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The Role of Social Groups in Environmental for the Sustainability of Community Life in the Small Islands of Banda Neira

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Abstract - Communities on small islands have high environmental vulnerability. Besides, communities on small islands are also very dependent on nature for their survival. This dilemma is felt directly by the people of the Banda Islands, most of whose economic activities are based on nature: fisheries, plantations, and marine tourism. With these economic activities, the damage potential to the environment is very possible. Responding to this, various stakeholders have made efforts to protect the environment, including non-governmental social groups. Various social groups in the Banda Islands are the 'backbone' in preserving the environment through initiatives. This research provides insight into the impact of the economic maritime on the environment and to examine the extent to which actors, especially communities, contribute to the environment for the sustainability of people's lives in the Banda Islands. This research is qualitative research with data collection using observation and interviews. This research uses narrative analysis to see how the maritime economy impacts the environment and stakeholder analysis to see how the role of stakeholders affects the environment. The results of this study indicate that both traditional and modern maritime economies have an impact on the decline in environmental quality. The community emerges as the key actor influencing the environment.

Keywords: small islands, social groups, environmental sustainability.

1 Introduction

The population of communities on small islands heavily relies on local resources, including economic activities dependent on limited resources and external forces such as demand conditions from outside the region and migration flows [1]. This dependence on natural resources is marked by activities in the fisheries, trade, marine tourism, and transportation sectors [2]. Additionally, the general geographical and morphological characteristics of island regions make small islands more vulnerable to various natural threats, such as climate change and natural disasters [3].

The Banda Islands are one such region consisting of small islands located in the center of the Banda Sea, Maluku Province, Indonesia. There are 12 small islands in the Banda Islands, with a total land area of 180.59 km² [4], and none of the islands exceeds 44 km² in size. Its position, far from larger islands, causes the Banda Islands to heavily depend on the natural resources of the area, particularly in agriculture and marine products. Currently, the main commodities that the Banda

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Islands rely on are nutmeg, cloves, and walnuts from agriculture, as well as tuna and flying fish from fisheries. With 85% of Banda's population depending on the traditional economy of the fisheries and plantations sector, the Banda Islands face environmental vulnerability due to unsustainable agricultural exploitation.

The trade-off between traditional agricultural economic growth and environmental degradation is further complicated by the emergence of the contemporary economic sector, namely tourism. The natural beauty of both land and underwater in the Banda Islands attracts domestic and international tourists, which not only stimulates economic growth for the community but also leads to environmental damage due to tourism-related waste and the development of tourism amenities along the coast. Environmental vulnerability in the Banda Islands is also exacerbated by the climate crisis, a result of collective extractive economic activities by humanity, with the most significant impacts felt by coastal communities, including the Banda Islands, such as rising sea levels and increased coastal temperatures. Some indications of environmental degradation that the community has experienced include: (1) declining quality and productivity of Banda nutmeg; (2) fishermen needing to go further out to catch tuna; (3) the presence of black sponge disease and damage to several coral reef areas in Banda; and others that will be elaborated upon in the Results and Discussion section.

In response to this, various stakeholders are working to protect the environment in the Banda Islands, including non-governmental social groups. Various social groups in the Banda Islands have become the 'backbone' in preserving the environment through their conservation initiatives involving a wide range of community members. Groups such as Molucca Coastal Care (MCC), Pokmaswas, Kelompok Kreatif Anak Banda (KKAB), and Bank Sampah are local non-governmental organizations actively taking action to restore the deteriorating quality of the environment. Additionally, the Coral Triangle Center (CTC), EcoNusa, and SEABanda, as non-governmental organizations, also support the social groups in maintaining environmental sustainability.

This paper attempts to understand the dynamics of the tug-of-war between the economy and the environment in the Banda Islands and how and to what extent social groups in the Banda Islands respond to this, providing support to local communities to make wiser choices in balancing economic growth and environmental protection in the Banda Islands.

2 Materials and methods

2.1 Selection and Description of the Study Location

The Banda Islands, Central Maluku Regency, Maluku Province, were chosen as a single case study because they represent a region that illustrates both traditional and modern economic sectors developing or planned for development in Eastern Indonesia: plantations, fisheries, and tourism. The famous Banda nutmeg production dating back to the Dutch colonial era, the abundant tuna from the Banda Sea, and the underwater beauty of Banda (part of the Coral Triangle) alongside the historical evidence of Indonesia's spice trade make the Banda Islands unique and quite representative of the archipelagic regions in Eastern Indonesia.

The Banda Islands are located between 5° 43' to 6° 31' South Latitude and 129° 44' to 130° 04' East Longitude, covering a total land and sea area of 763.3 km². There are 12 small islands in the Banda Islands, of which 7 are inhabited (Banda Neira, Banda Besar, Gunungapi, Syahrir, Ay, Rhun, and Hatta) and 5 are uninhabited (Manukang, Nailaka, Karaka, Manuk, and Batu Kapal). Across these islands, there are 18 villages with a total population of 21,425 residents.

The small islands in the Banda Islands have a tropical maritime climate and a seasonal marine climate due to their surrounding vast seas, which results in a climate similar to the existing seasonal

climate. The topography of the small islands in the Banda Islands is predominantly hilly. This is due to the convergence of two tectonic plates known as the Pacific and Mediterranean circumferences, which results in most of the area being elevated terrain with a slope of about 40% (Maluku Provincial Tourism Office, 2016). The Banda Islands are formed by the collision of three tectonic plates: Eurasia, Pacific, and Indo-Australia, creating the very deep Banda Sea and the volcanic mountain known as Banda Api (Maluku Provincial Tourism Office, 2016).

Source: Author, 2024
Fig. 1. Delineation of the Study Area

2.2 Survey Design and Data Collection

This research is a qualitative study aimed at understanding how local social groups on small islands play a significant role in the sustainability of their livelihoods. The study employs both secondary and primary data to conduct a comprehensive analysis, identifying the perspectives of the social group and other stakeholders, as well as reviewing planning documents, statistics, and relevant studies. These documents were obtained from local government sources, primarily from the Central Maluku Regional Planning Agency (Bappelitbangda) and the Central Maluku Statistics Agency (BPS).

