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COMMUNITY ENGAGEMENT ARTICLE

Mangrove Planting and Blue Economy Education as an Effort to Preserve Coastal Ecosystems on Pari Island, Thousand Islands

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Abstract
Mangrove ecosystems play a strategic role in protecting coastlines from abrasion, supporting biodiversity, and mitigating climate change through blue carbon storage. Environmental pressures have degraded mangroves across Indonesia's coasts, including Pari Island, where observations revealed mild abrasion, declining vegetation, and limited understanding of blue economy-based conservation. This activity aimed to raise environmental awareness and support coastal rehabilitation through mangrove planting and blue economy education on Pari Island, Seribu Islands, in collaboration with Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta, Indonesia Blue Economy, and Maritim Muda Indonesia. A participatory approach was applied, comprising environmental outreach, blue economy education, planting technique training, and direct planting. Forty-seven participants planted 500 Rhizophora mucronata seedlings, and the average score increased from 61.5 (pre-test) to 87.3 (post-test). Beyond improving knowledge of mangrove functions and blue economy concepts, the activity strengthened collaboration among universities, environmental communities, and local residents for sustainable coastal development. These findings indicate that combining education with field action can raise awareness and support coastal rehabilitation.

Keywords
Mangrove; Blue Economy; Coastal Conservation; Community Service.

Abstrak
Ekosistem mangrove berperan strategis dalam melindungi garis pantai dari abrasi, mendukung keanekaragaman hayati, dan memitigasi perubahan iklim melalui penyimpanan karbon biru. Berbagai tekanan lingkungan telah menurunkan kualitas mangrove di pesisir Indonesia, termasuk Pulau Pari, tempat pengamatan menunjukkan abrasi ringan, penurunan vegetasi, dan pemahaman masyarakat yang terbatas tentang konservasi berbasis ekonomi biru. Kegiatan ini bertujuan meningkatkan kesadaran lingkungan sekaligus mendukung rehabilitasi pesisir melalui penanaman mangrove dan pendidikan ekonomi biru di Pulau Pari, Kepulauan Seribu, melalui kolaborasi Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta, Indonesia Blue Economy, dan Maritim Muda Indonesia. Pendekatan yang digunakan bersifat partisipatif, meliputi penyuluhan lingkungan, pendidikan ekonomi biru, pelatihan teknik penanaman, dan penanaman mangrove secara langsung. Sebanyak 47 peserta menanam 500 bibit Rhizophora mucronata, dengan nilai rata-rata meningkat dari 61,5 pada pre-test menjadi 87,3 pada post-test. Selain meningkatkan pengetahuan tentang fungsi mangrove dan konsep ekonomi biru, kegiatan ini memperkuat kolaborasi antara universitas, komunitas lingkungan, dan masyarakat lokal untuk pembangunan pesisir berkelanjutan. Temuan ini menunjukkan bahwa perpaduan pendidikan dan tindakan nyata dapat meningkatkan kesadaran lingkungan dan mendukung rehabilitasi pesisir.

Kata Kunci
Mangrove; Ekonomi Biru; Konservasi Pesisir; Pengabdian Masyarakat.

1 | INTRODUCTION

Indonesia harbors nearly a quarter of the world's mangrove population, yet this abundance does not automatically guarantee the sustainability of coastal ecosystems at the local level. Coastal communities such as those on Pari Island face direct threats from abrasion and ecosystem degradation that call for participatory rehabilitation models. Mangroves are among the most important ecosystems found in coastal areas, functioning as a natural barrier against abrasion, a wave breaker, a habitat for various marine life, and a highly effective carbon sink. With approximately 24% of the world's mangroves, Indonesia plays a crucial role in global coastal ecosystem conservation (Arifanti *et al*., 2022). Beyond their ecological functions, mangroves are also a vital part of the blue economy concept, as they support the sustainability of marine resources while providing direct economic benefits to coastal communities. The Indonesian government has even designated mangrove rehabilitation as one of its blue economy and low-carbon development strategies (The World Bank, 2022).

Despite their significant ecological and economic value, mangroves face mounting threats from coastal erosion, climate change, coastal development, and human activities that collectively drive ecosystem degradation. The latest global assessment indicates that approximately 50% of the world's mangrove ecosystems are threatened by human activities and climate change (Reuters, 2024). This condition confirms that possessing extensive mangrove reserves, as Indonesia does, does not automatically shield these ecosystems from environmental pressure, particularly on small islands with limited adaptive capacity. Pari Island, one of the inhabited islands in the Seribu Islands, has experienced increasing coastal abrasion and shoreline changes over the past decade, with several coastal areas remaining vulnerable to erosion, especially during periods of high waves and extreme weather. The decline of coastal vegetation, compounded by tourism pressure and broader environmental change, has heightened the need for participatory rehabilitation efforts involving local communities. Mangrove restoration and environmental education are therefore essential not only for ecological protection but also for sustaining local livelihoods that depend on fisheries and marine tourism.

