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ASSESSING THE SUSTAINABILITY OF COASTAL TOURISM DESTINATIONS IN EGYPT—THE RED SEA GOVERNORATE AS A CASE STUDY

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Abstract: Coastal tourism occupies a central position in the economy of Egypt's Red Sea Governorate. However, the pace and spatial pattern of its development have placed noticeable pressure on both local communities and the region's fragile marine environment. This study evaluates the sustainability performance of 38 coastal tourism destinations using an integrated framework that encompasses environmental, economic, and social dimensions. An initial pool of 83 candidate indicators, drawn from a systematic review of international sustainability frameworks and refined through expert consultation, was reduced to a final set of 36 indicators. Data were sourced from official national statistics and strategic regional planning reports, and Exploratory Factor Analysis (EFA) was used to classify destinations by their composite sustainability performance. The findings reveal a notable spatial unevenness across the governorate. A small number of destinations, anchored by Hurghada, El Gouna, Safaga, and Marsa Alam, demonstrate relatively strong sustainability conditions, underpinned by established infrastructure and diversified services. Meanwhile, second-tier destinations record mixed performance, while the largest group, comprising the majority of coastal nodes and Bedouin settlements, remains characterized by limited sustainability driven by weak environmental governance, inadequate basic services, and structural economic marginalization. Drawing on these findings, the study proposes a territorially integrated policy framework to address the structural drivers of unsustainability and guide the governorate toward a more equitable, ecologically sound, and resilient model of coastal tourism development.

Keywords: coastal tourism sustainability; sustainable tourism indicators; Red Sea Governorate; coastal tourism planning; sustainable development planning

1. Introduction

Tourism is often described as a double-edged phenomenon. While it generates substantial economic benefits and development, it may also intensify environmental degradation, resource depletion, and social inequalities (Baloch et al., 2023; Tanguay et al., 2013). These conflicting outcomes have made sustainable tourism a central concern in both academic research and policy debates (Diéguez-Castrillón et al., 2022). In response, international frameworks and initiatives such as the United Nations World Tourism Organization

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(UNWTO), the Global Sustainable Tourism Council (GSTC), the Global Code of Ethics for Tourism (GCET), and the Sustainable Development Goals (SDGs), have emphasized responsible consumption, biodiversity conservation, and equitable socio-economic development as foundational principles of responsible tourism governance (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs [DG GROW], 2016; Global Sustainable Tourism Council [GSTC], 2019; World Tourism Organization [WTO], 2004, 2013). Coastal regions are particularly exposed to these dynamics, as they combine ecological fragility with the fastest-growing form of tourism worldwide (Blancas et al., 2011). Without effective management, mass tourism would accelerate habitat loss, waste generation, and unsustainable resource use (Punzo et al., 2022), leaving coastal ecosystems vulnerable to erosion, biodiversity loss, and water contamination (Ziaabadi et al., 2017).

Egypt's Red Sea Governorate is a prime example of these coastal regions. Internationally renowned for its beaches, coral reefs, and diverse diving sites, the governorate has experienced rapid expansion of resorts and related infrastructure, which has strained local ecosystems (Hilmi et al., 2018). Recent evidence indicates that the Red Sea region struggles with major sustainability problems such as pollution, loss of coastal habitats, and declining coral reefs (Kabil et al., 2022), while undergoing rapid and unplanned development with little regard for ecosystem vulnerability or long-term sustainability (Alhemimah et al., 2024; Eladawy et al., 2024). Studies also emphasize that tourism in the Red Sea is highly vulnerable to environmental damage and climate-related risks, putting both ecological health and the economic stability of coastal areas at risk (Gallegati et al., 2025). Despite its urgency, there is a marked gap in empirical research on the sustainability of coastal tourism in the Red Sea Governorate. Existing studies often focus on efficiency or general environmental monitoring (Kabil et al., 2022; Nour et al., 2022), rather than providing integrated, locally adapted sustainability assessments. This research addresses these gaps by evaluating the sustainability performance of coastal tourism destinations in the Red Sea Governorate and identifying suitable frameworks and indicators for this unique context. Specifically, the study is guided by two central research questions: (1) How sustainable is coastal tourism in the Red Sea Governorate when assessed across environmental, economic, and social dimensions? (2) What are the most appropriate indicators and frameworks for assessing and guiding sustainable tourism development in this Governorate? The objectives are to assess the sustainability performance of the Red Sea coastal tourism destinations and to provide evidence-based policies for improving sustainable tourism planning and management in the Governorate.

2. Literature review

2.1. Sustainable coastal tourism indicator frameworks

Sustainable tourism indicators serve as robust analytical instruments that translate overarching sustainability principles into quantifiable measures (Blancas et al., 2018; Carrillo & Jorge, 2017). By synthesizing complex biophysical and socio-economic data into accessible formats through composite indicator systems (Blancas & Lozano-Oyola, 2022), these tools enable policymakers to systematically evaluate destination performance, identify areas for targeted intervention, and monitor temporal trends (Buongiorno & Intini, 2021). Furthermore, they provide early-warning signals by detecting ecological and social

thresholds that indicate emerging stressors, thereby supporting proactive management strategies (Blancas et al., 2023). Over the past two decades, sustainability indicator frameworks for coastal tourism have evolved from standardized environmental metrics toward more integrated and participatory systems. Early initiatives, notably the European Tourism Indicators System (ETIS) and the UNWTO Sustainable Tourism Indicators, sought to standardize tourism sustainability measurement, not specifically coastal tourism, across destinations through indicators covering tourism revenue, visitor density, energy consumption, and waste generation (DG GROW, 2016; WTO, 2004, 2013). While effective in data-rich settings, these foundational frameworks proved less adaptable to contexts where local conditions vary, and monitoring capacity is limited (Pivčević et al., 2020). Accordingly, the literature demonstrates that these frameworks often require local adaptation to destination-specific conditions, especially in coastal settings, where environmental pressures, community impacts, and resilience vary considerably (Brščić et al., 2020; Coccossis & Koutsopoulou, 2020).

