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Towards Sustainable Coastal Tourism: Implementing the Railay Model for Environmental and Stakeholder-Centric Destination Management

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ABSTRACT

Coastal tourism serves as a vital mechanism driving the global economy; however, it simultaneously exerts significant pressure on fragile ecosystems. This study aims to develop a sustainable coastal tourism management approach by employing the "Railay Model" as a case study to balance economic growth with environmental conservation. Railay Bay in Krabi Province, Thailand, is a world-renowned tourist destination that continues to face persistent environmental issues, including water pollution, freshwater scarcity, noise pollution, and plastic waste accumulation. This research employs a qualitative methodology, utilizing in-depth interviews with 20 key stakeholders from the public sector, private enterprises, local communities, and tourism operators to assess environmental impacts and explore opportunities for integrated management. The conceptual framework of the study draws upon Environmental Impact Theory, Stakeholder Theory, and the Carrying Capacity Concept. The findings reveal that the lack of law enforcement, limited community participation, and insufficient environmental infrastructure are major obstacles to the sustainability of Railay Bay. The study proposes the "Railay Model for Sustainable Coastal Tourism", emphasizing participatory management, integrated visitor control mechanisms, and green business promotion. This model serves as a prototype for fostering sustainable coastal tourism development in Thailand. Theoretical and practical implications of the study results are discussed.

Keywords: Sustainable Coastal Tourism, Railay Model, Environmental Management, Stakeholder Participation, Destination Management

INTRODUCTION

Background and Rationale

Coastal tourism plays a pivotal role in the global tourism economy, offering substantial economic benefits while simultaneously exerting pressure on fragile marine and terrestrial ecosystems (Hall, 2019). Unregulated tourism activities, particularly in high-demand destinations, contribute to environmental degradation through coastal erosion, pollution, resource depletion, and disruption of local socio-economic structures (Diedrich, 2007).

These concerns necessitate integrated management strategies that balance tourism growth with sustainability principles (Sharpley, 2020).

Railay Bay, situated within Krabi Province, Thailand, exemplifies a coastal destination facing sustainability challenges due to rapid tourism expansion. As part of the Hat Nopparat Thara-Mu Koh Phi Phi National Marine Park, the bay attracts a high volume of domestic and international visitors drawn to its pristine beaches, limestone cliffs, and world-class rock-climbing sites (Hyslop, 2008). However, the growth of tourism has outpaced the implementation of effective environmental management, leading to critical concerns related to wastewater disposal, freshwater scarcity, noise pollution, and plastic waste accumulation (Phumsathan et al., 2022). While local stakeholders, including the Railay Business Association, have initiated management efforts through the Railay Model, further research is needed to align these efforts with best practices in sustainable tourism governance.

Existing studies on sustainable tourism in Krabi highlight the region's increasing vulnerability to environmental and social pressures, particularly in adventure tourism sectors such as rock climbing (Hyslop, 2008). Despite its potential as an ecotourism hub, Krabi's tourism sector has historically prioritized economic expansion over long-term sustainability. The lack of systematic environmental education for visitors, ineffective regulatory enforcement, and limited community participation in tourism governance exacerbate the sustainability crisis. The present study examines these challenges through an environmental impact lens, utilizing stakeholder theory and carrying capacity concepts to propose a sustainable coastal tourism model for Railay Bay.

Problem Statement

The tourism industry in Railay Bay has expanded significantly over the past two decades, driven by increased accessibility and global recognition of its natural beauty. However, the unregulated growth of tourism has led to severe environmental and socio-economic challenges, impacting both local communities and the natural ecosystem. Key concerns include:

Wastewater Management:

- Hotels and restaurants discharge untreated or partially treated wastewater into the marine environment, contributing to water pollution and degradation of marine biodiversity (Gössling et al., 2015).
- The limited wastewater treatment infrastructure is insufficient to support the high volume of tourism activities, leading to contamination of coastal waters.

Freshwater Scarcity:

- Railay Bay lacks natural freshwater sources, requiring reliance on external water supply systems (Giné-Garriga & Pérez-Foguet, 2013).
- The demand for freshwater from hotels, restaurants, and tourists strains local water supply systems, often prioritizing tourism businesses over local residents (Hyslop, 2008).

