

DOES ECOTOURISM IMPACT ON SUSTAINABLE DEVELOPMENT? AN EXPLORATORY STUDY IN THE COASTAL REGION OF SOUTH INDIA USING Q-GIS

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Abstract: Shore-side regions of Tamil Nadu is located in the southern part of India. The ecological livelihood of this Shore-side TamilNadu adds value for the tourism industry in socioeconomic and cultural aspects and altogether in a nutshell, it influences the attainment of Sustainable Development Goals 2030 Agenda (Goal 13, 14). Preserve and sustainably use the oceans' marine resources for the global ecosystem, sustainably accomplish forestry, battle desertification for biodiversity loss, and standstill land deprivation. To address this issue, sustainable tourism development is a tool to conserve the ecosystem of Shore-side regions in Tamil Nadu. Still there is a gap for evaluating and understanding the sustainable tourism development in India. In the current scenario many tourism sector professionals are indulging in this activity to add value to the tourism industry. In one angle, sustainable tourism adds economic value and on the additional it is disapproved for its communal and conservative destruction. If sustainable sight-seeing is used to endure as an instrument for development, there is a need to acknowledge the importance of each dimension like infrastructure facilities, government support to strive for a balance between competing objectives. The researcher has focused in the southern Shore-side regions of Tamil Nadu with the application of Q-Gis Mapping and a quantitative research strategy. The idea of sustainability in ecotourism must not be seen as an end-goal, but as a continues process, the values embedded in planning and managing processes is to be achieved to satisfy the needs and preferences of tourists and countries' development.

Keywords: Eco-tourism, biodiversity, sustainable tourism development, socioeconomic development, tourism planning, sustainable development goals

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INTRODUCTION

Tamil Nadu is the southernmost Shore-side region in India. It is proficient through approximating Shore-side vulnerability Index (ICV) for the complete elasticity shoreline using one-sided medians of six parameters like, shoreline changes, Shore-side slope Tamil Nadu Coast regions in terms of its vulnerability to Shore-side procedures (Rajan et al., 2019); CVI assesses the national shoreline in terms of risk flying and oceanic hazards with Shore-side stretches of 35 taluk of Tamil Nadu. Nearly two percent of Tamil Nadu Shore-side region comes under the minimum vulnerable category.

Already awareness created among local communities about marine natural hazards such as shore-side erosion, flood, loss of life and their properties (Rajan et al., 2019); Tamil Nadu has been endowed with the richest fishery wealth in India and a private financial zone from 1.9 Lakh sq.km, covering the Coromandel Coast, Gulf of Mannar, and Park Bay (Equations, 2020). Great contribution has been happening for improvement of the district's social comfort and the progress of blue economy sectors which makes a serious threat to the shore-side and maritime environment (Marignani et al., 2017); Great contribution for the development and compression on the environment and pollution caused by human influenced eutrophication, adulteration, oceanic noise, maritime clutter, the introduction of non-indigenous species and Shore-side land take (UNEPMAP, 2012); Tourism sector is one of the greatest significant maritime, youngest and Shore-side Mediterranean. Twenty percent of total global foreign tourist arrivals per year influences €25.3 billion, additional 40% of the entire 'Blue Economy' Mediterranean (EUNETMAR, 2014). There are operational features of tourism, such as seasonality and lack of difference, underpin its further potential in revenues and income generation (Bluem, 2018). Furthermore, tourism poses significant forces on the atmosphere and is observed as one of the major drivers of change in the shore-side and maritime atmosphere of the Mediterranean (Marignani et al., 2017). In terms of strategy, travel-related policy agendas could be considered as isolated in spatial and thematic terms, and the framework may be exclusively associated to tourism development in the Mediterranean level (MED-Iamer Project, 2015).

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According to the United Nations World Tourism Organization, tourism compliments both local communities and traveller with cultural heritage and the associated environment. It helps travelers to explore the inspiring knowledge and assistance to generate economic opportunities for local communities along with the peace, prosperity for sustainable development goals Canton (2021). Moreover, in the years of 2017 has been eminent as the international year of sustainable tourism development. The key aspects of Ecotourism and its sustainable development involve factors like decision making, communal involvement, sustainability, culture protection, economic authorization, and capacity building (Tran & Walter, 2018). The government of Tamil Nadu has placed down speculation friendly policy guidelines for the founding of more luxury resorts in the Shore-side areas. The government is pro-development and accords authorization for the building of beach resorts with an objective of creating engagement and communal development. Recent definitions are about the conservation of the natural environment (Donohoe & Needham, 2006).