In addition to document review, primary data was collected through surveys, interviews, and observations. The structured interviews were designed to gather information about the roles of various stakeholders related to the environment, community activities in Banda, and the historical and current conditions of the islands. Interviews began with traditional leaders to gain initial insights into the study area, followed by local social group representatives, academics, and finally private sector representatives. Unstructured interviews with local residents were conducted randomly and through snowball sampling to obtain information about local activities and other general information relevant to the study. The informants in this research included:

a. Representatives from the Bank Sampah Group
b. Representatives from the Kelompok Kreatif Anak Banda
c. Representatives from Moluccas Coastal Care
d. Representatives from Kelompok Masyarakat Pengawas (Pokmaswas)
e. Representatives from Farmers Groups
f. Two traditional leaders

g. Representatives from the private sector (plantations, fisheries, and tourism)
h. Academic representatives from Banda Neira University
i. Representatives from the Central Maluku Government
j. Representatives from the Maluku Provincial Government

In addition to interviews, observations were conducted on the 7 inhabited small islands in the Banda Islands. These observations aimed to assess the existing conditions of the study area, particularly regarding the environment, covering land, beach, and marine conditions. Some of the locations visited included nutmeg plantations, fishing villages, temporary waste disposal sites (TPS), agro-tourism areas, fish collection companies, historical tourist sites, and local settlements on each island to observe economic activities. The 5 uninhabited islands were only observed from a distance by circling them with a speedboat

2.3 Research Analysis Methods

Once all data requirements were met, the collected data were analyzed using qualitative analysis methods. Qualitative analysis was chosen because it effectively explores and reveals how social group respond to environmental impacts resulting from economic activities in the Banda Islands. This study focuses on two main aspects: (1) the impact of economic activities on the environment in the Banda Islands, and (2) the role of social groups in influencing the environmental conditions in the Banda Islands.

Point (1) will be elaborated upon using narrative analysis based on secondary document reviews and interview and observation results from the community. Narrative analysis emphasizes individual or group experiences to understand past experiences and how they contribute to current and future experiences [23] .

Point (2) will be processed using stakeholder mapping analysis by recording and examining information about groups with interests in environmental matters [24] . Stakeholder mapping is a method for identifying and describing the influence and interest levels of stakeholders in a given context. In this study, stakeholder mapping is used to determine whether the visible social group truly play the most significant role in the environmental dynamics of the Banda Islands compared to other stakeholders involved. This analysis begins by recording the roles of each stakeholder based on the interview results, which are then assessed according to their level of interest and influence, scoring them from 0 to 5 and assigning relationship values as positive (+), negative (-), or unknown (0). After assessment, stakeholders are mapped according to their levels of interest and influence and finally represented in a diagram.

3 Literature Review

3.1 Small Islands and Environmental Vulnerability of Coastal Areas

The characteristics of small islands in tropical countries are: (1) geographically limited in size, relatively isolated from major islands, with specific geomorphological features (coral, volcanic islands), and highly vulnerable; (2) socio-economically and politically, small islands have high population density, extensive social networks, diverse actors and cultures, numerous institutions, small economies, dependence on limited natural resources, and competition for those resources; (3) ecologically, small islands have high biodiversity, endemic species, and various ecosystems [5]. Small islands are often vulnerable to the impacts of climate change, such as rising sea levels, coral

bleaching, and ocean acidification [6]. These factors affect the ecosystems present in the coastal areas of small islands.

Meanwhile, the ecosystems of small islands in coastal areas have a variety of natural resources that are essential for the livelihoods of the communities living on these islands. As systems that support vital services for humans, these ecosystems provide attractive tourist destinations and protection from various natural disasters that can threaten coastal areas and small islands [7]. Therefore, it is crucial to protect habitats such as mangroves, coral reefs, and seagrass beds, which provide habitats for marine species and enhance resilience to the impacts of climate change [6].

3.2 Maritime Economy of Small Islands

The sea not only holds environmental value but also economic value through fisheries that can be processed into various products, resource extraction, tourism, and shipping [8] [9]. Therefore, the economic value of the sea must be utilized sustainably. The concept of blue economy becomes important to maintain the sustainability of marine resources in accordance with the Sustainable Development Goals (SDGs) set by the United Nations (UN), specifically Goal 14: Life Below Water. In Indonesia, the blue economy sector has developed in areas such as capture fisheries, marine product processing, shipping and ports, shipping, oil and gas, maritime manufacturing, coastal tourism, marine business services, research and development, marine education, and dredging [10]. In rural coastal areas, economic activities tend to focus on fisheries and natural tourism, while in urban coastal areas, economic activities are more diverse, including commercial industries, modern tourism, and transportation activities. The threat of anthropogenic activities at sea can also lead to changes in traditional economic activities (fisheries, agriculture) into newer and more modern economic activities in coastal areas [11]. Additionally, the success of high-quality economic development is not only determined by maritime economic strength but also by the conditions of other economic elements [12].

3.3 Impacts of Maritime Economic Development on Coastal Environment

The vulnerability of small islands to the impacts of climate change can be exacerbated by the socio-economic conditions of the region. The need to generate income for survival necessitates economic activities in coastal environments and small islands. A study shows that human activities are the main factor affecting coastal ecological environments [13]. Damage to one function can impact upstream ecosystems, highlighting the importance of careful management to maintain ecological balance [14]. For economic activities to be sustainable, intervention in the management of coastal ecosystems and small islands is required. One of the most widely used methods in coastal management to protect marine and coastal ecosystems is through Marine Protected Areas (MPAs), which restrict or regulate avoidable threats, such as overfishing, oil and mineral extraction, and dredging [15]. Strategies that can complement coastal management to enhance the resilience of coastal ecosystems and communities include (1) nature-based solutions for disaster risk management, (2) sustainable development planning, (3) coastal ecosystem restoration, (4) de facto protection, and (5) blue carbon for climate adaptation and mitigation [15]. Maintaining marine resources requires not only physical capital but also investment in social and human capital to establish functional institutions that optimally and sustainably utilize physical and human capital [16].