Plastic Waste Accumulation:

- Single-use plastics brought in by tourists and local businesses contribute to severe waste management challenges.
- Despite initiatives by the Railay Business Association to regulate plastic bottle usage, enforcement remains inconsistent, leading to persistent plastic contamination along beaches and marine habitats (Jang et al., 2018).

Noise Pollution:

- High-speed longtail boats, which serve as the primary mode of transportation to and within Railay Bay, contribute significantly to noise pollution, disrupting marine ecosystems and reducing the quality of the visitor experience (Miloslavich et al., 2018).
- Noise disturbances from tourist activities, nightlife establishments, and excessive boat traffic affect both wildlife and local communities.

These issues collectively threaten the long-term sustainability of Railay Bay as a premier tourism destination. While the Railay Model represents an important step toward structured local management, it remains fragmented and lacks integration with broader sustainability frameworks such as the Global Sustainable Tourism Council (GSTC) criteria.

Research Objectives

To address the identified challenges, this study aims to:
Assess the environmental impact of tourism in Railay Bay from the perspective of key stakeholders, focusing on:

- Wastewater discharge from restaurants and hotels.
- Freshwater shortages affecting both residents and tourism stakeholders.
- Plastic waste generation from tourist activities and local businesses.
- Noise pollution from boat operations.

Propose a sustainable coastal tourism management model, the "Railay Model," integrating:

- Environmental impact mitigation strategies.
- Stakeholder engagement mechanisms based on the stakeholder theory framework.
- Carrying capacity principles to regulate visitor numbers and resource consumption.

Theoretical Framework

The study is structured around three interconnected theoretical perspectives:

Environmental Impact Theory

Environmental impact theory provides a structured approach for assessing the effects of human activities on natural ecosystems (Glasson et al., 2013). Applied to Railay Bay, this framework enables the identification of critical environmental pressures and informs targeted mitigation strategies to reduce negative tourism-related impacts.

Stakeholder Theory

Stakeholder theory emphasizes the interdependent roles of multiple actors in destination management, including government agencies, tourism businesses, local residents, and visitors (Freeman, 1984). By understanding stakeholder interests and motivations, this study proposes collaborative governance strategies that ensure sustainable tourism development in Railay Bay.

Carrying Capacity Concept

Carrying capacity refers to the maximum level of tourism activity that an ecosystem can sustain without long-term degradation (Butler, 1999). By integrating carrying capacity assessments into the Railay Model, this study advocates for visitor quotas, resource conservation measures, and policy interventions to maintain ecological balance while supporting economic viability.

LITERATURE REVIEW

Environmental Impact of Coastal Tourism

Tourism development in coastal regions has led to significant environmental pressures, necessitating structured impact assessment frameworks to mitigate adverse effects (Gössling et al., 2015). Unregulated tourism contributes to habitat degradation, waste accumulation, water pollution, and the depletion of natural resources, particularly in fragile ecosystems such as Railay Bay (Phumsathan et al., 2022).

Wastewater Pollution and Marine Ecosystem Degradation

Tourism-driven wastewater discharge presents a critical environmental challenge, particularly in destinations with limited sanitation infrastructure. In many coastal areas, untreated wastewater from hotels and restaurants is discharged directly into marine environments, resulting in eutrophication, coral reef damage, and biodiversity loss (Henderson, 2001). Studies in Thailand have demonstrated the direct impact of tourism-related wastewater pollution on marine protected areas, highlighting the need for stricter regulatory enforcement (Gössling, 2006).

Freshwater Scarcity in High-Demand Tourism Zones

Freshwater scarcity is another pressing issue in tourism-dependent coastal areas, exacerbated by high tourist demand and limited local supply (Gine-Garriga & Pérez-Foguet, 2013). Railay Bay, which lacks natural freshwater sources, relies on external supply chains to meet demand, leading to competition between tourism businesses and local communities (Hyslop, 2008). Similar cases in Indonesia and the Maldives reveal the disproportionate allocation of freshwater resources to tourism enterprises over local populations, underscoring the need for sustainable water management practices (Cole, 2012).

