



Strengthening Fishermen's Household Resilience through Business Diversification in Facing Climate Change in Hulaliu Village

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Abstract: Climate change has a direct impact on the livelihoods of traditional fishermen, due to their high dependence on natural conditions and a lack of understanding of these environmental changes. Diversifying livelihoods based on local resources such as seaweed, shellfish, salt, coconuts, bananas, corn, bamboo, medicinal plants, or ornamental plants is a key strategy for strengthening the economic resilience of fishing households, especially during extreme weather conditions that can hinder fishing. This community service activity aimed to enhance understanding of climate change impacts on seasonal patterns and catches, as well as to increase knowledge regarding business diversification by utilizing local potential as alternative income sources for 12 fishermen and 10 fishermen' wives. The method employed was a community-based participatory approach that actively involved the fishers and their families in every stage of the activity. The implementation consisted of several stages: identifying problems and local potential, conducting a pre-test, delivering climate change education, organizing business diversification outreach, and administering a post-test. The results indicated a significant increase in participants' understanding before and after the material delivery, rising from 51.3% to 97.5%. This improvement demonstrates the effectiveness of the activity in equipping participants with foundational knowledge to mitigate climate change and strengthen household economies.

Keywords: Climate Change, Diversification, Economy, Fishermen, Resilience.

Introduction

Climate change is a global issue that directly affects the sustainability of coastal communities, particularly fishermen. Changes in weather patterns, rising sea surface temperatures, and shifts in wind seasons and ocean currents have significantly influenced the timing and quantity of fish catches (IPCC, 2021). Traditional fishermen, such as those in Negeri Hulaliu, are highly vulnerable to these changes because they still rely heavily on natural conditions to carry out their fishing activities (Puspitasari & Santosa, 2020). In addition to declining catches, fishermen also face greater safety risks due to increasingly unpredictable and difficult to forecast weather conditions (Yuniarti &

Nugroho, 2022). The lack of understanding regarding the impacts of climate change makes it difficult for fishermen to adapt their working patterns to changing environmental conditions. In fact, with proper education and awareness, fishermen can implement adaptive strategies such as adjusting fishing schedules or selecting safer fishing areas (Halim et al., 2020).

In addressing these challenges, business diversification has become an important strategy for strengthening the economic resilience of fishermen's households. By developing the potential of local natural resources, such as seafood processing, agriculture, or coastal resource-based handicrafts, fishermen and their families can generate additional sources of income and reduce their dependence solely on fish catches (Utami &

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Sari, 2021). This diversification also creates opportunities for women (fishermen's wives) to participate in economic activities, which indirectly strengthens the socio-economic resilience of fishermen's families (Nugraha & Nurjanah, 2020).

However, limited access to training and information has prevented most fishermen in remote coastal areas such as Hulaliu from optimally developing alternative livelihoods. Therefore, an integrated community service program is needed, one that not only provides education about climate change but also promotes livelihood diversification practices based on local potential (Wibowo et al., 2022). Through this approach, fishermen are expected not only to survive the impacts of climate change but also to achieve economic and social development.

This community service program aims to enhance the adaptive capacity of fishermen in Hulaliu Village through climate change education and the strengthening of alternative livelihood skills. Climate change education will focus on providing a basic understanding of its symptoms, causes, and impacts on marine ecosystems and fishing patterns, enabling fishermen to better interpret seasonal changes and make more adaptive decisions in their fishing activities. On the other hand, the outreach of business diversification skills will emphasize the utilization of local potential, such as seafood processing, agriculture, handicrafts based on marine waste, and simple aquaculture practices that can be independently managed by fishermen's households. Through a community-based approach and the active involvement of fishermen's households, this program will not only focus on individual fishermen as the main actors but will also recognize the important role of family members in supporting household economic resilience.

Method

The method used in this community service program was a community-based participatory approach which actively involved 22 fishermen and their families in every stage of the activities. This approach aimed to ensure that the solutions offered were relevant, applicable, and sustainable, as they were developed based on the needs and potential of the community itself.

The community-based participatory approach is a method that actively involves the community in the processes of problem identification, planning, implementation, and evaluation of programs that directly address their interests and needs (Cornwall & Jewkes, 1995). This approach positions the community not merely as an object, but also as a subject and partner

with the capacity to determine solutions to the problems they face (Pretty, 1995).

Participation in this context includes processes of co-learning, knowledge sharing between facilitators and the community, and collective decision-making (Minkler & Wallerstein, 2003). This is particularly important in community development programs because communities possess valuable local knowledge and direct experience regarding the impacts of climate change (Wong, 2012). By utilizing this approach, community service programs are not merely top-down in nature, but also accommodate bottom-up initiatives that are more contextual and effective.

The implementation of this program was carried out through several main stages as follows:

1. Identification of Problems

The activity began with field observations and Focus Group Discussions involving representatives of fishermen, fishermen's wives, community leaders, and village officials. This stage aimed to identify problems related to climate change and to explore local economic potential that could be developed as alternative business.

2. Pre-Test

A pre-test was conducted prior to the implementation of the program to assess the participants' initial level of understanding before the delivery of the materials.

3. Climate Change Education

Climate change education was conducted through training sessions and interactive counseling regarding climate change, its impacts on the fisheries sector, and adaptation strategies that could be implemented by fishermen's households. The materials were delivered through lectures, discussions, and simple simulations using visual media and local languages to facilitate better understanding.

