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Between Conservation and Edu-Ecotourism: The Strategy of PT Pertamina EP Pangkalan Susu Field for Community-Driven Mangrove Ecosystem Preservation

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Abstract. The mangrove ecosystem is one of the crucial ecosystems for climate and environmental balance. However, the existence of mangroves is increasingly threatened due to land-use changes, as seen on the Northern East Coast of Sumatra, particularly in the Langkat Regency area. The mangrove areas have been damaged due to illegal logging and gradually transformed into shrimp ponds and palm oil plantations. This situation prompted Pertamina EP Pangkalan Susu Field to initiate community-driven mangrove conservation through the Mangrove Edu-Ecotourism Program in Pasar Rawa. Utilizing a descriptive approach and qualitative data, this paper sought to explain the strategies implemented by Pertamina EP Pangkalan Susu Field in community-driven mangrove conservation and its positive impact on environmental ecosystems and community welfare. The results show that the Mangrove Edu-Ecotourism Program in Pasar Rawa consists of two main aspects. The first is the conservation aspect, demonstrated through activities such as mangrove seedling, planting, and education. The second aspect is community economic enhancement, manifested through the development of edu-ecotourism and MSMEs. Ultimately, the program has succeeded in realizing mangrove preservation and improving the living standards of the coastal communities in Pasar Rawa Village. The community, which was previously indifferent to preserving the mangrove ecosystem, has now become an integral part of its conservation efforts.

Keyword: *Mangrove Conservation; Edu-Ecotourism; Economic Enhancement.*

A. INTRODUCTION

Mangrove forests, which are scattered in tropical and subtropical coastal waters and estuaries, represent one of the most productive ecosystems (Sholeh, Evianovita, Mayasari, & Sudewo, 2024). Along with seagrass beds and coral reef ecosystems, mangroves play a crucial role in maintaining the ecological balance of our planet, particularly within aquatic ecosystems that span the sea, coast, and land (Aipassa, Apono, Siahaya, Ruslim, & Kristiningrum, 2023). Beyond their ecological significance, mangrove forests, situated at the intersection of land and sea, provide significant social and economic benefits to humanity. Mangrove forests serve as habitats for flora and fauna, thus playing an essential role in the economy and livelihoods of coastal communities through blue economy activities, tourism, and the production of timber and non-timber products (Islam & Bhuiyan, 2018). According to Hamilton and Friess (2018), each hectare of mangrove forest in Indonesia has an annual economic potential of US$106 from fish, mollusk, and crustacean catches and US$423 from crab potential (United Nations Environment Programme, 2023).

The presence of mangrove forests is capable of protecting coastal areas from various natural disaster threats such as storms, erosion, and even tsunamis. Mangroves also play a vital role in the global environment, especially in climate change mitigation, due to their higher effectiveness in storing and absorbing carbon compared to other types of tropical and

subtropical forests (Ilman, Dargusch, Dart, & Onrizal, 2016) (Kauffman & Donato, 2012). The carbon stock of mangroves in Indonesia is recorded at 891.70 tons of carbon per hectare, with a total national mangrove carbon stock of 2.89 TtC (Easteria, Imran, & Yulianto, 2022). Furthermore, the high biodiversity and unique value of mangrove areas make them suitable for development into nature tourism and educational activities (Arifanti, et al., 2022).

The total area of mangrove forests worldwide reaches 16 million hectares, spread across tropical and subtropical regions, including Asia, Africa, and the Americas (Onrizal, 2010). According to the National Mangrove Map, the total area of Indonesia's mangrove ecosystem reaches 3,364,076 hectares, or 20.37% of the world's total. This area consists of 92.78% dense mangroves, 5.60% moderate mangroves, and 1.62% sparse mangroves (Direktorat Konservasi Tanah dan Air, Ditjen PDASRH, 2021). In addition, 756,182.62 hectares still have the potential to be mangrove habitats (Badan Restorasi Gambut dan Mangrove, 2023).

Although mangrove forests play a significant role in ecosystems, their existence and preservation are not immune to degradation and shrinkage threats. Mangrove forest degradation is one of the most significant threats, with one of the main factors being rapid population growth leading to increased development in surrounding areas. Mangrove lands are often converted for residential, industrial, aquaculture, and other activities, causing the mangrove area to shrink (Sholeh, Evianovita, Mayasari, & Sudewo, 2024). Moreover, human activities (anthropogenic) contribute the most to mangrove forest damage in Indonesia. The conversion of mangrove forests for fisheries, plantations, agriculture, salt ponds, settlements, industries, legal and illegal logging, and mining are the main anthropogenic activities causing the degradation and loss of mangrove forests in Indonesia (Eddy, Mulyana, Ridho, & Iskandar, 2015).