Rameshwaram is an untouched, spiritual tourism hub and peaceful municipality in Tamil Nadu ranked 262 out of 468 Indian cities and is located on Pamban Island. The watercourse connects the urban to the rest of the nation. Famous traveller magnetism in southern India. This Shore-side tourism location enables an exclusive resource mix of land and three oceans (the Bay of Bengal, the Arabian Sea, and the Indian Ocean). Ecotourism has become a more common term.

It has been represented as accountable to travel to the natural areas provides the natural environments, understand the well-being of the local community (The Ecotourism Society) or an informative, participating travel experience to natural and cultural environments (Mangos et al., 2010); Ensures the sustainable use of ecological resources, while creating feasible economic opportunities for the host communities (University of Pretoria, Centre for Ecotourism) both quoted by (Nichol, 1998a). Community-based ecotourism is a movement in which the community of their own Excellency involves their economic development, governance, stakeholders and tourism development.

Firstly, the research explores the actor's interactions as they relate to the use of resources and the environment. Within this theme are seen more specific sets of social relations and sustainability elements (Palmer & Chuamuangphan, 2021).

To the bridge gap between natural heritage and tourism has been closely linked for ecotourism. But, ecotourism depends on individual intellectual over the nature and examination of adventurous recreation happenings like beach tourism (Saville, 2002); however, sustainable ecological tourism in the Shore-side areas has been criticized by some researchers. Sustainable ecotourism-based urban development in Shore-side regions is understood in various parts of the world. India is a very attractive destination for tourism, particularly for the distant tourist (Miroslaw, 2015).

Background of the Research

A distinct component of the tourist sector, ecotourism is centered on using travel to preserve or improve natural systems. Depending on the individual, ecotourism can signify several things. Some people use it as a catch-all term for adventure, soft adventure, nature-based, and Mircultural tourism (Garrigós-Simón, 2015). Mexican environmentalist "Hector Ceballos Lascurain" first popularized the term "ecotourism" in 1983 to refer to nature-based travel to comparatively untouched places with a focus on teaching. While creating revenue, ecotourism ensures the sustainable use of environmental resources, chances for the local population (Sarkar et al., 2011). The concept of ecotourism aims to be a sustainable type of travel that relies on natural resources (Boley & Green, 2016). Despite the absence of a precise definition, there are numerous accepted definitions of ecotourism (Manea & Cozea, 2022).

Development of ecotourism for sustainable development faces a lot of challenges. Understanding the awareness of ecotourism among tourists is still not highly significant in most of the research and case studies (Mondino & Beery, 2019); Strategies need to enhance the positive impacts, specifically the economic, environmental and social impacts, which include careful planning and administration, communal participation, and ecological education, indicate the ecotourism has positive ecological effects by promoting the preservation of expected resources (Ma et al., 2019). Construction of Shore-side regions always disturbs the normal equilibrium of ecology by transforming the Shore-side streams along with the mistreatment of coral earth and rocks for the construction of tourism amenities (Firaag, 1997).

Along with this removal, the Shore-side vegetation may be interpreted the removal of Shore-side vegetation from the normal succession processes while constructing the amenities (Lim, 1999). Contamination from non-biodegradable trash (like plastic materials and aluminium dismisses) rescinds marine species and several other harmful concerns, according to SDGs Goal 13, 14 (2030) Agenda. Ecotourism promotes intercultural understanding for the traveller to practice traditions, local duties besides livelihood (Surti et al., 2024). Additionally, ecotourism enhances the traveller to comprehend native societies about the tasks of social inequality, women empowerment poverty and environmental deprivation by providing cultural exchange and education, ecotourism promotes intercultural sympathetic breakdown besides tolerance of the cultural barriers. Ecotourism contributes to the economic maintenance for happiness and generating a lot of operative occasions and income generation. There are a lot of experiments to mature ecotourism in an inclusive paradigm through historic and commercial homestay for generation of the GDP (Fennell, 2020); mentioned about the SWOT-QSPM investigation the most serious method for ecotourism development and according to (Mallick et al., 2020) has been creased up the one global study where local people and government including tourism department had a major role with greater flexibility for the Shore-side based sustainable tourism development. The researcher has taken indicators for developing the potential of Destination. Analysed the gap between the customer expectation and the satisfaction level with Destination Cleanliness, Aesthetic/Scenic Beauty, Climatic and Weather Condition, Temple and Monuments, Accommodation Facilities, Quality of Food, Availability of Transport Vehicles, Parking Facilities and Charges, Condition of Road and Traffic, Tourist Information Counters & Guides, Tourist Safety and Security, Sanitation facilities, Timings of Tourism Sites and Restaurants.