In response, composite indicators and multi-criteria decision analysis (MCDA) models emerged as more dynamic alternatives, enabling longitudinal tracking and cross-destination comparisons by aggregating diverse indicators into single, policy-accessible scores (Modica et al., 2018; Punzo et al., 2022; Ziaabadi et al., 2017). Critics, however, caution that such aggregation risks obscuring localized trade-offs and compressing complex realities into oversimplified metrics (Marciš & Gajdošík, 2022; Torres-Delgado & López Palomeque, 2018). More recently, participatory frameworks have gained traction, advocating co-development of indicator systems with local stakeholders to ensure assessments reflect the specific ecological, cultural, and socio-economic conditions of each destination (Blanco-Romero & Blázquez-Salom, 2023; Kurniawan et al., 2021). Despite their conceptual appeal, participatory approaches remain resource-intensive and liable to stakeholder conflicts (Schumacher et al., 2018, 2020). Taken together, this trajectory reveals that sustainability assessment in coastal tourism is not merely a technical exercise but a political process, requiring a careful balance between methodological rigors, contextual sensitivity, and competing stakeholder interests.

2.2. Applications of sustainability indicators in coastal tourism

The operationalization of sustainability indicators within coastal tourism research has shifted from theoretical categorization to the empirical diagnosis of local pressures. In the environmental dimension, empirical applications of indicators have consistently revealed a widening gap between tourism expansion and ecological carrying capacity in mature coastal systems. By utilizing indicators such as tourism-generated solid waste per capita and localized wastewater treatment coverage, Coccossis and Koutsopoulou (2020) and Blancas and Lozano-Oyola (2022) demonstrated that rapid visitor growth frequently outpaces municipal infrastructure, leading to serious marine pollution and severe coral reef degradation. Furthermore, when evaluating resource efficiency through metrics like energy and water consumption per tourist, studies in the Mediterranean basin by Punzo et al. (2022) and Blancas et al. (2023) identified a critical decoupling where high-density tourist enclaves disproportionately exhaust local aquifers and grids relative to resident populations. Furthermore, a persistent finding across these empirical frameworks is that visible ecological proxies, such as beach cleanliness, frequently mask underlying systemic degradation, such as

accelerated coastal erosion and fragmented habitat connectivity in ecologically sensitive zones (Núñez-Lara et al., 2022; Torres-Delgado & Saarinen, 2014). Moreover, recent attempts to integrate climate resilience and environmental governance indicators have highlighted an extensive institutional deficit; frameworks applied by Blanco-Romero and Blázquez-Salom (2023) and Punzo et al. (2022) show that while environmental management certifications are increasing among private resorts, the absence of standardized, state-enforced monitoring frameworks prevents evidence-based enforcement and leaves coastal habitats vulnerable.

In the economic dimension, indicator-based research on coastal tourism has increasingly focused on the structural vulnerabilities hidden behind aggregate macroeconomic success. Traditional metrics such as tourism's share of regional GDP and employment often signal robust performance, yet when contextualized alongside microeconomic indicators like average length of stay and revenue retention, they reveal extensive capital leakages through foreign-owned intermediaries (Bršćić et al., 2020; Carrillo & Jorge, 2017). Seasonality indicators, particularly high-to-low arrival ratios and occupancy fluctuations, were utilized by Blancas et al. (2018) and Coccossis and Koutsopoulou (2020) to demonstrate that severe economic polarization undermines employment stability and inflates municipal infrastructure maintenance costs. Furthermore, applying indicators of local business participation and tourism investment distribution, studies by Tanguay et al. (2013) and Artal-Tur and Badillo-Amador (2024) proved that coastal tourism development inherently tends toward economic enclaving. Research findings indicate that established urban nodes systematically centralize public infrastructure investments and digital visibility, which marginalizes peripheral coastal destinations and prevents them from capturing shares of the global tourism value chain despite their natural endowments (Blancas et al., 2018; Coccossis & Koutsopoulou, 2020).

Social sustainability indicators represent the most complex yet underrepresented component of coastal destination assessments, primarily due to limited data availability at more localized levels. When applied empirically, indicators tracking resident-visitor density ratios, housing affordability, and access to healthcare (e.g., hospital beds per capita) consistently reveal social inequalities and patterns of tourism-driven gentrification in highly developed coastal zones (Blancas et al., 2018; Carrillo & Jorge, 2017; Núñez-Lara et al., 2022). Longitudinal assessments by Agyeiwaah et al. (2017) and Pivčević et al. (2020) have shown that while employment rates increase during peak tourism seasons, the quality of local human capital often deteriorates due to a lack of structured capacity-building programs and a heavy reliance on low-skilled seasonal labor. Crucially, studies incorporating participatory planning metrics and community satisfaction surveys have highlighted a persistent governance deficit; as documented by Tanguay et al. (2013) and Blancas et al. (2023), stakeholder engagement processes in coastal zones are often limited to formalities, where host communities and indigenous populations are excluded from destination governance. As a result, these power imbalances contribute to youth out-migration, the commodification of local cultural heritage, and the isolation of peripheral settlements from the broader regional planning and benefits (Punzo et al., 2022; Torres-Delgado & Saarinen, 2014). Finally, tracking tourist security and displacement metrics serves as a critical early-warning framework; as demonstrated by Cobacho-Tornel (2019) and Blancas et al. (2023), unmonitored civic stressors directly threaten to undermine community cohesion and accelerate the exclusion of local populations.

