

Post-Disaster Coastal Resilience: Fusing CSR and Local Agency in Coral Reef Restoration in East Nusa Tenggara

Danang Agung Saputra¹, Muhammad Imam Syafii², Dwi Apriandika³, Rani Dewi Eryani⁴,
Muhammad Azizul Ghofar⁵, Muhammad Farras Raihan S⁶, Choirul Muna⁷

¹⁻⁶ PT Pertamina Patra Niaga Integrated Terminal Tenau

⁷ UIN Sunan Kalijaga

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ABSTRACT

Cyclone Seroja severely damaged coral reef ecosystems and disrupted the socio-economic well-being of coastal communities. This study aims to analyze an integrative post-disaster recovery model based on Corporate Social Responsibility (CSR) programs in driving ecosystem restoration and local socio-economic self-reliance. Using a descriptive qualitative approach with a case study design, data were collected through in-depth interviews, field observations, and document analysis. Thematic analysis was employed, combining theoretical frameworks of the Theory of Planned Behavior, Skill Acquisition Theory, Sustainable Tourism, and Social Capital Theory. The findings indicate that integrated CSR interventions successfully bridge the dichotomy between techno-ecological and socio-economic approaches. Capacity-building training programs gradually formed active local agency, transforming subjective norms and perceived behavioral control toward conservation. Furthermore, strengthening social capital through collaborative governance among corporations, local governments, and communities optimized coral reef restoration while unlocking sustainable marine tourism opportunities. This model demonstrates that community-based post-disaster recovery via CSR not only rehabilitates marine ecosystems effectively but also fosters long-term socio-economic resilience.

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Corresponding Author:

Name: Choirul Muna

Institution: UIN Sunan Kalijaga, Jl. Laksda Adiucipto, Papringan, Caturtunggal, Kec. Depok, Kab. Sleman, Daerah Istimewa Yogyakarta 55291

Email: choirulmuna.pmi@gmail.com

1. INTRODUCTION

In recent years, tourism has become one of the fastest-growing areas in the world economy, playing an important role in providing

The destruction of coral reef ecosystems in Indonesia's coastal areas today

is no longer just an ecological crisis, but has developed into a complex socio-economic and institutional problem [1], [2], [3]. As part of the biodiversity-rich Coral Triangle region, Indonesia's marine region bears a multifold load of anthropogenic stresses: from destructive resource exploration and environmental pollution to the real impacts of

global climate change and natural disasters [4], [5]. The dialectic between the importance of environmental protection and the dependence of coastal communities on their livelihoods creates a knot of tension that is difficult to unravel if coastal development still uses a top-down and conventional technocratic paradigm [6], [7]. The presence of ecological disasters such as Tropical Cyclone Seroja in Kupang Bay, East Nusa Tenggara [8], further emphasizes the dual vulnerabilities faced by coastal communities, both from the physical aspects of the environment and socio-economic resilience [9].

In the academic context, the debate on coastal ecosystem rescue interventions and community empowerment in general is divided into two main study trends [10]. The first trend focuses on techno-ecological approaches that emphasize physical restoration, biodiversity restoration, and the establishment of isolated conservation zones [11]. While this approach is technically successful in ecosystem restoration, it often alienates local communities from their livelihood space and fails to build institutional sustainability at the site level [12], [13]. The second tendency is dominated by socio-economic studies that place community empowerment solely as a strategy to increase income through tourism activities or the provision of capital assistance [14]. This second approach is vulnerable to being trapped in environmental commodification and dependence on donors, without being accompanied by the internalization of adequate conservation awareness and capacity [15], [16].

The main limitation of the two tendencies in the above study lies in the dichotomous separation between the environmental conservation agenda and the community's economic empowerment agenda. There are still limited studies that analyze in depth how Corporate Social and Environmental Responsibility (TJSL) program interventions can bridge the two agendas in an integrative scheme based on edutourism and collaborative governance, especially in post-disaster areas in East Nusa Tenggara

[17]. The absence of this integrative model has led many community-based conservation programs to cease as ceremonial activities without sustainable impact [18].