Plastic Waste and Tourism-Generated Pollution

The proliferation of single-use plastics brought in by tourists and local businesses has become a primary environmental concern in coastal destinations (Jang et al., 2018). Railay Bay has attempted to address this issue

through local waste management initiatives, such as banning plastic water bottles, but enforcement remains inconsistent (Hyslop, 2008). Case studies from the Philippines and Bali demonstrate the effectiveness of integrated waste management policies, including tourist education programs and government-mandated plastic bans, in reducing environmental pollution (Jambeck et al., 2015).

Noise Pollution and Its Impact on Visitor Experience and Marine Life

Boat traffic, particularly from longtail boats, generates significant noise pollution, negatively affecting both wildlife and the visitor experience (Miloslavich et al., 2018). Research on marine environments indicates that excessive noise disrupts aquatic life behaviors, including breeding and feeding patterns, further threatening biodiversity (Williams et al., 2014). Effective noise pollution mitigation strategies, such as designated boat routes and restrictions on engine types, have been successfully implemented in marine protected areas in Australia and Mexico (Buckley, 2002).

Stakeholder Theory and Governance in Sustainable Tourism

Understanding Stakeholder Theory in Tourism Governance

Stakeholder theory, introduced by Freeman (1984), highlights the interdependent roles of various actors in the management and development of destinations. In the context of sustainable tourism, stakeholders include government agencies, local businesses, community members, tourists, and non-governmental organizations (Bramwell & Lane, 2011). These diverse interests require collaborative decision-making to balance economic benefits with environmental and social sustainability.

Role of Local Tourism Associations in Destination Management

The Railay Business Association, which governs local tourism enterprises in Railay Bay, serves as a key stakeholder in implementing sustainability initiatives. Previous studies suggest that locally managed tourism models, such as those in Costa Rica and New Zealand, have successfully integrated environmental conservation with economic benefits through stakeholder cooperation (Blackstock, 2005). However, challenges remain in ensuring compliance and equitable resource distribution among stakeholders.

Community Involvement and Participatory Governance

Community participation is essential in ensuring sustainable tourism development that aligns with local needs and cultural integrity (Pretty, 2003). Research in Thailand's Chiang Mai and Samui Island has shown that community-led tourism projects lead to improved resource management, economic inclusivity, and enhanced visitor experiences (Kontogeorgopoulos, 2005). However, in destinations like Railay Bay, where external business interests dominate, ensuring meaningful community involvement remains a challenge. Participatory governance models, such as those implemented in the Galapagos Islands and Norway's coastal regions, have demonstrated how community-driven decision-making enhances tourism sustainability (Hall, 2009). Integrating such models in Railay Bay could empower local stakeholders and ensure long-term conservation efforts.

Government Regulations and Policy Enforcement

While Thailand has established national policies for sustainable tourism, including the National Ecotourism Policy and the Marine National Park Regulations (Pipithvanichtham, 1997), enforcement gaps hinder their effectiveness. Regulatory frameworks in countries like Australia and Canada have demonstrated that clear policy directives, combined with incentive-based mechanisms, can strengthen tourism governance (Dodds & Butler, 2010). Railay Bay's governance could benefit from stricter policy implementation, including financial incentives for sustainable businesses and penalties for environmental non-compliance.

Carrying Capacity and Visitor Management in Coastal Destinations

Carrying capacity refers to the maximum level of tourism activity that a destination can sustain without causing long-term environmental degradation (Butler, 1999). Managing carrying capacity is essential for preserving natural resources while maintaining a positive visitor experience.

Visitor Quotas and Zoning Regulations

Successful tourism destinations such as the Galapagos Islands and Komodo National Park have implemented visitor quotas and zoning regulations to limit environmental impact (Eagles et al., 2002). These measures ensure that tourism remains within sustainable limits while protecting biodiversity. In Railay Bay, similar strategies, such as controlled entry points and guided eco-tours, could help manage visitor flow and reduce congestion.

Sustainable Infrastructure Development

Investing in sustainable infrastructure, including eco-friendly accommodations, renewable energy sources, and efficient waste management systems, is critical for maintaining carrying capacity (Dodds & Butler, 2010). Research in the Maldives demonstrates the effectiveness of eco-resorts in minimizing environmental impact while enhancing visitor experiences (Scheyvens, 2011). Railay Bay's future sustainability could benefit from adopting similar eco-friendly development models.

