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Synergy for Sustainability: Stakeholder Collaboration to Ecological Resilience in Gili Tramena, West Nusa Tenggara

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ABSTRACT: The sustainability of tourism in the Gili Tramena (Trawangan, Meno, Air) is under serious threat due to environmental damage from waste, sewage, and overexploitation of resources. This study aims to explore collaboration among stakeholders in sustainable tourism and ecological resilience. Using a qualitative approach with observation, in-depth interviews, and NVivo analysis. The results show that collaboration through routine activities such as a recycling tour, Friday cleanup, integrated waste processing, and coral reef restoration using biorock technology has helped improve ecological conditions. The resilience strategies are regulatory strengthening, empowerment of community organizations, environmental education, active participation of business actors, and stakeholder communication forums. To strengthen the role of stakeholders in enhancing ecological resilience, the GITEC (Gili Tramena Ecology and Tourism Multi-Stakeholder Collaboration) framework was developed with three main elements: steering element, a technical management element, and a supervisory board.

KEYWORDS: Tourism stakeholder, collaboration, ecological resilience, sustainable tourism, environmental management

INTRODUCTION

Gili Trawangan, Meno, and Air (Tramena) tourism area has become a globally popular tourist destination and one of Lombok's tourism icons. However, this popularity and economic benefits come with consequences: environmental damage caused by waste, litter, and overexploitation of resources can threaten the sustainability, and it's currently a critical issue in many countries. Collaboration and partnerships among tourism stakeholders are needed to ensure shared responsibility for tourism sustainability. The strength of collaboration can lead to delays in anticipating environmental damage.

The highest impact occurs in Gili Trawangan, which has a land area of only 340 hectares and produces 18 tons of waste per day, rising to 25 tons during the holiday season. Waste from tourism, particularly accommodations such as hotels and restaurants, contributes to environmental degradation, resulting in a decline in environmental aesthetics, chaotic views, and stenches. Another impact was the damage to coral reefs due by high tourist activity. The overdevelopment has put pressure on the Gili Islands' environmental carrying capacity. One consequence is the clean water crisis that has persisted for months, such as on Gili Meno (detik.com, 2024). Tourism has also significantly impacted water quality changes and environmental vulnerability on Gili Tramena (Chairunnisa et al., 2025; Duan et al., 2022). These impacts tend to increase as the number of tourists increases. Tourism activities have been shown to contribute to environmental degradation directly (Kasa et al., 2025). The cycle of tourism impacts in coastal areas shows that the number of tourists and recreational activities is associated with increased impacts (Chairunnisa et al., 2025; Duan et al., 2022).

The sustainability of tourism in Gili Tramena is a very important issue to be resolved, according to research results (Widianto et al., 2026) showing that the level of sustainability in Gili Tramena from the institutional aspect (63.83), infrastructure (58.32), and economy (56.53) is classified as quite sustainable, while the ecological aspect (44.91) and social aspect (45.26) are classified as less sustainable. This indicates the need for integrative policies that emphasize strengthening ecological and social aspects, accompanied by infrastructure and institutional support.

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Therefore, a collaborative partnership involving multiple tourism stakeholders is necessary as a holistic approach to resolving ecological issues. This collaboration serves as a platform for action to strengthen ecological resilience and sustainable tourism in the Gili Tramena of North Lombok Regency. The resulting collaboration is expected to provide a framework for building cooperation among stakeholders in protecting the environment, preserving nature, and ensuring sustainable tourism.

LITERATURE REVIEW

Partnership and Stakeholder Collaboration

Stakeholder collaboration research in tourism shows that stakeholder participation can increase the effectiveness of sustainable tourism destination management through collaborative networks between stakeholders with equal roles (Fontanari & Traskevich, 2025; Gannon et al., 2021; Rasoolimanesh et al., 2023). Collaboration and partnerships can strengthen shared values, emphasizing the integration of economic, social, and environmental goals through a systems approach to knowledge exchange, trust development, resource mobilization, and sustainability goals (Burton & Pachucki, 2026). The model of collaboration goals leads to dynamic ecological innovation in the complex interactions between stakeholders in sustainable tourism, one of which is community-based collaboration involving government, the private sector, and local communities (Jamal & Stronza, 2009; Lu et al., 2019; Melendez-Roman & Font, 2026).

