

Strengthening ASEAN Tourism Competitiveness through Sustainable and Digital Infrastructure: A Comparative Framework for Resilient Destination Development

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Abstract

ASEAN tourism destinations are entering a new phase of recovery and transformation following major disruptions caused by the COVID-nineteen pandemic, climate change, geopolitical uncertainty, and rapid technological advancements. Consequently, tourism infrastructure has evolved from conventional physical support into a strategic system integrating connectivity, sustainability, digital technology, community participation, and resilience. Although ASEAN international visitor arrivals reached approximately one hundred twenty-seven point one million in two thousand twenty-four, persistent disparities in infrastructure capacity and destination competitiveness remain. This study aims to comparatively examine tourism infrastructure management across ASEAN countries across three strategic dimensions: sustainable infrastructure, digital transformation, and destination competitiveness and resilience. Employing a comparative qualitative-descriptive approach, the study analyzes secondary data from official publications, national policies, and international reports through the frameworks of Systems Theory, the Triple Bottom Line, Destination Competitiveness Theory, and eTourism perspectives. The findings indicate varying levels of readiness across ASEAN: Singapore excels in integrated digital infrastructure; Malaysia and Thailand possess strong connectivity; Indonesia, Viet Nam, and the Philippines demonstrate vast potential but face spatial distribution and carrying capacity challenges; while emerging destinations require stronger connectivity and institutional capacity. Ultimately, infrastructure competitiveness must integrate green, digital, connected, inclusive, and resilient elements. To address this, the study proposes the ASEAN Integrated Sustainable-Digital Tourism Infrastructure Model, or ASDTIM, to guide policymakers and regional stakeholders.

Keywords: tourism infrastructure, sustainable tourism, digital transformation, destination competitiveness, tourism resilience

1. Introduction

Tourism has become an important economic and socio-cultural development sector in ASEAN. The region possesses highly diverse tourism assets, ranging from coastal and marine destinations, cultural heritage, urban tourism, ecotourism, wellness tourism, and creative tourism. However, the competitiveness of ASEAN destinations is increasingly determined not only by the attractiveness of natural and cultural resources but also by the quality, accessibility, sustainability, digitalisation, and resilience of tourism infrastructure.

ASEAN tourism has demonstrated significant post-pandemic recovery. International arrivals increased from only 2.95 million in 2021 to approximately 127.12 million in 2024. However, this figure remained below the 2019 level of 143.61 million, indicating that recovery is substantial but incomplete.

The infrastructure challenge is particularly important because tourism growth can generate pressure on transportation networks, water resources, energy systems, waste management, coastal ecosystems, public spaces, and local communities. The ASEAN Sustainable Tourism Action Roadmap explicitly recognises the need for a holistic and long-term approach to sustainability across the regional tourism industry.

At the same time, digital transformation has fundamentally altered the tourism value chain. With the advancement of information technology, the concept of smart tourism has emerged as an innovative approach to destination management. Smart tourism integrates digital technologies, data, and intelligent systems to enhance operational efficiency, service quality, and evidence-based decision-making (Kuntariningsih, 2026:65). Online booking systems, mobile applications, artificial intelligence, digital payment systems, smart destination platforms, data analytics, and personalized visitor experiences are increasingly influencing how tourists select, access, enjoy, and evaluate destinations. Research by Buhalis and Law indicates that information and communication technologies have fundamentally transformed business practices and the structure of the tourism industry.

The strategic challenge for ASEAN is therefore not simply building more infrastructure, but developing infrastructure that is:

connected + sustainable + digital + inclusive + resilient.

This leads to the central research question:

How can ASEAN countries strengthen tourism infrastructure management by integrating sustainability, digital transformation, and destination competitiveness into a resilient regional tourism development



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framework?



2. Literature Review

2.1 Grand Theory: Systems Theory

The study adopts Systems Theory as the grand theoretical foundation.