As a marine tourism destination with substantial coastal resource potential, Pari Island relies heavily on the presence of mangroves to maintain coastal environmental stability, support the fisheries sector, and preserve its tourist appeal, making conservation efforts that actively involve the community an unavoidable necessity. Preliminary observations and discussions with local residents identified several key issues that shaped the design of this program: several coastal locations already exhibited signs of mild abrasion and declining mangrove density, local livelihoods remained highly dependent on fisheries and marine tourism, making coastal ecosystem degradation a direct socio-economic concern, and most residents had not previously received structured education on the relationship between mangrove conservation and the blue economy concept. Together, these findings formed the empirical basis for designing a community engagement program that combines environmental education with concrete conservation action.

Community involvement in environmental conservation is a decisive factor in the success of coastal resource management, as a participatory approach allows the community to become a key actor in sustaining environmental outcomes rather than a passive recipient of a short-term intervention. Building on this rationale, and as an implementation of the Tri Dharma of Higher Education, Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta, in collaboration with Indonesia Blue Economy and Maritim Muda Indonesia, carried out a community service activity in the form of blue economy education and mangrove planting on Pari Island on May 6–7, 2026. The objectives of this activity were to increase public understanding of the benefits of mangroves, raise environmental awareness in coastal communities, and support coastal area rehabilitation through mangrove planting. The activity was also intended to encourage the implementation of the blue economy concept in coastal resource management and to strengthen collaboration between universities, environmental communities, and society.

2 | BACKGROUND THEORY

2.1 Mangrove Ecosystem

Mangroves are coastal forest ecosystems that grow in tidal areas of tropical and subtropical regions, consisting of various plant species capable of adapting to extreme environmental conditions such as high salinity, seawater inundation, and oxygen-poor soil (Friess *et al*., 2019). Indonesia has approximately 3.3 million hectares of mangrove forest, or around 23% of the world's total mangrove area, making it the country with the largest mangrove area globally (Bunting *et al*., 2022). Beyond their extent, mangroves perform a crucial ecological function for the sustainability of coastal ecosystems: their root systems retain sediment and reduce wave energy, allowing them to act as a natural barrier that protects coastlines from abrasion, erosion, and the impact of tropical storms (Alongi, 2014). Mangroves also serve as spawning grounds, feeding grounds, and habitat for various species of fish, shrimp, crabs, birds, and other marine organisms, reinforcing their position as one of the most biologically productive coastal ecosystems.

From an economic perspective, mangroves provide both direct and indirect benefits to coastal communities. Direct

benefits include fisheries, timber, honey, and other derivative products, while indirect benefits encompass coastal protection, the provision of ecosystem services, and support for nature-based tourism (The World Bank, 2022). Mangrove sustainability is therefore closely linked to the well-being of coastal communities that depend on these resources for their livelihoods. Despite their significant benefits, however, mangrove ecosystems continue to face threats from land conversion, coastal development, pollution, and climate change. According to a report by the International Union for Conservation of Nature (IUCN), more than 35% of the world's mangrove ecosystems have been degraded in recent decades, underscoring the need for ongoing rehabilitation and conservation efforts (Friess *et al*., 2019).

2.2 Blue Economy

The concept of the Blue Economy was first introduced by Pauli (2010) as a development approach that utilizes marine resources sustainably to generate economic growth, improve community welfare, and preserve the marine environment. Over time, the Blue Economy has become a key global development agenda, supported by the United Nations through Sustainable Development Goal (SDG) 14 on life below water. According to Leonardo *et al*. (2023), the Blue Economy is defined as the utilization of marine resources for economic growth, improved community livelihoods, and job creation, while maintaining the health of marine ecosystems, an approach that emphasizes balance between resource exploitation and environmental conservation rather than treating the two as mutually exclusive. In Indonesia, the Blue Economy is implemented through various programs such as mangrove rehabilitation, sustainable fisheries management, the development of marine protected areas, and the reduction of marine plastic waste, with the Ministry of Maritime Affairs and Fisheries positioning it as a primary strategy for marine sector development that supports national economic growth while maintaining the sustainability of marine resources. Within this framework, mangrove ecosystems constitute a crucial component of the Blue Economy because they contribute to increased fisheries productivity, coastal protection, and blue carbon storage. Mangrove rehabilitation, accordingly, does not merely yield environmental benefits but also generates tangible economic impacts for coastal communities.