Mangroves in Indonesia have been declining over the past six centuries. For example, in Java, deforestation has resulted in the loss of more than 70% of the original mangrove areas. The rate of mangrove loss began to increase dramatically in the 1970s when exploitation shifted to new areas outside Java, particularly in Kalimantan and Sulawesi, driven by government policies that increased timber production, followed by policies on aquaculture expansion in the 1980s and large-scale pond development triggered by rising shrimp prices during the 1997 Asian financial crisis. The result was a loss of nearly 800,000 hectares of mangrove forests in just 30 years (Ilman, Dargusch, Dart, & Onrizal, 2016).

The eastern coast of North Sumatra, stretching from Langkat to North Labuhanbatu, faces significant challenges. Environmentally unfriendly practices such as encroachment, land clearing for aquaculture, palm oil plantations, mangrove charcoal industries, and sand dredging are the main causes of the destruction of the green belt. In Paluh Sibaji Village, Pantai Labu District, Deli Serdang Regency, fishermen are facing increasingly alarming erosion problems. Hundreds of meters of thick mangrove forests have disappeared, leaving only a small portion of mangroves as the last line of defense. Additionally, the mangrove forest in Sei Siur Village, Pangkalan Susu District, Langkat Regency, North Sumatra, is gradually being converted into aquaculture areas palm oil plantations and is being repurposed for steam power plant (PLTU) areas. Over time, the livelihood of traditional fishermen, who rely on the mangrove ecosystem, has become increasingly difficult due to the conversion of mangrove forests (Dewantoro, 2023).

According to data from the Peatland and Mangrove Restoration Agency (BRGM), the remaining mangrove forest area in North Sumatra Province is 57,490 hectares. Meanwhile, the potential or damaged mangrove area amounts to 29,417 hectares. This potential mangrove area comprises accretion land (16,883 hectares), fishponds (9,418 hectares), open land (2,891 hectares), eroded mangroves (153 hectares), and eroded areas covering 72 hectares (Sinaga, 2023). Specifically, in Langkat Regency, the mangrove area covers 20,606 hectares, consisting

of dense mangroves spanning 14,593 hectares, moderate mangroves covering 4,498 hectares, and sparse mangroves over 1,515 hectares. The potential area for mangrove rehabilitation is 4,589 hectares, consisting of eroded areas, open land, fishponds, and accretion land (Mulkan, 2024).

The conservation and rehabilitation of mangroves in North Sumatra, particularly in Langkat Regency, are crucial for protecting and restoring coastal ecosystems vital to human and environmental well-being. Langkat Regency, with its long coastline and extensive mangrove ecosystems, faces serious threats from land conversion for agriculture, fisheries, logging, and unsustainable infrastructure development. The damage to mangrove ecosystems has direct negative impacts, such as reduced fish species abundance, mangrove area pollution, water quality degradation, rising sea levels, global climate change, coastal erosion, abrasion, potential salinity intrusion, and increased coastal area acidity (Cahyaningsih A. P., et al., 2022) (Bhowmik, Padmanaban, Cabral, & Romeiras, 2022).

Mangrove conservation efforts require collaborative work and multi-actor contributions to ensure the optimal achievement of the main objectives: preserving, improving, and restoring damaged mangrove ecosystems. One of the key players is the involvement of businesses and the community. Businesses or the private sector, including state-owned enterprises, play a significant role in mangrove conservation and restoration efforts. This role can take the form of initiatives through the management of social and environmental responsibility programs that focus on biodiversity conservation and efforts to improve the quality of life for local communities (Sam, Zabbey, Gbaa, Ezurike, & Okoro, 2023). Private sector participation can be realized in various ways, such as partnerships with the government (public-private partnerships), funding assistance for mangrove rehabilitation, promoting the establishment of legislation, and various other activities. (Eger, et al., 2022)

In response to the ongoing degradation of mangroves in the Langkat Regency, North Sumatra Province, PT Pertamina EP Pangkalan Susu Field has taken action by participating in conservation efforts through the Mangrove Edu-Ecotourism Program in Pasar Rawa. The program, located in Pasar Rawa Village, Gebang District, Langkat Regency, was initiated due to issues such as illegal mangrove logging for charcoal and building materials for houses on rivers and the conversion of mangrove land into illegal oil palm plantations and fishponds. These activities have led to a decline in fish, shrimp, and crab catches for the fishermen of Pasar Rawa Village, as these animals naturally live among the mangrove roots. Consequently, some fishermen turned to mangrove wood collection, perpetuating a vicious cycle of mangrove destruction that lasted from 2006 to 2019.