To fill this academic gap, this article proposes the main argument that coral reef conservation can function effectively as an instrument of community empowerment if articulated through an educational tourism approach that places local communities not just as passive instruments or beneficiaries, but as active agency subjects who have independent technical, institutional, and economic value capacities [19]. The novelty of this research lies in the empirical testing of the LEMBU BERSERI Edutourism Program (Lestarikan Terumbu untuk Berdaya, Sejahtera, dan Mandiri or Conserving Reefs for Empowerment, Prosperity, and Independence) initiated by PT Pertamina Patra Niaga Integrated Terminal Tenau together with the Anana Laut Community Group in Kupang City. The program offers a new synthesis that combines ecological engineering (coral transplantation), environmental education, skills certification (diving), and corporate-community schemes in one sustainable coastal development framework.

Based on this background description, this study aims to critically analyze the implementation and impact of the community empowerment model based on coral reef conservation education in Kupang Bay. Specifically, the study is designed to answer two key questions:

- a. How is the construction of the implementation of the LEMBU BERSERI Edutourism Program articulated as a model of community empowerment based on coral reef conservation in Kupang City?
- b. What are the implications of the program on community capacity accumulation, stakeholder collaboration dynamics, and the sustainability of coastal ecosystems?

2. METHODS

This research was conducted in the LEMBU BERSERI Edutourism Program, which is located in the Kupang Bay area, Kupang City, East Nusa Tenggara Province. This study uses a qualitative-descriptive approach based on case studies [20] to analyze the implementation of the LEMBU BERSERI Edutourism Program as a model of community empowerment through coral reef conservation and edutourism development [17]. To obtain credible data, the researcher conducted observations, interviews, and documentation studies on the program's implementation and related documents [21]. In addition, the researcher conducted a literature study by reviewing scientific articles, books, research reports, company documents, and various publications related to coral reef conservation, community empowerment, educational development, and Social and Environmental Responsibility (TJSL) programs [22].

To maintain the credibility of the data, the researcher prioritizes articles sourced from reputable scientific journals and reviews the theme, year of publication, and relevance of the research to the study topic [23]. The data analysis in this study uses thematic analysis to identify patterns, themes, and relationships between findings obtained during the research [24]. To ensure data validity, the source triangulation technique is used, which involves comparing information obtained through observation, interviews, documentation studies, and literature studies to produce comprehensive and accountable findings [25].

3. RESULTS AND DISCUSSION

3.1 Network Visualization

of European countries prevails. Such countries as Spain, Portugal, Greece, Poland, Malta, and the United Kingdom have good regional connections. This proves the fact that it is very important to pay attention to the European destinations in order to solve problems of tourism pressure and social sustainability.

1.1 Implementation of the LEMBU BERSERI Edutourism Community Empowerment Program

The LEMBU BERSERI (Preserving Reefs for Empowered, Prosperous, and Independent Edutourism Program) was developed by PT Pertamina Patra Niaga Integrated Terminal Tenau as part of the implementation of the Social and Environmental Responsibility (TJSL) program, which focuses on the rehabilitation of coastal ecosystems as well as community empowerment in the Kupang Bay area, Kupang City, East Nusa Tenggara Province. This program is present as a response to the high potential of marine tourism in the Kupang Bay area. However, it faces various challenges, including coral reef damage due to human activities, climate change, and the impact of Tropical Cyclone Seroja, which results in a decline in the quality of coastal ecosystems and community economic activities. In this context, the LEMBU BERSERI Edutourism Program is designed as a model of community empowerment that integrates coral reef conservation, environmental education, and community-based marine tourism development, so that ecological and economic benefits can run in harmony.

The implementation of the program began with identifying regional potential and mapping community needs, then continued with coordination with local governments, academics, environmental communities, and the Anana Laut Community Group as the main partner in implementing the program. This participatory approach is the basis for preparing various conservation activities, so that the community is involved from the planning stage to program evaluation. Through this mechanism, the community is no longer positioned as a beneficiary, but as the main actor in the management of conservation areas and edutourism development.

As part of strengthening community capacity, the LEMBU BERSERI Edutourism Program carries out various activities including Focus Group Discussion (FGD),

coral reef conservation training, diving training and certification, coral reef transplantation, community group assistance, and periodic monitoring and evaluation activities. The entire series of activities is designed to improve the community's knowledge, skills, and ability in rehabilitating marine ecosystems, as well as preparing them as local instructors, underwater tour guides, and managers of conservation-based edutourism areas. In addition to serving as a medium for environmental rehabilitation, conservation areas are also developed as educational facilities for students, tourists, and various institutions that want to learn community-based coral reef conservation practices.