Monitoring and Impact Assessment

Continuous monitoring and environmental impact assessments are essential for evaluating tourism's effects on coastal ecosystems (Buckley, 2012). Implementing real-time monitoring systems, such as those used in marine parks in the Caribbean and Hawaii, can provide valuable data for adaptive management and policy adjustments (Newsome et al., 2013).

Summary of Literature Review

The review of existing literature highlights the pressing environmental challenges facing coastal tourism in Railay Bay and the potential for stakeholder-driven management solutions. The integration of environmental impact assessments, stakeholder engagement frameworks, and carrying capacity principles presents a viable pathway for achieving sustainable coastal tourism. Building on these insights, the next section outlines the research methodology employed to assess environmental impacts and propose a sustainable tourism model for Railay Bay.

RESEARCH METHOD

Research Design

This study employs a qualitative research approach, utilizing in-depth interviews to assess environmental impacts and governance issues related to tourism in Railay Bay. The research focuses on stakeholder perspectives to evaluate the sustainability challenges facing the destination.

Sampling and Data Collection

A purposive sampling method was used to select 20 key informants representing various governance and tourism management organizations, including:

- District governance officials
- Park rangers from the National Park Authority
- Ao Nang Marine Department representatives
- Krabi Provincial Office of Tourism and Sports
- Thailand Tourism Authority - Krabi Office
- Ao Nang Boat Service Cooperative
- Railay Tourism Club
- Railay Rock Climbing Club
- Krabi Hotel Association
- Representatives from Railay hotels and restaurants

Each stakeholder group was selected based on their direct involvement in tourism management and environmental governance. Semi-structured interviews were conducted to gain insights into policy implementation, environmental concerns, and sustainable tourism strategies.

Data Analysis

Data from interviews were analyzed using thematic analysis, which involves identifying patterns and themes across the qualitative dataset. Thematic analysis was conducted in the following steps:

Familiarization with Data – All interviews were transcribed verbatim, followed by multiple readings to ensure a deep understanding of the narratives provided by the stakeholders.

Initial Coding – A coding framework was developed to categorize key issues related to tourism management and environmental sustainability. Codes were derived inductively from the data and deductively based on the research objectives.

Theme Identification – Related codes were grouped into overarching themes, distinguishing between destination management (supply-side issues) and visitor experience (demand-side challenges).

Theme Refinement – Themes were reviewed and refined to ensure clarity and coherence, removing overlaps and ensuring alignment with the study's conceptual framework.

Interpretation and Discussion – The final themes were synthesized into a structured narrative, comparing findings with existing literature and policy frameworks.

RESULTS

Environmental Impact Findings

The interviews revealed significant challenges related to environmental degradation in Railay Bay, with stakeholders expressing concern over wastewater pollution, freshwater scarcity, waste accumulation, and noise disturbances. The findings indicate:

Wastewater Pollution: Park rangers and local governance officials reported that untreated or insufficiently treated wastewater from hotels and restaurants contributes to marine pollution, causing algal blooms and declining water quality.

Freshwater Issues: All stakeholder groups highlighted an increasing strain on freshwater resources, with hotels and restaurants consuming the majority of the limited supply, often leaving local communities at a disadvantage.

Waste Management: Participants identified that the accumulation of plastic and organic waste exceeds local management capacities, leading to uncollected waste in key tourist areas.

Noise Pollution: The impact of longtail boats, particularly during peak seasons, was noted as a critical concern, with excessive noise disturbing both visitors and marine wildlife.

Table 1. Positive and Negative Environmental Impacts of Ecotourism Management in Railay Bay.