The Mangrove Edu-Ecotourism Program in Pasar Rawa aims to transform Pasar Rawa Village into an educational, environmentally conscious tourism village to enhance economic welfare and mangrove conservation. This program aligns with efforts to empower the local economy while preserving mangroves and their ecosystems to protect them from the threats of mangrove logging, coastal erosion, and land conversion through the appropriate and responsible use of forests.

Based on the above description, this paper seeks to explain the strategies for community-based mangrove conservation efforts undertaken by Pertamina EP Pangkalan Susu Field through the Edu-Ecotourism Mangrove Program in Pasar Rawa and its positive impacts on environmental ecosystems and community welfare.

B. METHODS

A descriptive research method utilizing qualitative data was employed in this study. The qualitative descriptive research method was chosen because it can generate data and provide explanations regarding who, what, and where events or experiences occur from a subjective

viewpoint (Kim, Sefcik, & Bradway, 2016). This method offers clarity in terms of the phenomena being studied and the methods employed by the researchers, as the data collected remains closely connected to the phenomenon throughout the study (Doyle, McCabe, Keogh, & Brady, 2020). We gathered data and documents from internal sources at PT Pertamina EP Pangkalan Susu Field, conducted focus group discussions with program beneficiaries, carried out field observations, and collected scientific data from related studies on community-based mangrove conservation. The obtained data were then analyzed and interpreted to explain how the Mangrove EDU-Ecotourism Program of Pasar Rawa contributes to ecosystem sustainability and community welfare.

C. RESULTS AND DISCUSSION

1. Community-Based Mangrove Conservation

Mangroves, as a biodiversity-rich ecosystem that plays a crucial role in climate regulation, must be preserved. One way to achieve this is through conservation efforts. A well-maintained coastal mangrove ecosystem, supported by awareness and a shared perception among various stakeholders about the importance of mangroves, will have a positive impact on coastal sustainability (Suraningsih, 2020). Generally, biodiversity conservation can be conducted through two methods: *in situ* and *ex situ*. *In situ* conservation refers to the preservation of genetic resources in their natural habitats, such as forests or other native ecosystems. Conversely, *ex-situ* conservation involves the relocation of endangered or rare species from their natural habitats to artificial protected areas. *Ex-situ* conservation is an important alternative strategy when in-situ conservation is not feasible (Ajayi, 2019).

Mangrove conservation efforts can be carried out through various strategies such as rehabilitation and restoration, institutional arrangements, and regulatory frameworks for mangrove protection, as well as direct community involvement in the conservation process. Mangrove rehabilitation and restoration efforts aim to restore damaged mangroves to reinstate their ecological functions, such as protecting coastal areas and maintaining biodiversity within the mangrove ecosystem. These efforts include ecological engineering, planting, and the application of the Ecological Mangrove Restoration (EMR) approach (Ellison, Felson, & Friess, 2020). Rehabilitation and restoration activities will be more effective if supported by the institutionalization of mangrove protection regulations enacted by the government. One example is the green belt policy, which designates a mangrove protection zone along the coast where logging, conversion, or other destructive activities are prohibited (Djamaluddin, 2018).

The involvement of multiple stakeholders in mangrove conservation is essential, including direct participation from local communities. Community participation in natural resource management is fundamental to ensuring the sustainability of the efforts. In mangrove conservation, the community plays a vital role and, therefore, should be involved in program planning, implementation, and evaluation to instill a sense of responsibility regarding the long-term sustainability of their mangroves (Cahyaningsih A. P., et al., 2022).

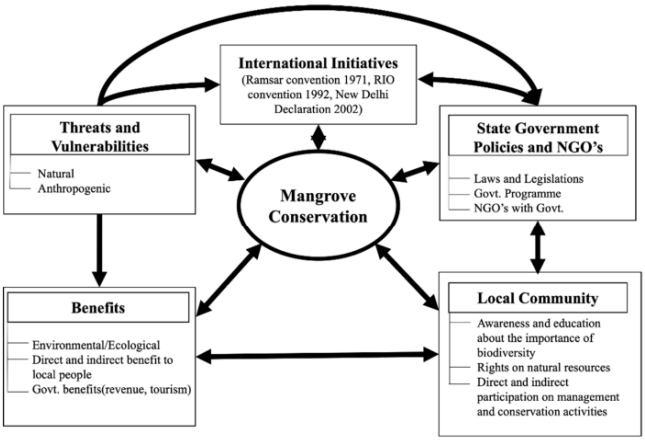

Figure 1. Conceptual framework for mangrove conservation (Mondal, Bowers, & Ali, 2021).