4. Business Diversification Outreach

After establishing a basic understanding, the program continued with business diversification outreach based on local potential, such as seafood processing, agricultural product processing, simple cultivation practices, and the production of handicraft products. Simulations of income calculations for these diversification activities were also conducted.

5. Post-Test

At the end of the program, a post-test was conducted to measure the participants' understanding of the materials that had been delivered.

Result and Discussion

The socialization activity, as shown in Figure 1, began with the administration of a pre-test to 22 community members and was followed by the delivery of climate change education materials. At the beginning of the session, participants were introduced to the basic concept of climate change, defined as long-term changes in global climate conditions, including rising global temperatures, changes in rainfall patterns, and sea-level rise. The distinction between daily weather variability and long-term climate trends was also explained to help fishermen understand that these phenomena are not merely ordinary adverse weather conditions. The main causes of climate change were subsequently discussed, including the increase in greenhouse gas emissions (CO_2 , CH_4 , and N_2O) resulting from fossil fuel combustion, deforestation, and industrial activities. The explanation was further related to changes in sea temperature, disruptions in wind circulation, and shifts in seasonal patterns in tropical regions, including Central Maluku Regency.



Figure 1. Presentation of Materials and Discussion with Participants

The impacts of climate change were also explained, including changes in sea water temperature that affect fish migration patterns, disruptions in the timing of fishing seasons (for example, skipjack tuna and mackerel tuna arriving later than usual), increasingly extreme and unpredictable ocean waves and wind conditions, and declining fish catches due to disturbances in fish habitats and food sources. In addition, the occurrence of coral bleaching, which

threatens fish breeding grounds, was also discussed. Particular emphasis was placed on the shifting patterns of the western and eastern monsoon seasons in the Banda Sea and surrounding areas. The local seasonal calendar traditionally used by fishermen to predict fishing seasons is no longer considered accurate. Fishermen were encouraged to compare their own experiences with climate data in order to strengthen their understanding of these changes. Furthermore, they were introduced to various adaptation strategies, including livelihood diversification and the mapping of weather-prone areas based on both local experience and available data.

The second topic presented, which constituted the main focus of this community service program, was business diversification and income calculation simulations based on local potential to enhance resilience to climate change. The material covered the concept of business diversification as a strategy for developing various alternative income outside the primary occupation in order to strengthen household economic resilience. The benefits of business diversification include increasing sources of income, reducing dependence on a single sector (fisheries), creating employment opportunities for family members, and encouraging the empowerment of women and youth within fishermen's households.

Discussions were conducted throughout the presentation session to gather information from the community regarding their experiences in dealing with climate change and the potential natural resources available in their surroundings, including seaweed, shellfish, salt, coconuts, bananas, corn, bamboo, herbal plants, and ornamental plants. These resources could be utilized while taking local wisdom and cultural values into consideration. Based on the identified local potential, various products could be developed, including handicrafts made from shells, bamboo, or coconut shells; processed agricultural products; and coastal culinary products such as fish floss, fish crackers, and smoked fish. Furthermore, income calculation simulations were conducted for fish floss and smoked fish production, showing estimated monthly earnings ranging from IDR 2,100,000 to IDR 2,500,000. These estimates provide an illustration of the potential income opportunities that could be obtained when sea conditions do not allow fishermen to engage in fishing activities.

The program concluded with the administration of a post-test to evaluate the effectiveness of the activity by measuring the community's understanding of the materials presented in comparison with their level of understanding prior to receiving the materials. The results are presented in Table 1.

Table 1. Level of Understanding Before and After the Community Service Program

No	Pre-Test	Post-Test	Explanation
1	Participants (50%) did not yet understand climate change.	Improvement (100%) in participants' understanding of climate change.	Based on the responses provided, it was identified that some participants previously lacked understanding regarding climate change. After the implementation of the community service program, participants were able to understand the concept of climate change.
2	Participants (80%) did not yet understand the impacts of climate change on the capture fisheries sector.	Improvement (100%) in participants' understanding of the impacts of climate change on the capture fisheries sector.	Most participants previously lacked understanding regarding the impacts of climate change on the capture fisheries sector. Through this outreach activity, participants were able to understand these impacts.
3	Participants (40%) did not yet understand business diversification.	Improvement (100%) in participants' understanding of business diversification.	Some participants previously lacked understanding regarding business diversification and its benefit. After the outreach activity, all participants were able to understand business diversification.
4	Participants (65%) did not yet understand how to initiate business diversification.	Improvement (90%) in participants' understanding of the steps involved in initiating business diversification.	Most participants previously did not understand how to start business diversification. Through the outreach activity, participants were able to understand the initial steps for implementing business diversification.

Table 1 shows a significant improvement in participants' understanding. Based on the four measured material points, the results indicate that, on average, participants demonstrated a very high level of understanding of the materials presented (90%-100%), as they were able to relate the concepts delivered to their direct experiences. Thus, this program not only increased participants' understanding of alternative sources of income for fishermen's households, but also helped reduce their dependence on fish catches, which have become increasingly uncertain due to climate change.

Conclusion

The community service program conducted with 22 participants using a community-based participatory approach was proven to be quite effective in providing information and improving participants' understanding. This was demonstrated by the increase in understanding observed before and after participation in the program. The pre-test and post-test results showed a significant average increase in knowledge of 97.5%. This improvement in knowledge may help participants obtain alternative sources of income and reduce their dependence on fish catches, which have become increasingly uncertain due to climate change.

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