3. Methods

3.1. *Rationale for selecting the study area*

The Red Sea Governorate was selected as the study area due to its strategic significance as one of Egypt's most intensive coastal tourism destinations. According to recent reports, the governorate accounts for approximately 28% of the total national tourism demand and 33% of all the recorded tourist nights in 2024, while national tourism-related expenditure constitutes around 35% of its total public budget (General Organization for Physical Planning [GOPP], 2025), reflecting a pronounced policy orientation toward tourism-led regional development. Spatially, the governorate forms a linear coastal strip along the western shores of the Red Sea, encompassing Hurghada as its capital, and 6 major cities serving as the capitals of the governorate's districts (Marakez): Ras Gharib, Safaga, Quseir, Marsa Alam, Shalateen, and Halayeb, and 21 coastal tourism nodes, and 10 Bedouin settlements. These destinations' tourism assets span a wide spectrum, from archaeological sites, natural springs, palm oases, and mountain valleys, to traditional Bedouin crafts such as kilim weaving, palm frond products, oil painting, embroidery, and wood carving (GOPP, 2025). In addition, the governorate contains three major protected areas: the Northern Islands Reserve (marine), Wadi El-Gemal Reserve (terrestrial and marine), and Gabal Elba Reserve (terrestrial and marine), collectively covering nearly 37% of the governorate's total area (Central Agency for Public Mobilization and Statistics [CAPMAS], 2024b; Egyptian Environmental Affairs Agency, 2026). This combination of rapid tourism development, diverse typologies, significant ecological sensitivity, and substantial fiscal dependence makes the Red Sea Governorate an instructive case for assessing the sustainability of coastal tourism at the regional scale.

3.2. *Indicators' development and data collection*

The indicator framework was constructed through a two-stage screening process. First, an initial pool of 83 candidate indicators, mapped onto the three dimensions of sustainability—environmental, economic, and social—was compiled from a comprehensive review of existing international sustainability frameworks and empirical coastal tourism studies detailed in the preceding literature review section. This pool was then screened against three criteria: (a) frequency of appearance in coastal tourism studies; (b) conceptual alignment with the study objectives; and (c) availability and reliability of official statistical data, resulting in the exclusion of 19 indicators and a refined list of 64 indicators.

In the second stage, expert-based indicator screening was conducted with a purposively selected panel of ten specialists in tourism development and coastal tourism planning. The panel was selected based on their professional experience, ranging from 20 to 30 years, in national tourism strategy and coastal tourism planning. To ensure institutional and geographic depth, the panel included representatives from key national and regional entities, namely two experts from the Tourism Development Authority, two experts from the Tourism Promotion Authority in the Red Sea Governorate, two experts from the GOPP, the tourism and economic development consultants of the Strategic Plan for the Red Sea Governorate, the Secretary-General of the Red Sea Governorate, and the Director of the Urban Planning Department of the Red Sea Governorate. Each expert rated the 64 indicators on a five-point scale (1–5) across three attributes: relevance to the Red Sea coastal

destinations, importance for sustainability monitoring, and data availability at the destination level. The indicators were subsequently screened based on the level of agreement among the experts, resulting in the exclusion of a further 28 indicators: 9 environmental indicators due to insufficient data coverage, 6 economic indicators due to limited local applicability, and 13 social indicators primarily related to community satisfaction and participation, which would require dedicated field surveys beyond the scope of this study. The resulting indicator framework comprises 36 indicators: 13 environmental, 14 economic, and nine social indicators. Within each of these three dimensions, the indicators are structured into five specific thematic groups, with metrics detailed in Tables 1–3. Indicators' data were subsequently retrieved from multiple official repositories, including: (1) Statistical Yearbook (CAPMAS, 2024b), data year: 2023; (2) Governorate Information Note (Information and Decision Support Center [IDSC], 2025), data year: 2024; (3) General Census of Population, Housing and Establishments 2017: the Red Sea Governorate (CAPMAS, 2018), data year: 2017; (4) Annual Bulletin of Hotel Activity and Tourist Villages Statistics (CAPMAS, 2024a), data year: 2023; and (5) Strategic Development Plan for the Red Sea Governorate (GOPP, 2025), information year: 2024.