The success or failure of a natural resource conservation effort is highly dependent on the local community. Therefore, the process must be mindful of the rights of local communities through what is known as community-based conservation. Stakeholders, including the community, can be involved in forest protection and mangrove reforestation, providing economic support and even offering education and awareness to the public about sustainable mangrove management (Mondal, Bowers, & Ali, 2021).

2. Sustainable Mangrove Edu-Ecotourism

The development of sustainable tourism is becoming increasingly popular, including in mangrove areas. This strategy provides positive benefits for both humans and the mangrove ecosystem (Cahyaningsih A. P., et al., 2022). The natural resources of mangroves, such as their unique vegetation formations, fauna, and the associations within the mangrove ecosystem, have the potential to be developed as tourist attractions that offer educational and conservation concepts known as ecotourism. Ecotourism is one of the alternative programs that can be implemented to improve the welfare of local communities to prevent damage to the mangrove ecosystem (Wardhani, 2011).

The philosophy of ecotourism is a response to human concerns over rapid and significant industrial growth and its consequences on the environment, communities, and culture (Buckley, 2012). Ecotourism is then intended as a type of tourism related to visiting natural areas and all types of living organisms. In other words, ecotourism is travel to natural areas that protect environmental resources to stabilize the welfare of local communities and includes interpretation and education about ecosystems (Hafezi, Bijani, Gholamrezai, Savari, & Panzer-Krause, 2023).

The development of nature-based educational tourism in the mangrove ecosystem is the embodiment of the edu-ecotourism concept. Edu ecotourism is a combination of ecotourism infused with educational elements that are currently being widely developed (Susanto, 2021). The natural environment, local cultural heritage, community participation, and the welfare of residents are important elements in edu-ecotourism. The involvement of residents is also a crucial aspect to consider in the development of edu-ecotourism. Indirectly, the community will be empowered through the edu-ecotourism program, which will have an impact on the local economy (Ridlwan, Muchsin, & Hayat, 2017). This involvement of residents is what is known as community-based edu-ecotourism.

Community-based edu-ecotourism is a form of community-based tourism that has gained attention in recent years because it is believed to support ecological, social, and cultural

sustainability in tourism practices. Community-based tourism, in its various forms, is promoted as a means of empowerment and economic development for communities. For local communities, the benefits of community-based tourism are seen as tools to combat poverty, improve welfare, encourage local participation, and certainly contribute to the preservation of natural ecosystems (Diarta & Pitana, 2022).

3. The Role of PT Pertamina EP Pangkalan Susu Field in the Mangrove Edu-Ecotourism Program in Pasar Rawa

Pertamina EP Pangkalan Susu Field is a unit of the state-owned oil and gas company involved in exploration, with its operational area located in Langkat Regency, North Sumatra Province. As a state-owned oil and gas company that thrives within the community, various programs have been implemented to demonstrate its commitment to environmental and social improvement. One such effort is the community-based mangrove conservation initiative through the Mangrove Edu-Ecotourism Program in Pasar Rawa.

This Edu-Ecotourism Program was initiated in 2022 under the Community Development Program (PPM) of Pertamina EP Pangkalan Susu Field in collaboration with the Kelompok Tani Hutan (KTH) Penghijauan Maju Bersama of Pasar Rawa Village and Kesatuan Pengelola Hutan (KPH) 1 Stabat. The activities conducted include the construction of a mangrove walking track, the revitalization of a literacy library, the planting of 2,500 mangrove seedlings in 2022 and 1,500 seedlings in 2023, the revitalization of a small-scale seafood processing house, and the construction of an aquarium to hold catches such as fish, shrimp, and crabs before further processing. The program consists of three main phases: program planning, implementation, and monitoring and evaluation.

a. Program Planning Phase

The initial concept of the Mangrove Edu-Ecotourism Program in Pasar Rawa emerged following the completion of social mapping in 2022. The social mapping data indicated issues such as the illegal logging of mangroves for charcoal and building materials for houses on the river and the conversion of mangrove land into palm oil plantations and illegal fish ponds. These activities resulted in flooding and a decline in fishermen's income in Pasar Rawa Village due to the destruction of habitats for fish, shrimp, and crabs that thrive around mangrove roots. Consequently, some fishermen turned to harvesting mangrove wood, creating a vicious cycle of mangrove destruction that persisted from 2006 to 2019.