The stakeholder commitments are a key factor in developing sustainable collaboration. Vision and goals shared are needed, as well as a strong institutional framework to support collaboration, including regulations, incentives, and coordination mechanisms that govern each element (Graci, 2013; Shang et al., 2025). Collaborative processes can effectively raise awareness and encourage the adoption of adaptation measures, helping stakeholders recognize practical solutions and shift from a state of inaction to proactivity (Boqué-Ciurana et al., 2025; Melenez-Roman & Font, 2026). Shared responsibility among stakeholders helps enhance collective interaction between stakeholders, encouraging joint action in managing tourism sustainability (Burton & Pachucki, 2026; Melenez-Roman & Font, 2026).

The Role of Stakeholders in Ecological Resilience

Collaboration and partnerships require the government to be the leading sector. The success of collaboration depends on the role of local governments in establishing policies into concrete actions at the regional level, and active community participation must be facilitated through government programs (Bello et al., 2018; Firdaus et al., 2021). The government also formed as a mediator to ensure multi-perspective decision-making processes and that each policy intervention is measurable and sustainable. This role is realized through its function as a policy regulator to environmental challenges in tourism areas (Sarhan et al., 2025; Sitohang et al., 2024). Local governments also serve as intermediaries between citizen aspirations and macro government policies (Iddawela et al., 2021).

The important role of local governments is to connect the aspirations of local communities with regional governments, harmonize sectoral interests, and ensure resource management through the role of community groups to ensure ecological sustainability while empowering the local economy (Mcloughlin & Hanrahan, 2025a; Sarhan et al., 2025). They also have a function as implementers of technical controls in each regional zone, reflecting the principle of supervision in regulating tourism activities in sensitive areas through zoning mechanisms (Miccini et al., 2026). The community serves as a role model, influencing local perceptions, daily actions to support environmental protection, and serving as a reference for tourists in sustainable practices (Quang, 2025). They also monitor the tourism industry, ensuring that tourism practices do not damage the ecosystem (Rifai et al., 2024). Communities are not merely objects of development but can also be central subjects connecting cultural preservation, sustainability actions, and industry oversight, contributing to the creation of sustainable tourism (Novianti et al., 2025; Simanihuruk et al., 2024). The preservation of local traditions and practices by communities is an important foundation for sustainable tourism development, particularly in strengthening community identity and maintaining cultural ecosystems through cultural strategies (Wirawan, 2025). Effective collaboration requires strong relevance between government development programs and community aspirations (Mertha et al., 2025). The success of area management is greatly influenced by the oversight role of local communities in ensuring tourism practices do not damage the ecosystem (Rifai et al., 2024).

To increase community support and participation in environmental protection, communities can form forums and organizations. Government support for community empowerment and enhancing the managerial capacity of tourism awareness groups is crucial for developing community-based tourism initiatives (Lubis et al., 2024). Local leadership in integrating tourism priorities into formal development plans and mobilizing tourism awareness groups to coordinate destination operations can be strengthened through community institutions (Rahman et al., 2025). Community social institutions are tasked with identifying policy options, strengthening community representation, and building resilience through practices with local perspectives (Li & Yaakop, 2025).

The industry in environmental resilience and sustainable tourism can achieve relevant economic, social, and environmental goals, generating sustainable positive impacts for destinations and communities. Through Corporate Environmental Responsibility (CER), the role of industry stakeholders in preventing environmental impacts and issues can be strengthened (Dłużewska & Giampiccoli, 2024; Vergara Romero et al., 2025). Collaboration must be able to integrate economic, social, and environmental dimensions into every operational policy by synergistically involving science, policy, and industry actors (Saviano et al., 2025). Then, educational institutions play a key role in generating applied knowledge and ensuring development policies are grounded in empirical data through the development of ecological resilience research and environmental databases (Dananjaya, 2025). The three main functions of educational institutions are: first, as agents of change in knowledge, awareness, and ecological literacy in the community through sustainability education that can strengthen local commitment to natural resource management (Conefrey et al., 2025; van Onselen et al., 2025). Second, as partners in community development, through the initiation of educational tourism models that integrate ecological conservation with local economic empowerment, encouraging knowledge transfer to support community-based tourism (Purmintasari et al., 2025; Räikkönen, n.d.). Third, they serve as a bridge between traditional knowledge and modern approaches in managing tourist destinations that are adaptive to change (van Onselen et al., 2025; J. Wu et al., 2024).

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Furthermore, tourism organizations serve as catalysts for ecological innovation through knowledge exchange, trust building, and resource mobilization relevanted with sustainability goals. It is also necessary to raise relevant sustainability concerns among all actors, where tourists are invited to actively participate in practices that minimize ecological footprints and support the local economy, such as the use of local services and products (Burton & Pachucki, 2026). The importance of local leadership in integrating tourism priorities into formal development plans and mobilizing tourism awareness groups to coordinate destination operations (Rahman et al., 2025).