Research Framework

Ecotourism Development and environment, social, and economic development:

In order to help local populations, ecotourism combines conservation with tourism (and the associated economics), with a particular emphasis on sustainability (Myburgh & Saayman, 2002); Ecotourism is grounded on the values of the natural and cultural landscape. Geographical location, microclimate, water availability, natural beauty, natural vegetation, animals, surface features, geo-morphologic structure, regional cuisine, and festivals are some of these values. Ecotourism is based on the values of scenic and cultural landscape (Figure 1). Geography, microclimate, water, natural beauty, natural vegetation, surface features, wildlife, local cuisine, festivals, pageants, geo-morphologic structure, traditional agricultural structure, local handicrafts, regional dress culture, historical events and people, architectural variety, traditional music, heritage appeals, folk dance, artistic activities, and so forth are some of these values (Mushkudiani et al., 2023).

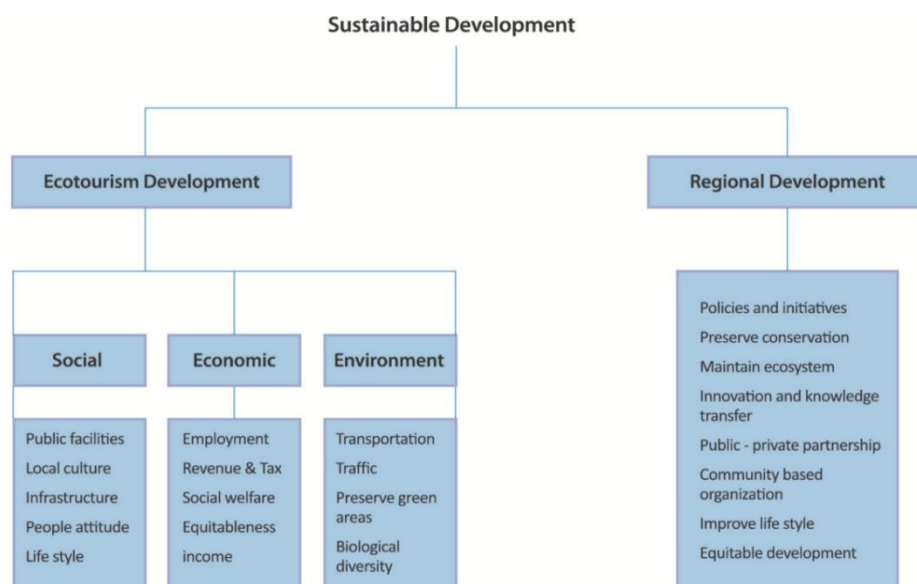


Figure 1. The Role of Ecotourism for Sustainable Development in East Coast Economic Region (ECER), Malaysia (Source: Bhuiyan et al., 2012)

When it comes to the economic use of natural resources, ecotourism offers one or more environmentally benign alternatives to mining, hunting, farming, and other activities (Li, 2006). By introducing tourists to natural settings, ecotourism fosters a greater understanding of them and environmental education. Ecotourism is stranded on the values of natural and cultural landscapes. Geography, microclimate, water, natural vegetation, natural beauty, surface features, wildlife, geomorphologic structure, local cuisine, traditional agricultural structure, festivals, pageants, local handicrafts, regional dress culture, historical events and people, heritage appeals, architectural variety, traditional music and folk dance, artistic activities, and so forth are some of these values (Gerry, 2001); The process of globalization, which is credited with fostering socioeconomic alliances between nations, is also blamed for promoting environmental deterioration by means of excessive energy and natural resource consumption, land erosion, deforestation, and weakening (Sun et al., 2021);

Sustainable Tourism and Regional Development

Sustainable development and tourism, according to (Hall, 2008); present change, which is the transition between one state or condition and another. Whether or not such a change is depending on the initial standards used to assess change, it might be either positive or negative. All pertinent parties must participate in sustainable tourism with knowledge and strong political Ecotourism-driven sustainable development. The connection between sustainable tourism and regional development, with the following factors serving as a reference for our analysis, tourism has a significant economic influence (Bhuiyan et al., 2012). From one perspective, it has favourable effects on the environment and the neighbourhood (more jobs, higher GDP contribution, better services, higher wages, more production, capital creation, bigger local budget through tax collection, drawing in investors, etc., but it can also have unfavourable effects (high pollution, more pronounced polarization, etc. (Saarinen, 2006; Cernat & Gourdon, 2012); The majority of research assessing the economic impact of tourism typically considers information on arrivals, revenue per visitor, and average duration It can have positive effects on the environment and the community (more jobs, higher GDP contributions, better services, higher wages, more production, capital generation, larger local budget through tax collection, drawing in investors, etc.), but it can also have negative effects (high pollution, more pronounced polarization, etc.).

