitoring dashboards. Prioritize open-source or low-cost solutions suitable for community-based operators with limited financial capacity.

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