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Status of Sustainability Mangrove Ecosystem in Ecomarine Mangrove Muara Angke, Jakarta

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Abstract: The northern coast of Jakarta has experienced mangrove forest degradation and loss of natural protection from abrasion, tidal flooding, and storms. However, awareness of the need for mangrove rehabilitation has grown in recent decades, with one location being the Kali Adem delta by community named Komunitas Mangrove Muara Angke (KOMMA). These mangroves must be managed sustainably to ensure that their benefits can be felt over the long term. This study aims to analyze the sustainability of mangrove ecosystem management in the Muara Angke Ecomarine Mangrove. A multidimensional scaling (MDS) approach using the Rapid Appraisal for Fisheries (RAPFISH) ordination technique was employed. The results indicate that the sustainability status of mangrove ecosystem management at Ecomarine Mangrove Muara Angke falls into the moderately sustainable category with an index value of 53.14. However, one of the four dimensions with a low value is the economic dimension. The sustainability index value for the economic dimension is 44.73, with the key factor that need to be considered is the additional income of the Muara Angke community. Efforts to manage mangroves must be enhanced to ensure the continued existence of mangroves in Muara Angke and to provide benefits for the environment and socio-economic well-being.

Keywords: Community-based management; Mangrove; Multidimensional; North Jakarta; Sustainability.

Introduction

As one of the major coastal cities in Southeast Asia, Jakarta has a mangrove ecosystem in its northern part, covering an area of approximately 682 hectares. Even though the mangrove ecosystem represents approximately 0.02% of Indonesia's total mangrove coverage of 3.44 millions hectares (MoF 2021), the mangrove ecosystem in Jakarta plays a role in providing ecosystem services on a local and global scale. Locally, this ecosystem acts as a natural buffer, protecting the urban coastline from tidal flooding and storm surges, thereby playing a crucial role in reducing disaster risk. The study of Dasgupta et al. (2019) shows that mangrove can reduce wave and surge height significantly. Protected mangrove areas are more effective in minimizing the impact of such natural hazards compared to unprotected areas (Setiacahyandari & Hizbaron, 2024). Additionally, Jakarta's mangroves act as significant carbon sinks, storing large amounts of carbon both in biomass and soil, thereby contributing to climate change mitigation. Sumarga et al. (2023) mention that carbon storage in Jakarta mangrove can reach up to 111.5 tonnes C ha^{-1}. The ability of mangroves to improve urban air quality by absorbing air pollutants and regulating microclimates by moderating local temperature and humidity further highlights the importance of this ecosystem in densely populated urban areas. Sumarga et al. (2023) note that mangrove is able to improve urban air quality by absorbing PM2.5, SO2, and NO2 at rates of 35.7, 27.4, and 16.5 $kg.ha^{-1}.year^{-1}$, respectively.

Beyond local benefits, Jakarta's mangroves also provide services of global significance. They contribute to the regulation of the global carbon cycle, with Indonesia's mangrove forests representing one of the

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world's largest carbon reserves (Murdiyarso et al., 2015). Furthermore, these ecosystems offer habitats and nursery grounds for numerous marine and terrestrial species. Beyond ecological functions, Jakarta's mangroves support recreational and cultural activities, fostering ecotourism and providing socio-economic benefits to surrounding communities (Sumarga et al., 2023). These multifaceted services highlight the urgent need for integrated conservation and management strategies to preserve the ecological integrity and sustainability of mangrove ecosystems in urban coastal regions.

However, the functionality of mangrove ecosystems as natural defenses against tidal floods and other coastal hazards under pressure and threat due to a multitude of factors, including unsustainable resource exploitation, fragmented management approaches, and inadequate conservation efforts (Friess et al. 2012; Setiacahyandari & Hizbaron, 2024). The loss of mangroves is further exacerbated by reclamation, urban development, and coastal landfills, which have been major drivers of mangrove degradation over the past decades (Samanta et al., 2021).