Table 1. Environmental indicators for sustainable coastal tourism

Thematic Group	Indicator	Metrics
1. Waste and Pollution Management	Solid waste management ⁵	Quantity of solid waste (t/day) - Number of sanitary landfills
	Tourism-generated waste per capita ²	Quantity of solid waste generated by the tourism sector per capita (t/person/day)
	Water quality ²	Output capacity of desalinated drinking water plants (m ³ /day)
	Wastewater treatment coverage ⁵	Capacity of wastewater treatment plants (m ³ /day) - Per capita treated wastewater (m ³ /person/day)
2. Resource Efficiency	Tourism-sector water consumption ⁴	Percentage of buildings in the tourism sector connected to the drinking water supply
	Access to clean water (population %) ³	Per capita desalinated drinking water (m ³ /person/day)
	Tourism-sector energy consumption ⁴	Percentage of buildings connected to electricity and natural gas - Per capita electricity consumption (kWh/person/year)
	Renewable energy share ⁵	Per capita renewable energy generation (MWh/person/year)
3. Ecosystem and Biodiversity Protection	Protected areas (marine / terrestrial) ¹	Percentage of protected areas (terrestrial, marine) compared to total settlement area - Proximity to protected areas
	Rare plant/animal species (per area) ¹	Number of rare plant and animal species
	Species diversity (per area) ¹	Number of plant and animal species – biodiversity index
4. Climate Resilience	Tourism-related GHG Emissions ¹	Per capita mitigation of harmful carbon emissions (thousand pounds/person)
5. Environmental Governance and Management	Air quality ¹	Per capita mitigation of harmful carbon emissions

Note. ¹CAPMAS (2024b); ²IDSC (2025); ³CAPMAS (2018); ⁴CAPMAS (2024a); ⁵GOPP (2025).

Table 2. Economic indicators for sustainable coastal tourism

Thematic Group	Indicator	Metrics
1. Macroeconomic Contribution	Tourism contribution to GDP ⁴	Percentage of tourism revenues from GDP
	Tourism employment share ⁴	Percentage of employees in tourism activities compared to employees in all economic activities
	Total number of tourist arrivals ⁴	Number of tourists visiting the destination during the year
	Unemployment rate in the destination ²	Unemployment rate for the population aged 15–65 years
2. Tourist Expenditure and Profitability	Tourism revenue per capita ⁴	Total tourism revenues
	Average tourist spending ⁴	Average tourist expenditure (thousand EGP/tourist/night)
	Length of stay ⁴	Number of tourist nights/number of tourists (night/tourist)
3. Seasonality and Stability	Seasonality of demand ⁴	Number of months in the year with peak tourism demand - Hotel occupancy rate
4. Local Participation and Investment	Public tourism investment ⁵	Total public investment in tourism projects
	Tourism investment ratio ⁵	Percentage of tourism investment/total investments
5. Infrastructure and Fiscal Performance	Tourism infrastructure index ³	Centralization of tourism facilities and services (Tourism Services Location Quotient)
	Access to airports ¹	Time (minutes) to the nearest airport
	Telephone communications ⁵	Number of phone lines per 1,000 inhabitants
	Mobile line rate ⁵	Mobile lines per capita

Note. ¹CAPMAS (2024b); ²IDSC (2025); ³CAPMAS (2018); ⁴CAPMAS (2024a); ⁵GOPP (2025).

Table 3. Social indicators for sustainable coastal tourism

Thematic Group	Indicator	Metrics
1. Employment and Capacity Building	Local employment in the tourism sector ⁴	Percentage of local tourism workforce / total tourism workforce
2. Community Satisfaction and Participation	Social carrying capacity of the destination ⁵	Ratio of tourists to locals
3. Cultural Preservation and Identity	Centralization of social, cultural, and sports services ⁵	Centralization of social, cultural, and sports services (Location quotient for services—associations, cultural centers, clubs, youth centers, and libraries)
	Population growth due to tourism ⁵	Population growth rate during the period (1996–2025)
4. Equity and Social Well-Being	Effects on local population welfare ⁵	Gross Domestic Product Index (expressing the average income per settlement)
	Effect on local population structure ³	Percentage of young population
	Hospital beds per 1,000 inhabitants ²	Number of hospital beds per 1,000 inhabitants
5. Safety, Civic Stability, and Conflict Management	Safety and security for tourists and locals ¹	Number of accidents on urban roads per 1,000 persons
	Displacement of local populations ¹	Net population migration

Note. ¹CAPMAS (2024b); ²IDSC (2025); ³CAPMAS (2018); ⁴CAPMAS (2024a); ⁵GOPP (2025).

3.3. Data analysis

All 36 indicator values were harmonized before the analysis by converting raw counts and mixed-scale variables into ratios or percentages relative to appropriate bases such as population, tourism revenues, or tourism capacity, followed by log-transformation to stabilize variance, particularly given the disproportionate weight of high-activity destinations such as Hurghada and Safaga, and subsequent standardization into z-scores (*Mean* = 0, *SD* = 1). The statistical analysis was conducted using IBM SPSS (v.28) and pursued three sequential objectives: condensing the 36 sustainability indicators into a smaller set of latent

sustainability dimensions, assessing the multidimensional performance of the 38 destinations, and deriving factor-based scores suitable for spatial comparison and policy application. Regarding data integrity, due to pre-screening of indicators, missing data were minimal and addressed through single imputation from the existing data series. Following this, data suitability was confirmed using the Kaiser–Meyer–Olkin measure ($KMO = 0.74$) and Bartlett's test of sphericity ($p < 0.001$), thereby validating the application of Exploratory Factor Analysis (EFA). Using Principal Components extraction, components with eigenvalues exceeding 1.0 were retained, and variables with communalities below 0.50 were excluded. The final solution yielded four factors collectively explaining 78% of the total variance: (1) environmental protection and resource pressure, (2) tourism economic performance and accommodation capacity, (3) infrastructure and accessibility, and (4) social and services provision. In order to align the study findings with established planning and policy frameworks, these four identified factors were translated into the classic sustainability pillars: environmental, economic, and social. The environmental dimension was drawn directly from factor 1, while the social dimension was informed by factor 4. Meanwhile, the economic dimension was constructed by combining factors 2 and 3, using weighted averages based on their contribution to the overall explained variance. Last, for comparative analysis across destinations, an overall coastal tourism sustainability index was calculated as the mean of the standardized scores for each pillar, thereby ensuring balanced representation of all core sustainability dimensions. The index values were then categorized into three performance tiers and spatially mapped to identify patterns of sustainability performance and destination disparities across the governorate.