2.3 Mangroves and Climate Change Mitigation

Climate change is one of the greatest challenges facing the world today, with rising global temperatures, rising sea levels, and the increasing frequency of hydrometeorological disasters exerting significant impacts on coastal areas. In this context, mangroves play a strategic role as a nature-based solution for climate change mitigation and adaptation, and are recognized as one of the most effective carbon sinks compared to other terrestrial ecosystems. Donato *et al*. (2011) found that carbon reserves in mangrove ecosystems can be up to four times greater than those in terrestrial tropical forests, with carbon stored not only in vegetation biomass but also in sediment layers that can persist for hundreds to thousands of years. The concept of blue carbon refers to carbon stored by coastal ecosystems such as mangroves, seagrasses, and tidal marshes. According to Arifanti *et al*. (2022), mangrove conservation and restoration have the potential to contribute significantly to achieving Indonesia's emission reduction targets within the Nationally Determined Contributions (NDC) framework. Beyond their mitigation function, mangroves also play a role in climate change adaptation by protecting coasts from storm surges, reducing the risk of coastal flooding, and increasing community resilience to the impacts of climate change, making mangrove rehabilitation a strategy consistently recommended across various sustainable development policies.

2.4 Community Participation in Environmental Conservation

Community participation is a key principle in sustainable development and community-based natural resource management. According to Chambers (2012), community participation does not merely mean involvement in program implementation but also encompasses involvement in planning, decision-making, and evaluation of activities. In the context of environmental conservation, community participation plays a crucial role in increasing program effectiveness, as community involvement creates a sense of ownership that encourages program sustainability once the intervention has concluded. Various studies have shown that mangrove rehabilitation programs involving communities achieve higher success rates than programs implemented in a purely top-down manner (Mansuri & Rao, 2013). Participatory approaches also contribute to strengthening community capacity through knowledge transfer, skills development, and the formation of social networks, allowing community service activities to function as a collaborative learning process between academics and local communities. Green and Haines (2023) explain that asset-based community development is an effective approach to strengthening community capacity for the sustainable management of local resources; in the context of mangrove conservation, this approach encourages communities to draw on local potential as a primary resource for environmental development. Through education and mangrove planting activities on Pari Island, the community becomes not merely a beneficiary but also a key actor in coastal environmental conservation, an approach expected to foster program sustainability and strengthen long-term community environmental awareness.

3 | METHOD

A community service activity was held on May 6–7, 2026, on Pari Island, South Seribu Islands District, Jakarta Province. This activity was a collaboration between the Master of Management Study Program, Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta, Indonesia Blue Economy, and Maritim Muda Indonesia. The program was designed to increase environmental awareness in coastal communities while supporting the rehabilitation of mangrove ecosystems through an educational and participatory approach.

3.1 Activity Approach

The method used in this activity was Participatory Community Engagement (PCE), a community empowerment approach that positions the community as both subject and partner in the planning, implementation, and evaluation of activities. This approach was chosen because it is considered capable of increasing a sense of ownership, active participation, and the sustainability of environmental conservation programs. The implementation of the activity integrated three main components: environmental education to increase participants' knowledge of the functions and benefits of mangroves, technical training to provide practical skills in planting and maintaining mangroves, and conservation action in the form of direct mangrove planting in coastal areas experiencing environmental stress.

3.2 Activity Location and Participants

The activity was conducted in the coastal area of Pari Island, where, based on initial observations, there were indications of mild abrasion and reduced mangrove vegetation at several points along the coast. A total of 47 participants took part, consisting of local residents, students, lecturers, and representatives of partner organizations, as shown in Table 1.

Table 1. Composition of Activity Participants

Participant Category	People
Pari Island Community	30
Students	5
Lecturers and Community Service Team	4
Indonesia Blue Economy	2
Indonesian Young Maritime	6
Total	47

The involvement of these various stakeholders was intended to build multi-stakeholder collaboration in support of sustainable coastal environmental conservation.

3.3 Activity Implementation Stages

Program implementation was carried out through five main stages.