One of the efforts to restore the mangrove ecosystem is replanting mangrove trees or rehabilitation efforts. The Muara Angke Mangrove Community (KOMMA) has successfully planted 27,000 mangrove seedlings on land at the mouth of the Kali Adem river (Rahadian et al., 2019). The mangrove vegetation there are called the *Kawasan Ecomarine Mangrove Muara Angke* (Ecomarine Mangrove Muara Angke Conservation Area). The mangroves have now reached an area of about two hectares. According to research by Assa and Adirinekso (2022), the community around the mangrove sees the potential of *Sonneratia casseolaris* (Pidada) fruit to be used as a viable and hygienic food or beverage product for sale. All mangrove forest resources, which have the characteristics of a common pool resource and are open access, tend to be easily damaged. Excessive mangrove harvesting will result in physical and functional changes to the area. This will then result in a damaged forest (Tragedy of the common) and cause various problems in maintaining mangrove sustainability (Ambinari et al. 2016).

Considering the ecological protection, economic utilization, and social welfare provided by mangroves, sustainable management of mangrove ecosystems must be implemented in the Ecomarine Mangrove Muara Angke Conservation Area. According to Djamaluddin (2018), leaving the mangrove ecosystem without optimal utilization is not a wise choice, as predecessors have demonstrated its many benefits, including medicine, fuel, fishery resources, and habitat protection and restoration techniques. Therefore, the sustainability status of mangrove areas must be assessed before developing a management strategy for the mangrove area, ensuring its long-term viability.

Method

Data Collection

The data used in this study includes primary and secondary data. Primary data such as mangrove biophysical data was obtained and collected directly through field observations and survey, while for some economic, social, and institutional parameters, in-depth interviews were conducted with relevant actors such as Ministry of Forestry Mangrove Rehabilitation section, Muara Angke Port Management Unit, Pluit Village Office Staff, Muara Angke Mangrove Community, Community Leaders, Academics, and NGOs. Secondary data collection was conducted through literature studies from various documents in several relevant agencies and previous research results. This research was conducted from January to May 2025 in the Ecomarine Mangrove Muara Angke Conservation Area, Pluit Village, Penjaringan District, DKI Jakarta. Study location shows in Figure 1.

Figure 1. Ecomarine Mangrove Muara Angke location

Data Analysis

The sustainability status of the mangrove ecosystem in the Muara Angke Mangrove Ecomarine area was analyzed using the Multidimensional Scaling (MDS) method with the RAPMANGROVE (Rapid Appraisal for Mangrove Ecosystem Sustainability) approach. The RAPMANGROVE approach is a modified version of the RAPFISH (Rapid Appraisal for Fisheries) approach developed by the Fisheries Center, University of British Columbia (Schaduw, 2018). This method analyzed four main dimensions, they are ecological, social, economic, and institutional dimensions. Based on these four dimensions, 30 attributes were determined, consisting of 7 attributes in

the ecological dimension, 8 attributes in the social dimension, 7 attributes in the economic dimension, and 8 attributes in the institutional dimension.

Furthermore, the data was processed using RAPMANGROVE software to determine the index and status of sustainability in each dimension, in order to formulate a sustainable mangrove ecosystem management strategy. To determine the sustainability index for each dimension, each attribute was assessed and analyzed. The sustainability index value for each dimension visualized in a kite diagram and analyzed multidimensionally to determine the point or position of mangrove forest management sustainability. Since the sustainability index values in the RAPMANGROVE method range from 0 (bad) to 100 (good), the index values are classified to facilitate the determination of sustainability status. The index values are 0 – 25 (classified as unsustainable); the range of 26 – 49 (less sustainable); in the range of 50 – 75 (moderately sustainable); and the range of 76 – 100 (highly sustainable) (Fauzi and Anna, 2005). The data was further analyzed using Leverage analysis to determine the key factors that most influence the sustainability of mangrove ecosystems and Monte Carlo analysis to detect sources of error from data diversity.

Result and Discussion

Ecomarine Mangrove Muara Angke Area

Ecomarine Mangrove Muara Angke Conservation Area is a mangrove vegetation due to the work of community named Komunitas Mangrove Muara Angke (KOMMA) who lived in Muara Angke Port area (Figure 1.). This area was initially a land that emerged due to river sedimentation and accumulated marine debris. Seeing this condition, the KOMMA planted mangroves since 2010 and continues to do so today. A total of 70,200 seedlings have been planted, consisting of four mangrove species: *Rhizopora mucronata*, *Sonneratia caseolaris*, *Nypa fructicans*, and *Avicennia marina*. At present, associated plants such as *Terminalia catappa, Ipomoea pes-caprae, Morinda citrifolia,* and *Wollastonia biflora* are existed and formed vegetation there.