Based on the results of the monitoring and evaluation of the program, the implementation of the LEMBU BERSERI Edutourism program shows a positive impact on the ecological, social, and economic aspects of coastal communities. From an environmental perspective, the sustainable implementation of coral reef transplantation and conservation activities contributes to coastal ecosystem rehabilitation efforts while increasing public awareness of the importance of preserving marine resources. From a social perspective, various training and mentoring activities have increased the capacity of members of the Anana Laut Community Group in conservation, diving, and marine tourism management. Hence, the community has a better ability to manage conservation areas independently. Meanwhile, from an economic perspective, the development of conservation-based edutourism opens new business opportunities through dive tour guide services, the provision of marine tourism services, and various supporting economic activities that sustainably utilize local potential.

An important point of the overall implementation of the LEMBU BERSERI Edutourism Program is the formation of multi-stakeholder collaboration involving PT Pertamina Patra Niaga Integrated Terminal Tenau, the Anana Laut Community Group,

local governments, academics, the environmental observant community, and various other strategic partners. This synergy not only strengthens the effectiveness of program implementation, but also builds collaborative governance that supports the sustainability of coral reef conservation and the empowerment of coastal communities. The integration between environmental rehabilitation, community capacity building, educational development, and multi-stakeholder collaboration is the basis for discussion in the next section, especially in analyzing the LEMBU BERSERI Edutourism Program as a model of community empowerment based on coral reef conservation that can integrate ecological, social, and economic dimensions sustainably.

1.1.1 Implications of the LEMBU BERSERI Edutourism Community Empowerment Program

In this discussion, we will examine the outcomes of empowerment activities through the LEMBU BERSERI Eduwisata program, fostered by PT Pertamina Patra Niaga Subholding C&T Integrated Terminal Tenau. Based on field findings, it has produced several impacts that are directly felt by group members, especially fishermen groups and local communities. These impacts are related to increasing knowledge, technical skills, and economic potential, as well as strengthening social cohesiveness among coastal communities.

1.1.2 Increasing Knowledge and Awareness of Environmental Conservation

One of the most obvious outcomes of this program is increased knowledge and awareness among local communities, especially fishermen, about the importance of preserving coral reefs. Previously, coastal communities did not understand the important role of coral reefs as homes for a variety of marine species and as a buffer for healthy marine ecosystems. However, through the education in this program,

participants became more aware of the adverse impacts that human activities can cause, such as overfishing or the use of fishing gear that damages coral reefs. Now, they have a better understanding of the importance of maintaining and caring for coral reefs, both for the environment and the sustainability of their catch.

This increase in knowledge and awareness of environmental conservation provides insight for the community, especially when viewed through the lens of the Theory of Planned Behavior [26], which emphasizes that changes in knowledge and awareness can affect a person's attitudes and behavior. In this context, increased public knowledge about environmental conservation leads to positive attitudes toward coral reef conservation, which is expected to change behavior in the long run. They are more likely to take care of the marine environment after understanding the consequences of destructive actions.

1.1.3 Formation of Technical Skills in Coral Reef Transplantation

The program also provides technical training to participants related to coral reef transplantation. Previously, fishermen did not have knowledge or experience related to marine environmental rehabilitation techniques like this. Through the LEMBU BERSERI Eduwisata program, they learn how to transplant coral reefs, from preparation to planting and reef maintenance. This training provides much-needed skills, especially for fishermen who have lost their livelihoods due to coral reef damage from Cyclone Seroja. These skills are expected to help them actively participate in ocean conservation efforts while improving the quality of the environment in which they work.

The formation of these technical skills is important to be transmitted to the community. This, when reviewed in Skill Acquisition Theory, explains that new skills are learned through several stages, ranging from the cognitive stage (learning basic theory), associative (practicing with

guidance), to the autonomous stage (where a person can perform tasks independently) [27]. In the early stages of training, the fostered group learns through theory, then practices performing transplants under supervision, until they finally have the skills to do it themselves in the future.

3.1.5 Increasing the Potential of Marine Education Tourism

In addition to environmental impacts, this program also produces short-term outcomes in the form of identifying potential marine educational tourism that can be developed around Namosain Village. Previously, the potential of marine tourism in this area had not been widely looked at by the wider community. However, through the LEMBU BERSERI Edutourism program, this area began to be known as a center for marine environmental education, especially in coral reef transplantation. This opens up new economic opportunities for local communities, especially in developing the conservation-based tourism sector. Tourists can learn about coral reef preservation while enjoying the beauty of the underwater nature in the area.