4. Results

4.1. Classification of destinations by environmental sustainability performance

The classification of the Red Sea Governorate's coastal tourism destinations revealed three distinct tiers of environmental sustainability performance (Table 4). Hurghada and El Gouna emerged as the highest-performing destinations, demonstrating strong outcomes in solid waste management, water supply, and wastewater treatment efficiency (exceeding 90%), as well as in renewable energy generation. Hurghada's per-capita carbon emission reduction surpasses the national average, and the governorate's sanitary landfill infrastructure is largely concentrated within it (65%). However, both destinations remain under pressure from intensive diving activity and marine traffic within the Red Sea Northern Islands Reserve, contributing to coral reef degradation and threats to rare marine species.

The second tier of moderate sustainability performance encompasses the urban centers of Ras Gharib, Safaga, Quseir, and Marsa Alam, as well as smaller tourism nodes such as South Magawish, Sahl Hasheesh, and Abu Makhadeg, alongside selected Bedouin communities including Al-Zafrana, Abu Ghusun, and Hamata. These destinations benefit from the proximity to Hurghada's established infrastructure and show emerging progress in renewable energy adoption, as Ras Gharib hosts significant wind and solar installations, though gaps in solid waste collection and environmental policy enforcement persist. At the lowest tier, the remote southern centers of Shalateen and Halayeb, along with the remaining Bedouin settlements and tourism nodes, exhibit critical deficiencies in drinking water access, waste disposal systems, and electricity supply. Despite harboring ecologically significant

protected areas such as Gabal Elba, Abraaq, and El-Daib, these centers face noticeable coral reef degradation driven by unregulated fishing and diving, weak conservation, and limited environmental awareness.

4.2. Classification of destinations by economic sustainability performance

The classification of the Red Sea Governorate's coastal tourism destinations based on their economic sustainability performance produced three distinct tiers (Table 4). The highest-performing tier is anchored by Hurghada City, El Gouna, Sahl Hasheesh, South Magawish, Abu Makhadeg, Safaga, and Marsa Alam. According to the quantitative assessment of this study, tourism accounts for over 20% of local GDP across these destinations, exceeding 50% in Hurghada alone, while the city concentrates approximately 56% of all the implemented tourism investments in the governorate and hosts more than 60% of four- and five-star accommodation capacity. Direct international airport access and well-developed telecommunications infrastructure further reinforce the economic resilience and investment attractiveness of these destinations, cementing their role as the governorate's core.

The second tier of moderate economic performance includes Quseir City and adjacent tourism nodes such as Bir Asal and El Sharm El Bahari, alongside several Marsa Alam sub-centers including Jebel El-Gezira and Marsa Shagra. Based on this study's empirical evaluations, tourism contributes 10–20% of local GDP in these destinations, with tourism employment representing 4–7% of the workforce, though limited product diversification, below-average connectivity, and modest investment shares constrain their growth trajectory. At the lowest tier, destinations in the Shalateen, Halayeb, and Ras Gharib centers, together with coastal Bedouin settlements and some Safaga sub-centers, exhibit critical economic weaknesses across all measured dimensions. This includes minimal tourism infrastructure, poor accessibility to airports and major transport corridors, and an almost exclusive reliance on coastal resources without complementary eco-tourism or cultural offerings.

4.3. Classification of destinations by social sustainability performance

The classification of the Red Sea Governorate's coastal tourism destinations revealed three distinct tiers of social sustainability performance (Table 4). The highest-performing destinations, Hurghada, El Gouna, Safaga, and Marsa Alam, concentrate over 60% of the governorate's social, cultural, and sports facilities and maintain Local GDP Index values above the governorate average (0.57), reflecting the tangible social dividends of sustained tourism investment. Nevertheless, these destinations are not without shortcomings; hospital-bed-to-population ratios fall short of national standards at 0.94 beds per 1,000 inhabitants, and road-traffic accident rates on regional highways remain above the national average, underscoring persistent gaps in public health and safety infrastructure.

The intermediate tier, comprising Ras Gharib, Al-Zaafarana, Quseir, Al-Hamraween, a few Bedouin communities within Marsa Alam center, and Shalateen, accounts for only 20% of the governorate's social service provision, according to the empirical assessment of this study, revealing a marked spatial inequality in resource distribution. These destinations possess notable cultural assets, including the historic sites of Old Quseir and the ancient port of Berenice, as well as living Bedouin craft traditions; however, weak institutional support and limited policy attention have prevented these resources from being meaningfully integrated into tourism offerings. At the lowest tier, Bedouin settlements in Shalateen and Halayeb

districts, alongside smaller southern coastal nodes, exhibit critical deficiencies across virtually all social dimensions, from inadequate healthcare infrastructure and scarce community facilities to declining youth retention driven by outmigration. Accordingly, despite their considerable natural and cultural assets, such as unspoiled beaches, coral reefs, and scenic mountain valleys, they have yielded few tangible social or economic benefits for residents.