Based on the observation result, we found three species of fish, six species of reptile, three species of mammals, and 27 of birds. The types of fish that can be found, such as *Plotosus canius* (Gray eel-catfish or *Ikan Sembilang*), *Periophthalmodon schlosseri* (Giant mudskipper or *Ikan Glodok*), and *Channa striata* (Snakehead murrel or *Ikan Gabus*) while the most frequent encountered reptile is the monitor lizard or *Varanus salvator*. As a coastal habitat, water birds such as *Ardeola speciosa* (javan pond heron), little egret (*Egretta garzetta*), great egret (*Egretta alba*), and Javan plover (*Charadrius javanicus*) are observed looking for food and home.

The existence of mangroves saves the surrounding community from the effects of tidal flooding, abrasion, and strong winds. Based on the interview with some residents live within a 2 km radius of the mangrove forest, this urban area is always affected by tidal flooding, but if there were no mangroves, the flooding would probably be worse. Besides having an impact on the environment, this area can be a source of income for the community around Muara Angke through tourism, mangrove product processing, and silvofishery ponds.

Status of Mangrove Ecosystem Management Sustainability

The multidimentional analysis show that the status of mangrove ecosystem in the Ecomarine Mangrove Muara Angke area is classified as moderately sustainable based on an index score of 53.14, with the values for each dimension varying (see Table 1.). Sustainability values and status in each dimension, are as follows: ecological dimension 58.96 (moderately sustainable), social dimension 57.55 (moderately sustainable), economy dimension 44.73 (less sustainable), and institutional dimension 51.35 (moderately sustainable).

The validity of this analysis is also supported by statistical parameters including stress values and R-square (R^2) values from the MDS model used in RAPMANGROVE. Stress values each dimension is above 25% while R-square values are above 80%. These results indicate that the multidimensional mapping is accurate and reliable. Kavanagh and Pitcher (2004), said that stress values are considered good if they are below 25% and R-square (R^2) values are above 80%.

Table 1. Index values and parameters of mangrove ecosystem sustainability in Muara Angke

Dimensions Sustainability	Index Sustainability	Sustainability Status	Parameter (%)	
			Stress	*R-square*
Ecology	58.96	Moderately Sustainable	15.91	93.88
Social	57.55	Moderately Sustainable	15.08	94.35
Economy	44.73	Less Sustainable	15.68	94.01
Institutional	51.35	Moderately Sustainable	15.54	94.15
Average	53.14	Moderately Sustainable		

The sustainability index value of the four dimensions visualized in the kite diagram which can be seen in Figure 2. Kite diagram visualization reflects the contribution of dimensions positively or negatively to the overall sustainability status. This study shows that the average index value is at a moderate sustainable status and to maintain this index value in the future, it is necessary to maintain sensitive attributes that affect the index value of the ecological, social, economic, and institutional dimensions.

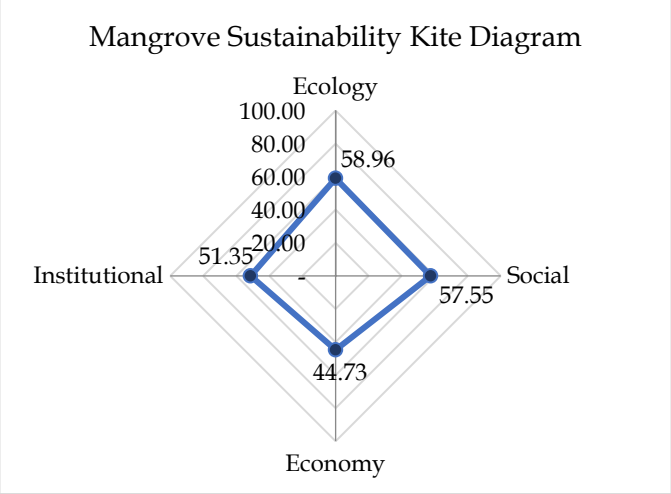

Figure 2. Four-dimensional sustainability diagram (primary data processed in 2025)

Table 2. Differences between Rapfish analysis and Monte Carlo analysis

Dimension	Analysis Results		
	MDS value	*Monte Carlo*	Difference
Ecology	58.96%	58.81%	0.15
Social	57.55%	57.11%	0.44
Economy	44.73%	44.32%	0.41
Institutional	51.35%	51.09%	0.26

Source: Primary data (2025)

Based on Table 2, the results of the *Monte Carlo* analysis show that the differences between MDS and *Monte Carlo* in each dimension are relatively small, i.e., <5%. Therefore, the sustainability analysis in the four dimensions have a relatively small scoring error, a relatively small range of scores, a stable analysis process, and have avoided missing data errors, which means that the results of the sustainability status analysis of mangrove ecosystem management in Muara Angke have a high level of confidence. Although it has a moderately sustainable status, it is still necessary for KOMMA to pay attention to critical aspects and continue to improve management quality so that mangroves in the research location can be preserved and sustainable.