The majority of studies assessing the economic impact of tourism typically consider information on arrivals, income per visitor, average duration of stay, and other economic indicators (Saarinen, 2006; Cernat & Gourdon, 2012); In contrast to many studies that focus solely on the physical and human environment (Miller, 2010); offers a number of indicators that address a wide range of sustainability-related topics, including employment, environmental concerns, systemic financial leaks, client-related factors (such as satisfaction level).

Table 1. Indicators taken into account regarding the regional sustainability of tourism Indicators within the Environmental Sustainability pillar (Source: Gössling & Peeters, 2015)

S.No	Regional sustainability of tourism; Indicators within the Environmental Sustainability pillar
1.	The strictness of environmental regulations
2.	Application of environmental protection regulations
3.	Sustainability of the development of the tourism sector
4.	Carbon dioxide emissions
5.	Concentration of harmful particles
6.	Endangered species
7.	Ratification of environmental protection treaties

Table 2. Sustainable Tourism Development (Source: Rustagi & Kaja, 2022)

Indicator	Definition	Example Data (2023)	Sustainable Practices
Tourist Arrivals	Number of tourists visiting a destination.	1.5 million (Tamil Nadu Coastal Areas)	Promote off-season travel to reduce pressure on resources.
Local Employment Rate	Percentage of tourism jobs held by locals.	65% in fishing communities near Mahabalipuram	Encourage local hiring and skill development programs.
Eco-certified Facilities	Percentage of eco-certified hotels and resorts.	20% in Tamil Nadu coastal regions	Incentivise eco-certification and energy-efficient practices.
Waste Management	Percentage of waste recycled by tourism businesses.	45% in Rameswaram and Kanyakumari	Promote zero-waste policies and recycling programs.
Carbon Footprint	Average emissions per tourist (kg CO ₂).	150 kg CO ₂ per visitor	Encourage use of public transport and green energy sources.
Biodiversity Conservation	Funds allocated for preserving coastal ecosystems.	₹50 crores (Gulf of Mannar Marine Reserve)	Support mangrove restoration and marine life conservation.
Cultural Heritage	Number of heritage sites restored for tourism.	(Mahabalipuram, Chola Temples, etc.)	Ensure preservation aligned with community and ecological needs.
Community Participation	Percentage of tourism projects with community involvement.	30% in sustainable tourism initiatives	Develop participatory planning frameworks with local
Visitor Satisfaction	Average rating by tourists on Sustainability initiatives.	4.5/5 for ecotourism activities	Enhance tourist education on sustainable practices.
Revenue from Tourism	Share of tourism revenue invested in sustainability.	15% in Tamil Nadu	Increase reinvestment in local communities

Sustainable development

If development satisfies the requirements of both visitors and locals while preserving potential for growth, tourism can be sustainable (Gössling & Peeters, 2015); Locals gain from ecotourism, which also provides development, conservation, and educational opportunities. A sustainable type of tourism centered on natural resources is ecotourism (Dowling & Fennell, 1999). Nature, its environment, plants, fauna, and their habitats, as well as local cultural artefacts, are the main subjects of study and experience (Table 1). In order to help local populations, ecotourism combines conservation with tourism (and the associated economics), with a particular emphasis on sustainability (Myburgh & Saayman, 2002). Ecotourism is based on the values of the natural and cultural landscape (Rustagi & Kaja, 2022); these assets include things like location, microclimate, water availability, natural beauty, flora, animals, surface features, geomorphologic structure, regional cuisine, festivals, etc (Table 2).

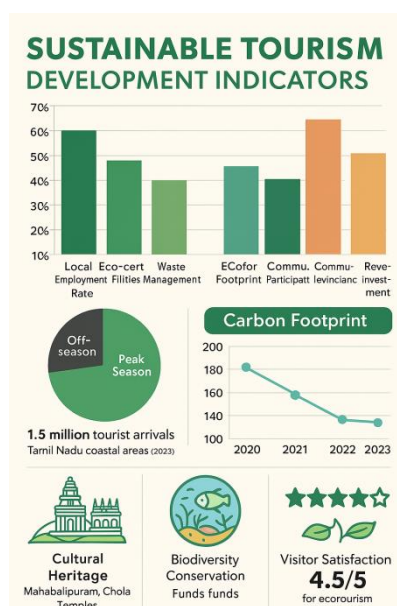


Figure 2. Sustainable development (Source: Rustagi & Kaja, 2022)