Table 4. Classification of tourism sustainability indicators for urban destinations

Administrative Districts	Urban Destinations	Environmental Sustainability	Economic Sustainability	Social Sustainability	Overall Tourism Sustainability
Ras Gharb district	Ras Gharb City	**	*	**	**
	Zafarana village	**	*	**	**
El Hurghada district	El Hurghada City	***	***	***	***
	El Gouna tourism center	***	***	***	***
	South Magawish tourism center	**	***	*	**
	Sahl Hasheesh tourism center	**	***	*	**
	Abu Makhadig Bay tourism center	**	***	*	**
Safaga district	Safaga City	**	***	***	***
	Umm El Huwaitat village	*	*	*	*
	Sharm El Arab tourism center	*	*	*	*
	Sharm El Naqa tourism center	*	*	*	*
	Abu Soma tourism center	*	*	*	*
	North Safaga tourism center	*	*	*	*
El Quseir district	El Quseir City	**	**	**	**
	El Hamrawein village	*	*	**	*
	Umm Gheig village	*	*	*	*
	Safaga-El Quseir tourism center	*	*	*	*
	Bir Asal tourism center	*	**	*	*
	Sharm Bay tourism center	*	**	*	*
	Marsa Wazur tourism center	*	*	*	*
	Ras Trombi tourism center	*	*	*	*
Marsa Alam district	Marsa Alam City	**	***	***	***
	Branis village	**	*	**	**
	Abu Ghosoun village	**	*	**	**
	Hamata village	**	*	**	**
	Gebel El-Gezira tourism center	*	**	*	*
	Marsa Shoni tourism center	*	*	*	*
	Marsa Morin tourism center	*	*	*	*
	Al-Nabaa Al-Saghir tourism center	*	**	*	*
	Marsa Shagra tourism center	*	**	*	*
	Ras Dory tourism center	*	**	*	*
	Sharm El-Fekiry tourism center	*	**	*	*
	Wadi Lahmi tourism center	*	**	*	*
Shalateen district	Shalateen City	*	*	**	*
	Marsa Hamira village	*	*	*	*
Halaib district	Halaib City	*	*	*	*
	Abu Ramad village	*	*	*	*
	Ras Abu Hadraba village	*	*	*	*

Note. ***high, **intermediate, *low.

4.4. Classification of destinations by the overall tourism sustainability index

The spatial classification of the Red Sea Governorate's coastal tourism destinations identified three distinct tiers based on the overall coastal tourism sustainability index (Figure 1) and (Table 4). These tiers reflect the combined performance of destinations across the environmental, economic, and social dimensions of tourism sustainability.

4.4.1. Destinations with high tourism sustainability performance

The high-performance tier encompasses four major coastal destinations (10% of the total): Hurghada, El Gouna, Safaga, and Marsa Alam. These destinations form the governorate's core tourism development nodes, demonstrating strong economic and social sustainability, underpinned by tourism-driven economies, diversified employment, and advanced service provision. However, their sustainability profile is uneven; while Hurghada and El Gouna perform well environmentally, with developed waste management, water infrastructure, and renewable energy systems, Safaga and Marsa Alam lag slightly in eco-coastal management.

4.4.2. Destinations with moderate tourism sustainability performance

The moderate performance tier comprises nine coastal destinations (24% of the total) characterized by highly fragmented and structural imbalance across the three pillars. This fragmentation is exhibited in three spatial profiles. The first features tourism nodes within Hurghada center (South Magawish, Sahl Hasheesh, and Abu El-Mokhadeg) that show strong economic indicators from investment spillover, unmatched by improvements in social and environmental infrastructure. The second profile consists of Ras Gharib, Al-Zaafarana, and Bedouin communities in Marsa Alam center (Baranis, Abu Ghusun, and Hamata), which exhibit moderate environmental and social performance, but remain economically constrained by limited tourism diversification and low investment attraction. The third profile is represented by Quseir City, which demonstrates balanced but uniformly moderate outcomes across all the pillars.

4.4.3. Destinations with limited tourism sustainability performance

The limited performance tier constitutes the largest spatial concern, comprising 25 destinations (66% of the total), mainly located in the southern periphery, including Shalateen, Halayeb, and parts of Safaga and Quseir centers. While a small number of destinations, including Abu Soma, Bir Asal, and El Sharm El Bahari, display moderate economic performance driven by emerging investment, their environmental and social indicators remain critically lagging. Besides, Shalateen City and El-Hamraween Village exhibit relative strengths in certain environmental and social metrics, while broadly characterized by persistent and overlapping challenges. Across this tier, there is underdeveloped tourism infrastructure, low economic diversification, poor social service coverage, and deficient environmental governance.