Tourism infrastructure is viewed as an interconnected system rather than a collection of individual facilities. Airports, roads, ports, hotels, utilities, digital networks, environmental systems, public services, communities, and government institutions interact to produce tourism experiences and destination competitiveness.

Thus :

Infrastructure Input → Tourism System → Visitor Experience → Destination Performance → Economic, Social and Environmental Outcomes

A weakness in one component can affect the entire tourism system.

For example, a destination may have high-quality hotels but remain less competitive because of poor airport connectivity, unreliable public transportation, limited digital connectivity, environmental degradation, or inadequate disaster preparedness.

2.2 Sustainable Tourism Infrastructure

Sustainable tourism infrastructure is based on balancing three dimensions:

Dimension	Main Focus
Economic	Efficiency, investment, employment, tourism revenue
Social	Community participation, accessibility, inclusion, local welfare
Environmental	Energy, water, waste, emissions, biodiversity and carrying capacity

This perspective is consistent with ASEAN's current direction toward sustainable and resilient tourism development. The ASEAN Sustainable Tourism Action Roadmap emphasises sustainability as a long-term and holistic regional priority.

2.3 Digital Tourism Infrastructure

Digital infrastructure has become an essential component of tourism infrastructure management.

The transformation includes :

- broadband and mobile connectivity;
- digital payment;
- online booking platforms;
- destination management systems;
- artificial intelligence;
- big-data analytics;
- smart tourism applications;
- digital visitor information;
- integrated transportation information;
- digital safety and emergency communication.

Buhalis and Law identify ICT as a transformative force that has reshaped tourism operations, marketing, distribution, and consumer behaviour.

Therefore, the contemporary concept of tourism infrastructure should be expanded from physical infrastructure toward physical-digital infrastructure integration.

2.4 Destination Competitiveness Theory

The study adopts the destination competitiveness framework of Dwyer and Kim (2003).

Their model was specifically developed to enable comparisons among countries and tourism destinations and identifies multiple determinants of destination competitiveness.

For this research, destination competitiveness is operationalised through:

1. **Core tourism resources**
2. **Supporting infrastructure**
3. **Accessibility and connectivity**
4. **Destination management**
5. **Digital capability**
6. **Environmental sustainability**
7. **Safety and resilience**



8. Visitor experience

The framework is particularly appropriate because infrastructure is positioned not as an isolated factor but as a supporting system that interacts with tourism resources and destination management.



3. Research Methodology

3.1 Research Design

This research employs a comparative qualitative-descriptive research design.

The ASEAN countries are compared according to their relative tourism infrastructure development, sustainability orientation, digital readiness, and destination competitiveness.

For analytical clarity, ASEAN destinations can be grouped into three broad categories:

Group A – Advanced Tourism Infrastructure

- Singapore
- Malaysia
- Thailand

Group B – Large and High-Potential Tourism Markets

- Indonesia
- Viet Nam
- Philippines

Group C – Emerging/Developing Tourism Infrastructure

- Cambodia
- Lao PDR
- Brunei Darussalam
- Myanmar
- Timor-Leste

This grouping is analytical rather than a formal ASEAN classification.

3.2 Sources of Data

The study uses secondary data from:

- ASEAN Secretariat;
- ASEANstats;
- national tourism organisations;



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- national infrastructure policies;
- UN Tourism;
- World Bank;



- academic journals;
- destination development reports;
- sustainable tourism frameworks;
- digital tourism and smart destination literature.

ASEAN's current policy agenda already identifies connectivity, sustainable tourism, tourism investment, digitalisation, and regional tourism corridors as important components of tourism development.

3.3 Analytical Dimensions

The comparative analysis uses three major dimensions:

Dimension	Key Indicators
Sustainable Infrastructure	Green energy, water, waste, environmental management, carrying capacity
Digital Infrastructure	Internet, digital payment, smart tourism, AI, data integration, online services
Competitiveness & Resilience	Accessibility, connectivity, visitor experience, crisis preparedness, governance

These dimensions are analysed through a comparative matrix to identify similarities, differences, gaps, and strategic opportunities.

