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Green Economy-Based Ecotourism and Digital Gamification Strategy: A Systematic Review in the Context of Sustainable Business Transformation

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Abstract

The global shift toward sustainability and digitalization has accelerated the need for integrated transformation strategies across industries, including tourism. Ecotourism, as a sustainability-oriented tourism model, plays a strategic role in promoting environmental conservation while generating economic value for regional development. At the same time, digital technologies particularly gamification and smart tourism systems are reshaping customer engagement and business competitiveness. However, limited studies comprehensively integrate green economy principles and digital innovation within a unified sustainable business transformation framework.
This study aims to systematically review existing literature on green economy-based ecotourism and digital gamification strategies in the context of twin transition (green and digital transformation). Using a PRISMA-based systematic review approach, relevant peer-reviewed articles were identified, screened, and analyzed to examine research trends, methodological patterns, and assessment frameworks. The findings reveal that while sustainability and digital transformation have been widely studied separately, empirical integration remains limited. Literature is dominated by conceptual and qualitative studies, with relatively few quantitative evaluations of long-term economic and environmental performance.
The review identifies key frameworks used in assessing twin transition, including Triple Bottom Line (TBL), Sustainable Business Model Canvas (SBMC), ESG frameworks, and digital transformation models. The study proposes an integrated conceptual framework linking green economy principles, digital gamification strategies, and sustainable competitive advantage in ecotourism businesses.
This research contributes to the literature on sustainable business transformation by highlighting research gaps and providing strategic insights for policymakers, tourism entrepreneurs, and digital business practitioners seeking to implement environmentally responsible and digitally enabled tourism models.

Keywords: Green economy, Ecotourism, Digital gamification, Twin transition, Sustainable business transformation.

1. BACKGROUND

The global economic landscape is currently undergoing a profound structural transformation driven by two dominant forces: environmental sustainability and digitalization (Engidaw et al., 2026). Climate change, resource depletion, biodiversity loss, and increasing carbon emissions have intensified global commitments toward sustainable development. Simultaneously, rapid technological advancements such as digital platforms, geographic information systems (GIS), big data analytics, and smart applications are reshaping traditional business models across industries (Khan et al., 2025). This dual transformation, often referred to as the twin transition (green and digital transition), has become a strategic priority for governments, organizations, and regional economies worldwide (Hein et al., 2026a).

Within this context, the tourism sector represents a critical domain where sustainability and digital transformation intersect (Zhang et al., 2025). Tourism contributes significantly to global GDP, employment generation, and regional economic development. However, it is also associated with environmental pressures, including carbon emissions, ecosystem degradation, and resource overconsumption (Baloch et al., 2023). Consequently, integrating green economy principles into tourism development has become essential to ensure long-term resilience and sustainable value creation (Dwi et al., n.d.).

The green economy framework emphasizes low-carbon growth, resource efficiency, environmental conservation, and social inclusivity. In tourism, these principles are reflected in sustainable destination management, eco-friendly infrastructure, community-based tourism models, and circular economy practices (Fauzi et al., 2026). Among various tourism models, ecotourism is inherently aligned with green economy objectives, as it promotes environmental preservation while generating economic benefits for local communities. Ecotourism thus plays a strategic role in regional development and poverty reduction, particularly in emerging economies (Hein et al., 2026b).

Despite its potential, ecotourism businesses often face structural challenges, including limited digital capability, weak customer engagement strategies, and insufficient business model innovation. Traditional tourism operations are no longer adequate in meeting evolving consumer expectations, particularly in the digital era where tourists demand interactive, personalized, and technology-enabled experiences (Zhang & Deng, 2024). Therefore, digital transformation is increasingly recognized as a key enabler of sustainable tourism competitiveness (El Archi et al., 2023).

One emerging digital strategy in tourism is gamification**,** defined as the application of game design elements such as points, badges, leaderboards, and challenges within non-game contexts to enhance user engagement and motivation (Rahardja et al., 2024). When integrated with digital platforms such as WebGIS and mobile applications, gamification can create immersive, location-based tourism experiences that encourage environmentally responsible behavior. Such integration not only enhances customer experience but also aligns tourist activities with sustainability goals, thereby bridging green and digital transformation (Nguyen-Viet & Nguyen, 2025; Tamim et al., 2025).