1) Preparation and Needs Identification Stage
   The initial stage was carried out through coordination with Indonesia Blue Economy, Maritim Muda Indonesia, and representatives of the Pari Island community. At this stage, the team surveyed potential mangrove planting locations, identified coastal environmental conditions, determined the exact planting points, arranged the provision of mangrove seedlings, and prepared both the environmental education materials and the evaluation instruments to be used later in the program. The identification results confirmed the need for mangrove vegetation rehabilitation in several coastal areas vulnerable to abrasion.
2) Environmental Education and Blue Economy Stage
   Educational activities were carried out in the form of outreach and interactive discussion, covering the ecological function of mangroves in maintaining coastal ecosystems, the role of mangroves in mitigating climate change through blue carbon storage, the impact of abrasion, pollution, and climate change on coastal areas, the Blue Economy concept and its implementation in sustainable development, and the role of the younger generation in marine and coastal environmental conservation. The material was delivered through presentations, group discussions, case studies, and a question-and-answer session to encourage active participant engagement.
3) Mangrove Planting Technique Training Stage
   After receiving the educational materials, participants took part in technical training on mangrove planting facilitated by the community service team and environmental practitioners. The training covered the introduction of mangrove species suitable for the site's characteristics, techniques for selecting healthy seedlings, preparation of the planting area, correct planting techniques, and post-planting maintenance and monitoring. The mangrove species used was *Rhizophora mucronata*, selected for its strong adaptation to the coastal conditions of Pari Island.

4) Mangrove Planting Stage
The core activity, mangrove planting, was carried out in groups under the guidance of the implementation team, with a total of 500 *Rhizophora mucronata* seedlings planted in the predetermined coastal area. The planting process involved determining planting points, digging planting holes according to substrate conditions, planting the seedlings, installing markers at each planting location, and documenting the activity throughout. This stage was intended to increase mangrove vegetation cover while giving participants firsthand experience of the importance of coastal ecosystem rehabilitation.
5) Evaluation and Reflection Stage
The evaluation instrument consisted of ten multiple-choice questions administered to all 47 participants before and after the educational session. The questionnaire covered four indicators: knowledge of mangrove ecological functions (3 items), understanding of coastal ecosystem degradation and abrasion (2 items), understanding of the blue economy concept (3 items), and community participation in environmental conservation (2 items). Each correct response received one point, and the final score was converted into a percentage scale ranging from 0 to 100. In addition, a participant satisfaction survey was conducted using a 1–5 Likert scale covering aspects of the material, resource persons, activity implementation, and program benefits.

3.4 Data Analysis Techniques

Quantitative data obtained from the pre-test and post-test results were analyzed descriptively by comparing the average scores before and after the activity, with improvement in participant understanding calculated based on the percentage increase in the average score. Participant satisfaction data were likewise analyzed using frequency distributions and percentages to illustrate the level of participant acceptance of the program, while qualitative data obtained through field observations and group discussions were analyzed descriptively to identify changes in perception, participation levels, and community commitment to coastal environmental conservation.

3.5 Program Success Indicators

Program success was measured based on several indicators, namely the level of participant participation across all activities, the increase in the average post-test score compared to the pre-test, the number of mangrove seedlings successfully planted, the level of participant satisfaction with the activity, and the extent of community commitment established to support sustainable mangrove conservation on Pari Island. Through these indicators, the community service activity was assessed not only by the number of seedlings planted, but also by the increase in community capacity and awareness in maintaining the sustainability of coastal ecosystems.

4 | RESULT AND DISCUSSION

4.1 Results

The community service activity held on May 6–7, 2026, on Pari Island successfully engaged various stakeholders, including local residents, students, lecturers, Indonesia Blue Economy, and Maritim Muda Indonesia. The participatory approach implemented enabled participants to actively engage in the entire series of activities, from environmental education and technical training to mangrove planting. Overall, 47 participants attended the activity, demonstrating a high level of participation throughout the program, with their enthusiasm evident in active engagement during discussions, Q&A sessions, and planting practice, as well as in their commitment to supporting mangrove conservation efforts after the activity concluded.

Figure 1. Environmental Education and Blue Economy Activity

To measure the effectiveness of the educational program, a pre-test and post-test were conducted on all participants, and the evaluation results showed a significant increase in understanding of the ecological function of mangroves, the concept of the blue economy, and the importance of coastal environmental conservation, as summarized in Table 2.