Ecological Dimension

This study uses seven attributes in analyzing the sustainability of the ecological dimension. The attributes are mangrove density, mangrove coverage, mangrove fauna diversity, mangrove land pressure, planting and maintenance activities, seedling availability, and water quality (Muhsimin, 2018). The results show that the sustainability status index value of the ecological dimension of mangrove ecosystem management in Muara Angke from seven attributes is 58.96. This value shows a moderate sustainable result. The results of the sustainability index and leverage analysis are shown in Figure 3 and Figure 4.

Based on the results of the leverage analysis, the three most sensitive attributes in the ecological dimension of mangrove ecosystem management in the Muara Angke Mangrove Ecomarine Area are land pressure (1.91), fauna diversity (1.71), and water quality (1.40). The high leverage value of land pressure indicates that this factor has the most significant influence on ecosystem sustainability. Ecomarine Mangrove Muara Angke is not a protected area and is not registered as a forest area, so the Forestry Law cannot provide comprehensive legal protection. Moreover, due to the emerged land is considered a common-pool resource, the mangrove growth area competes with the increasing demand of the urban settling in Muara Angke. Turchwell et al. (2020) findings highlight that increased rate of mangrove degradation in urban areas with high population densities is a result of lack in mangrove protection.

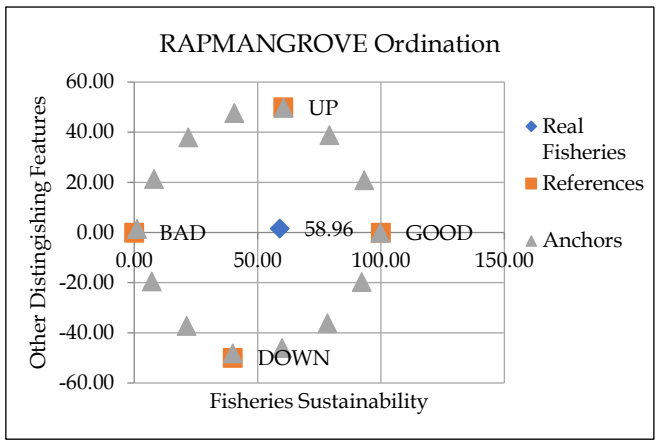

Figure 3. RAPMANGROVE Ordination of Ecological Dimension (primary data analyzed in 2025)

The attribute of faunal diversity occupies the second important position in this analysis. The diversity of fauna species such as birds, fish, and various other organisms acts as a marker of ecosystem health as well as a guardian of natural balance. The success of mangrove rehabilitation cannot be separated from the influence of the existence of mangrove fauna, including

crabs, mollusks, birds, reptiles, and mammals, that contribute to nutrient cycling, sediment turnover, and organic matter decomposition (Ashton & Macintosh, 2024).

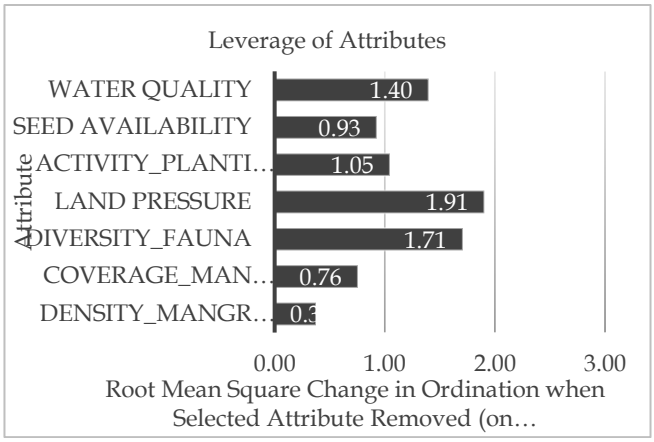

Figure 4. Ecological dimension leverage analysis (primary data analyzed in 2025)

Water quality emerges as the third critical factor determining the survival and growth of mangrove ecosystems by influencing nutrient availability, physiological processes, and overall ecosystem health. Key water quality parameters impacting mangrove development include salinity levels, oxygen content, pH, temperature, nutrient, and pollution levels (Amalo et al., 2024). The decline in water quality allegedly due to human activities needs to be managed through the implementation of an effective waste treatment system, regular monitoring of water quality, and guidance to businesses around the area. By paying attention to these three important aspects, mangrove ecosystem management is expected to run sustainably and provide optimal benefits for both the environment and the surrounding community.