4. Results and Discussion

4.1 Comparative ASEAN Tourism Infrastructure

The comparative analysis indicates that ASEAN countries have different levels of tourism infrastructure maturity.

Table 1. Comparative Strategic Position of ASEAN Tourism Infrastructure

Country	Sustainable Infrastructure	Digital Tourism	Connectivity	Competitiveness	Resilience
Singapore	Very High	Very High	Very High	Very High	Very High
Malaysia	High	High	Very High	Very High	High
Thailand	High	High	Very High	Very High	High

Viet Nam	Medium–High	High	High	High	Medium–High
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Country	Sustainable Infrastructure	Digital Tourism	Connectivity	Competitiveness	Resilience
Indonesia	Medium	High	Medium–High	High	High potential
Philippines	Medium	High	Medium	High potential	Medium–High
Cambodia	Medium	Medium	Medium	Growing	Medium
Lao PDR	Medium	Medium	Medium	Growing	Medium
Brunei Darussalam	High	High	Medium	Niche	High
Myanmar	Low–Medium	Medium	Low–Medium	Constrained	Low–Medium
Timor-Leste	Emerging	Emerging	Emerging	Emerging	Emerging

4.2 Dimension 1 – Sustainable Infrastructure

The first strategic finding is that sustainability has become a fundamental infrastructure issue. Traditional tourism infrastructure generally prioritised:

road + airport + hotel

+ attraction. The

emerging model

requires:

green transport + renewable energy + water efficiency + waste management + ecosystem protection + resilient buildings + community infrastructure.

This is particularly important for coastal and island destinations such as Indonesia, Philippines, Thailand, Malaysia, and parts of Viet Nam.

The ASEAN sustainable tourism roadmap recognises that sustainability outcomes across the region remain uneven and that implementation costs, capacity gaps, climate risks, and limited financing continue to constrain



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progress.

Thus, infrastructure investment should be assessed not only through economic return but also through:

Environmental Return + Social Return + Economic Return.



4.3 Dimension 2 – Digital Transformation

The second finding concerns the increasing importance of digital infrastructure. Digital transformation creates a new layer of destination infrastructure:

Physical Infrastructure + Digital Infrastructure = Smart Tourism Infrastructure

Examples include:

- digital visitor centres;
- integrated booking systems;
- e-ticketing;
- cashless payment;
- smart parking;
- destination apps;
- real-time traffic information;
- AI-powered visitor services;
- digital crowd management;
- disaster early-warning communication.

The ASEAN Tourism Outlook identifies AI, digital personalisation, contactless payments and e-visas as technologies capable of reshaping visitor experiences and destination management.

The implication is that a destination with excellent physical infrastructure but weak digital integration may increasingly lose competitiveness against destinations capable of providing seamless digital visitor experiences.

4.4 Dimension 3 – Destination Competitiveness and Resilience

The third dimension integrates competitiveness with resilience.

Dwyer and Kim's destination competitiveness model provides an appropriate basis for comparing countries because competitiveness depends on multiple interacting destination factors rather than tourism attractions alone.

For ASEAN, competitiveness increasingly depends on the capacity to withstand:



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- pandemics;
- climate change;
- flooding;
- earthquakes;
- tsunamis;
- volcanic eruptions;



- extreme weather;
- geopolitical disruption;
- economic shocks;
- technological disruption.