The Mangrove Edu-Ecotourism Program aims to transform Pasar Rawa Village into an educational and environmentally conscious tourist village. This effort seeks to improve economic welfare and the conservation of mangroves, protecting them from threats such as mangrove logging, coastal erosion, and land conversion. In response to these challenges, Pertamina EP Pangkalan Susu Field partnered with the Kelompok Tani Hutan Penghijauan Maju Bersama and Kesatuan Pengelola Hutan (KPH) 1 Stabat to initiate a mangrove conservation program.

b. Implementation Phase

The Mangrove Edu-Ecotourism Program in Pasar Rawa targets fishermen, housewives, and former charcoal makers, directly benefiting 23 individuals who are members of KTH Penghijauan Maju Bersama. The program's primary focus is on mangrove conservation and community empowerment to enhance environmental quality and well-being. This is achieved through various activities such as mangrove nurseries and planting, the development of a mangrove walking track, libraries, fishing spots, the revitalization of a small-scale seafood processing house, and the construction of an aquarium for fishermen's catches.

Mangrove nurseries and planting

The degradation of mangroves in certain areas along the coastal regions of Langkat Regency has left some land barren of mangroves. To address this, mangrove planting has been undertaken in 2022 and 2023. In 2022, 3,500 *Rhizophora* sp. mangrove seedlings were planted, and in 2023, an additional 1,500 seedlings of the same species were planted. According to biodiversity index studies conducted in Pasar Rawa, this mangrove planting has contributed to the absorption of CO2 at a rate of 2.838 tons per hectare. The planting activities involved the Kelompok Tani Hutan Penghijauan Maju Bersama and Kesatuan Pengelolaan Hutan (KPH) 1 Stabat.

Figure 2. plant mangrove trees

Development of the mangrove exploration track

As part of efforts to develop the mangrove area into an educational ecotourism destination, various supporting facilities for visitors are essential. One such facility is an access pathway designed for exploring and observing the mangroves. Consequently, a mangrove exploration track, often referred to as a "mangrove boardwalk" or "mangrove walkway," was constructed along the riverbank. This track, built over or near the mangrove area using primarily wooden materials, serves as a vital facility for tourism development.

The mangrove track serves several functions, including tourism (observation, promotion, and education) and environmental protection. The track allows visitors to explore the mangrove ecosystem without damaging the existing vegetation. Additionally, it can be used as a pathway for monitoring and researching mangroves.

Development of an MSME

Fish are one of the readily available resources in the mangrove area. As the mangrove ecosystem improves, the diversity and quantity of seafood also increase. To enhance the local economy in the Pasar Rawa mangrove area, efforts have been made to develop an MSME focused on fishery products. This development initiative includes the revitalization of the production house and knowledge transfer to the Kelompok Tani Hutan Penghijauan Maju Bersama. Regular training sessions are conducted to teach them how to process low-economic-value fish into high-value products.

Figure 3. Baronang Crispy

The KTH Penghijauan Maju Bersama successfully processed baronang fish, which was previously discarded, into crispy baronang fish products. This MSME development involved a group of seven housewives, the majority of whom were the wives of fishermen.

c. Monitoring and evaluation phase

The Edu-Ecotourism Program that has been implemented is subject to periodic monitoring and evaluation every four months, along with regular weekly visits. This allows the company to identify the strengths and weaknesses of the program, which will serve as a basis for improvements in the next implementation period. In addition to program monitoring and evaluation, the company also conducts a Community Satisfaction Index (CSI) survey, particularly among the beneficiaries, with a CSI score of 91, indicating that the beneficiaries are very satisfied with the implementation of the community empowerment program.

The process of monitoring and evaluation in the community-based mangrove conservation program in Pasar Rawa Village, which has been developed as an educational ecotourism initiative, is crucial to ensuring the program's effectiveness and sustainability. Regular monitoring allows Pertamina EP Pangkalan Susu Field to track the progress of activities, such as the growth of planted mangroves, the level of community participation, and the program's environmental impact. This is essential to ensure that every conservation and community empowerment effort proceeds according to the established plans and objectives.