Social Dimension

The attributes used in analyzing the sustainability of the social dimension are community knowledge about mangroves, community education level, local community access to mangrove ecosystems, damage to mangrove ecosystems by the community, community awareness of the importance of mangrove resources, local wisdom, community participation in mangrove ecosystem management, and conflicts over the use of mangrove resources (Muhsimin, 2018).

The sustainability status index value of the social dimension of mangrove ecosystem management in Muara Angke from eight attributes of 57.55. This value shows a moderate sustainable result. Figure 5 shows the results of the leverage analysis using the RAPMANGROVE method. The three most sensitive attributes in the social dimension of mangrove ecosystem management in the Ecomarine Mangrove Muara Angke Area are level of damage (4.19), local wisdom (2.51), and level of education (2.10). The very high leverage value for the damage level indicates that this factor greatly influences the area's socio-ecological sustainability. The current state of the mangroves, which have high coverage and density, is inextricably linked to human intervention in the form of patchwork maintenance. If mangroves are damaged due to over-extraction or land conversion, the sustainability of the Muara Angke mangroves will be severely affected.

The Agrarian Reform Task Force and Productive Innovative Research Team of the University of Indonesia noted that land acquisition in Muara Angke, particularly in Empang Block, began in 1978, with initial occupation occurring in 1981. Land expansion for settlements and small micro-enterprises occurred between 2000 and 2003 due to the filling of ponds that began in 1998. This reinforces the fact that conversion of coastal areas for residential and business purposes has led to a decline in mangrove area and coverage since 1970 (Ambinari et al., 2016).

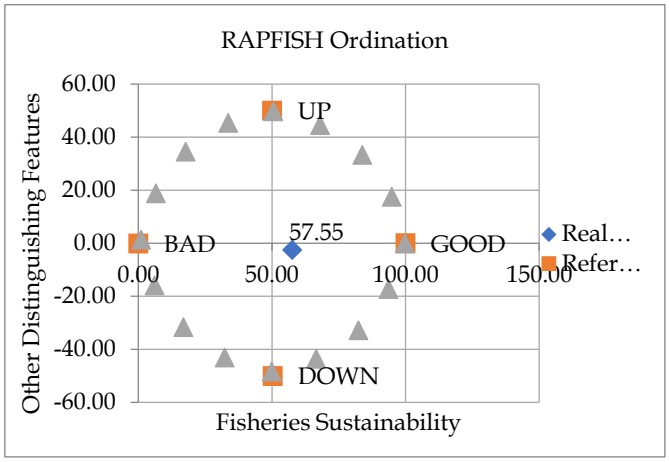

Figure 5. RAPMANGROVE Ordination of Social Dimension (primary data analyzed in 2025)

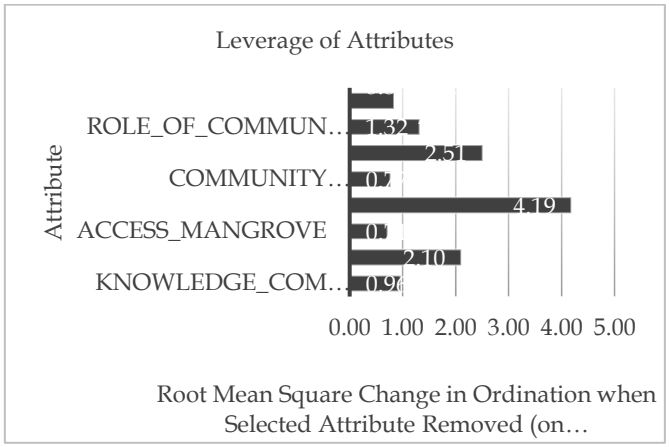

Figure 6. Social dimension leverage analysis (primary data analyzed in 2025)