This produces a shift from:

Competitive Destination

toward:

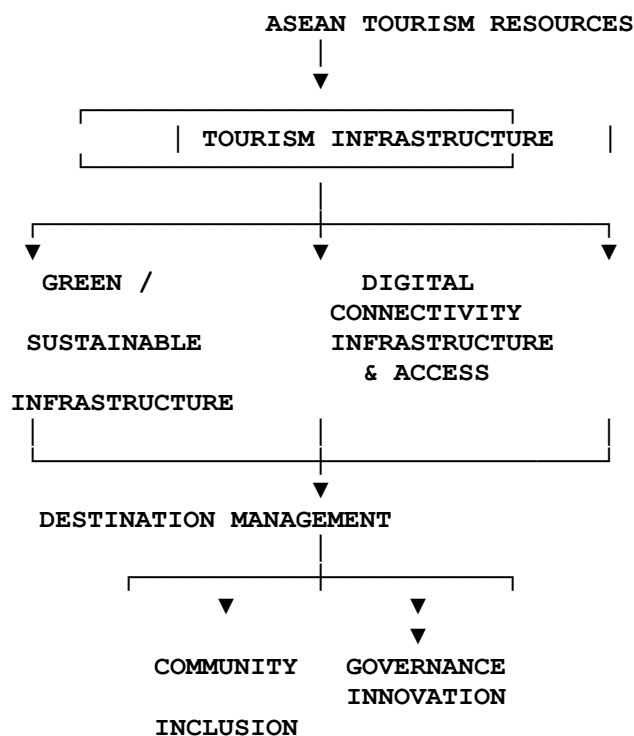
Competitive + Sustainable + Resilient Destination.

The ASEAN Tourism Outlook similarly identifies climate change, disasters, pandemics, social inequity, and economic downturns as continuing vulnerabilities for the region.

5. Proposed Conceptual Model

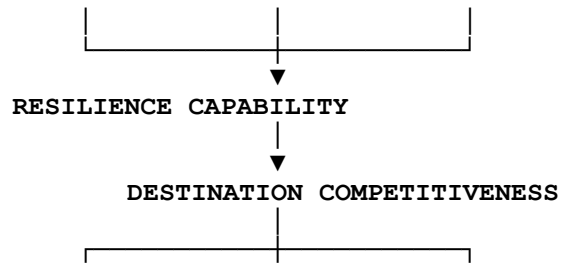
ASEAN Sustainable-Digital Tourism Infrastructure Model (ASDTIM)

Based on the comparative analysis, this study proposes the following conceptual model:





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▼
Economic
Performance

▼
Social
Value

▼
Environmental
Value

Core proposition

The model argues that:

Tourism infrastructure contributes to destination competitiveness when physical connectivity is integrated with sustainable infrastructure, digital transformation, effective governance, community participation, and disaster resilience.

This is the principal conceptual contribution of the article.

6. Strategic ASEAN Infrastructure Framework

The proposed model can be translated into five strategic pillars.

Pillar	Strategic Orientation	Expected Outcome
1. Green Infrastructure	Renewable energy, water, waste, low-carbon transport	Environmental sustainability
2. Digital Infrastructure	AI, IoT, digital payment, smart tourism	Visitor experience & efficiency
3. Regional Connectivity	Air, sea, road, rail and tourism corridors	Accessibility
4. Resilient Infrastructure	Disaster preparedness, redundancy, early warning	Tourism continuity
5. Inclusive Infrastructure	Community, SMEs, accessibility, local economy	Inclusive tourism growth

The framework is consistent with ASEAN's broader policy direction, which increasingly emphasises sustainable and resilient tourism as well as regional connectivity.



7. Implications

7.1 Theoretical Implications

This research contributes to tourism infrastructure literature in three ways.

First, it expands the conventional understanding of tourism infrastructure from physical infrastructure toward an integrated physical-digital-environmental system.

Second, it connects **destination competitiveness theory** with sustainability and resilience. Destination competitiveness should not be measured solely through visitor arrivals or tourism revenue, but also through the capacity of destinations to sustain tourism under environmental, technological, and crisis pressures.

Third, the study proposes an integrated framework connecting:

Infrastructure → Sustainability → Digital Transformation → Resilience → Competitiveness.

This integration provides a potential conceptual basis for future empirical research.