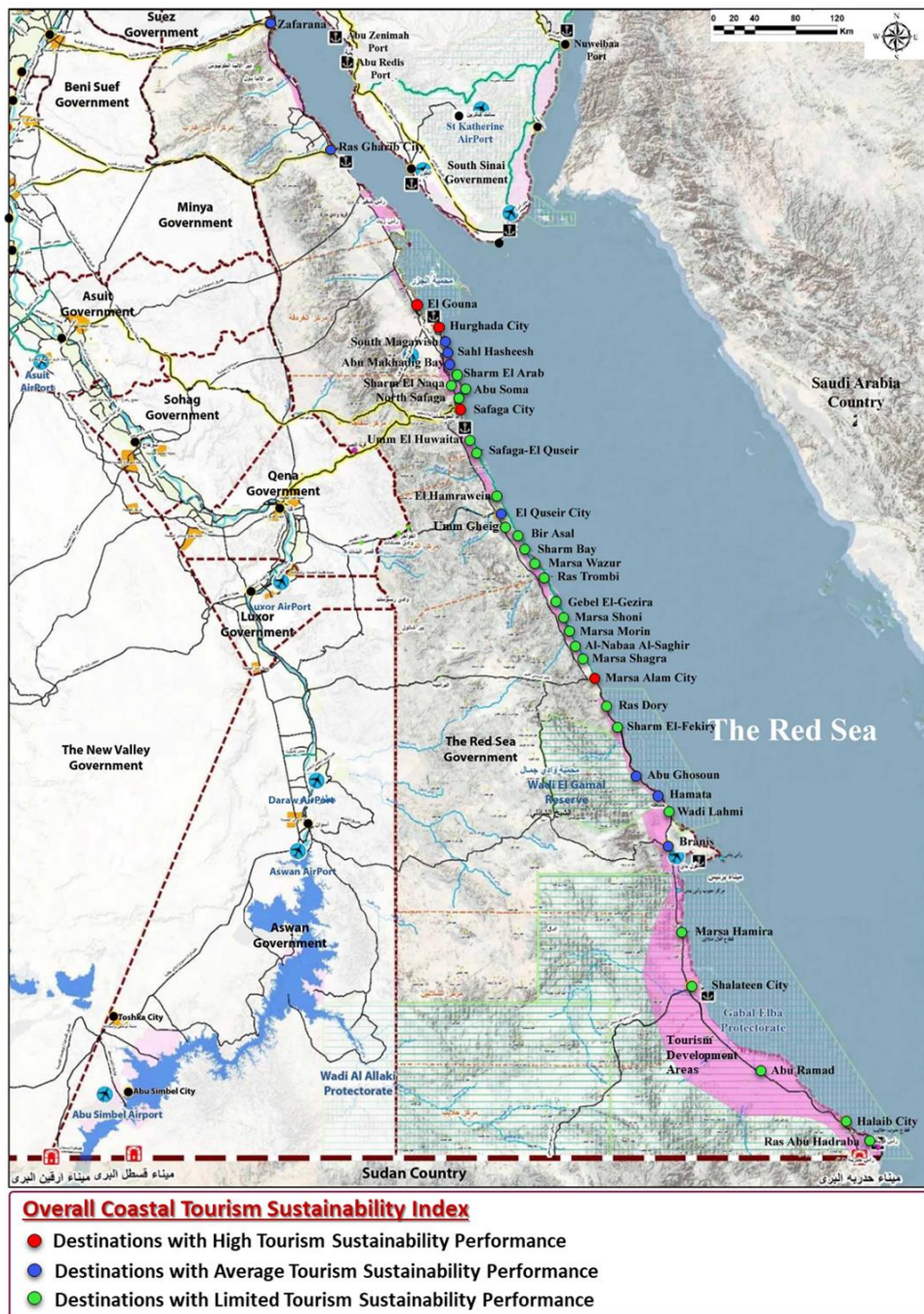


Figure 1. Classification of destinations based on their overall tourism sustainability performance.

5. Discussion

5.1. Key coastal tourism sustainability challenges in the Red Sea Governorate

The analysis reveals a pronounced spatial unevenness in coastal tourism sustainability across the Red Sea Governorate, reflecting the broader structural tensions between rapid tourism expansion, environmental capacity, economic concentration, and community inclusion that characterize many coastal regions globally. Environmental sustainability emerges as the most persistently underperforming pillar across the governorate, driven by recurrent challenges of solid-waste accumulation, inadequate wastewater treatment, deteriorating air quality and coral-reef degradation, particularly around Hurghada, Safaga, and Marsa Alam. These findings are consistent with patterns reported for comparable coastal contexts by Coccossis and Koutsopoulou (2020) and Ziaabadi et al. (2017). Moreover, low wastewater-treatment coverage and deteriorating air quality caused by traffic congestion, diesel-powered transport, and energy-intensive tourism facilities all add pressure on the coastal ecosystems already stressed by high visitor densities. Most critically, the governorate lacks a coherent and adaptive environmental monitoring framework, a gap that prevents evidence-based management responses and mirrors the institutional deficiencies identified by Blancas et al. (2023) in the Mediterranean coastal destinations facing similar sustainability pressures.

In parallel, economic sustainability performance in the governorate is remarkably polarized. Hurghada and El Gouna together capture most of the share of tourism revenue, accommodation investment, and visitor expenditure, while destinations further along the coast, especially those in the southern centers, remain economically marginal despite their considerable natural and cultural endowments. Such centralization of tourism investment reflects long-standing investment patterns and infrastructure decisions that have favored established coastal tourism nodes over emerging ones, generating regional imbalances that are difficult to reverse, where this polarization dynamic is well-documented by Modica et al. (2018) in Italy and Cobacho-Tornel (2019) in Spain. Conversely, in destinations where tourism is already limited, poor road and air connectivity, minimal digital visibility, and low rates of local-business participation further narrow the prospects for economic diversification, echoing the concerns that Artal-Tur and Badillo-Amador (2024) have similarly raised in the Mediterranean coastal settings where peripheral destinations struggle to capture meaningful shares of tourism value chains.