Sustainable Tourism Development Theory emphasizes the importance of tourism development that is not only economically beneficial but also has a positive impact on the environment and society [28]. The program creates the potential for sustainable tourism that combines education and environmental conservation, in hopes of attracting conservation-concerned tourists while providing economic benefits to local communities.

3.1.6 Strengthening the Cohesiveness of Coastal Community Groups

This program also has a significant impact on strengthening social cohesiveness among coastal communities. Prior to the program, fishermen's groups often worked individually or in small groups without strong synergy. However, through joint activities such as coral reef transplantation, communities began to work collaboratively

and share responsibilities in preserving the marine environment. This increases solidarity and cooperation among members of fishermen's groups and establishes a sense of shared responsibility to protect and conserve marine resources that are their source of livelihood.

Strengthening group cohesiveness in Social Capital Theory shows that social interaction and cooperation between community members can strengthen social relationships and build social capital that is important for community development [29]. This outcome shows how the LEMBU BERSERER Eduwisata program has succeeded in building and strengthening social networks among the participants, which in turn increases their capacity in facing future challenges, such as natural disasters or climate change.

3.2 Discussion

The development of coastal areas in the era of sustainable development is no longer oriented only toward the use of natural resources, but also emphasizes the balance between environmental conservation, community empowerment, and local economic growth [30]. In this context, coral reef ecosystems have a strategic role as a buffer for coastal communities because they support fisheries productivity, protect coastlines, and become the main attraction of marine tourism [31]. However, various pressures due to resource exploitation, pollution, climate change, and human activities have led to a decline in the quality of coral reef ecosystems in various regions of Indonesia [32]. These conditions show that the success of conservation is not only determined by ecosystem rehabilitation, but also by the ability to increase community capacity to manage coastal resources sustainably [33].

Various coral reef conservation programs developed in Indonesia are generally still oriented toward the success of physical ecosystem rehabilitation, such as coral transplantation or protection of conservation areas [34]. Despite providing

ecological benefits, these approaches are often not able to create sustainability if they are not followed by strengthening the capacity of local communities and institutions [35]. This research offers a different perspective through the LEMBU BERSERER Edutourism Program, which integrates coral reef conservation, environmental education, community empowerment, and local economic development into a sustainable coastal development framework. The integration shows that conservation can be an instrument of empowerment if communities are placed as the main actors in the management of coastal resources, not just beneficiaries of the program [36].

3.2.1 Empowerment of the LEMBU BERSERER Edutourism Community as a Foundation for Sustainable Conservation

The results of the study show that the success of the LEMBU BERSERER Edutourism Program is not solely determined by the number of coral reef transplants carried out, but rather by the success in increasing the capacity of the community as a conservation area manager. Various activities such as conservation training, diving certification, community group assistance, and active involvement in monitoring and evaluation have built knowledge, skills, and a sense of belonging to coastal areas. This condition shows that the community is no longer positioned as an object of conservation, but as a subject of development who has the responsibility to maintain the sustainability of the marine ecosystem.

The findings reinforce the concept of community-based conservation that places local communities as the main actors in natural resource management. According to Neil et al, the success of conservation is greatly influenced by the ability to build community participation as well as strong local institutions [37]. This is also in line with Ssekajja's thinking, who explained that the sustainability of shared resource management will be easier to achieve when the community has rights, responsibilities, and collective

mechanisms in managing these resources [38]. Thus, the success of the LEMBU BERSERI Edutourism Program shows that conservation combined with community empowerment can create a more adaptive and sustainable coastal management system.

3.2.2 LEMBU BERSERI Edutourism as a Strategy for Conservation Integration and Economic Empowerment

The findings of the study show that the development of edutourism is one of the main innovations in the LEMBU BERSERI Edutourism Program. In contrast to the conventional conservation approach, which is oriented towards ecosystem protection alone, this program develops conservation areas as an educational space as well as a space for economic empowerment for the community. Through diving training, the development of underwater tour guides, conservation education, and strengthening the capacity of community groups, conservation not only produces ecological benefits, but also opens up new economic opportunities for coastal communities.

