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The Implementation of Sepatin Village Community Empowerment Program as the Blue Carbon Initiative Project of the Mahakam Delta

Fajar Apriani[1*], Sutrimo Selamet[2]

[1]Program Study of Public Administration, Universitas Mulawarman, Indonesia
[2]Program Study of Magister of Public Administration, Universitas Mulawarman, Indonesia
*Correspondence: fajar.apriani@fisip.unmul.ac.id

Abstract
The Community Empowerment Program in Sepatin Village is part of the Blue Carbon Initiative Project of the Mahakam Delta. Sepatin Village is situated in the coastal area of Kutai Kartanegara Regency, East Kalimantan. This research aims to analyze the implementation of the Sepatin Village Community Empowerment Program within the context of mangrove forest rehabilitation and restoration in Sepatin Village, a coastal village located in the Mahakam Delta. Through qualitative approach and case studies, the research results show that the Sepatin Village Community Empowerment Program has been implemented well with involving the community in mangrove rehabilitation and restoration activities, training in hydroponic plant cultivation, installing solar-powered street lights, and providing rainwater harvesting facilities. For developing this Community Empowerment Program, there is potential for fishermen's catch, which is currently still unutilized, to be processed into value-added products. So, for the sustainability of efforts to improve the welfare of the Sepatin Village community, further assistance efforts are needed from Mulawarman University academics who can also act as distributors of these processed products.

Keywords
blue carbon project, community empowerment, cultivation training, mahakam delta, mangrove rehabilitation

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Introduction

Mangroves are one of the natural resources in coastal areas that play important roles in the production, protection, and conservation of nature. Mangrove forests are also a very unique ecosystem, namely as an interface between land ecosystems and ocean ecosystems. Mangrove forests grow at river estuaries in tidal areas or on the seashore (Cesario et al., 2015).

Mangrove makes a major contribution to mitigating and adapting to climate change. Mangrove forests are confirmed to be able to store carbon better than other types of tropical forests by up to four times (https://fahutan.unmul.ac.id). Indonesia is the country that has the largest mangrove forests in the world, with an area of 20 to 25 percent of the world's mangrove ecosystem, followed by Brazil in second position and Nigeria in third position. According to the Ministry of Environment and Forestry of the Republic of Indonesia, the area of Indonesian mangrove forests is 3.36 million hectares. The four largest mangrove forest areas are in Papua, with a mangrove forest area of 1.56 million hectares, followed by Kalimantan, with a mangrove forest area of 688,000 hectares, Sumatra, with a mangrove forest area of 660,000 hectares, and Maluku, with a mangrove forest area of 224,000 hectares (in https://kanalkomunikasi.pskl.menlhk.go.id).

Blue Carbon Initiative is a program formed as a nature-based solution from a commitment to preserving mangrove forests, which play an important role in maintaining the global climate change. On September 9, 2022, the Faculty of Forestry, Mulawarman University, signed a cooperation agreement with the Pertamina Foundation in order to implement the Blue Carbon Initiative Program. The Pertamina Foundation appointed the Faculty of Forestry, Mulawarman University, as the executor of the Blue Carbon Initiative Project in the mangrove forest area located in the Mahakam Delta.

The Mahakam Delta is an important landscape covering an area of 150,000 hectares that is suitable for mangrove forest ecosystems. The Mahakam Delta area is important for providing ecosystem services such as storing carbon dioxide stocks, habitat for important biodiversity, and ensuring the productivity of the fisheries sector. However, based on monitoring by the East Kalimantan Regional Climate Change Council over the last 20 years, half of the mangrove forest ecosystem in the Mahakam Delta (80,000 hectares) has been converted, and 67,000 hectares have been turned into ponds (https://ggc.ddpikaltim.org). The rapid conversion of mangrove forests into aquaculture has resulted in degradation in various places. This shows that mangrove forests are experiencing systematic degradation due to human interests.