Regarding tourism, the presence of large numbers of tourists can potentially lead to environmental pollution [17]. The impacts of coastal tourism on the environment include increased waste, noise pollution, deforestation, fragmentation of natural habitats, loss of biodiversity, flooding, coastal erosion, and reduced water sources [13] [18]. This is due to coastal tourism's heavy reliance on physical environments and various natural resources such as fisheries, aquaculture, and water quality [18]. The ecological integrity of small islands, which is a major attraction for the tourism industry, is threatened by tourism activities themselves [19]. Loss of biodiversity due to tourism activities can occur because of (i) landscape changes to support tourism development; (ii) resource depletion due to overconsumption; (iii) water pollution and waste accumulation; (iv) wastewater from hotels and other tourism facilities; and (v) coral damage due to careless tourist behavior [18].

3.4 Community Involvement in Coastal Management

High levels of distrust in public authorities indicate a desire to shift from technocratic coastal management to participatory coastal management, where community preferences are recognized and included [20]. In Mozambique, for instance, although the social group and community's education level is low, awareness of the socio-ecological functions of marine ecosystems is high [21]. Similarly, a study conducted on Kei Island, Maluku, Indonesia, found that the majority of local coastal communities strongly support the protection of marine resources and the implementation of Marine Protected Areas (MPAs) in their region [6]. This is because coastal communities recognize that the coastal environment affects their security and livelihoods. Furthermore, individual participation in adopting environmentally friendly practices in daily life plays a significant role in the relationship between moral norms and intentions to protect the environment [22]. Nevertheless, local community involvement globally can still be considered low in government-centered decision-making processes [19]. This is evidenced which found that ecological restoration and community-based initiatives in small islands in the Western Indian Ocean remain low [5].

4 Results and discussion

4.1 Result

4.1.1 The Impact of Economic Activities on the Environment in the Banda Islands

Plantation Activities

With significant plantation potential, particularly for nutmeg, the majority of the community in the Banda Islands works as plantation farmers and fishermen. BPS data indicates that with nutmeg plantations covering 2,928 hectares spread across the islands, the nutmeg production in the Banda Islands reached 940 tons in 2023, contributing significantly, at 37% of the total production in Central Maluku or 15% in the Maluku Province. Almost all of the nutmeg production is sold to collectors from Ambon/Surabaya, while a small portion is processed by the Banda community into various products, including nutmeg oil, nutmeg candy, nutmeg syrup, and other derivative products.

As an endemic plant of Banda, Banda nutmeg has been renowned for its high quality since ancient times, attracting various nations to come to Banda, such as the Malays, Chinese, Indians, Arabs, and Europeans. However, over time, the quality of Banda nutmeg is perceived to be declining and increasingly less competitive both nationally and globally, amid expanding nutmeg production areas in Indonesia (Siau, North Sulawesi; Morowali, Central Sulawesi; Fakfak, West Papua; South/North Aceh, Nanggroe Aceh Darussalam). Currently, in terms of productivity, Banda nutmeg has a relatively low productivity rate of 0.32 tons per hectare (2020) (Ministry of Agriculture, 2021), which is far below the global average of 0.72 tons per hectare (2019). The decline in quality and

productivity of Banda nutmeg is attributed not only to natural factors, as the nutmeg trees in Banda are over 50 years old (approaching non-productive age) (BPTP Maluku, 2020), but also to the lack of sustainable practices in nutmeg plantation management.

More specifically, here is an overview of the farmer's activities in managing nutmeg plantations that do not adhere to sustainable principles:

1. Many farmers have not implemented proper planting distance regulations in nutmeg cultivation. This is indicated by the distance between nutmeg trees being less than 7 meters, whereas the ideal distance should be around 9-10 meters [25] . Additionally, farmers are planting many other types of crops in nutmeg fields, which worsens plant spacing and negatively impacts Banda nutmeg productivity.
2. The farmers are harvesting nutmeg fruits too early, at 7 months of age, while the optimal harvesting period is around 9 months [26], leading to disrupted nutmeg harvest cycles. Furthermore, the harvested nutmeg fruits often lack optimal maturity, reducing the quality and competitiveness of Banda nutmeg.
3. The use of unregulated chemical fertilizers (inorganic) has resulted in diseases such as mold affecting Banda nutmeg plants (BSN, 2018).
4. The rampant logging of wanlut trees, which serve as protective canopies for nutmeg plants against wind and salt vapor, has left the nutmeg plants without adequate protection, thereby affecting nutmeg fruit production.

From these unsustainable plantation activities, there is potential for a decline in soil quality in Banda in the future. Early harvesting, the use of chemical fertilizers, and several other indicators can disrupt the plantation soil cycle, worsening the output of nutmeg production. This unsustainable plantation management will negatively impact the soil quality, which in turn will reduce the quality and productivity of nutmeg plantations.

Source: Author, 2024
Fig. 2. Nutmeg Field in Ai Island

Fishing Activities

The Maluku Islands (Maluku Province and North Maluku) have long been known as the "National Fish Barn" due to their substantial fish catch potential, reaching 875,592 tons (12.5% of Indonesia's total production). The Banda Islands are no exception, with the majority of catches being flying fish and tuna. Due to their relatively higher and stable prices, tuna is the main commodity exported from

the Banda Islands. There are 400 fishing boats selling their catch to 10 collecting companies (cold storage) on Banda Neira Island, which will later be exported to Ambon, Surabaya, Bali, and Jakarta.