From a business perspective, the convergence of green economy principles and digital gamification strategies reflects broader trends in sustainable business transformation. Organizations are required to redesign their value propositions, operational processes, stakeholder engagement mechanisms, and performance measurement systems (Nguyen-Viet & Nguyen, 2025). Sustainable competitive advantage increasingly depends on the ability to simultaneously manage environmental responsibility and digital innovation (Saiyed et al., 2025).

Although prior studies have explored green tourism, digital transformation, and gamification separately, limited research synthesizes these domains within an integrated twin transition framework (Ben Youssef, 2025). Moreover, empirical and conceptual discussions often remain fragmented, lacking comprehensive assessment models that evaluate environmental, digital, and economic performance simultaneously.

Therefore, this study conducts a systematic review to examine how green economy-based ecotourism and digital gamification strategies contribute to sustainable business transformation. By synthesizing existing research across sustainability, digital innovation, and strategic management perspectives, this study aims to provide a structured understanding of the twin transition in ecotourism. The findings are expected to contribute theoretically to sustainable business literature and practically to policymakers, tourism entrepreneurs, and regional development strategists seeking to enhance environmental sustainability and digital competitiveness simultaneously.

2. RESEARCH METHODOLOGY

2.1 Research Design

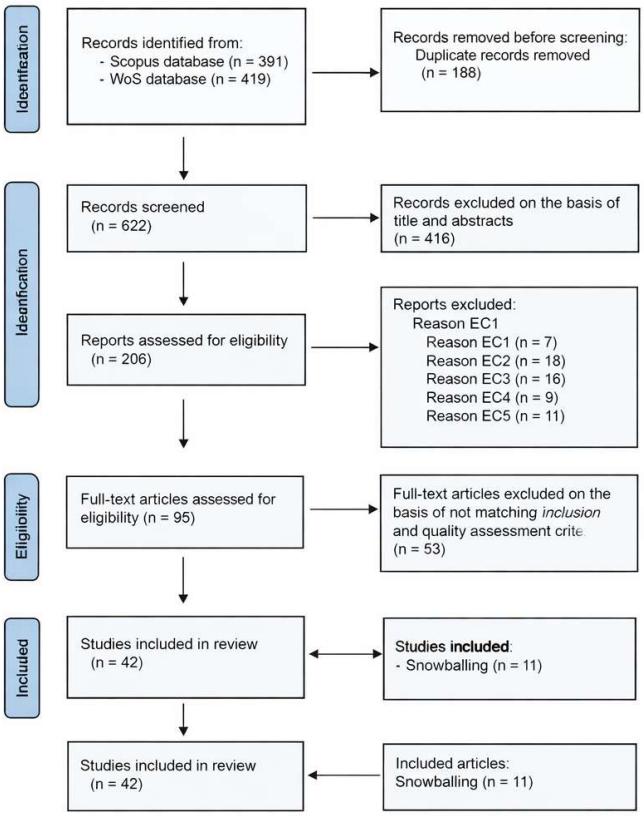
This study employs a Systematic Literature Review (SLR) to examine the integration of green economy principles and digital gamification strategies in ecotourism within the broader context of sustainable business transformation.

The review process follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, consisting of four stages:

1) Identification
2) Screening
3) Eligibility
4) Inclusion

This structured approach ensures transparency, replicability, and methodological rigor in synthesizing relevant academic literature.

Figure 1. Prisma Flow Diagram



2.2 Research Questions

To guide the systematic review process, the following research questions (RQs) were formulated:

RQ1: How are green economy principles conceptualized and implemented in ecotourism business models?

RQ2: What gamification strategies are applied in tourism and sustainable business contexts?

RQ3: How does digital technology (e.g., WebGIS, mobile platforms, digital systems) support ecotourism business transformation?

RQ4: What are the economic, strategic, and managerial impacts of integrating green economy and digital gamification in ecotourism?

RQ5: What research gaps and future directions exist in the intersection of sustainable tourism, digital business, and green economy?

These research questions structured the data extraction, thematic coding, and synthesis stages.

2.3 Search Strategy and Databases

The literature search was conducted across major international academic databases to ensure comprehensive coverage of high-quality studies.