Ecological Resilience

Ecological resilience is a crucial foundation for sustainable tourism in coastal and small island areas. Therefore, integration of environmental conservation policies and tourism development is essential (Rasoolimanesh et al., 2023). Implementing strict regulations, such as visitor restrictions and ecosystem zoning in natural destinations, is effective in preventing environmental degradation (Liu, 2003; Buckley, 2020). Policies on environmental carrying capacity are needed to ensure stakeholders understand their rights and obligations in supporting natural resource conservation (Markatos et al., 2024).

The ecological resilience perspective emphasizes the capacity of tourism systems to address challenges and reorganize without losing their function, structure, and identity from an environmental perspective (Kutzner, 2019). Ecological resilience is the ability to adapt and transform towards a better evolution (Clark et al., 2026; Mandić et al., 2025). In its implementation for sustainable tourism, ecological resilience is operationalized through various dimensions, including maintaining the integrity of ecosystems that serve as tourist attractions, building diverse livelihoods for local communities that are not dependent on just one sector, and developing adaptive and participatory governance to respond to various environmental and social challenges (Das & Mishra, 2026; Sharifi et al., 2025). This approach recognizes that tourism is not only a cause of ecological stress but can also be part of the solution if managed with resilience principles through collaboration (Clark et al., 2026; Das & Mishra, 2026).

Ecological resilience can be achieved by strengthening the role of tourism stakeholders. Synergy between participatory approaches and government support creates a conducive environment for raising awareness (Indrarosa et al., 2025). Good communication between all stakeholders is also necessary (Brizga et al., 2024). Communication forums can foster community awareness and participation in management, enabling knowledge exchange, trust building, and regulatory negotiation that balances local autonomy with collective responsibility (Ratner et al., 2022; Ssekajja, 2025). Community participation and conservation initiatives can be fostered through increased conservation education (Salat et al., 2025). Community participation and empowerment are two of the best strategies for environmental conservation (Sarhan et al., 2025; Sulistyo et al., 2023). Therefore, preserving local traditions and practices in sustainable tourism development, particularly maintaining cultural ecosystems, is crucial.

MATERIALS AND METHODS

This research uses a qualitative approach to explore in-depth the dynamics of collaboration and partnerships among stakeholders in sustainable tourism management in the Gili Tramena area. This exploratory research aims to analyze social issues within the context of collaboration and partnerships in ecologically resilient tourism management (Creswell, 2014). The research was conducted in Gili Trawangan, Gili Meno, and Gili Air, North Lombok Regency, West Nusa Tenggara. This area was selected based on the urgency of the issues there, as well as the importance of collaboration among stakeholders in the region to address the environmental impacts of tourism.

This research was conducted through the following three steps:

1) Preparation for analysing phenomena related to the research topic involves mapping the problem to create a background and problem formulation, and focusing on the research objectives and literature.
2) Data Collection was conducted using several methods:
    a) Observations were conducted at the three locations (Gili Trawangan, Gili Meno, and Gili Air) by observing various aspects to obtain an overview of the environmental situation, ecological conditions, tourism infrastructure, social situation at the research locations, and available tourism facilities and infrastructure.
    b) In-depth interviews and focus group discussions (FGDs) to obtain data on the roles of stakeholders, the dynamics of collaboration and partnerships, and the management challenges faced. Informants were determined by purposive sampling from stakeholder elements including: (1) Tourism Office and Environmental Office of North Lombok Regency (2) Tourism business actors (hotels, restaurants, small enterprises, transportation providers), (4) local community representatives, (5) Gili Eco Trust (6) Academics, (7) Environmental Care Community Front (8) tourists, (9) Waste management.
3) Data analysis with the assistance of NVivo software, with the following steps:
    a) Qualitative data collected through in-depth interviews and observations were processed and imported into the NVivo project for further narrative analysis.
    b) Qualitative analysis using NVivo was conducted by manually coding (theme marking) to identify, group, and categorize data based on emerging themes, such as stakeholder roles, forms of collaboration, partnership dynamics, and role allocation among stakeholders.
4) Integration and conceptualization of the NVivo analysis results were then analysed and integrated with relevant theories and concepts, including theories of collaboration, collaborative governance, ecological resilience, and sustainable tourism, and then analysed and described narratively.