However, the fishing activities conducted over the years have had environmental impacts that are acutely felt by fishermen. Currently, fishermen need to venture further out to sea to catch tuna, whereas 10 to 20 years ago, tuna could be caught at much closer distances. This indicates that the fishing practices employed by fishermen are highly over-extractive, with minimal protection for the environment and aquatic ecosystems. At least three indicators highlight the decline in water quality in the Banda Islands due to fishing activities:

1. Illegal Use of Purse Seine: Fishermen using purse seine nets illegally are causing the catch of small fish that serve as food for tuna. These small nets capture juvenile fish that ultimately cannot be marketed due to size standards and are discarded by fishermen on the beach. As a result, communities can smell decomposing fish on the docks, posing a potential threat to the coastal marine ecosystem.
2. Illegal and Unregulated Deployment of Fish Aggregating Devices: The mass installation of illegal fish aggregating devices (FADs) in the Banda Sea has contributed to shifts in the pelagic fish ecosystem of Banda. These artificial reefs attract pelagic fish, especially tuna, leading to a decrease in tuna quantities near the coast. In addition to environmental impacts, the illegal deployment of FADs can reduce local fishermen's catch, disrupt navigation routes, and potentially lead to social conflicts among fishermen.
3. Use of Diesel-Powered Boats: All fishing boats in the fleet, including those used for collection and transport of fish outside the Banda Islands, run on diesel fuel. Pollution from diesel spills over the years has contributed to the degradation of coastal ecosystems, adversely affecting tuna populations that are increasingly moving away from the smaller islands in the Banda Islands.

Source: Author, 2024
Fig. 3. Small Fish Carcasses on Rhun Island

Marine Tourism Activities

Banda tourism is renowned for its underwater marine tourism. In addition to abundant fishing resources, the Banda Sea is home to diverse coral reefs with various marine animals inhabiting them. The Banda Sea ranks second in conservation priority in Indonesia due to its rich diversity of coral species and habitats (Ministry of Marine Affairs and Fisheries, 2012). There are a total of 48 tourist destinations in Banda Neira, comprising marine tourism, historical sites, and cultural experiences (Central Maluku Tourism and Youth Sports Office, 2024). In 2023, the Banda Islands received 24,774

domestic tourists and 1,265 international tourists, totaling approximately 30% of all tourists in Central Maluku (Central Maluku Tourism and Youth Sports Office, 2024).

While providing a source of economic growth and new non-agricultural jobs in the Banda Islands, the influx of tourists has caused various environmental issues, particularly related to waste management. The increase in waste generated by tourism activities is not supported by adequate waste processing facilities, resulting in the only Temporary Waste Disposal Site (TPS) in Banda Neira becoming overcapacity, obstructing roadways. The majority of this waste consists of plastic, posing serious risks to ecosystem health. This has also led to social friction, where residents of Kampung Baru village have prohibited other villagers or institutions from disposing of waste at the TPS located in their village, as the waste accumulation on the roads disrupts their daily activities.

Moreover, due to its significant attraction, there has been an increase in the development of floating accommodations around Gunungapi Island, which is designated as a protected area according to the Central Maluku Spatial Planning (RTRW) for 2012 - 2032. This development is also a consequence of the absence of detailed spatial planning (RDTR) for the Maluku Islands, which could serve as a regulatory tool for development, especially in protected areas, as well as the weak enforcement of regulations concerning physical construction in the Banda Islands. Unregulated accommodation development poses potential environmental issues in these conservation areas, such as waste management problems or habitat degradation of endemic wildlife on Gunungapi Island and the surrounding sea.

Additionally, diving and snorkeling, which are the main activities of Banda's marine tourism, have not been properly monitored and can adversely impact the biodiversity of the Banda Sea. One of the issues is the lack of established anchoring procedures for vessels, leading to many anchors damaging the coral reefs. Without stricter regulations for diving and snorkeling activities, there is a risk of declining ecosystem quality and biodiversity in the Banda Sea.

Source: Author, 2024
Fig. 4. Temporary Waste Disposal Site on Banda Neira Island and Development on Gunungapi Island

4.1.2 The Role of Stakeholders in Impacting the Environment in the Banda Islands

In response to the unsustainable economic activities of the community, various stakeholders are involved, including the Government (Central, Provincial, and District), Social Groups, Universities/Academics, and the Private Sector. The table below will map all activities that have an influence/impact on the environment from all stakeholders, allowing for the identification of key actors related to environmental sustainability. The roles of stakeholders concerning the environment are grouped into five categories: (1) roles related to the preservation of biodiversity in nature and the sea, (2) roles related to preventing environmental degradation, (3) roles related to the productivity of

marine and agricultural resources, (4) roles related to maintaining cleanliness in terrestrial and marine environments, and (5) roles related to education.