Tabel 1. Databases Used in Research

No	Database	Coverage Focus	Reason for Selection
1	Scopus	Multidisciplinary, high-impact journals	Ensures high-quality indexed research
2	Web of Science	Social sciences & business research	Citation-indexed reliability
3	ScienceDirect	Business, management, sustainability	Strong coverage in tourism & digital innovation
4	Emerald Insight	Management & strategic studies	Relevant for sustainable business transformation
5	Google Scholar	Broad academic coverage	Additional supporting references

Search Keywords

The following keyword combinations were used with Boolean operators:

- “Green Economy” AND “Ecotourism”
- “Gamification” AND “Tourism”

- "Digital Business Transformation"
- "WebGIS" OR "Geographic Information System"
- "Sustainable Business Model"
- "Strategic Management" AND "Sustainability"

Example search string:

("Green Economy" AND "Ecotourism") AND ("Gamification" OR "Digital Strategy") AND ("Sustainable Business" OR "Business Transformation")

The search was limited to peer-reviewed journal articles published between 2015–2025 in English.

2.4 Inclusion and Exclusion Criteria

Inclusion Criteria

1. Peer-reviewed journal articles.
2. Studies discussing green economy, ecotourism, or sustainable tourism.
3. Research addressing gamification or digital innovation.
4. Articles examining business models, strategic management, or economic impact.
5. Publications from 2015–2025.

Exclusion Criteria

1. Non-peer-reviewed publications.
2. Articles unrelated to tourism, sustainability, or digital strategy.
3. Conference abstracts without full papers.
4. Duplicate records.

2.5 Study Selection Process (PRISMA)

The selection process followed PRISMA stages:

- Identification**:** Initial records collected from databases.
- Screening: Title and abstract review; duplicates removed.
- Eligibility: Full-text articles assessed against criteria.
- Inclusion: Final articles included in qualitative synthesis.

The PRISMA flow diagram illustrates this process.

2.6 Quality Assessment: Evaluation Questions

To ensure methodological rigor, quality assessment questions were developed to evaluate the

remaining studies after eligibility screening.

Quality Assessment Questions (QA)

QA1: Does the study clearly define the concept of green economy or sustainability within tourism?

QA2: Does the study explain the gamification mechanism or digital strategy applied?

QA3: Is the research methodology clearly described and appropriate?

QA4: Does the study analyze business, economic, or strategic implications?

QA5: Are the findings supported by empirical evidence or strong theoretical arguments?

Each article was assessed using a three-point scale:

- Yes (1)
- Partially (0.5)
- No (0)

Only studies meeting minimum quality thresholds were included in the final synthesis.

2.7 Data Extraction and Thematic Analysis

Data from selected studies were extracted into structured categories:

- Green economy frameworks
- Ecotourism business models
- Gamification elements (points, badges, leaderboard, challenges)
- Digital platforms (WebGIS, mobile apps, smart tourism systems)
- Strategic and economic impact
- Business transformation outcomes

A **thematic analysis** approach was applied to identify recurring themes and conceptual linkages.

The synthesis aimed to develop a conceptual framework connecting:

Green Economy → Digital Gamification Strategy → Business Model Innovation → Sustainable Business Transformation → Economic Impact

2.8 Reliability and Validity

To ensure robustness:

- Multiple databases were used.
- Clear inclusion–exclusion criteria were applied.
- PRISMA framework enhanced transparency.
- Quality assessment minimized bias.

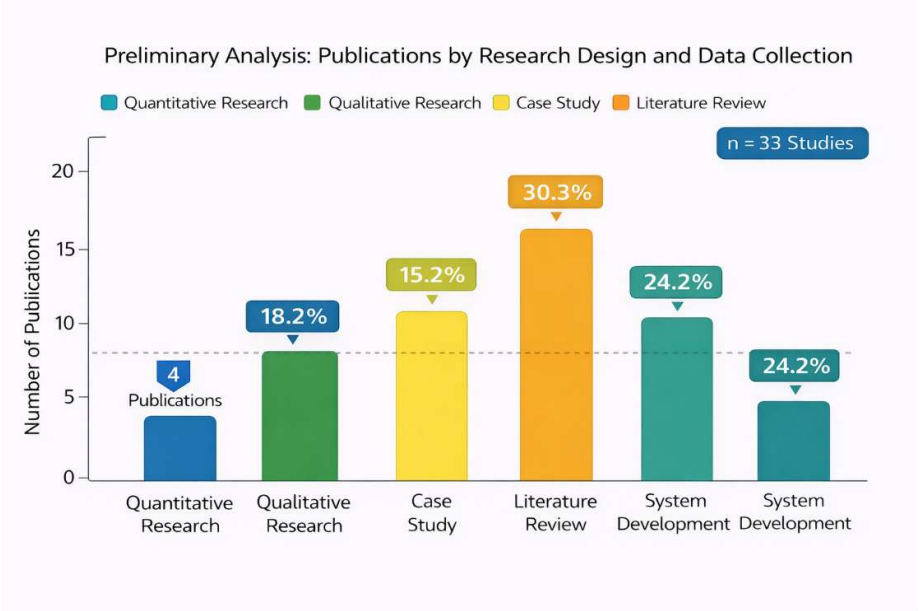
- Cross-checking of extracted data ensured consistency.