The attribute of local wisdom occupies the second position with a significant leverage value. Traditional knowledge and proven local practices in mangrove management contribute to maintaining ecosystem sustainability. Findings in the field indicate that the Muara Angke fishing community has strong ties to the sea and continues to hold the *Nadranan* tradition to express gratitude for the abundant seafood harvest and to pray for the safety of fishermen and traders who work on the coast from natural disasters. However, local wisdom in preserving and managing mangroves has not been manifested in customary laws or traditions of the community. This is emphasized by Ambinari et al. (2016), who state that the Muara Angke community holds superstitions about the mangrove forest, which prohibits them from disturbing it. These beliefs support the conservation of the mangrove forest.

In sustainable mangrove management in Muara Angke, education level emerged as the third most influential factor. Communities with higher levels of mangrove-related education or literacy tend to have better awareness and capacity to participate in mangrove conservation. According to Aswita, Suryadarma & Suyanto (2018), Communities that have strong traditional practices and robust local institutions are better able to manage and conserve their environment, which supports sustainable tourism and ecosystem health. Therefore, management strategies should include programs to improve environmental literacy, ecosystem-based skills training, and local curriculum development that integrates environmental education. By strengthening these three levers, it is expected that community participation in mangrove management will be optimized and sustainable.

Economic Dimension

The sustainability status index value of the economic dimension of mangrove ecosystem management is in the less sustainable category, which is 44.73 (Figure 7). The attributes used in this assessment are the contribution to GDP, mangrove utilization by the community, community income to the minimum wage, other income, inventory of mangrove product utilization, stakeholder involvement in the mangrove processing economy, and zoning of mangrove land use.

The utilization of Muara Angke Mangrove Ecomarine has so far taken the form of environmental service-based businesses such as ecotourism and non-timber processed products. Facilities that have been built include 1) entrance gate, 2) toilet, 3) bamboo bridge, 4) jogging track, 5) education house and 6) batik house, and 7) lighting in the area. Business types of non-timber processing products are batik and pidada fruit processing. Through silvofishery ponds, the community received a net profit of Rp.48,091,000 in 2020.

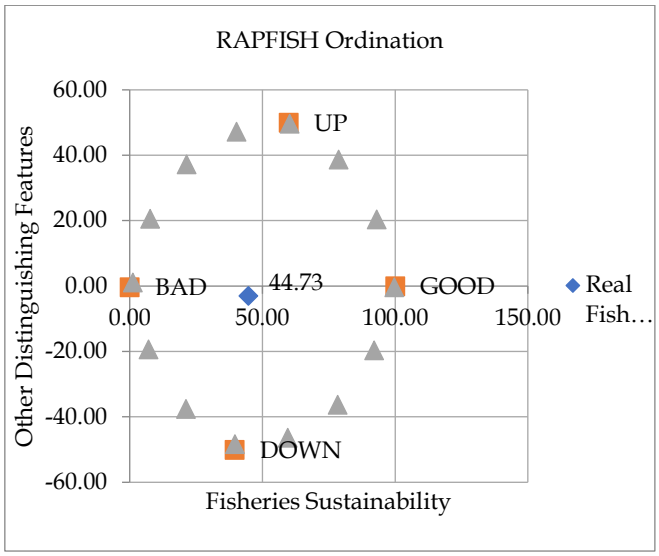

Figure 7. RAPMANGROVE Ordination of Economy Dimension (primary data analyzed in 2025)

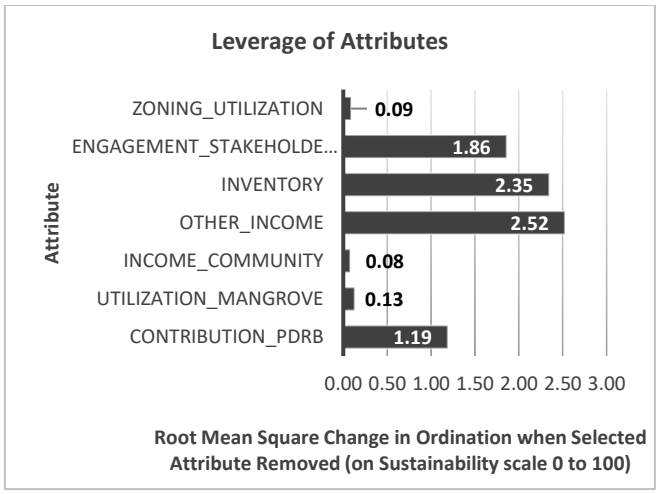

Figure 8. Economy dimension leverage analysis (primary data analyzed in 2025)