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RESULTS AND DISCUSSION

Ecological Environment of the Gili Tramena Area

Gili Tramena consists of three small island clusters: Gili Trawangan, Gili Meno, and Gili Air. Administratively, in Gili Indah Village, Pemenang District, North Lombok Regency, West Nusa Tenggara Province. The Tramena island cluster covers approximately 678 hectares, including land and coastal areas. The area's topography is dominated by lowlands with a relatively flat land surface, around 0-5 meters above sea level (Selvia & Iemaaniah, 2024), the land serving as the primary location for residential areas, hotels, restaurants, other tourist facilities, and a center of tourist activity. There are low hills, approximately 50-114 meters above sea level.

Observations show that environmental conditions vary visually, with Gili Trawangan having a higher building and human density than Gili Meno and Air. This contributes to ecological impacts, particularly in terms of waste and litter. Single-use plastic waste (bottles and food packaging) remains a significant environmental problem. Several drainage and wastewater treatment systems (WWTP) are experiencing blockages, and waste is the most concerning environmental impact of tourism, particularly on Gili Trawangan. Research found that total waste production in Trawangan reaches 18 tons per day, with a composition of approximately 60% organic and 40% inorganic. Waste management efforts can only handle about 20% of the daily volume, leaving the remainder piling up. This situation creates an environmental emergency. Limited capacity, infrastructure, and suboptimal processing technology are the main obstacles.

Gili Trawangan's marine ecosystem consists of coral reefs, habitats for green turtles and hawksbills. Gili Meno's mangroves, along with marine biodiversity with over 20 coral species and over 200 fish, support marine biodiversity and are major tourist attractions (Partelow et al., 2023). However, the ecological conditions are potentially under pressure from domestic waste pollution. A collaborative study between the Faculty of Agriculture, University of Mataram (Unram) and the Leibniz Center for Tropical Marine Research (ZMT), entitled Transdisciplinary Science for Sustainable Tourism, published in 2024 (fp.unram.ac.id), revealed critical findings: the most common form of wastewater management on Gili Trawangan is open septic tanks. This is a highly risky situation because the island's groundwater level is high and the soil is predominantly porous limestone, making wastewater prone to leaking and seeping into the environment.

This pollution tends to increase with the increase in tourist numbers, proving that tourism activities directly contribute to environmental degradation (Kasa et al., 2025). Chairunnisa et al. (2025) identified the cycle of tourism impacts in coastal areas, the increase in tourist numbers and recreational activities leads to an increase in waste. Fuel from boats and sunscreen containing compounds such as oxybenzone accumulate in the waters, triggering coral bleaching and inhibiting coral reproduction. Gili Eco Trust noted that coral reef damage in the Gili Tramena area reached an area of 2,364 m² in 2024 due to various pressures. However, through collaboration between various parties, especially Gili Eco Trust, the Environmental Care Community Front (FMPL), and the Gili Divers Association (GDA), the condition improved in 2025 and 2026.

Strengthening Ecological Resilience Based on Stakeholder Roles

Research findings indicate that collaboration has been established between several stakeholders, including the North Lombok Regency Government, represented by the Tourism and Environmental Office, and involving tourism businesses, academics, local communities, and non-governmental organizations (NGOs), including Gili Eco Trust, the Environmental Care Community Front, and the Gili Divers Association (GDA). Routine activities undertaken by these stakeholders include the Recycle Tour and Friday Clean Up, which are periodically coordinated by the Gili Eco Trust. This is a positive sign, as active stakeholder participation can increase the effectiveness of sustainable tourism destination management. Through collaborative stakeholder networks, all parties involved can play an active and equal role in decision-making (Fontanari & Traskevich, 2025; Gannon et al., 2021; Rasoolimanesh et al., 2023).

Multi-stakeholder participation is a positive factor; for example, the Gili Eco Trust contributes technical expertise in conservation, environmental education, and structured sustainability programs. The Environmental Care Community Front and the Gili Divers Association focus on maintaining the terrestrial and marine environment. This collaboration can strengthen integration for environmental, economic, and socio-cultural goals. Working together can facilitate knowledge exchange, build trust, mobilize resources, and achieve sustainability goals, leading to dynamic ecological innovation through collaborative models involving government, the private sector, and local communities (Burton & Pachucki, 2006; Jamal & Stronza, 2009).

Gili Eco Trust and the Gili Divers Association have collaborated to maintain the ecological environment through coral reef restoration using Biorock technology. This technology uses low-voltage electrical currents to accelerate coral growth by 3-5 times and increase its resilience to environmental stress. Initiatives such as Coral Reef'Orm are also present to support research, turtle protection, and cleanup efforts (Fondation Grenoble INP., 2025). These efforts demonstrate the application of sustainability principles through innovation and collective action. Shared responsibility helps build interactions among stakeholders collectively, encouraging sustainable innovation in tourism management (Burton & Pachucki, 2026; Melenez-Roman & Font, 2026). Biorock's success is not only ecological but also socio-economic, attracting diving tourists and raising conservation awareness in the Gili Tramena environment.