This approach aligns with the concept of ecotourism, which places conservation, environmental education, and community welfare as the three main pillars of sustainable tourism development [39]. In addition, the strategy also reflects the principle of community empowerment put forward by Chambers and Suharto, namely development oriented toward increasing community capacity to manage resources and determine the direction of development independently [40], [41]. Therefore, edutourism in the LEMBU BERSERI Program not only functions as a tourist destination, but also as a medium for environmental learning and an instrument for community economic empowerment based on conservation.

3.2.3 Multi-stakeholder collaboration in Supporting Program Sustainability

The success of the LEMBU BERSERI Edutourism Program also shows the

importance of multi-stakeholder collaboration in realizing sustainable coastal development. This program involves PT Pertamina Patra Niaga Integrated Terminal Tenau, the Anana Laut Community Group, local governments, academics, and various other strategic partners at every stage of the program's implementation. The collaboration allows for the division of roles, resource utilization, knowledge transfer, and strengthening community institutions, so that the implementation of the program does not depend on one actor alone.

These findings support the concept of Collaborative Governance, which explains that solving public problems requires cooperation between stakeholders through a participatory decision-making process, sharing of responsibilities, and joint use of resources [42], [43]. In the context of coastal development, such collaboration is an important factor because conservation is a multidimensional issue and requires synergy between the government, the private sector, academia, and the community. Thus, the success of the LEMBU BERSERI Edutourism Program lies not only in implementing conservation activities, but also in building collaborative governance that can maintain the program's long-term sustainability.

Overall, this study shows that the LEMBU BERSERI Edutourism Program has developed a community empowerment model that integrates coral reef conservation, environmental education, community capacity building, and multi-stakeholder collaboration in one sustainable coastal development framework. Unlike various conservation programs that focus solely on ecosystem rehabilitation, the LEMBU BERSERI Program shows that conservation can be an instrument to build community independence while simultaneously creating ecological, social, and economic benefits. These findings reinforce the importance of a community-based development approach in supporting the achievement of the Sustainable Development Goals, especially in protecting marine ecosystems, strengthening

partnerships, and improving the welfare of coastal communities [44].

4. CONCLUSION

Based on the results of the research and discussion above, this study shows that the LEMBU BERSERI Edutourism Program has succeeded in developing a community empowerment model that integrates coral reef conservation, environmental education, and local economic development in one sustainable coastal development framework. This approach proves that conservation not only functions as an effort to maintain ecosystem sustainability, but can also be an instrument of community empowerment if the community is placed as the main actor at every stage of coastal resource management. There are at least three main findings in this study. First, strengthening community capacity as a foundation for sustainable conservation. The LEMBU BERSERI program has succeeded in increasing knowledge, skills, and community participation through conservation training, diving certification, group assistance, and coral reef transplantation activities. The active involvement of the Anana Laut Community Group shows that the community-based conservation approach can build a sense of belonging, so that the community no longer plays the role of beneficiaries but becomes the main manager of the conservation area.

Second, the integration of conservation with the development of community-based edutourism. This program shows that conservation areas can generate ecological benefits while creating economic value through the development of educational tourism, dive guide services, and various economic activities based on local potential. The integration shows that environmental conservation and improving community welfare are not two conflicting

goals, but can run synergistically to support sustainable coastal development. Third, strengthening multi-stakeholder collaboration as a program sustainability strategy. The involvement of PT Pertamina Patra Niaga Integrated Terminal Tenau, the Anana Laut Community Group, local governments, academics, and various strategic partners shows that conservation success requires collaborative governance that integrates resources, knowledge, and responsibilities among stakeholders. This collaboration is an important factor in maintaining the sustainability of program implementation while strengthening coastal community institutions.

More broadly, this study implies that the model of community empowerment through coral reef conservation-based edutourism can be an alternative to coastal development strategies that are oriented not only toward environmental rehabilitation, but also toward community capacity building, strengthening the local economy, and sustainable institutional development. This model shows that conservation combined with community empowerment can generate ecological, social, and economic benefits simultaneously, so it has the potential to be replicated in other coastal areas with similar characteristics and challenges. As a recommendation, the implementation of the LEMBU BERSERI Edutourism Program needs to continue to be strengthened through sustainable community capacity building, the development of conservation-based edutourism innovations, and the expansion of cross-sector partnerships so that the benefits of the program can be felt more widely. In addition, this model can be used as a reference in formulating community-based coastal area management policies to support the creation of inclusive, adaptive, and sustainable coastal development.

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