Factors sensitive to sustainability are other income (score 2.52); inventory of mangrove forest utilization (score 2.35); and stakeholder involvement in supporting economic businesses with a score of 1.86 (Figure 8). The economic turnover in Muara Angke relies on fisheries activities carried out by the Muara Angke fishing community, which is divided into several classifications, namely capture fishermen, stall fishermen and manager fishermen (Agustin et al., 2023). With a money turnover in the Muara Angke Port Area of 842 billion rupiah (KKP, 2025), people still depend on their lives as fishermen. Of the large turnover of money, there is no contribution of fisheries sourced from mangrove ecosystems. The majority of fish comes from capture fisheries. The community does not make mangrove resources the main income but only an additional income.

The purpose of the inventory is to provide factual data related to the type of utilization, the potential of mangroves that can be developed, the contribution of mangroves in supporting the production of the fisheries sector and information on mangrove damage. It aims to facilitate the taking of strategic, efficient and effective steps in mangrove management in the sub-district (Haris, Hardjomijdojo, & Kusmana, 2021). Currently, the inventory of mangrove benefits is known to be archived by several parties, namely at the DKI Jakarta Provincial Food Security, Marine and Agriculture Office, KOMMA as a management community, and PT PJB UP Muara Karang as a conservation funding institution at Ecomarine Mangrove Muara Angke.

Stakeholder involvement in supporting mangrove-based community economic enterprises is also a crucial factor to support the success of mangrove management. Harmonious collaboration between government, business actors, academics, and community groups in planning and implementing economic programs can create equitable and sustainable utilization schemes (Rahadian et al., 2019). Findings in the field show that there is involvement from actors such as academics (Assa and Adirinekso, 2022), the Fishery Port Management Unit, the Village, and the Company. However, the involvement that has been carried out is still considered insufficient to make the non-timber mangrove product management group financially independent and sustainable business (interview results, 2024).

Institutional Dimension

The results of the sustainability status index value of the institutional dimension of mangrove ecosystem management in Muara Angke from eight attributes are in the fairly sustainable category with a value of 51.35 (Figure 9). The attributes used for assessing the sustainability status are mangrove forest management policies and planning, availability of rules and the role of non-formal institutions, involvement of community institutions, coordination between institutions or stakeholders, availability of instructors or field officers, compliance with management rules, sanctions for violators, monitoring and supervision.

The results of the institutional dimension leverage factor analysis, factors that are sensitive and contribute to the institutional dimension sustainability index value, namely: (1) sanctions for violators, (2) availability of extension workers or field officers, (3) involvement of community institutions, and (4) coordination between institutions or stakeholders (Figure 10).

Based on the results of interviews, sanctions carried out by the Muara Angke Mangrove Ecomarine manager in the form of verbal warnings for people who take mangrove resources without permission. Sanctions that are more severe than verbal warnings have never been applied due to the absence of rules at the local or site level and local wisdom of mangrove management. It is suspected that due to the history of the formation of Muara Angke Mangrove Ecomarine, the recognition of rights to land arising in the estuary of Kali Adem was once a conflict between the community and the surrounding community. The conflict was resolved legally and the land was designated as the green zone of Muara Angke Harbor through the letter of the head of the DKI Jakarta Provincial DKPKP fisheries port management unit No.1371/-1.823.6 of 2015 regarding Recommendations for Greening Land Designation to KOMMA (Muara Angke Mangrove Community). So, in the end, the management community did not dare to enforce strict regulations in the area.

The provision of sanctions for violators, according to Muhsimin (2018), is closely related to local wisdom and the role of non-formal institutions. This local wisdom of mangrove ecosystem management needs to be discussed and agreed upon in order to guide the community to be more concerned and responsible for the environment.