The efforts made by tourism stakeholders from the government, community, and private sectors to realize ecological resilience and sustainable tourism in Gili Tramena, based on the results of NVivo thematic data analysis, are:

1. Strengthening environmental management regulations, spatial planning, zoning, and development restrictions by implementing strict rules on environmental carrying capacity through the leading role of the North Lombok Regency Government. Strict regulations on domestic and industrial waste and garbage management through the role of the environmental agency. Also regulates the obligations of tourism and industry actors to maintain ecosystems, coordinated by the tourism agency. Policies on environmental carrying capacity are needed so that stakeholders are aware of their rights and obligations in supporting natural resource conservation (Markatos et al., 2024). (Buckley, 2020; Liu, 2003) states that implement strict rules, such as visitor restrictions and zoning at destinations, are very effective in preventing environmental degradation.
2. Empowering community organizations, particularly tourism awareness groups in Gili Indah Village, can enable local communities to become key stakeholders in environmental governance through capacity building and local institutionalization. One effective strategy

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for environmental conservation is strengthening community participation through community organizations (Sarhan et al., 2025; Sulistyo et al., 2023). Community-based tourism management not only strengthens environmental ethics but also ensures sustainable development through active community participation in ecosystem conservation (Nawari et al., 2022). Community participation through groups can enhance a sense of ownership and trust, fostering a greater appreciation for environmental values and protection (Chatterjee & Datta, 2024). Thus, environmental resilience is not solely built through formal regulations but also through a collective social learning process that empowers communities as guardians and sustainable users of resources.

3. Organizing environmental management education at the village level, especially for the Gili Indah community, to develop technical skills in protecting the environment. Improving community education is crucial for encouraging conservation initiatives (Salat et al., 2025). This approach reflects the concept of community and citizen science, which, in systematic studies by Ballard et al. (2024) Indrarosa et al., 2025), has been shown to not only increase community knowledge and skills but also strengthen community awareness of the environment. It also serves as a vehicle for building social ecological memory, namely, strengthening knowledge, experience, and practices about ecosystem management that are passed down and adapted collectively by local communities (Barthel et al., 2010)
4. Requires business actors to be active in environmental preservation through the implementation of waste sorting systems, especially in accommodation and restaurant businesses, with more intensive transportation schedules during peak tourist seasons, especially for Gili Meno and Gili Air. By making sustainability a strategic principle, entrepreneurs can achieve relevant economic, social, and environmental goals, resulting in a sustainable positive impact (Vergara Romero et al., 2025).
5. Establish a stakeholder communication forum as a platform for participation in the management and environmental resilience of Gili Tramena. To achieve a shared understanding of stakeholder roles, effective and appropriate communication with all stakeholders is essential (Brizga et al., 2024). Achieving sustainable management requires effective environmental communication (Herutomo & Istiyanto, 2021). A communication forum can facilitate knowledge exchange, trust building, and regulatory negotiation that balances collective responsibility (Ratner et al., 2022; Ssekajja, 2025). This communication forum is not simply a forum for exchanging ideas, but rather an institutional mechanism that facilitates the integration of perspectives, adaptive management, and shared decision-making to strengthen ecological resilience.

Multi-Stakeholder Collaboration

Collaboration and partnerships between multiple stakeholders, with varying resources, interests, and perceptions, create diverse dynamics. Commitment between stakeholders is a key factor in building sustainable collaboration. A shared vision and goals are needed for stakeholder collaboration, as well as a strong institutional framework to support collaboration, including clear regulations, incentives, and coordination mechanisms (Graci, 2013; Jamal & Stronza, 2009). The dynamics of collaboration between stakeholders on Gili Tramena are complex, evolving from a passive phase before awareness of the importance of ecological resilience arises. Then, the impacts of tourism trigger a reactive phase for stakeholders to address the problems faced. This reflects the social learning process within complex socio-ecological governance (Burton & Pachucki, 2026). The passive phase, in which collective awareness has not yet formed, can be understood as the condition before a policy window or before external pressure strong enough to drive collective action. According to the collaborative governance framework, this phase is often characterized by the lack of trust and shared perception among stakeholders regarding the urgency of a problem (Susilo, 2025).