Table 1. The Role of Stakeholders Related to the Environment

Role	Communities	Social Groups	Government	Universities / Academics	Private Sectors
1. The role related to the preservation of biodiversity in nature and the sea.	Unsustainable marine tourism activities (tourist boats anchoring freely, damaging coral reefs).	1. Monitoring marine and terrestrial ecosystems to ensure the Banda ecosystem is well-preserved (Pokmaswas). 2. Implementing coral reef transplantation programs (MCC).	Formulating policies related to the conservation plan for the Banda Sea (Ministerial Decree No. 37 of 2022, Ministerial Decree No. 48 of 2021, Director General of Marine Spatial Management Decree No. 64 of 2023, Provincial Spatial Planning of Maluku 2013-2033, and Central Maluku District Spatial Planning 2012-2032), which includes plans for the preservation of biodiversity in nature and the Banda Sea.	1. Conducting studies and publications related to marine biodiversity (Journal of Fisheries Science and Coastal Communities, UBN). 2. Carrying out conservation activities such as coral spawning monitoring (UBN).	N/A
2. The role related to the prevention of environmental damage.	1. Development of floating accommodations around the conservation area of Gunungapi Island. 2. Unsustainable farming activities by the farmers as community (early harvesting), which indicate a decline in soil quality. 3. Unsustainable fishing practices by the fisherman (use of illegal purse seine and fish aggregating devices, as well as oil spills from diesel-powered boats), which indicate a decline in coastal ecosystem quality.	1. Initiating a sasi system to maintain the productivity of agriculture and fisheries while preventing damage to terrestrial and marine ecosystems (Community Surveillance Groups and CTC). 2. Providing guidance/training on marine conservation to Community Surveillance Groups (CTC).	Formulating policies related to the conservation plan for the Banda Sea (Ministerial Decree No. 37 of 2022, Ministerial Decree No. 48 of 2021, Director General of Marine Spatial Management Decree No. 64 of 2023, Provincial Spatial Planning of Maluku 2013-2033, and Central Maluku District Spatial Planning 2012-2032), which includes plans for the prevention of environmental damage (specifying prohibited/allowed activities).	Conducting studies and publications related to the prevention of environmental destruction.	N/A
3. The role related to the productivity of marine and agricultural yields.	1. Unsustainable farming activities by the farmers, which indicate a decline in productivity and quality of agricultural results (lack of spacing regulations for nutmeg plants, early harvesting, and cutting down	1. Initiating a sasi system to maintain the productivity of agriculture and fisheries while preventing damage to terrestrial and marine ecosystems (CTC). 2. Planting nutmeg	N/A	N/A	Gathering and processing fishery, agricultural, and marine natural resources to gain profits.

Role	Communities	Social Groups	Government	Universities / Academics	Private Sectors
	protective walnut trees). 2. Unsustainable fishing practices by the community (use of illegal purse seine and fish aggregating devices, as well as oil spills from diesel-powered boats), which indicate a decline in productivity and quality of fishery yields.	seedlings (MCC).			
4. The role related to the cleanliness of terrestrial and marine environments.	Participating in maintaining environmental cleanliness by joining community/group programs.	1. Encouraging students to clean up litter on land (Bank Sampah, Kelompok Kreatif Anak Banda) 2. Processing community plastic waste for sale (Bank Sampah)	N/A	N/A	N/A
5. The role related to community education.	N/A	1. Educating schools on waste management (MCC) 2. Educating the community on waste management (Bank Sampah) 3. Conducting beach clean-ups to remove litter from the sea (MCC, Bank Sampah)	N/A	N/A	N/A

Source: Analysis, 2024

After identifying the roles of each stakeholder related to the environment, these roles are then assessed for their impact and assigned a value based on their level of importance and influence. A positive impact indicates a role that benefits the environment, while a negative impact indicates a role that harms it. The values range from 0 to 5, where 0 indicates that the role is unknown in terms of importance and influence, and 5 represents the most important and influential roles.

Table 2. Assessment of Stakeholder Roles

Stakeholder	Interest(s)	Effect (+ 0 -)	Importance	Degree of Influence
Communities	1. Participating in maintaining environmental cleanliness by joining community programs/groups.	+	5	5
	2. Unsustainable fishing activities (disposal of fishing waste on the beach by fishermen and the use of purse seine nets).	-	3	5
	3. Engaging in agriculture/plantation activities that reduce garden productivity.	-	4	5

Stakeholder	Interest(s)	Effect (+ 0 -)	Importance	Degree of Influence
	4. Unsustainable tourism activities (community tour boats anchoring in ways that damage coral reefs, development of floating accommodations around the conservation area of Mount Api Island)	-	4	5
Social Groups (Internal: MCC, Bank Sampah, Pokmaswas / Eksternal: CTC)	1. Educating schools on waste management.	+	4	3
	2. Encouraging students to clean up land-based litter.	+	4	3
	3. Processing community plastic waste for sale.	+	4	3
	4. Educating the community on waste management.	+	5	5
	5. Conducting clean-up efforts for marine litter.	+	5	5
	6. Monitoring marine ecosystems to ensure they are well-preserved.	+	5	5
	7. Initiating a sasi system to maintain garden productivity and prevent marine ecosystem damage.	+	5	5
	8. Planting nutmeg seedlings.	+	3	4
	9. Providing guidance/training for marine conservation to community monitoring groups (Pokmaswas).	+	4	4
	10. Conducting coral transplantation.	+	5	5
Government (Central, provincial, district)	1. Policy makers related to nature conservation, especially marine.	+	4	4
	2. Policy makers related to environmental damage prevention.	+	4	4
	3. Providing guidance on marine conservation.	+	5	5
	4. Formulating investment policies that have the potential to harm the environment.	-	4	4
Universities/ Akademics	1. Conducting studies and publications related to marine biodiversity.	+	3	2
	2. Conducting studies and publications related to environmental damage prevention.	+	3	2
	3. Carrying out conservation activities such as coral spawning monitoring.	+	5	5
Private Sector (PT Harta Samudra, Nutmeg Entrepreneurs)	1. Utilizing fisheries, plantation resources, and marine natural conditions for profit.	-	1	3
	2. Disposing of fishing waste on the beach	-	1	3