Table 2. Participant Knowledge Evaluation Results

Indicator	Pre-Test	Post-Test
Average score	61.5	87.3
Participants with a score >75	22%	89%
Understanding of mangrove functions	58%	91%
Understanding of the blue economy concept	42%	88%

According to Table 2, the average participant score increased by 25.8 points after participating in the program, while the percentage of participants scoring above 75 rose from 22% to 89%, indicating that the educational method combined with field practice was effective in increasing participant understanding. The largest increase occurred in understanding of the blue economy concept, from 42% to 88%, a finding that suggests most participants had previously not understood the relationship between environmental conservation and sustainable economic development. After participating in the activity, participants began to understand that preserving coastal resources is a long-term investment that supports community welfare. In addition to increasing knowledge, this activity resulted in coastal area rehabilitation through the planting of 500 *Rhizophora mucronata* mangrove seedlings in a coastal area that, based on initial observations, was experiencing environmental stress in the form of mild to moderate abrasion. *Rhizophora mucronata* was chosen for this purpose because the species adapts well to shallow water conditions, muddy substrates, and relatively high salinity levels, and is known to have a high growth success rate in mangrove rehabilitation programs across Indonesia. Planting was carried out in groups so that each participant gained hands-on experience in coastal ecosystem rehabilitation techniques, making the activity not only ecologically beneficial but also an effective tool for experiential learning. Beyond the improvement in knowledge, participants also demonstrated increased practical capacity in mangrove rehabilitation. During field activities, they were able to identify suitable planting locations, select healthy *Rhizophora mucronata* seedlings, apply proper planting techniques, and understand basic post-planting maintenance procedures, with facilitators observing that most participants were able to carry out planting activities independently after receiving technical training.

Figure 2. Mangrove Seedling Planting Activity

Participant satisfaction evaluations were conducted to determine perceptions of the quality of the activity's implementation, and the results indicated that participants gave very positive assessments across all aspects of the activity, as shown in Table 3.

Table 3. Participant Satisfaction Level

Assessment Aspect	Percentage Satisfied
Activity Material	96%
Informant	95%
Field Practice	98%
Activity Benefits	97%
Overall Satisfaction	97%

The highest level of satisfaction was found in the field practice aspect, at 98%, indicating that participants more easily understood environmental conservation material when it was accompanied by direct field experience. In addition, 97% of participants stated that the activity provided significant benefits in increasing their environmental awareness. Beyond these quantitative indicators, the activity also generated a number of social and environmental impacts identified through field observations and group discussions. These included increased participant awareness of the importance of preserving coastal ecosystems, the building of community commitment to sustainable mangrove conservation, stronger collaboration between universities, environmental communities, and local communities, the establishment of a collaborative network for future environmental conservation activities, and increased understanding among the younger generation regarding the concept of the blue economy and sustainable development. Taken together, these results indicate that the community service activity produced outcomes extending well beyond the seedlings planted, contributing to meaningful change in participants' knowledge, attitudes, and behavior regarding environmental conservation.

4.2 Discussion

The results of the activity indicate that an environmental education approach combined with direct conservation action increased participants' knowledge and awareness regarding the importance of coastal ecosystem preservation. The increase in participants' average score from 61.5 to 87.3 suggests that experiential learning methods are effective in strengthening public understanding of environmental issues, a finding consistent with Pranitasari *et al*. (2024), who found that training-based interventions significantly improve participants' self-efficacy and optimism, suggesting that experiential learning can strengthen both knowledge acquisition and long-term behavioral commitment toward sustainable practices. According to Acut (2024), learning involving direct experience has a stronger impact on changes in knowledge and behavior than conventional learning methods; in the context of this activity, participants' involvement in mangrove planting provided an opportunity to concretely understand the ecological functions of mangroves and the challenges faced in coastal area management.

The increase in participants' understanding of mangrove functions from 58% to 91% indicates that the educational activity successfully strengthened community environmental literacy, aligning with research by Friess *et al*. (2019), which states that increasing public awareness is a critical factor in the long-term success of mangrove rehabilitation, as communities that understand the ecological benefits of mangroves tend to have a stronger commitment to protecting and preserving coastal areas than those without adequate knowledge. This is consistent with the ecological role mangroves play in maintaining the stability of coastal ecosystems: their root systems retain sediment, reduce wave energy, and protect coastlines from abrasion and erosion, while also serving as habitat for various species of fish, shrimp, crabs, mollusks, and waterbirds, all of which carry economic value for coastal communities (Alongi, 2014). Mangrove rehabilitation through the planting of 500 *Rhizophora mucronata* seedlings in this activity therefore provides not only environmental benefits but also the potential to support the sustainability of livelihoods for communities dependent on the fisheries and tourism sectors, an approach that aligns with Brown *et al*. (2014), who emphasize community participation and ecosystem recovery as key elements of successful coastal restoration initiatives.