Study Area

Tamil Nadu's coastline stretches 1,076 km along the Bay of Bengal and the Indian Ocean, ranking as India's second-longest coastal state after Gujarat (Government of Tamil Nadu, 2023). This dynamic region combines scenic landscapes, rich cultural heritage, and vital economic activities. Key attractions include Chennai's Marina Beach (the world's second-longest urban beach), the UNESCO-listed Shore Temple of Mahabalipuram, and the sacred pilgrimage sites of Velankanni and Rameswaram (Tamil Nadu Tourism Department, 2022) (Figure 2). The coast is also home to unique ecological treasures, such as Pichavaram's mangrove forests—the second-largest in India—and the Gulf of Mannar's coral reefs, a designated Marine Biosphere Reserve (UNESCO, 2020) (Newsome et al., 2020); Economically, Tamil Nadu's coastline plays a crucial role, supporting thriving fishing communities and major commercial ports like Chennai, Thoothukudi, and Ennore, which handle a significant portion of India's maritime trade (Indian Ports Association, 2023). However, the region faces environmental challenges, including coastal erosion, frequent cyclones (such as Cyclone Gaja in 2018), plastic pollution, and rising sea levels due to climate change (National Centre for Coastal Research, 2021). Experts emphasize the need for sustainable coastal management to protect this invaluable ecological and economic asset for future generations (World Bank, 2022).

RESEARCH METHODOLOGY

Research Question

RQ1: Geo-Mapping of the Eco-tourism for sustainable development in the coastal regions of southern India.

RQ2: Firstly, to identify the Gap between the expectation and satisfaction level of the customers.

RQ3: Secondly to Analyse the factors of sustainable ecotourism which highly influence the destination development.

Sample study

The study is based on Descriptive Research Design. The sampling technique used for research is non-probability judgmental sampling. This type of sampling may have a degree of bias owing to the population surrounding not being identical. The population is surrounded by a list of all the items, units, people, etc. Judgment sampling is honorable to provide exhaustive information about the problems in procurement, the distinction.

Analysis and Interpretation

RQ1: Geo-Mapping of the Eco-tourism for sustainable development in the coastal regions of southern India

Tamil Nadu boasts a stunning 1,076 km coastline along the Bay of Bengal and the Indian Ocean, making it India's second-longest coastal stretch after Gujarat. This vibrant coastal belt blends natural beauty, cultural heritage, and economic activity. From Chennai's bustling Marina Beach to Kanyakumari's serene sunset views, the region offers diverse attractions including ancient temples like Mahabalipuram's Shore Temple, pilgrimage sites such as Velankanni and Rameswaram, and ecological wonders like Pichavaram's mangrove forests (Berdenov et al., 2025).

The coast supports thriving fishing communities, major ports like Chennai and Thoothukudi handling significant trade, and unique ecosystems, including the Gulf of Mannar's coral reefs (Figure 3). However, the region faces challenges like coastal erosion, cyclone threats, pollution, and climate change impacts, calling for sustainable conservation efforts to protect this invaluable natural and economic resource for future generations (Zeppel, 2008).

The coastal regions of Tamil Nadu include Rameswaram Island is in the eastern part of Ramanathapuram district in Tamil Nadu, India, with a covered area of 9°8'55"N to 9°19'N latitude and 79°12'30"E to 79°27'30"E longitude. The exact location of Rameswaram Island is on the island of Pamban and it is separated from mainland India by the Pamban Channel, connected through the Pamban Bridge. Rameswaram municipality was established in 1994. The island shelters a total area of 53 km² (20 sq mi) and with a population of 44,856 as of the 2011 Census (Figure 3).

Travel and fishery employment are the mainstream of the workforce in Rameswaram. It is not a unique tourist spot but is a significant religious spot for domestic pilgrims as per Indian mythology and Ramayan. The Ramanathaswamy Temple in the centre of Rameswaram is the Hindu Temple dedicated to Lord Shiva. Another tourist spot is Dhanushkodi, located on the south-eastern tip of Pamban Island (Mallick et al., 2020).

The town was demolished during the 1964 Rameswaram typhoon and the ruins were uninhabited in the aftermath. Although empty of inhabitants, Dhanushkodi leftovers a traveler magnetism due to its ancient and mythological relevance. Consequently, it lacks a disciplined process. The preservation of the environment and cultural heritage is actively supported by ecotourism (Lew et al., 2016). The researcher by using Q- Gis mapping, has mapped the coastal regions of southern India and identified the Eco-tourism destinations. Local groups are complicated in the development, planning, and operation of ecotourism, which benefits their well-being.