Notably, a significant finding of this study is the persistence of deep social inequities in communities that exist within one of Egypt's most prosperous tourism regions. Bedouin settlements and southern centers such as Shalateen and Halayeb experience critical basic service deficiencies, and minimal residents' participation in tourism employment and local governance, confirming the concerns of Agyeiwaah et al. (2017) and Blancas et al. (2011) that sustainable tourism cannot exist without the active engagement and genuine empowerment of host communities. The governorate's cultural heritage and traditional crafts are underutilized due to the absence of institutional frameworks capable of integrating them meaningfully into the destination offer. The absence of reliable social data and participatory planning mechanisms further limits the ability of policymakers to identify, monitor, and respond to these social pressures, representing a governance deficit that Torres-Delgado and Saarinen (2014) identify as one of the most persistent obstacles to socially inclusive tourism development.

5.2. Spatially tailored planning mechanisms and policy directions

Addressing the sustainability of distinct spatial and structural disparities found across the Red Sea Governorate's coastal destinations requires a multi-dimensional policy framework. By shifting focus from broad, uniform tourism policies to targeted local interventions aligned with the distinct performance levels of each destination, sustainable coastal tourism can be advanced by coordinating environmental integrity, economic resilience, and social inclusion. For the high-performance core destinations, which include Hurghada, El Gouna, Safaga, and Marsa Alam, the vital primary policy focus is advanced environmental mitigation, as demonstrated in mature coastal systems (Blancas et al., 2023; Coccossis & Koutsopoulou, 2020). While these primary centers function as the governorate's economic and social anchors, their rapid growth has put strain on fragile ecosystems. Targeted policies should integrate real-time marine monitoring, strict waste recycling and marine-waste controls, and renewable energy adoption. In addition, it necessitates reinvesting tourism revenues into regional road safety improvements and healthcare service enhancements.

In contrast, moderately performing destinations exhibit fragmented profiles that require highly specific, localized policy interventions to resolve structural imbalances, where preventing economic isolation is commonly reported in peripheral Mediterranean zones (Artal-Tur & Badillo-Amador, 2024; Modica et al., 2018). For private resort enclaves such as Sahl Hasheesh, policy must legally mandate private investment in municipal infrastructure to protect surrounding marine ecosystems. For destinations like Ras Gharib, planning frameworks should leverage the existing heavy renewable energy infrastructure to draw clean-tech and eco-industrial tourism ventures. Alongside, for historic centers such as Quseir City, urban regeneration initiatives should focus on supporting local businesses and promoting Bedouin cultural traditions, helping diversify the regional tourism offer and distributing economic benefits more broadly.

Finally, the limited-performance peripheral destinations, including the destinations and Bedouin settlements, represent a critical regional planning challenge due to severe service gaps and geographic isolation. Overcoming these barriers requires a robust, state-led effort to decentralize infrastructure, prioritizing basic utilities such as clean water, waste management, and reliable electricity. Furthermore, improving transport corridors and local airfield connectivity in places like Shalateen and Halayeb can foster new eco-tourism and research opportunities. Most importantly, shifting from environmental enforcement to participatory co-management models, actively involving indigenous Bedouin leaders in local tourism councils, can transform the protection of fragile habitats like Gabal Elba and Wadi El-Gemal into a source of localized employment and stewardship. This transition translates ecological conservation into a direct mechanism for community empowerment and local resource ownership (Blanco-Romero & Blázquez-Salom, 2023; Schumacher et al., 2020).

6. Conclusion

This study assessed the sustainability performance of coastal tourism destinations in Egypt's Red Sea Governorate through an integrated, multidimensional framework encompassing environmental, economic, and social dimensions. Environmental sustainability emerged as the most challenging pillar, constrained by issues of waste accumulation, inadequate wastewater treatment, and coral-reef degradation, none of which have been matched by effective governance measures. Economic sustainability is most evident in urban centers

such as Hurghada and El Gouna, while peripheral and Bedouin communities experience economic marginalization despite their considerable natural and cultural assets. Similarly, social sustainability demonstrates an uneven pattern, with urban centers exhibiting advancement while southern destinations continue to experience deficiencies in healthcare, education, and participatory tourism planning.

The mechanisms proposed in this study, ranging from environmental monitoring reform, renewable-energy transition, product diversification, connectivity improvements, community empowerment, and heritage preservation, are not isolated interventions but components of an integrated approach. Their value lies in their interdependence: environmental protection preserves resources driving economic competitiveness, while social inclusion builds the local stewardship necessary to maintain both over time. Embedding these coordinated, tier-specific priorities within regional planning frameworks and local governance structures would enable the Red Sea Governorate to move beyond its current model of concentrated, growth-driven tourism toward a more resilient and balanced system.

The major limitations of this study are data-related. First, difficulty to access localized data at the scale of urban destinations, as most official statistics in Egypt are collected at the district or governorate level. Second, achieving consistency across environmental, economic, and social datasets was complicated by the separation of environmental data systems from socio-economic and municipal records. Furthermore, some internationally recognized sustainable tourism indicators could not be calculated due to gaps in national data repositories. While this approach maintains empirical rigor, it also highlights the ongoing disconnect between the requirements of global assessment frameworks and the realities of data availability for regional planning.

Future research should extend these findings through longitudinal analyses that monitor sustainability performance over time, allowing for a more dynamic understanding of the destination evolving across the three dimensions. The integration of community-based assessments alongside quantitative indicators would enrich the evaluation of the social dimension, capturing aspects of well-being and participation that are not fully reflected in official data sources. Furthermore, comparative studies involving other Egyptian coastal governorates would further contextualize the Red Sea case within the broader national representation, while the application of geospatial and remote-sensing tools holds considerable promise for advancing the monitoring of environmental change.

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