The success of this activity was also evident in participants' increased understanding of the Blue Economy concept, with post-test results showing an increase from 42% to 88%. This finding indicates that most participants had previously not understood the link between environmental conservation and economic development, and that after participating in the activity, they began to understand that coastal resource conservation is a long-term investment capable of supporting community well-being. The initially low level of understanding regarding the blue economy concept suggests that previous environmental programs may have focused primarily on ecological conservation without sufficiently linking environmental protection to tangible economic benefits, as environmental sustainability is often perceived by coastal residents as separate from livelihood improvement. The participatory workshops conducted in this program helped bridge this gap by demonstrating how mangrove conservation can support fisheries productivity, ecotourism development, and long-term coastal resilience, a pattern also reported by Lhosupasirirat *et al*. (2023), who found that improving community knowledge of mangrove ecology and restoration techniques significantly contributes to the long-term success of restoration programs. This finding highlights the importance of integrating environmental education with local economic realities in order to achieve more sustainable behavioral change.

The substantial increase in participants' understanding of the blue economy concept further suggests that the primary knowledge gap was not ecological awareness alone, but rather the limited ability of participants to connect environmental conservation with long-term livelihood security. In Pari Island, where fisheries and marine tourism constitute important sources of income, demonstrating the economic value of mangrove conservation helped participants better appreciate the relevance of environmental protection to their daily lives, and this context-specific approach likely contributed to the effectiveness of the intervention. The Blue Economy concept itself emphasizes the sustainable use of marine resources to generate economic growth without damaging the environment; according to Leonardo *et al*. (2023), it is a development approach capable of simultaneously generating economic growth, improving community welfare, and preserving marine ecosystems. In the context of Pari Island, which holds strong potential for marine tourism and fisheries, the presence of mangroves is a strategic asset supporting the implementation of the blue economy, given their role in

maintaining aquatic productivity, increasing the attractiveness of nature-based tourism, and protecting coastal infrastructure from the threat of abrasion and sea level rise.

From a climate change mitigation perspective, mangrove planting activities make a significant contribution, as mangroves are known to be among the ecosystems with the highest carbon storage capacity in the world. Donato *et al*. (2011) state that carbon reserves stored in mangrove ecosystems can be three to five times greater than those in terrestrial tropical forests, with carbon stored not only in vegetation biomass but also in sediment layers that can persist for hundreds of years, making mangrove rehabilitation one of the recommended nature-based strategies to support greenhouse gas emission reduction. Research by Arifanti *et al*. (2022) further demonstrates that mangrove conservation and restoration in Indonesia hold significant potential to support the achievement of Indonesia's Nationally Determined Contributions (NDC) targets. In this context, the community service activity conducted on Pari Island provides benefits not only at the local level but also contributes to the national agenda of climate change mitigation, as increasing mangrove vegetation cover will improve the coastal area's capacity to absorb carbon and cope with the impacts of climate change.

Beyond these ecological benefits, the activity also generated significant social impacts. The high overall participant satisfaction rate of 97% indicates that the program was well received by the community, while the particularly high satisfaction rate for field practice (98%) suggests that the community understood conservation material more easily when directly involved in the activities. This finding aligns with research by Chambers (2012), who explains that a participatory approach can increase the effectiveness of community empowerment programs because the community not only receives information but also gains direct experience in implementing the activities. Community participation is, indeed, a key factor in the success of environmental conservation programs, a conclusion also supported by Pranitasari *et al*. (2024), who emphasize that community empowerment programs become more sustainable when they combine training, mentoring, and stakeholder collaboration to strengthen participant engagement and program ownership. Mansuri and Rao (2013) similarly explain that participatory development programs achieve higher success rates because they foster a sense of ownership in the program; in this activity, the Pari Island community played a role not merely as participants but also as partners involved in the planning, implementation, and evaluation of the activities, an involvement that has the potential to increase the program's sustainability because the community feels responsible for the success of mangrove rehabilitation. This finding is further consistent with Kusumadewi *et al*. (2024), who emphasize that community-based mangrove restoration programs are more sustainable when local communities are actively involved in planning, implementation, and long-term management of restoration activities.

The collaboration between Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta, Indonesia Blue Economy, Maritim Muda Indonesia, and the Pari Island community demonstrates the importance of a multi-stakeholder approach to environmental management. This result supports Putra *et al*. (2025), who highlight that community-based mangrove conservation can strengthen coastal resilience while fostering collaboration among local stakeholders and supporting sustainable livelihoods. According to Green and Haines (2023), community-based development becomes more effective when it involves various actors with complementary resources, knowledge, and networks: universities serve as providers of knowledge and mentoring, environmental organizations provide technical expertise, and local communities offer contextual knowledge about coastal conditions, a synergy that provides crucial social capital for the success of conservation programs.