Environment	Positive Impacts	Negative Impacts
Water	- Some hotels treat wastewater before discharging it into the sea. - Some hotels collect rainwater for use. - Campaigns to reduce water consumption.	- Salty tap water, insufficient during peak tourist season - No central wastewater treatment plant - Wastewater from residences and shops - Oil spills from boats - Some tourists are sick from seawater
Garbage	- Some entrepreneurs manage their waste well, such as separating waste at the source. - Promote zero waste.	- Excessive amounts of wet and plastic waste - Lack of adequate bins for sorting waste - Waste remains behind because it cannot be removed daily - Odor emanates and poses public health problems
Noise	- Some eco-friendly activities are quiet, such as hiking and boating.	- Noise from vehicles - Noise from nightlife venues - Noise from construction

Regulatory Compliance

Tourists face increasing dissatisfaction with environmental conditions, including:

- Overcrowding and congestion in peak seasons, exceeding the carrying capacity of beaches and recreational areas.
- Insufficient enforcement of waste disposal regulations, leading to littering in high-traffic zones.
- Strong odors from wastewater and garbage accumulation, reducing the overall visitor experience.
- Continued use of plastic straws and single-use packaging by some businesses, despite local regulations against them.

Governance and Policy Implications

The findings underscore the urgent need for improved governance mechanisms in Railay Bay. While stakeholder initiatives such as the Railay Model have introduced local waste management strategies, inconsistent enforcement and lack of coordinated governance limit effectiveness. Recommendations include:

- Strengthening policy enforcement through increased government oversight and stricter penalties for non-compliance.
- Implementing carrying capacity limits by regulating visitor numbers and introducing seasonal restrictions.
- Enhancing stakeholder collaboration to ensure tourism businesses, local communities, and government agencies jointly manage resources.

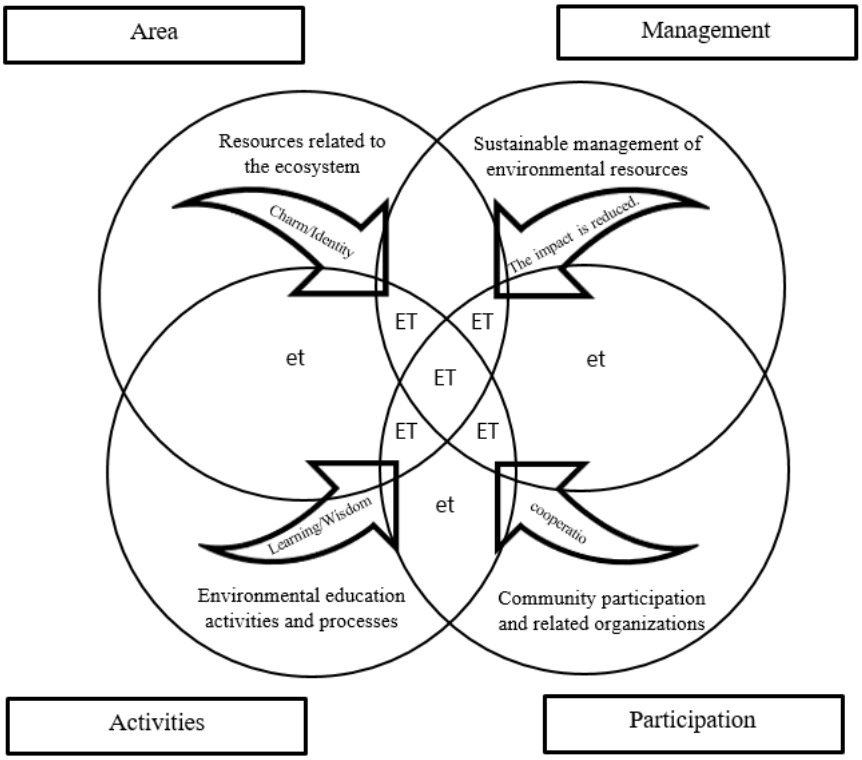

Figure 1. Ecotourism Management Model in Railay Bay, Krabi Province, towards an Environmentally Friendly Destination
Source: Subin Rakkhan, 2024

DISCUSSION OF RESULTS

Based on the study and analysis of environmental impacts resulting from ecotourism management in Railay Bay, Krabi Province, using field surveys and in-depth interviews with representatives from government agencies, private sector organizations, tourism operators, and local community members. The study found that although ecotourism aims to promote sustainable tourism and minimize environmental impacts, various environmental effects were nevertheless observed, as follows:

Water Quality: Although the overall seawater quality remains within acceptable standards—consistent with the Surface Water, Seawater, and Air Quality Monitoring Report of Krabi Province, 2024 by the Pollution Control Department (2024), which indicated that the water quality in Railay Bay ranged from fair to good—the absence of proper wastewater treatment systems for accommodations, shops, and local communities has resulted in the discharge of untreated wastewater into the sea. This contamination has led to skin irritation among some tourists, reflecting the inadequacy and uneven coverage of environmental infrastructure management in the area.