RQ2: Firstly, to identify the Gap between the expectation and satisfaction level of the customers towards the destination attributes.

H₀: There is no significance in the level of expectation and level of satisfaction towards the factor of Sustainable Tourism Indicators.

Table 3. level of expectations and level of satisfaction

Factor	Mean	N	T	Df	Sig. (2-tailed)	Sig.	Null Hypothesis
Level of Expectation	64.3240	250	9.178	249	.000	.000**	Rejected
Level of Satisfaction	58.8720	250					

Data Analysis

From the above Table 3, it is inferred that there is a significant difference in opinion between the level of expectations and the levels of satisfaction. Hence, the Null Hypothesis is rejected for level of expectations and the level of satisfaction.

The level of expectation attributes like have more negative gaps (e.g., poor infrastructure, inadequate customer service tourist dissatisfied with public transportation (Table 3).

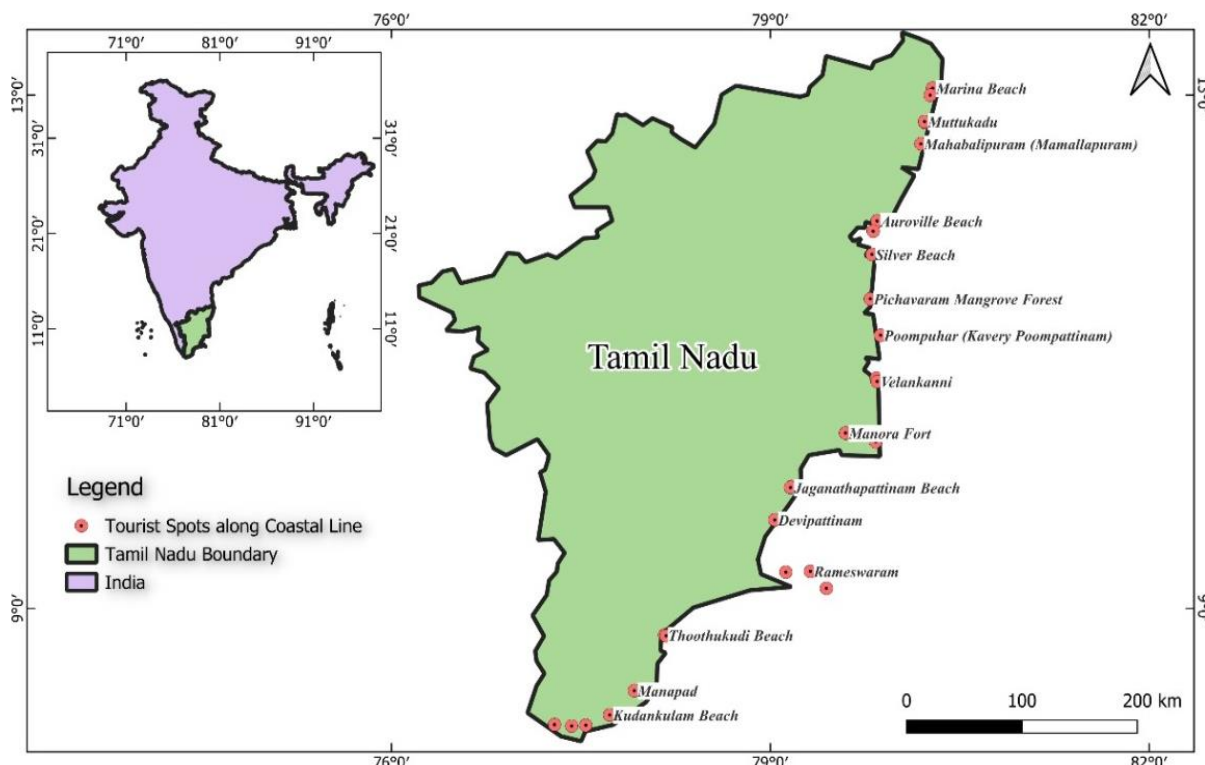


Figure 3. Tourist Spots in Tamil Nadu along Coastal Line

Highlight of areas exceeding expectations to leverage in marketing and customer communication. Further in-depth analysis with expectation score in customer view according to customer expectation is still has more research gap.