This activity also supports the achievement of several Sustainable Development Goals (SDGs), contributing to SDG 13 (Climate Action) through mangrove rehabilitation as a climate change mitigation effort, SDG 14 (Life Below Water) through efforts to preserve coastal ecosystems that serve as habitats for various marine organisms, and SDG 17 (Partnerships for the Goals) through collaboration between universities, civil society organizations, environmental communities, and local communities. Thus, this community service activity benefits not only the Pari Island community but also supports sustainable development agendas at the national and global levels.

Although the activity produced positive results, several limitations warrant attention. The program evaluation focused on changes in participants' knowledge, so long-term behavioral impacts could not be comprehensively measured; the success of mangrove rehabilitation is heavily influenced by environmental factors such as substrate quality, tides, rainfall, and anthropogenic disturbances that require regular monitoring; and the relatively short implementation period did not allow for measurement of the survival rate of the planted mangrove seedlings. A follow-up program is therefore needed, including regular monitoring of mangrove growth for at least one to three years after planting, as previous restoration programs in Indonesia have demonstrated that continuous monitoring and community involvement can substantially improve mangrove survival rates and long-term ecosystem resilience (UNDP, 2025). Community capacity building is likewise needed through continued training on mangrove maintenance, mangrove-based ecotourism development, and sustainable economic utilization of coastal ecosystem services, so that the program's benefits extend beyond mangrove planting to develop into a sustainable community conservation movement capable of providing long-term ecological, social, and economic benefits. These findings also support the empowerment framework proposed by Pranitasari *et al*. (2024), which highlights that sustainable community development requires not only knowledge transfer but also practical engagement, mentoring, and collaborative networks to ensure long-term social and environmental impacts.

4.3 Sustainability and Follow-Up Plan

To ensure the sustainability of the program, a follow-up monitoring plan was established involving the Pari Island community, Indonesia Blue Economy, and Maritim Muda Indonesia, with monitoring activities planned every six months during the first two years after planting. The indicators to be tracked include mangrove seedling survival rate, seedling growth, signs of coastal abrasion, and community participation in maintenance activities. Indonesia Blue Economy will provide technical guidance, while local community members will be encouraged to take an active role in monitoring and reporting mangrove conditions, with the long-term objective of integrating mangrove conservation activities into community-based environmental education and ecotourism initiatives on Pari Island.

5 | CONCLUSIONS AND FUTURE WORK

A community service activity involving blue economy education and mangrove planting on Pari Island successfully increased participants' environmental knowledge and awareness, engaging 47 participants and resulting in the planting of 500 mangrove seedlings alongside an increase in participants' average score from 61.5 to 87.3. This program demonstrated that combining education with field practice can strengthen community participation in environmental conservation, and beyond its ecological contribution through coastal rehabilitation, the activity also deepened community understanding of the blue economy as a sustainable development approach. To ensure the sustainability of coastal conservation efforts, local governments should integrate mangrove conservation into coastal development planning and strengthen community-based monitoring systems, while educational institutions are encouraged to develop continuous environmental literacy programs and community organizations should be involved in the long-term maintenance and monitoring of planted mangroves. Future researchers are recommended to conduct longitudinal studies evaluating mangrove survival rates, behavioral changes among participants, and the long-term socio-economic impacts of blue economy education programs in small island communities. Expanding collaboration among universities, local communities, environmental organizations, and government agencies will remain essential to sustaining coastal ecosystem management well beyond the scope of this single intervention.

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REFERENCES

Acut, D. (2024). From classroom learning to real-world skills: An autoethnographic account of school field trips and STEM work immersion program management. *Discipline and Interdisciplinary Science Education Research, 6*(24). https://doi.org/10.1186/s43031-024-00111-x

Alongi, D. (2014). Carbon cycling and storage in mangrove forests. *Annual Review of Marine Science, 6*, 195–219. https://doi.org/10.1146/annurev-marine-010213-135020

Arifanti, V. B., Kauffman, J. B., Ilman, S. M., Tosiani, A., & Novita, N. (2022). Contributions of mangrove conservation and restoration to climate change mitigation in Indonesia. *Global Change Biology*, 1–16. https://doi.org/10.1111/gcb.16216

Bappenas. (2023). *Peta jalan ekonomi biru Indonesia*. Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional.