Source: Analysis, 2024

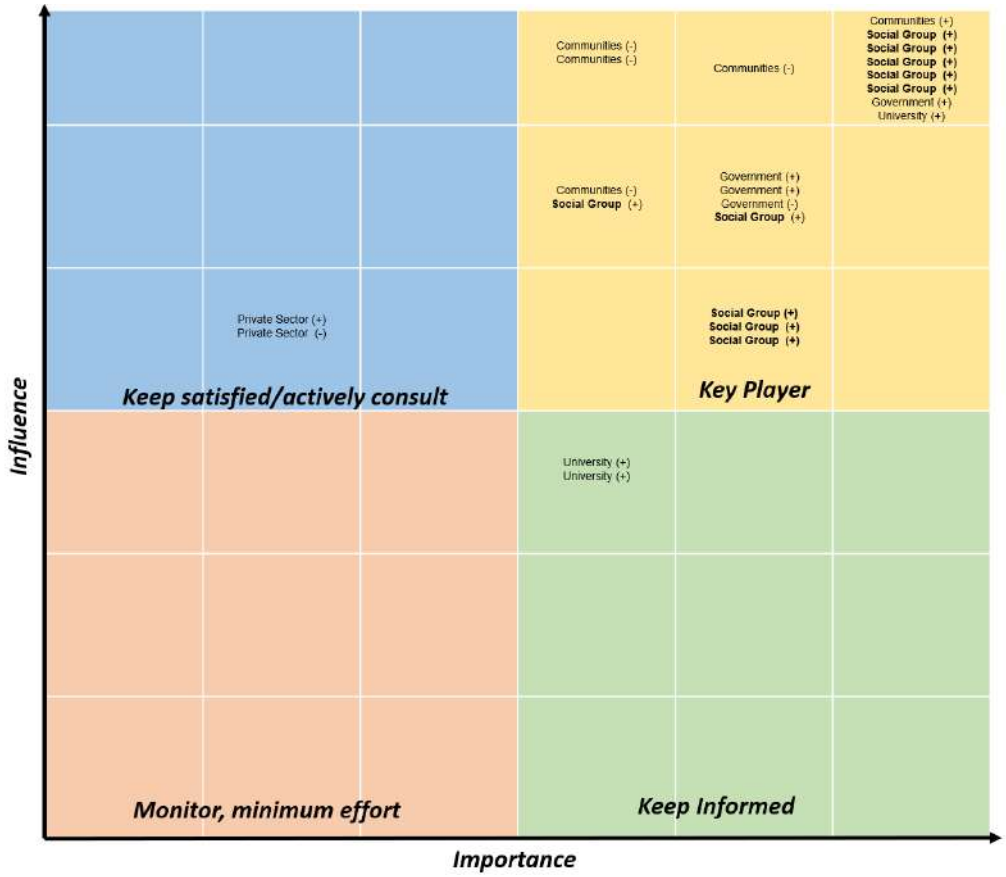
Based on the assessment results, the stakeholders were then mapped to identify which ones have the most significant roles. The mapping revealed that the social group has the most influential positive role and is a critical player in environmental matters. Additionally, the position of the local population is also significant and important, although most of their roles have negative impacts. The government

holds a significant and important influence, especially regarding policy, but not all policies have positive values. Universities have only a minimal influence and interest, despite their positive contributions. Meanwhile, the private sector in the Banda Islands also has minimal influence and interest, with negative impacts. After being mapped into a diagram (Figure 5), it was found that the social group, government, local population, and universities are key players in the sustainability of the small islands in the Banda Islands. Among these four key players, only the social group demonstrates the largest and most positive role concerning the environment of the small islands in the Banda Islands.

Table 3. Stakeholder Mapping

Influence of Stakeholders	**Importance of Activity to Stakeholders**					
	Unknown (0)	**Little/ No Importance (1)**	**Some Importance (2)**	**Moderate Importance (3)**	**Much Importance (4)**	**Critical Player (5)**
Unknown (0)						
Little/No Influence (1)						
Some Influence (2)				University (+) University (+)		
Moderate Influence (3)		Private Sector (+) Private Sector (-)			Social Group (+) Social Group (+) Social Group (+)	
Significant Influence (4)				Community (-) Social Group (+)	Government (+) Government (+) Government (-) Social Group (+)	
Very Influential (5)				Community (-) Community (-)	Community (-)	Community (+) Social Group (+) Social Group (+) Social Group (+) Social Group (+) Social Group (+) Government (+) University (+)

Source: Analysis, 2024



Source: Analysis, 2024
Fig. 5. Stakeholder Mapping

4.1.3 Social Groups Contributing to the Environment in the Banda Islands

There are several local social group involved in preserving the environment of the small islands in the Banda Islands. These social group include Pokmaswas, Molucca Coastal Care, Bank Sampahs, and the Banda Creative Youth Group.

a. Kelompok Masyarakat Pengawas (Pokmaswas)

Pokmaswas (Kelompok Masyarakat Pengawas) is a social group under the guidance of the Maluku Provincial Marine and Fisheries Office, which plays a role in monitoring the condition of the sea. Pokmaswas conducts surveillance and monitoring of marine areas, particularly in conservation zones established by the Minister of Marine Affairs and Fisheries Decree No. 58/KEPMEN-KP/2014 in 2014. Monitoring is carried out once a week using a boat. With the assistance of the Coral Triangle Centre (CTC), Pokmaswas also oversees sasi activities, which are traditional resource management practices that set rules or norms governing when harvesting can occur. Sasi is a tradition commonly used in eastern Indonesia, particularly in regions like Maluku, Nusa Tenggara, and Papua. In the Banda Islands, sasi is divided into four categories:

1. Individual sasi, which applies specifically to each local resident's land, usually for personal gardens.
2. State sasi, which is approved by the local government.
3. Forest sasi, which pertains to forest areas and gardens not owned by individuals.
4. Sea sasi, which applies to marine animals such as fish, shellfish, shrimp, and crabs.

The sasi issued by Pokmaswas focuses on sea sasi, particularly in marine conservation areas, to ensure that marine ecosystems are preserved and fish productivity does not decline.

b. Bank Sampah

Bank sampah is a social group that collaborates with Luminocean, consisting of local residents focused on waste management based in Banda Neira. Since 2019, the Bank Sampah has periodically collected plastic waste from the Banda community using boats, providing monetary rewards based on the amount of waste collected. The collected plastic waste is then sorted and recycled into plastic pellets and fuel oil (for heating recycling machines/facilities and garbage transport vehicles). The recycled plastic pellets are subsequently sold to plastic processing companies in Surabaya. Currently, 72 families from various small islands in the Banda Islands are actively involved in collecting plastic waste.