It was explained in the research of Purba and Poedjirahajoe (2011) that the impact of the conversion of mangrove forests is the creation of a decrease in the ability to absorb carbon dioxide in the atmosphere and the decomposition of carbon dioxide stored through the decomposition process into the atmosphere. The role of the mangrove forest ecosystem, which was originally as an absorber and carbon reservoir, has changed to become a contributor to carbon emissions. This will affect climate change in the world, so this condition requires optimal rehabilitation and restoration efforts in mangrove forests involving the cooperation of various parties.

The Blue Carbon Initiative Project includes mangrove forest rehabilitation, evaluation and monitoring of biodiversity restoration, and empowering energy-independent communities. Mangrove forest rehabilitation activities involve collaboration with Forest Farmer Groups in the Muara Jawa area and Sepatin Village, Kutai Kartanegara Regency. This research examines whether the community empowerment program in the Blue Carbon Initiative Project can be implemented well in the context of rehabilitation and restoration of mangrove forests in Sepatin Village, which is a coastal village in the Mahakam Delta.

Literature Review

In this research, there are several theories that are relevant to understanding the implementation of community empowerment programs in the context of sustainable development. One of the global Sustainable Development Goals (SDGs) targets that are relevant to this research variable is Life Below Water (Ocean Ecosystems), which focuses on the protection and preservation of marine ecosystems and the sustainable use of marine resources, including coastal areas. These theories provide an important framework for understanding in exploring the implications of essential community empowerment in the process of sustainable development towards a prosperous society while preserving the environment.

Development is the first theory that is relevant for this research. Development is defined as an evolutionary process in which the human capital increases in terms of initiating new structures, coping with problems, adapting to continuous change, and striving purposefully and creatively to attain new goals (Peet in Du Pisani, 2006). According to Reyes (2001), development is understood as a social condition within a nation, in which the needs of its population are satisfied by the rational and sustainable use of natural resources and systems. Then, literally, sustainability means a capacity to

maintain some entity, outcome, or process over time (Basiago, 1999), and sustainability connote improving and sustaining a healthy economic, ecological, and social system for human development by most academics (Milne & Gray, 2013; Thomas, 2015; Tjarve & Zemite, 2016; Mensah & Enu-Kwesi, 2018).

When the concept of development is combined with the concept of sustainability, it would simply mean development that can be continued either indefinitely or for a given time period (Lele, 1991; Dernbach, 1998, 2003; Stoddart et.al, 2011). Cerin (2006) stated that sustainable development is a core concept within global development policy and agenda. It provides a mechanism through which society can interact with the environment while not risking damaging the resource for the future.

To achieve sustainable development, government programs and activities are needed that empower communities to gain increased independence and prosperity. Then a theory regarding the implementation of public policy is needed as a conceptual basis for this research, also. The policy implementation stage is the stage that really determines whether a policy implemented by the government is truly applicable and successful in producing outputs and outcomes as planned. Policy implementation, as stated by O'Jones (1996), is those activities directed toward putting a program into effect.

In this research, these theories are used to embrace an understanding of how a community empowerment program can guarantee its successful implementation by paying attention to three main activities, which include the organization, the interpretation of the program itself, and how it is implemented. As in the public policy implementation model by Charles O'Jones (1996), which states that policy implementation is an activity intended to operate a program by taking into account the three main activities. O'Jones (1996) describes organization as the first activity in policy implementation, including the formation or arrangement of resources, units, and methods to support the program running. Regarding resources, of course, community participation is closely related to the implementation of a community empowerment program.

In the context of sustainable development, community participation is recognized as a key component. According to Kumar (2002), a participatory approach that encourages direct involvement of local communities in development projects can increase the relevance and acceptability of the resulting solutions. This was also confirmed by Jackson and Shade (1973), who showed that community participation can improve the quality and sustainability of development, especially in empowering communities to manage natural resources.

Then, related to the second main activity, namely interpretation, refers to the activity of interpreting so that a program becomes a plan and has appropriate direction and can be accepted and implemented. In this case, the Sepatin Village Community Empowerment Program was carried out with assistance from the academic community of the Faculty of Forestry of Mulawarman University, who were appointed by the Pertamina Foundation as the technical team for the Community Empowerment Program in the Mahakam Delta Blue Carbon Initiative Project. The parties also collaborate with the Forestry Service, which is the manager of the mangrove forest area in Sepatin Village, Kutai Kartanegara Regency.