Brown, B., Fadillah, R., Nurdin, Y., Soulsby, I., & Ahmad, R. (2014). Community based ecological mangrove rehabilitation (CBEMR) in Indonesia. *SAPIENS, 7*(2). https://journals.openedition.org/sapiens/1589

Bunting, P., Rosenqvist, A., Hilarides, L., Lucas, R. M., Thomas, N., Tadono, T., Worthington, T. A., Spalding, M., Murray, N. J., & Rebelo, L.-M. (2022). Global mangrove extent change 1996–2020: Global Mangrove Watch version 3.0. *Remote Sensing, 14*(15), 3657. https://doi.org/10.3390/rs14153657

Chambers, R. (2012). *Participatory workshops: A sourcebook of 21 sets of ideas and activities* (1st ed.). Routledge. https://doi.org/10.4324/9781849772136

Donato, D. C., Kauffman, J. B., Murdiyarso, D., Kurnianto, S., Stidham, M., & Kanninen, M. (2011). Mangroves among the most carbon-rich forests in the tropics. *Nature Geoscience, 4*(5), 293–297. https://doi.org/10.1038/ngeo1123

Friess, D. A., Rogers, K., Lovelock, C. E., Krauss, K. W., Hamilton, S. E., Lee, S. Y., Lucas, R., & Primavera, J. (2019). The state of the world's mangrove forests: Past, present, and future. *Annual Review of Environment and Resources, 44*, 1–27. https://doi.org/10.1146/annurev-environ-101718-033302

Green, G. P., & Haines, A. (2023). *Asset building & community development* (5th ed.). SAGE Publications.

Kusumadewi, S. D., Purnomo, H., Nadhira, S., & Putrizulfan, R. (2024). Systematic review on the implementation of mangrove community-based restoration in Indonesia and beyond. *IOP Conference Series: Earth and Environmental Science, 1315*(1), Article 012052. https://doi.org/10.1088/1755-1315/1315/1/012052

Lhosupasirirat, P., Dahdouh-Guebas, F., Hugé, J., Wodehouse, D., & Enright, J. (2023). Stakeholder perceptions on Community-Based Ecological Mangrove Restoration (CBEMR): A case study in Thailand. *Restoration Ecology*, 1–14. https://doi.org/10.1111/rec.13894

Mansuri, G., & Rao, V. (2013). *Localizing development: Does participation work?* World Bank. https://doi.org/10.1596/978-0-8213-8256-1

Pauli, G. (2010). *The blue economy: 10 years, 100 innovations, 100 million jobs*. Paradigm Publications.

Pranitasari, D., Anhar, M., Adli, K. N., Harini, S., Said, M., & Irawan, N. (2024a). Optimizing micro, small, and medium business assistance programs in the food sector. *Indonesian Journal of Business and Entrepreneurship, 10*(2), 422–435. https://doi.org/10.17358/IJBE.10.2.422

Pranitasari, D., Anhar, M., Warcito, Said, M., Harini, S., & Endri, E. (2024b). Optimism and entrepreneurial self-efficacy in Indonesia MSMEs. *Journal of Infrastructure, Policy and Development, 8*(10), 1–17. https://doi.org/10.24294/jipd.v8i10.6238

Pranitasari, D., Suriwinata, S. I., & Warcito. (2026). A gender-sensitive sustainable model of digital and financial inclusion for women-led MSMEs in Indonesia. *Frontiers in Human Dynamics, 8*. https://doi.org/10.3389/fhumd.2026.1795115

Putra, D. S., Yusuf, M., Rizal, A. N., & Rahmadani, S. (2025). Strengthening coastal resilience through community-based mangrove conservation. *Community Empowerment, 10*(12), 2367–2375.

Reuters. (2024, May 23). *Half of world's mangroves under threat, says conservation group*. https://www.reuters.com/business/environment/half-worlds-mangroves-under-threat-says-conservation-group-2024-05-23/

The World Bank. (2022). *The economics of large-scale mangrove conservation and restoration in Indonesia*. https://thedocs.worldbank.org/en/doc/89fd7ff87561a4a913ed3371278e7933-0070062022/related/The-Economics-of-Large-scale-Mangrove-Conservation-and-Restoration-in-Indonesia-Brief-Note-Interactive-220516.pdf

UNDP. (2025). *In Indonesia, mangrove restoration is protecting the coastline against rising sea levels*. https://www.adaptation-undp.org/indonesia-mangrove-restoration-protecting-coastline-against-rising-sea-levels.

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