Gili Eco Trust and the Environmental Care Community Front act as boundary organizations that bridge the interests of diverse actors, facilitating movements for long-term environmental management. Based on the concept of social-ecological systems, where external disturbances can trigger adaptive responses from their social components (van Onselen et al., 2025), this represents a shift from mere crisis response to more structured adaptive governance. Collaborative processes can effectively raise awareness and encourage the adoption of adaptation measures, helping stakeholders identify practical solutions and shift from a state of inaction to a state of proactive resilience-building (Boqué-Ciurana et al., 2025).

Based on thematic analysis using NVivo, the role of each stakeholder element can be grouped into 3 elements as in the following table:

Table 1. Government and Tourism Organizations

Stakeholder Elements	Roles
Government:	
Regional Government of North Lombok Regency	1) Policy facilitator and control system 2) Provider of tourism facilities and their maintenance 3) Driving force for collaboration and establishing regional programs 4) Determinant of rewards and punishments
Local Government of Gili Indah Village	1) Program implementers at the Gili Indah Village 2) Promote community awareness in their areas 3) Intermediary between local communities and the local government 4) Implementers of environmental control in the Gili Indah Village
Tourism organizations and operators	1) Intermediary between government, community, and business actors 2) Coordinator of the ecological and sustainable tourism forum

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Table 2. The Role of Industrial Elements

Stakeholder	Roles
Private Sector/Industrial:	
Tourism Utilities and Infrastructure Providers	1) Driving environmental awareness campaigns for tourists and workers 2) Funding environmental sustainability programs through Corporate Environmental Responsibility (CER)
Small enterprise	1) Providing small-scale, environmentally friendly products and services 2) As an active partner with other stakeholders to reduce tourism waste
Suppliers	1) Optimizing the distribution of environmentally friendly raw materials and equipment. 2) Distributing supplies with minimal waste
Transportation service providers	1) Organizing visitor movement and complying with transportation zones. 2) Mapping and regulating transportation facilities in marine areas according to the correct standards.
Educational	1) Developing research related to ecological resilience 2) Developing environmental education and sustainable tourism guidelines 3) An agent of environmental awareness education through educational activities
Tourists	1) Comply with environmental regulations and be a responsible visitor to Gili Tramena. 2) Provide constructive feedback to management.

Table 3. Local Community Roles

Stakeholder	Roles
Community:	
Local Community	1) Maintaining local wisdom and culture regarding environmental conservation values 2) Being a role model for tourists in their behavior 3) Implementing sustainability programs in the household zone 4) Controlling industrial activities in the surrounding area
Non-government organizations (NGOs)	1) Facilitates collaboration between the community and other stakeholders 2) Controls and ensures the implementation of environmental sustainability policies 3) Drives and monitors organizational performance and stakeholder collaboration forums

Based on the role mapping of each element and sub-stakeholder above, a collaborative design can be developed, called the Gili Tramena Ecology and Tourism Multi-Collaboration (GITEC). This frame work is divided into three main elements based on the capabilities of each stakeholder, consisting of a steering element, a technical management element, and a supervisory board, which can be depicted in Figure 1:

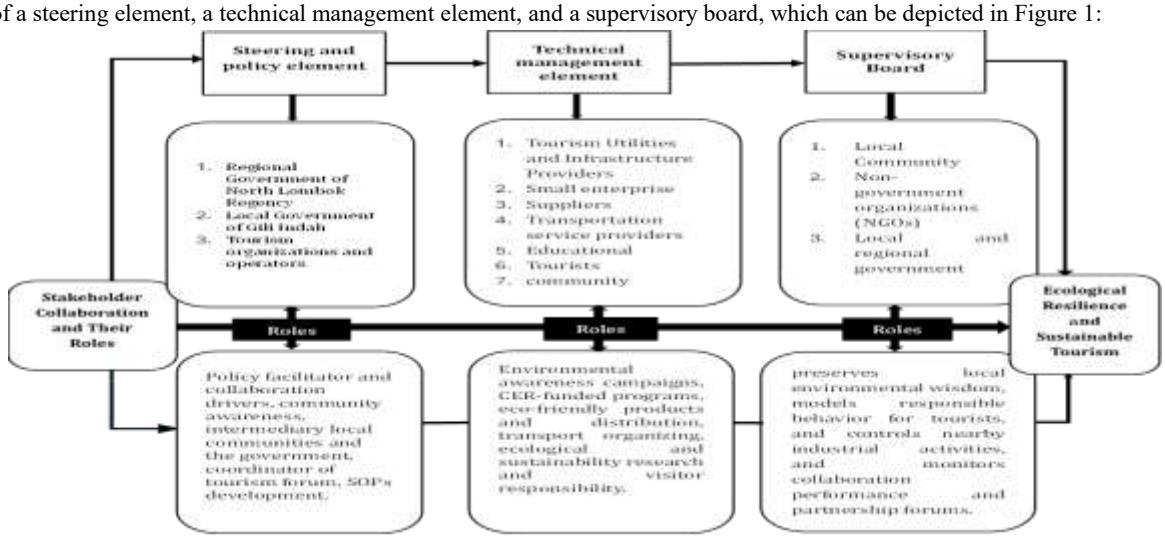


Figure 12. GITEC Framework

Source: Research Data Analysis (2025)