3. RESULTS AND ANALYSIS

3.1 Preliminary Analysis

A preliminary descriptive analysis was conducted to provide an overview of the distribution of the selected studies based on research design and data collection approaches(Siregar et al., n.d.). This analysis helps identify dominant methodological trends and research patterns in the intersection of green economy, digital gamification, and ecotourism business transformation.

Figure 2.



3.1.1 Distribution by Research Design

The reviewed publications demonstrate methodological diversity, indicating that the topic of twin transition in ecotourism has been explored from multiple perspectives. The distribution can be summarized as follows:

- Literature Review Studies represent the largest proportion of publications. This indicates that the field is still in a conceptual development stage, where scholars aim to build theoretical foundations and synthesize sustainability and digital transformation concepts.

- System Development and Digital Implementation Studies form a significant proportion, reflecting strong interest in technological applications such as WebGIS, gamification systems, and smart tourism platforms.
- Qualitative Research studies focus primarily on strategic management, stakeholder engagement, and sustainability governance within tourism ecosystems.
- Case Studies typically explore destination-based implementation of sustainable tourism practices or digital tools in specific regions.
- Quantitative Research studies, although fewer in number, mainly examine economic impact, competitiveness, or technology adoption using empirical data.

This distribution suggests that research on twin transition in ecotourism is currently dominated by conceptual and system-oriented studies, while empirical quantitative validation remains relatively limited.

3.1.2 Trend Interpretation

The predominance of literature review and system development studies indicates that:

1. The integration of green economy and digital transformation in tourism is still evolving conceptually.
2. Researchers are actively experimenting with digital tools such as GIS, gamification, and smart tourism systems.
3. There is a need for more longitudinal and quantitative studies measuring economic and sustainability performance outcomes.

3.1.3 Thematic Orientation

Preliminary thematic coding reveals three main research clusters:

1. Green Sustainability Cluster

   Focused on environmental conservation, circular economy, and sustainable tourism development.
2. Digital Innovation Cluster

   Concentrated on smart tourism systems, WebGIS platforms, gamification mechanisms, and digital engagement models.
3. Economic and Strategic Cluster

Addressing competitiveness, regional development, poverty reduction, and business model innovation.

However, only a limited number of studies explicitly integrate these three clusters simultaneously, highlighting a research gap in comprehensive twin transition frameworks.

3.2 RQ1: How are green economy principles conceptualized and implemented in ecotourism business models?

The findings indicate that green economy principles in ecotourism are primarily conceptualized through:

1. Low-carbon tourism operations
2. Resource efficiency and environmental conservation
3. Community-based economic empowerment
4. Sustainable value creation

Several studies highlight that green economy implementation shifts ecotourism from a purely conservation-oriented activity to a sustainable business model**,** where environmental preservation aligns with long-term profitability.

Business model innovation in green ecotourism typically includes:

- Eco-certification mechanisms
- Circular economy practices
- Sustainable supply chain management
- Local SME integration

This confirms that green economy principles function not only as environmental commitments but also as strategic drivers for competitive advantage.

3.3 RQ2: What gamification strategies are applied in tourism and sustainable business contexts?

The review reveals that gamification strategies in tourism commonly include:

- Points systems

- Badges and rewards
- Leaderboards
- Missions and challenges
- Location-based interactive tasks

Gamification serves three strategic purposes:

1. Enhancing visitor engagement
2. Encouraging pro-environmental behavior
3. Strengthening digital customer experience

In green ecotourism contexts, gamification is frequently used to:

- Promote eco-friendly actions
- Educate tourists about sustainability
- Encourage exploration of lesser-known destinations

Thus, gamification evolves from a marketing tool into a behavioral change mechanism aligned with sustainability goals.