In addition to collecting waste from local residents, the Bank Sampah also contributes to marine cleanliness by gathering plastic debris found in the sea. According to Maga (2024), the Chair of the Bank Sampah, there is a significant amount of floating waste, especially during the summer season when many domestic and international tourists visit the Banda Islands

Source: Author, 2024 (Bank Sampah), Luminocean, 2024 (Ship)
Fig. 6. Bank Sampah and Waste Transport Vessel

c. Kelompok Kreatif Anak Banda

Kelompok Kreatif Anak Banda (KKAB) is a social group focused on environmental education in Banda Island. KKAB established a learning center and conducts education for the residents of the small islands in the Banda Islands on waste management, particularly plastic waste. KKAB provides training for women in Banda Neira to process plastic waste into various crafts such as bags and wallets. The crafts produced by these women are then sold in the market. This initiative not only helps protect the environment but also enhances creativity and serves as a source of income for the community in Banda Neira.

Source: Luminocean, 2024
Fig. 7. Craft Products from Plastic Waste

d. Moluccas Coastal Care

Moluccas Coastal Care (MCC) is a social group aimed at preserving coastal ecosystems and empowering small islands residents. Some of the activities carried out by the MCC include educating the public about the rat shark ecosystem, establishing drying houses for nutmeg farmers, providing environmental conservation education for elementary, middle, and high school students, planting nutmeg seedlings, transplanting coral reefs, and creating learning centers focused on environmental issues for children in Banda. Additionally, every Friday, a cleanup activity is organized for all students to collect trash on Rhun Island, which is then donated to the Bank Sampah.

Source: Author, 2024
Fig. 8. Learning Center on Rhun Island and Nutmeg Drying House on Banda Besar Island.

Table 4. Role of Social Groups to Environment

Social Group	Role
Kelompok Masyarakat Pengawas	1. Monitoring and surveillance of marine ecosystems 2. Preserving the sustainability of marine ecosystems by implementing the sasi system
Bank Sampah	Maintaining the cleanliness of land and sea through activities such as plastic waste collection in the ocean and on land, as well as the waste bank system.

Social Group	Role
Kelompok Kreatif Anak Banda	Maintaining land cleanliness through education for women
Molucca Coastal Care	1. Preserving the sustainability of marine ecosystems through education for children. 2. Increasing garden productivity through the planting of nutmeg seedlings. 3. Preventing damage to marine ecosystems through coral reef transplantation.

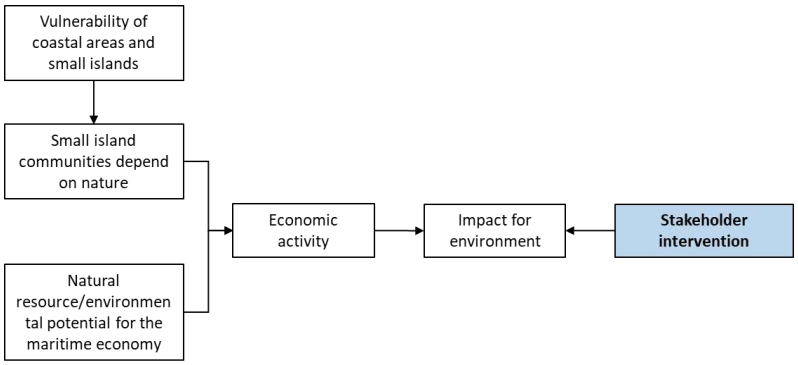
Source: Analysis, 2024

Environmental preservation efforts by social group in the Banda Islands are also strengthened by the presence of non-governmental organizations such as Coral Triangle Center, EcoNusa, and Luminocean. The Coral Triangle Center contributes to capacity building and raising awareness about marine conservation, including waste management for the community and training for Pokmaswas. EcoNusa focuses on nature conservation, such as developing floating net cages to provide alternative livelihoods for fishermen and serving as a platform for field classes for students from Banda Neira University. Luminocean also supports environmental preservation by providing financial assistance for the sustainability of the Waste Bank and other conservation communities/groups in Banda.

4.2 Discussion

The Role of Social Groups in the Sustainability of Life in the Banda Islands

The small islands in the Banda Islands are located far and remote from the surrounding urban areas (Ambon City and Tual City), forcing residents to rely on all their natural resources to sustain their livelihoods. These economic activities not only provide a means of living for the community but also have environmental impacts, as their processing is not yet fully sustainable. Fortunately, various stakeholders are responding to and intervening in these environmental impacts to ensure the preservation of the island's environment.