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1) Steering and policy

These are key elements in ensuring the direction, regulations, and legitimacy of collaboration. The North Lombok Regency government is tasked with establishing regulations oriented toward sustainable tourism development goals. The local government serves as an intermediary to ensure multi-perspective decision-making processes (Sarhan et al., 2025). The local government is also responsible for designing and implementing measurable and sustainable policies (Sitohang et al., 2024). The capacity of the North Lombok Regency government plays a crucial role in translating policies into concrete actions at the regional level, including in the Gili Tramena area. Local government support is crucial in achieving ecological resilience through community empowerment and increasing the managerial capacity of tourism awareness groups to build resilient tourism initiatives (Firdaus et al., 2021; Lubis et al., 2024).

The local government of Gili Indah Village acts as a support system at the village level, connecting stakeholder policies with the local community. (Sarhan et al., 2025) emphasize the critical role of local government in linking the interests of local communities with those of the regional government. Local government acts as an intermediary between citizen aspirations and macro policies of the regional and central governments (Iddawela et al., 2021). In the policy realm, the local government of Gili Indah harmonizes various sectoral interests. They can facilitate the appropriate management of tourism assets by granting management permits to community groups to ensure ecological sustainability while empowering the local economy (Mcloughlin & Hanrahan, 2025b; Rahman et al., 2025). Effective collaboration between government development programs and community aspirations is needed to achieve sustainable tourism growth (Mertha et al., 2025).

Tourism organizations are tasked with developing technical Standard Operating Procedures (SOPs) for environmental resilience that their members, particularly tourism service businesses, can implement. These technical procedures are implemented in each business's operations with sustainable principles. Referring to the Guiding Principles for Sustainable Investment from UN Tourism and UNCTAD (2025), organizations such as the Gili Divers Association, hotel and restaurant associations, travel agent associations, and others must develop SOPs to govern the implementation of environmentally sustainable tourism services. In the context of vulnerable destinations like Gili Tramena, SOPs also need to adopt an adaptive, ecosystem-based approach, as recommended by the Pacific Tourism Organization (2025) through systematic environmental audit guidelines for tourism accommodations, to strengthen resilience to coastal ecosystem changes.

2) Technical Management

This section is the primary element receiving benefits and also the most influential element in terms of environmental pressures and impacts. The industrial sector in Gili Tramena, including the utilities and infrastructure sub-sector, plays a key role in driving environmental awareness campaigns and implementing technical environmental maintenance through the implementation of the Corporate Environmental Responsibility (CER) concept. This is an evolution of traditional CSR, which, according to Dłużewska & Giampiccoli (2024), often emphasizes environmental issues over social ones, but remains crucial in maintaining the destination's carrying capacity.

At the same time, small entrepreneurs and suppliers to the Gili Tramena industry are driving the economy and integrating environmentally friendly products into the tourism supply chain. Developing the quality of tourism human resources is the responsibility of educational institutions. Through the development of ecological resilience research and environmental databases, they play a key role in generating applied knowledge and ensuring development policies are grounded in empirical data (Dananjaya, 2025). Educational institutions have three main functions: first, as agents of change in community knowledge, awareness, and ecological literacy through sustainability education that can strengthen local commitment to natural resource management around Gili Tramena (Conefrey et al., 2025; van Onselen et al., 2025). Second, as a community development partner, through educational tourism to build the technical knowledge of the Gili Tramena Community on ecological environmental management (Purmintasari et al., 2025; Räikkönen, n.d.) Third, it functions as a bridge between traditional and modern knowledge sources in managing tourist destinations that are adaptive to change (Barthel et al., 2010; van Onselen et al., 2025; X. Wu et al., 2024).