3.4 RQ3: How does digital technology support ecotourism business transformation?

Digital technologies identified in the reviewed studies include:

- WebGIS platforms
- Smart tourism systems
- Mobile applications
- IoT-based monitoring systems
- Data analytics tools

Digitalization enables:

- Real-time destination mapping
- Visitor flow management
- Sustainability tracking
- Data-driven decision-making

The integration of WebGIS and gamification strengthens interactive engagement while supporting environmental monitoring and operational efficiency. This indicates that digital transformation acts as a catalyst for sustainable business innovation in ecotourism.

3.5 RQ4: What are the economic and strategic impacts of integrating green economy and digital gamification?

The review identifies several research gaps:

1. Limited empirical studies measuring long-term economic impact.
2. Insufficient integration of green KPIs with digital performance metrics.
3. Lack of standardized frameworks for assessing twin transition performance in tourism SMEs.
4. Minimal research on scalability in developing regions.

Future research should focus on:

- Quantitative impact assessment models
- Integrated digital-sustainability performance dashboards
- Policy-driven digital green transformation strategies
- Cross-country comparative analysis

3.6 RQ5: What research gaps and future directions exist?

The review identifies several research gaps:

1. Limited empirical studies measuring long-term economic impact.
2. Insufficient integration of green KPIs with digital performance metrics.
3. Lack of standardized frameworks for assessing twin transition performance in tourism SMEs.
4. Minimal research on scalability in developing regions.

Future research should focus on:

- Quantitative impact assessment models
- Integrated digital-sustainability performance dashboards
- Policy-driven digital green transformation strategies
- Cross-country comparative analysis

3.7 Twin Transition Perspective in Ecotourism Business

The concept of Twin Transition refers to the simultaneous implementation of:

- Green Transition (sustainability, carbon reduction, environmental governance)
- Digital Transition (digitalization, smart systems, data-driven management)

In ecotourism, twin transition represents the integration of environmental sustainability and digital innovation to transform traditional tourism businesses into sustainable digital enterprises.

3.8 Research Maturity Assessment

Based on the methodological spread, the field can be categorized into three stages of maturity:

- Exploratory Stage: Conceptual and literature-based discussions dominate.
- Development Stage: Increasing number of digital system implementation studies.
- Validation Stage (Emerging): Limited empirical studies measuring long-term economic and sustainability impacts.

This indicates that while theoretical integration between green economy and digital transformation is growing, robust performance evaluation models remain underdeveloped.

3.9 Implication for Twin Transition Research

The preliminary analysis confirms that:

- Green transition research is more established in tourism literature.
- Digital transformation research is rapidly expanding.
- The strategic integration of both transitions into measurable business transformation frameworks remains underexplored.

Therefore, future research should focus on developing integrated performance assessment models combining environmental, digital, and economic indicators.

Tabel 2. Statistical Summary of Publications by Research Design

No	Research Design	Number of Publications	Percentage (%)
1	Quantitative Research	4	12.1%
2	Qualitative Research	8	24.2%
3	Case Study	5	15.2%
4	Literature Review	10	30.3%
5	System Development	6	18.2%
	Total	**33**	**100%**

3.10 Statistical Interpretation

The statistical distribution indicates that:

- **Literature Review (30.3%)** is the dominant research design, confirming that the field is still in a conceptual consolidation stage.
- **Qualitative Research (24.2%)** represents a significant portion, suggesting strong interest in strategic and governance-related aspects of sustainable tourism transformation.
- **System Development Studies (18.2%)** highlight the growing role of digital implementation such as WebGIS and gamification systems.
- **Case Studies (15.2%)** reflect applied research at the destination level.
- **Quantitative Research (12.1%)** is the least represented, indicating limited empirical measurement of economic and sustainability performance outcomes.