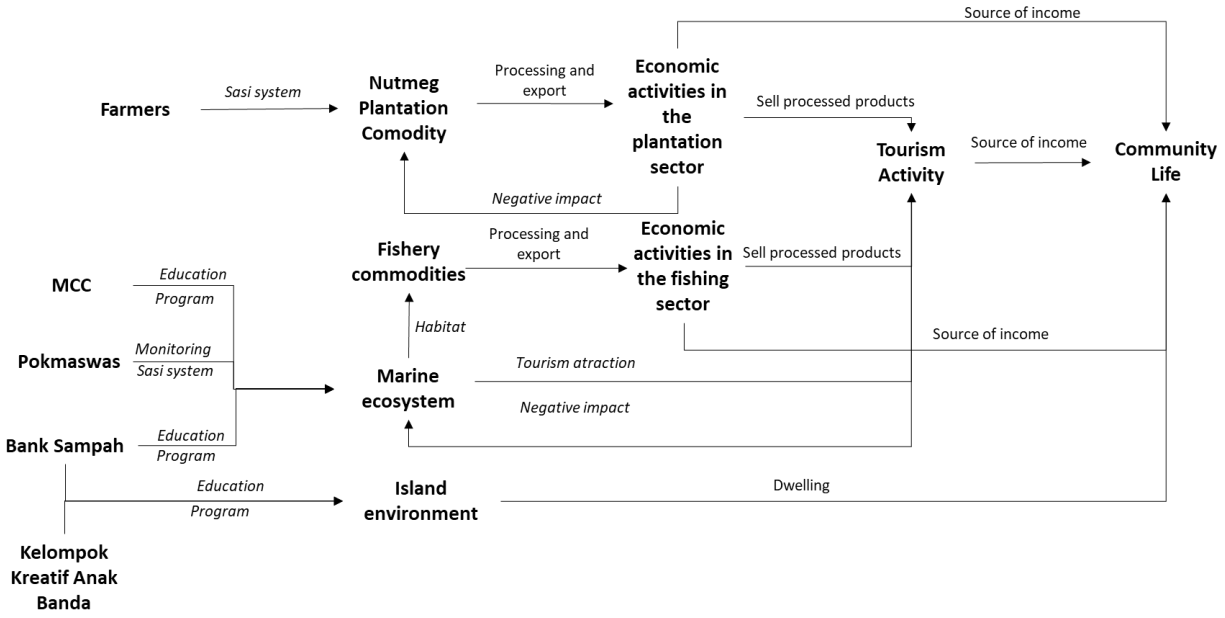


Source: Analysis, 2024
Fig. 9. The Relationship Between the Environment and Economic Activities on Small Islands

It is well-known that communities are significant stakeholders with a major role in the environmental management of the small islands in the Banda Islands. Various activities, from providing education to engaging directly in field programs for environmental improvement and monitoring, are carried out by these communities. The education provided to individuals ranging from children to adults ensures that knowledge and experiences are passed down through generations,

creating a sustainable legacy. Traditions like sasi, along with the monitoring of conservation areas, and the preservation of natural/marine biodiversity, contribute to the sustainability of natural resources for the future.

Natural resources, as commodities utilized by the community, can ultimately be preserved due to the interventions made by various stakeholders, particularly the social groups that have emerged and developed from the Banda community itself. These social group serve to absorb and mitigate the environmental impacts of economic activities, thereby fostering the sustainable availability of natural resources that can be managed and used by the population. The community can sustain itself by consuming existing natural commodities to generate income, which is then used to meet their daily needs.



Source: Analysis, 2024
Fig. 10. The Connection Between Social Group Roles and the Continuity of Life for Small Island Communities in the Banda Islands

Although social groups are the backbone of environmental sustainability on the small islands in the Banda Islands, this does not mean that their role eliminates all the negative impacts generated by economic activities. Various impacts increasingly felt by the community, as explained in the previous section, demonstrate that the significant role of communities is not enough to ensure the sustainability of the small islands and seas in the Banda Islands. Social groups indeed make a substantial contribution to the environment; however, a greater involvement from all stakeholders in the Banda Islands is needed for more effective environmental management.

The community and government, as key players, can be more actively involved in efforts to manage the environment and natural resources. The community can become more aware of domestic waste management by implementing the 3R system (reduce, recycle, reuse) in collaboration with existing environmental groups, especially the Waste Bank and KKAB. Additionally, there needs to be a shift among fishermen to move away from using purse seines and instead use larger mesh nets. For farmers, it is hoped that they can further tighten the sasi system and the spacing of nutmeg trees to prevent a decline in nutmeg productivity.

To encourage behavioral change within the community, the government can act as a facilitator by implementing and overseeing the protection and utilization of natural resources in the Banda Islands. Currently, many regulations and policies have been issued by the Central, Provincial, and District Governments to control the use of natural resources and prevent environmental degradation, such as the the Minister of Marine Affairs and Fisheries Decree No. 37 of 2022 on the Banda Sea Conservation Area and Surroundings in Maluku Province, Decree No. 48 of 2021 on Conservation Areas in the Waters of Ay Island and Rhun Island, and the Director General of Marine Spatial Planning Regulation No. 64 of 2023 on the Management Plan for the Banda Sea Conservation Area and Surroundings from 2022 to 2042, RTRW Provinsi Maluku 2013-2033, RTRW Kabupaten Maluku Tengah 2012-2032, and other regulations. Despite these policies, there is still minimal oversight regarding their implementation. Both the Central and Local Governments have not fully dedicated their resources to monitor all economic activities on land and in the waters of the Banda Islands. The government has many social groups, such as Pokmaswas and CTC, that can act as agents of change at the local level. In addition to collaborating intensively with all existing social groups, the government can also serve as a bridge between these communities and funding institutions or the private sector to finance programs related to environmental preservation and biodiversity, as well as to support communities in adopting more sustainable economic practices.

5 Conclusion

This study provides insights into the impacts of both traditional and modern maritime economic activities on the environmental quality of the small islands in the Banda Islands, as well as the roles of various actors, particularly social group, in the environment of these islands. The impacts resulting from maritime economic activities are related to the sustainability of natural resources in both the land and sea, including the decline in quality and productivity of garden commodities, reduced fishery yields and marine biodiversity, damage to marine ecosystems, destruction of endemic wildlife habitats, and waste management issues on the islands. While various stakeholders are involved in island environmental issues, social group play the most significant role in the sustainability of the small islands in the Banda Islands. The roles held by social group encompass many aspects, such as education, monitoring, damage prevention, environmental restoration, and maintaining the quality of natural resources. But this is not enough to eliminate the negative impact of economic activity in Banda Islands.

From this study, we learn that the communities of small islands require greater efforts in conducting their economic activities to ensure environmental sustainability, which directly or indirectly affects their livelihoods. Communities on small islands need to seek a balance and sustainability between the environment and maritime economy so that the vulnerability of island residents due to limited resources and their remote location can be mitigated, ensuring livelihoods for future generations. Ultimately, finding common ground between economic growth and environmental preservation should be a collaborative effort among all elements, including the government, communities, NGOs, donor agencies, the private sector, and academia. The government, as the policymaker regarding the livelihoods of small island communities, can serve as the main facilitator in encouraging action from other stakeholders, especially social groups, which act as catalysts for change and possess knowledge and experience in environmental conservation.

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