7.2 Policy Implications

For ASEAN governments, tourism infrastructure policies should move from individual national projects toward regional infrastructure ecosystems.

Priority policies include:

1. developing integrated ASEAN tourism connectivity;
2. accelerating green infrastructure investment;
3. establishing interoperable digital tourism systems;
4. improving digital payment and visitor information systems;
5. developing common sustainability indicators;
6. strengthening disaster-resilient tourism infrastructure;
7. increasing community participation;
8. supporting SMEs in digital transformation;
9. integrating tourism infrastructure with spatial planning;
10. establishing destination carrying-capacity management.

This direction is particularly relevant because ASEAN's current tourism



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agenda includes regional connectivity initiatives such as tourism corridors and infrastructure-related programmes.



8. Strategic Implication for Indonesia

For Indonesia, the ASEAN comparison indicates that infrastructure development should not focus exclusively on increasing the number of hotels, attractions, airports, roads, and other physical facilities.

The strategic priority should be:

“From Infrastructure Development to Infrastructure Integration.”

This means integrating:

Transport + Hotel + Destination + Digital + Environment + Community + Disaster Management.

For coastal destinations such as **Anyer**, this framework is particularly relevant because tourism infrastructure must simultaneously address:

- coastal accessibility;
- hotel and resort infrastructure;
- waste and wastewater management;
- beach ecosystem protection;
- digital marketing;
- digital guest services;
- disaster early warning;
- evacuation infrastructure;
- community participation;
- business continuity.

Consequently, the competitiveness of a coastal destination should be understood not only from its attractiveness but also from its ability to remain accessible, sustainable, digitally connected, safe, and operational during crises.

9. Conclusion

This study concludes that the future competitiveness of ASEAN tourism destinations increasingly depends on the quality and integration of tourism infrastructure. The comparative analysis demonstrates that infrastructure development across ASEAN remains uneven, particularly in terms of sustainability, digitalisation, connectivity, institutional capacity, and resilience.

Three strategic transformations are therefore required.

First, tourism infrastructure must become **sustainable**, incorporating energy



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efficiency, water management, waste reduction, environmental protection, and climate adaptation.

Second, infrastructure must become **digital**, integrating smart tourism technologies, digital payments, AI, data analytics, and seamless visitor services.



Third, infrastructure must become **resilient**, enabling destinations to maintain essential tourism functions during disasters, pandemics, climate events, and other disruptions.

The proposed ASEAN Sustainable-Digital Tourism Infrastructure Model (ASDTIM) provides an integrated conceptual framework connecting green infrastructure, digital infrastructure, connectivity, governance, community participation, resilience, and destination competitiveness.

The main contribution of the study is therefore the proposition that:

The competitiveness of future ASEAN tourism destinations will depend not on infrastructure quantity alone, but on the degree to which infrastructure is sustainable, digitally integrated, regionally connected, inclusive, and resilient.

10. Limitations and Future Research Agenda

This study has several limitations. First, it relies primarily on secondary data and therefore does not yet measure infrastructure performance using primary field observations. Second, the comparative assessment uses a conceptual classification rather than a statistically validated ASEAN infrastructure index. Third, differences in data availability among ASEAN countries may affect comparability.

Future research should therefore develop an ASEAN Tourism Infrastructure Competitiveness Index (ATICI) incorporating measurable indicators for:

1. physical infrastructure;
2. digital infrastructure;
3. green infrastructure;
4. accessibility;
5. resilience;
6. governance;
7. community inclusion; and
8. destination competitiveness.

Future studies could also employ Structural Equation Modelling (SEM), AHP, TOPSIS, Data Envelopment Analysis (DEA), or panel-data analysis to quantitatively test the proposed model.

A particularly relevant research direction is to compare coastal tourism destinations in Indonesia, Thailand, Malaysia, Philippines, and Viet Nam,



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because these destinations face similar challenges related to climate change, coastal degradation, natural disasters, carrying capacity, and tourism infrastructure pressure.\



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