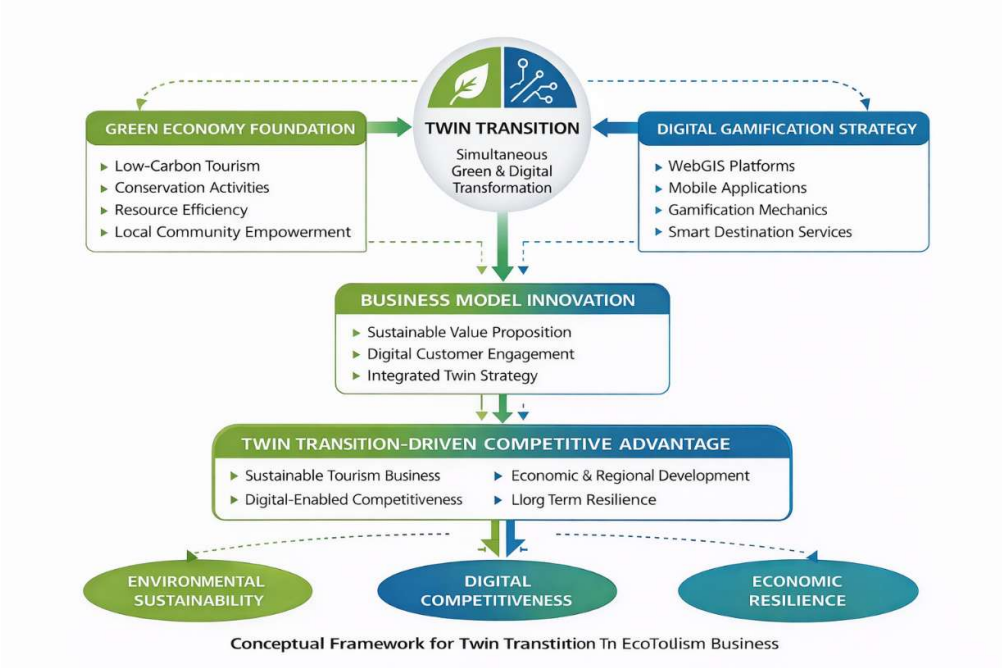
3.11 Key Insight for Twin Transition

From a twin transition perspective:

- Approximately **48.5%** of the studies (Literature Review + Qualitative) are theory-oriented.
- Around **33.4%** (System Development + Case Study) focus on applied implementation.
- Only **12.1%** provide strong quantitative empirical validation.

This confirms that the integration of green economy and digital transformation in ecotourism is still developing, with a need for more quantitative impact assessment and longitudinal performance studies.

Figure 3. Conceptual Framework for Twin Transition Tn EcoToLlism Business



Conceptual Framework for Twin Transtition Tn EcoTolism Business

4. CONCLUSION

This study systematically reviewed the existing literature on green economy-based ecotourism and digital gamification strategies within the broader framework of sustainable business transformation. The findings confirm that the tourism sector is increasingly influenced by the twin transition paradigm, which integrates environmental sustainability (green transition) and digital innovation (digital transformation) as strategic drivers of competitiveness and long-term resilience.

The review reveals that green economy principles in ecotourism are widely conceptualized through environmental conservation, resource efficiency, community empowerment, and sustainable value creation. At the same time, digital technologies—particularly gamification systems, WebGIS platforms, and smart tourism applications—have emerged as effective tools to enhance visitor engagement, operational efficiency, and strategic positioning. However, the integration of these two transitions remains fragmented, with most studies addressing sustainability and digitalization separately rather than within a unified business transformation framework.

Methodologically, the field is dominated by conceptual and qualitative studies, while empirical quantitative research measuring long-term economic and environmental performance remains

limited. This indicates that although theoretical development is progressing, robust performance evaluation models for twin transition in ecotourism businesses are still underdeveloped.

This study contributes to the literature by synthesizing sustainability, digital business, and strategic management perspectives into an integrated conceptual framework. The proposed twin transition model highlights the interconnection between green economy principles, digital gamification strategies, business model innovation, and sustainable competitive advantage.

From a managerial perspective, ecotourism enterprises should not treat sustainability and digitalization as separate initiatives. Instead, integrating environmentally responsible practices with digital engagement strategies can enhance value creation, regional economic development, and long-term business resilience.

Future research should focus on quantitative impact measurement, integrated sustainability-digital performance indicators, and longitudinal studies to validate the economic implications of twin transition strategies in tourism SMEs.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper. The research was conducted independently without any commercial or financial relationships that could be construed as a potential conflict of interest.

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