3) Supervisory Board

This role is carried out by the local community in the Gili Tramena area, which plays a role in preserving local wisdom and culture related to environmental conservation values. This is relevant to the concept of cultural sustainability, which emphasizes that preserving local traditions and practices is a crucial foundation for sustainable tourism development, particularly in strengthening community identity and maintaining cultural ecosystems through cultural negotiation strategies (Quang, 2025; Wirawan, 2025). Their position also serves as role models for tourists visiting Gili Tramena, serving as role models in responsible tourism practices. As noted by Quang (2025), local community perceptions and behaviors are crucial in supporting environmental protection, where the community's daily actions serve as concrete references for tourists regarding sustainable practices.

The Gili Tramena community also plays a role in implementing sustainability programs in the household zone as an implementation of the principle of community-based tourism at the micro level (Rifai et al., 2024). They also control tourism industry activities, because the success of tourism destination management is highly dependent on socio-cultural understanding and the control role of local communities to ensure that tourism practices do not damage the ecosystem (Rifai et al., 2024). The synergy of these roles shows that the local community in Gili Tramena is not only an object of development, but can play a role as a central subject that bridges cultural preservation, sustainability actions, and industrial supervision, which contributes to the creation of sustainable tourism (Aquino & Andereck, 2024; Novianti et al., 2025; Simanihuruk et al., 2024).

Non-government organizations, particularly Gili Eco Trust, facilitate collaboration between stakeholders and bring together various stakeholders to protect the environment. (Moreno-serna et al., 2021) emphasize that the role of facilitators is critical in multi-stakeholder collaboration, particularly in creating a safe space to build trust and providing a liaison function between sectors. NGOs also play a role as drivers of environmental sustainability programs. According to Li & Yaakop (2025), NGOs play a central role in identifying policy options, strengthening community representation, and building resilience through practices with a local perspective. The function of NGOs as both motivators and monitors of organizational performance and stakeholder collaboration forums reflects the dual role also identified by (Li & Yaakop, 2025), where NGOs are not only involved in policy formulation but also play a role in increasing accountability and transparency by monitoring stakeholder commitments, assessing progress, and exposing policy gaps. Thus, the effectiveness of NGOs in Gili Tramena is based on their capacity to facilitate

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comprehensive collaboration, drive a sustainability agenda based on local wisdom, and carry out oversight functions to ensure the effectiveness of the collaboration forum.

CONCLUSION

Gili Tramena (Trawangan, Meno, and Air) is facing serious environmental threats caused by waste, litter, overexploitation of resources, coastal erosion, and coral reef damage, with a critical level of ecological sustainability. Ecological pressures are caused by high tourism activity. Waste production reaches 18 tons per day with only 20% processing capacity. The wastewater treatment system, which consists of septic tanks, has the potential to leak into the ground, causing pollution that threatens marine ecosystems such as coral reefs and marine habitats. However, collaboration between Gili Eco Trust, the Environmentally Care Communities Front, and the Gili Divers Association (GDA) has at least mitigated the damage, including restoring the coral reef, which in 2024 was damaged by nearly 2,364 m².

Strengthening ecological resilience at Gili Tramena requires active multi-stakeholder collaboration that includes the government, all elements of the private sector, and the community. Based on the results of the research analysis, there are five strategic steps: 1) Strengthening environmental management regulations; 2) Empowering community organizations; 3) Organizing environmental management education at the village level; 4) Requiring business actors to be active in environmental preservation through the implementation of waste sorting systems, especially in accommodation and restaurant businesses; and 5) Establishing a stakeholder communication forum as a platform for participation in the management and environmental resilience. The purpose of this step is to integrate ecological, economic, and socio-cultural objectives. Participatory collaboration not only encourages sustainable innovation but also builds environmental resilience through collective learning and shared responsibility.

Ecological resilience in the Gili Tramena Tourism Area can be realized through synergy between government, industry, and the community in the form of multi-stakeholder collaboration. Based on the mapping of the roles of each stakeholder element, the GITEC (Gili Tramena Ecology and Tourism Stakeholder Multi Collaboration) model was developed which divides collaboration into three main elements: 1) Steering and policy elements (regional government, local government, and tourism organizations) tasked with providing regulations, policies, and SOPs for environmental maintenance in industrial areas; 2) Implementer element (industry, small enterprises, transportation providers, educational institutions, and tourists) that implement environmentally friendly programs, research, regulate the flow of visitors and campaigns for responsible tourism towards ecology; and 3) Supervisor board (local communities and NGOs) that maintain cultural wisdom, serve as role models, implement community-based programs, and facilitate and oversee collaboration. With a strong institutional framework, clear regulations, and shared commitment, this model encourages a crisis response from passive to proactive adaptive governance in building ecological resilience and sustainable tourism in Gili Tramena.

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