With the same acceptance and understanding of the program implementation guidelines by all parties involved in program implementation, including policy recipients (the Sepatin Village community), the Community Empowerment Program can be implemented according to plan.

Next, the third main activity is application or implementation. This is, of course, the most important step, which is the realization of action activities to achieve program targets. In this case, the main objective of the Community Empowerment Program for Sepatin Village is to provide incentives for community efforts to support the successful

rehabilitation and restoration of mangroves in coastal and marine ecosystems. Community empowerment is an effort to develop community independence and welfare by increasing knowledge, attitudes, skills, behavior, abilities, awareness, and utilizing resources through establishing policies, programs, activities, and assistance that are in accordance with the essence of problems and priority needs of the community (Law of the Republic of Indonesia Number 6 of 2014 concerning Villages).

This research will explore how the Sepatin Village Community Empowerment Program can be implemented through the Mahakam Delta Blue Carbon Initiative Project by involving the community in the context of rehabilitation and restoration of mangrove forests as a form of development that can improve their welfare while also being fair to the coastal environment where they live.

Method

The location of this research is Sepatin Village, which is located in Anggana Sub-district, Kutai Kartanegara Regency, which is included in the Mahakam Delta area. This research uses qualitative research methods, conducted from November 2023 to March 2024. This approach provides depth of understanding of the implementation of community development programs, as well as allowing researchers to explore the various dimensions and contexts that influence this phenomenon (Creswell & Creswell, 2017).

This research aims to analyze the implementation of the Sepatin Village Community Empowerment Program within the context of mangrove forest rehabilitation and restoration in Sepatin Village, a coastal village located in the Mahakam Delta.

The object of this research is the coastal community group in Sepatin Village who are members of the Forest Farmers Group. The data collection technique was carried out by means of field observations of mangrove forest rehabilitation activities through community empowerment, interviews with informants from the Sepatin Village community, and documentation of community empowerment activities. Data analysis was conducted using descriptive analysis by an interactive model consisting of the stages of data collection, condensation, presentation, and concluding/verification.

Results and Discussion

General Description of Sepatin Village and Its Mangrove Forest

Sepatin Village was formed on December 7, 1941, and has an area of 55,819 hectares, which is drained by a 140-hectare Mahakam tributary. The Sepatin Village area consists of 33,170.2 hectares of Delta land and 21,980.9 hectares of pond area. Sepatin Village is divided into three hamlets: Hamlet I consists of five neighborhood associations (RT), Hamlet II consists of seven neighborhood associations, and Hamlet III consists of three neighborhood associations.

Sepatin Village in the coastal area in the south and east borders directly on the Makassar Strait. In the north, Sepatin Village borders Muara Pantuan Village, while in the west it borders Muara Jawa. Sepatin Village has small islands, including Kelambu Island, Datok Island, Rinding Island, Tanjung Berukang Island, Three Island, New Island, Sepatin Island, Bujid Island, and Tanjung Pamerung Island.

Administratively, Sepatin Village is included in the Anggana Sub-district, Kutai Kartanegara Regency, East Kalimantan Province. Topographically, Sepatin Village is located in a tidal coastal area, which is a lowland area 1-4 meters above sea level with a land surface slope of around 0-5 percent or flat, wavy.

The people in Sepatin Village are people who live and carry out socio-economic activities related to coastal and marine resources. So, it can be said to have quite high dependence on the potential and conditions of coastal and marine resources. Sepatin Village communities are generally fishermen, which is an important element in the

existence of coastal communities because it encourages regional economic activities and the formation of the socio-cultural structure of coastal communities. However, in Sepatin Village, there are still other community groups that also support the socio-economic activities of coastal communities.

Sepatin Village population data records that in 2023, there were 3,492 residents, consisting of 1,830 men and 1,662 women. The number of heads of families reached 958 people. Based on ethnic classification, the majority of Sepatin Village residents are Bugis (70 percent) and Makassar (22 percent). The rest are Javanese and Banjar (three percent each) and Kutai (two percent).