Moreover, comprehensive evaluation is key to assessing the long-term impact of the mangrove edu-ecotourism program and the Pasar Rawa community. Evaluation provides valuable feedback on how the program can be improved and further developed to optimize its benefits for both the environment and the community. Additionally, the results of the evaluation can be used to disseminate information about mangrove conservation to stakeholders, garner additional support, and attract greater participation and investment in future conservation efforts.

The Mangrove Edu-Ecotourism Program in Pasar Rawa, initiated by Pertamina EP Pangkalan Susu Field in collaboration with the Penghijauan Maju Bersama beneficiary group, generally consists of two main aspects. The first is conservation efforts, and the second is economic improvement for the community. Conservation efforts are realized

through mangrove seedling, planting, and educational programs, while economic improvement is achieved through the development of ecotourism and MSMEs.

Mangrove Edu-Ecotourism Program in Pasar Rawa		
Conservation	**Economy**	**Involved Stakeholders**
- Mangrove nursery - Mangrove planting - Mangrove education	- Deveopment of Edu-Ecotourism (Construction of mangrove tracks) - Revitalization of MSME production kitchens - MSME training on crispy baronang fish processing	- Pertamina EP Pangkalan Susu Field - KTH Penghijauan Maju Bersama - Kesatuan Pengelola Hutan (KPH) 1 Stabat - Peatland and Mangrove Restoration Agency

Table 1. Matrix of Development Aspects and Involved Stakeholders in the Program

As stated by (Mondal, Bowers, & Ali, 2021), in mangrove conservation efforts, the involvement of multiple stakeholders is essential, particularly the local community, to ensure that the program operates optimally and sustainably. In the Mangrove Edu-Ecotourism Program in Pasar Rawa, there are at least three categories of stakeholders: Pertamina EP Pangkalan Susu Field, representing the business sector and serving as the program initiator; KTH Penghijauan Maju Bersama as the beneficiary community group; and the Kesatuan Pengelola Hutan (KPH) 1 Stabat and the Peatland and Mangrove Restoration Agency, representing the government entities responsible for mangrove ecosystem conservation.

The Mangrove Edu-Ecotourism Program in Pasar Rawa, implemented in Pasar Rawa Village, targets fishermen, housewives, and former charcoal makers, with 23 direct beneficiaries who are members of the KTH Penghijauan Maju Bersama. As the primary beneficiaries and leading actors in conservation activities, this group gains the most from the program. The direct economic impact of the program on KTH Penghijauan Maju Bersama members includes a group income of IDR 245,000,000 from Edu-Ecotourism and an income of IDR 10,000,000 per month for the Women's MSME Group from seafood processing during 2023. Moreover, the program has positively impacted the natural environment, as all components implemented are part of efforts to preserve the mangrove ecosystem.

This edu-ecotourism program has successfully reduced the community's previous habit of illegal mangrove logging. Through group activities such as communal work, socialization, and regular meetings, the bonds among fishermen, farmers, and mangrove conservationists along the coast have strengthened.

Ultimately, the program has improved the living standards of the coastal communities in Pasar Rawa Village. The community, once indifferent to the preservation of the mangrove ecosystem, has now become an integral part of its conservation efforts. The community has also developed creative abilities to leverage mangrove potential to increase income through ecotourism management and seafood processing into higher-value products.

D. CONCLUSION

The Mangrove Edu-Ecotourism Program in Pasar Rawa, initiated by Pertamina EP Pangkalan Susu Field in collaboration with the KTH Penghijauan Maju Bersama, is a part of community-based mangrove conservation efforts. Through its primary activities, including mangrove planting, ecotourism development, and the development of MSMEs for seafood processing, the program has not only succeeded in restoring and conserving the mangrove

ecosystem but has also had a broad positive impact on the surrounding environment and community. Mangrove planting has improved habitat quality, reduced coastal erosion, and enhanced the overall health of the coastal ecosystem.

From a social perspective, the program has strengthened local community engagement by giving them active roles in the conservation and management of the mangrove ecosystem. Through training and educational activities related to ecotourism, the community has gained a better understanding of the importance of mangroves and the benefits of their ecosystems. This has not only raised environmental awareness but also fostered a sense of ownership and responsibility towards natural preservation.

Economically, the program has made a positive contribution by developing MSMEs for seafood processing, providing new economic opportunities for the community. The development of edu-ecotourism has also attracted tourists, increased local income, and created new jobs. Overall, this program's initiation demonstrates that a community-based approach to mangrove conservation can yield holistic and sustainable benefits, encompassing environmental, social, and economic aspects synergistically.

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