Waste Management: The increasing volume of waste, particularly from hotels and tourists, reflects the behavioral patterns of both service providers and visitors, as well as the inefficiency of the existing waste management system. This finding aligns with Wimuktayon (2025), who noted that waste management in natural tourism destinations remains a major challenge to achieving sustainable tourism.

Noise Pollution: The problem of noise pollution reflects the inconsiderate use of public spaces, particularly noise generated from boats, construction activities, and entertainment venues. Such disturbances contradict the fundamental principles of ecotourism, which emphasize tranquility and harmonious coexistence with nature.

CONCLUSION AND GAP ANALYSIS

Conclusion

The findings of this study highlight that while tourism has brought economic prosperity to Railay Bay, it has also created severe environmental and governance challenges. Freshwater shortages, waste accumulation, wastewater pollution, and noise disturbances remain unresolved, significantly impacting both local communities and the natural ecosystem. Weak enforcement of environmental regulations and fragmented governance structures continue to exacerbate these issues.

The Railay Model represents an important initiative for local sustainability, but its implementation has been inconsistent due to a lack of integration with national and international sustainability frameworks. Effective governance mechanisms, participatory decision-making, and stronger enforcement of environmental policies are urgently required to ensure Railay Bay's long-term sustainability as a premier coastal tourism destination.

Gap Analysis

Regulatory Gaps: There is a disconnect between national sustainability policies and their enforcement at the local level, leading to inconsistent implementation of environmental laws.
Stakeholder Involvement Gaps: While some local businesses and community organizations participate in sustainability efforts, broader multi-stakeholder collaboration remains weak, limiting long-term impact.
Waste Management Gaps: Current waste collection and disposal systems are inadequate, with daily waste accumulation exceeding management capacity.
Carrying Capacity Gaps: Overcrowding continues to strain local resources, but there is no structured visitor quota system to regulate tourism flow.
Infrastructure Gaps: Limited investment in eco-friendly infrastructure and sustainable tourism alternatives restricts the destination's ability to manage tourism sustainably.

By aligning local management initiatives with global best practices in sustainable tourism, this research contributes to the development of a replicable governance model for ecologically sensitive coastal destinations.

RECOMMENDATIONS

Policy Recommendations

- Environmental protection measures and strict control of tourist numbers should be established, such as imposing daily limits on the number of visitors, implementing effective waste management systems, and regulating activities that may cause environmental degradation.
- Environmentally friendly infrastructure should be developed, along with eco-friendly facilities such as water-saving restrooms, sustainable waste collection points, and the adoption of diverse alternative energy systems.
- Resources should be allocated to support community-driven conservation projects by providing financial and technical assistance to local communities for the development of environmental preservation initiatives.
- Practical guidelines for reducing environmental impacts should be developed. Tourism operators should adopt operational practices that minimize environmental harm, such as using biodegradable packaging and promoting sustainable consumption.

Recommendations for Local Implementation

- Collaboration among all stakeholders should be promoted. Government agencies, private sector entities, tourism operators, and local residents should engage in participatory ecotourism management — from planning and implementation to monitoring, evaluation, and equitable benefit-sharing from tourism activities.
- Common regulations and agreements among all stakeholders should be established and jointly enforced to ensure compliance with relevant laws and to collectively promote nature conservation and the responsible use of natural resources.
- The capacity of tourism operators and local communities should be strengthened to effectively manage tourism resources, implement tourism practices that minimize environmental impacts, and preserve local lifestyles and cultural heritage.
- The use of renewable energy in tourism services and activities should be encouraged, enabling both tourism operators and local communities to adopt cleaner and more sustainable energy practices.

- Tourism operators and community-based tourism groups should work toward achieving environmentally friendly service standards, such as developing eco-lodgings, offering local food and community products, and organizing low-carbon tourism activities.

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