Table 4. Expectation score and Tourist Satisfaction

Attribute	Expectation Score	Satisfaction Score	Gap	Priority
Cleanliness	4.5	3.8	-0.7	High
Accessibility	4.2	3.9	-0.3	Moderate
Local Cuisine	4.2	4.5	+0.3	Promote Strength
Transportation	4.3	3.1	-1.2	Critical improvement

To remove this gap still Gen Z Younger tourists may expect better nightlife (Table 4 and Figure 4). Whereas older tourists may value safety more. International visitors may expect better multilingual services. Business travelers may value Wi-Fi connectivity, while leisure travellers prioritize activities Pawlak (2020).

RQ3: Secondly to Analyze the Factors highly influencing the destination development.

H₀: To analyse, the factors of sustainable ecotourism highly influencing the destination development.

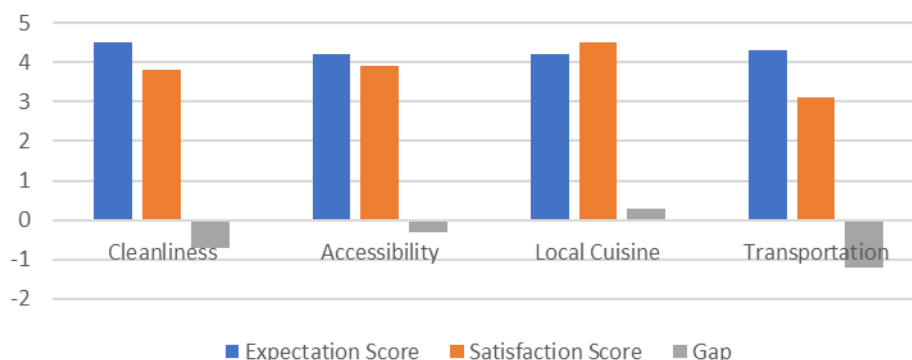


Figure 4. Expectation score and Tourist Satisfaction

From the (Table 5) by Principal Component Matrix, the factors are rotated, and the factors are extracted they are Factor 1 is Eco ethics in Sustainable Tourism, which has been newly derived from the factors traveler/public buses, Eco-friendly hotels, Experience of local culture and lifestyle. Factor 2 is Adaptation towards Sustainable Tourism, which has been newly derived from the factors Tourist safety, Accommodation, Ticket counter, money exchange and internet services, overcrowded with tourists and Publicity to Sustainable Tourism.

Table 5. Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	6.197	38.729	38.729
2	3.083	19.268	57.997
3	1.503	9.393	67.390
4	1.445	9.029	76.418
5	1.136	7.098	83.516
6	.817	5.108	88.624
7	.718	4.491	93.115
8	.497	3.109	96.224
9	.365	2.280	98.504
10	.147	.919	99.423
11	.055	.346	99.769
12	.030	.187	99.956
13	.006	.039	99.994
14	.001	.006	100.000

Factor 3 is Topography well being, which has been newly derived from the factors Cleanliness of the place and Natural environment. Factor 4 is Obligatory needs for destination, which is been newly derived from the factors Wastebasket, Consumption water, Traveler police/guards. Factor 5 is Cognitive utility, which is been newly derived from the factors Utilization of resources, and Medical and first and services (Dhanabagiyam et al., 2024).

Research Findings & Suggestions

Sustainable ecotourism development in the Shore-side region of Tamil Nadu requires a comprehensive understanding of the local environment, culture, and socio-economic factors. Factor 3 of the matrix assessment of the Shore-side ecosystem, including mangroves, coral reefs, and marine biodiversity. Identify vulnerable areas and species to develop appropriate conservation measures. The technical analysis of Factor 1 involves local communities in decision-making processes and ecotourism initiatives. Encourage community-based ecotourism enterprises to ensure that economic benefits directly reach local residents. Establish clear regulations and guidelines for ecotourism operations to prevent over exploitation of natural resources and mitigate negative impacts on the environment.

Table 6. Rotated Component Matrix

	Component				
	1	2	3	4	5
Cleanliness of the place			.767		
Wastebasket				.817	
Consumption water				.901	
Tourist safety		.508			
Traveler police/guards				.693	
Traveler/public buses	.697	.			
Accommodation		.588			
eco-friendly hotels	.897				
Proper utilization of resources					.631
Experience of local culture and lifestyle	.612				
Ticket counter, money exchange and internet services		.942		.	
Medical and first aid services					.957
Local community development	.692				
Natural environment			.928		
Overcrowded with tourists	.	.661			
Publicity to sustainable tourism		.663			

Implement monitoring and enforcement mechanisms to ensure compliance. Promote awareness and appreciation of the local culture, traditions, and heritage among tourists. Offer opportunities for cultural exchange and interaction with indigenous communities while respecting their rights and privacy (Table 6). Explore alternative livelihood options for

communities dependent on natural resources, such as sustainable agriculture, handicrafts, or eco-friendly fishing practices. Diversifying income sources can reduce pressure on fragile ecosystems. As per the data of Factor 2, develop eco-friendly infrastructure such as low-impact accommodations, renewable energy systems, and waste management facilities.