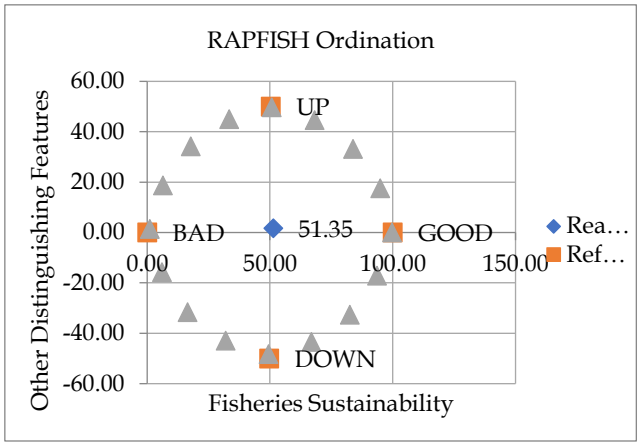

Figure 9. RAPMANGROVE Ordination of Institutional Dimension (primary data analyzed in 2025)

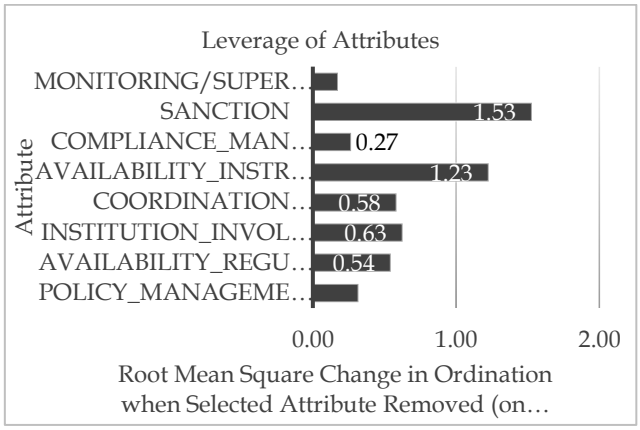

Figure 10. Economy dimension leverage analysis (primary data analyzed in 2025)

The availability of extension workers or field officers is key in sustainable mangrove management. Field workers or extension workers function to facilitate and assist the community, socialize management programs and policies on mangroves and monitor and supervise the community in carrying out a sustainable management system (Muhsimin, 2018). So far, there are approximately three field staff at Ecomarine Mangrove Muara Angke who play a role in caring for mangrove seedlings, maintaining the cleanliness of facilities in the area, cleaning mangroves from marine debris and monitoring the area. Existing field officers also have side jobs so that the function of sustainable mangrove management counseling has not been implemented. The high leverage value reflects that the limited number and quality of extension workers can be a serious obstacle in the implementation of management programs, so efforts are needed to strengthen the capacity and increase the quantity of extension workers on an ongoing basis.

In rehabilitating mangrove ecosystems in the Muara Angke Mangrove Ecomarine Area, KOMMA always involves related institutions and the community. Communication and coordination between KOMMA and formal institutions such as UP3 and the village is quite good because these two institutions are always informed about activities in the area. The value of the leverage analysis indicates that strengthening coordination forums and cooperation mechanisms between institutions needs to be developed to support more integrated management. These sensitive attributes are interrelated and form a comprehensive institutional system, where effective enforcement of sanctions must be supported by adequate counseling and solid institutional cooperation, all of which are important elements in supporting the success of sustainable mangrove ecosystem management.

Conclusion

Mangrove forest management in Ecomarine Mangrove Muara Angke in terms of ecological, social, economic and institutional dimensions is in a fairly sustainable status with a sustainability index value of 53.14. Lever attributes whose influence is very sensitive to the sustainability of mangrove forest management in Ecomarine Mangrove Muara Angke are: (1) land pressure; (2) fauna diversity; (3) water quality; (4) level of damage; (5) social wisdom; (6) community education level; (7) community income; (8) mangrove inventory; (9) stakeholder involvement in mangrove management; (10) sanctions and (11) availability of extension workers. The eleven leverage attributes must be prioritized by the KOMMA community through the preparation and implementation of appropriate program strategies and policies so that the sustainability of mangrove forest management in Muara Angke can be maintained.

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Author Contributions

Conceptualization, Talida Salma Khairunnisa and Sri Mulatsih; methodology, Talida Salma Khairunnisa and Sri Mulatsih; formal analysis, Sri Mulatsih, Efi Yuliati Yovi.; survey and investigation, Talida Salma Khairunnisa; data curation, Talida Salma Khairunnisa, Sri Mulatsih, Efi Yuliati Yovi; writing-preparation of initial draft, Talida Salma Khairunnisa; writing-review and editing, Sri Mulatsih, Efi Yuliati Yovi. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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