Minimize the environmental footprint of tourism activities while providing essential amenities for visitors. Implement educational programs and interpretive materials to raise awareness about the importance of conservation and sustainable tourism practices. Encourage visitors to participate in conservation efforts and support local conservation initiatives.

From factor 4, assess the carrying capacity of ecotourism sites to determine the maximum number of visitors that can be accommodated without causing environmental degradation. Implement visitor management strategies to ensure sustainable tourism growth. Foster partnerships between government agencies, non-profit organizations, academic institutions, and the private sector to promote sustainable ecotourism development. Pool resources, expertise, and knowledge to address common challenges and achieve shared goals. On the basis of Factor 5 the officials should establish a monitoring and evaluation framework to track the environmental, social, and economic impacts of ecotourism activities over time. Use feedback from stakeholders to adapt management strategies and improve sustainability practices.

By integrating these research findings and suggestions into ecotourism planning and management, the Shoreside region of Tamil Nadu can achieve a balance between conservation and economic development, ensuring long-term benefits for both the environment and local communities (Palmer & Chuamuangphan, 2021).

CONCLUSION

The pros and cons of ecotourism development in the Shore-side region of Tamil Nadu have been transparently displayed in the paper. The massive potential for utilizing the area's normal magnificence and social legacy to cultivate monetary development while safeguarding its biological trustworthiness. The significance of adopting a holistic approach to ecotourism development that places an emphasis on environmental preservation, community empowerment, and socioeconomic sustainability is emphasized by our findings (Garrigós-Simón et al., 2015).

We have seen how all around arranged ecotourism drives can act as impetus for neighbourhood advancement, giving business open doors to waterfront networks while protecting delicate biological systems. Tamil Nadu's coastal areas are a complex interplay of ecological, socioeconomic, and cultural factors. Emphasis on integrated approaches for sustainable development to balance conservation and livelihoods. However, the urgent need for coordinated action to address key issues like waste management, infrastructure development, and stakeholder collaboration has also been highlighted by our research (Jeganathan et al., 2021). Ecotourism's long-term viability in the region is still uncertain without effective governance mechanisms and community engagement strategies.

Thus, we suggest a complex methodology that includes cooperation between government organizations, neighbourhood networks, NGOs, and the confidential area (Moreno, 2023). The following should be given priority in this strategy: Protecting sensitive habitats, biodiversity hotspots, and marine ecosystems from the negative effects of tourism is known as environmental conservation (Van der Merwe & Saayman, 2005).

Community Empowerment: Empowering local communities through skill development, capacity building, and equitable participation in ecotourism development-related decision-making processes (Chandarana et al., 2017).

Tourism Planning and Management: Implementing carrying capacity assessments and zoning regulations as part of comprehensive tourism master plans that strike a balance between visitor experiences and ecological sustainability (Kirikkaleli & Adebayo, 2021). **Infrastructure Development:** Making an investment in long-term infrastructure projects like eco-friendly lodging, waste management facilities, and renewable energy initiatives that both make it easier for visitors to get around and reduce their impact on the environment.

Schooling and Mindfulness: Bringing issues to light among sightseers and neighbourhood inhabitants about the significance of dependability the travel industry rehearses, natural protection, and social conservation. Additionally, ecotourism boosts local governments' and communities' bottom lines by bringing in extra revenue. Ecotourism can meet the primary and secondary needs of connected organizations and serve as a source of revenue for areas with low regional incomes. Similarly, employment in the tourism industry can both directly and indirectly lower the unemployment rate and boost the local economy in an ecotourism destination (Irfan et al., 2024); Increasing the production of goods and services is the final economic function, which is accompanied by an increase in the number of requests from tourists (Wu et al., 2025). The degree of productivity increases in proportion to the level of demand.

These findings indicate that ecotourism serves a variety of purposes for the local population. In conclusion, all stakeholders must work together and share a commitment if sustainable ecotourism in Tamil Nadu's Shore-side region is to succeed. We can ensure the long-term prosperity of the region's natural environment and vibrant Shore-side communities by embracing sustainability principles and utilizing ecotourism's transformation potential.

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