Regarding coastal area facilities, Sepatin Village has 12 ports and nine bridges. The means of transportation are dominated by 480 boats, 410 0-5 Gross Tonnage (GT) motorboats, 300 ces boats, 78 outboard motorboats, 24 5-10 GT motorboats. Of course, the livelihood of the residents of Sepatin Village in general is agriculture/ponding as many as 413 people, and fishing as many as 373 people. Followed by carpenters with 106 people, stall or restaurant business owners with 33 people, and the home industry with 24 people.

Based on their level of education, 7 percent of the Sepatin Village community is illiterate, 13.6 percent are elementary school students, 4.9 percent are junior high school students, and 3.3 percent are high school students. The population completed high school by 4.8 percent of the population, completed junior high school by 4.7 percent of the population, completed elementary school by 4.2 percent of the population, and completed kindergarten by 3.4 percent.

Related to forest and conservation areas in Sepatin Village, there are 15 rivers, such as Kabeh, Bennati, Banjar, Sepatin, Penangkaran, Benrang, Saiba, Babi, Lenro, Pemekaran, Patin, Sebubu, Sebayur, Arsad, and Red Rivers. The mangrove area consists of 35,000 hectares of *Avicennia*, 15,000 hectares of Nipah, and 1,000 hectares of mangroves. The dominant trees found in Sepatin Village include Nipah trees, *Avicennia*, mangroves, Devil's plant, and *Boli*. The home industry businesses in Sepatin Village that utilize coastal area and marine resources include industries in drying salted fish and Papai shrimp with 20 business units, seaweed or *sango-sango* processing with 17 units, shrimp crackers with 10 business units, shrimp paste and shrimp terrace each with three business units.

Empowerment of the Sepatin Village Community in the Blue Carbon Initiative Project

Coastal and marine areas are an integrated and mutually correlated ecosystem (Siregar and Purwaka, 2002). Each element in the ecosystem has roles and functions that support each other. Damage to one of the ecosystem components (land and ocean) directly affects the balance of the entire ecosystem. Mangrove forests are the element that play the most role in balancing environmental quality and neutralizing various pollutants.

In the mangrove forest conservation and rehabilitation program, the government plays more of a mediator and facilitator role (allocating funds through an established mechanism). While the community as implementers is expected to be able to take the initiative (Director General of Land Rehabilitation and Social Forestry, 2002). Mangrove forest conservation is an effort to protect nature in the form of setting aside areas as natural reserve areas, both for marine waters, coastal areas, and mangrove forests (Mulyadi and Fitriani, 2010).

According to the Minister of Forestry Regulation of the Republic of Indonesia Number 03/MENHUT-V/2004, mangrove forest rehabilitation is an effort to restore the function of degraded mangrove forests to a condition that is considered good and capable of developing ecological and economic functions. Meanwhile, mangrove forest restoration

is an effort to improve the ecological function of mangrove forests that have been degraded so that they can return to their original state.

In the Blue Carbon Initiative Project, the community empowerment program is an incentive for the community to support the success of mangrove forest rehabilitation and restoration efforts in coastal and marine ecosystems. The main program in this activity is training in preparing seeds and involving planting and maintaining mangrove plants, as well as implementing an integrative model based on environmentally friendly energy independence and developing other programs.

The line of thinking built into the design of the Blue Carbon Initiative Project is that when communities around the mangrove forest area gain material benefits, direct benefits to capacity building, and knowledge, then the community will provide support for the program and carry out every appeal given. Therefore, the Blue Carbon Initiative Project focuses on community empowerment efforts in the Mahakam Delta mangrove forest area, one of which is Sepatin Village.

Community empowerment is an effort to develop community independence and welfare by increasing knowledge, attitudes, skills, behavior, abilities, awareness and utilizing resources through establishing policies, programs, activities and assistance that are in accordance with the essence of problems and priority needs of the community (Law of the Republic of Indonesia Number 6 of 2013 concerning Villages).

The details of community empowerment activities in implementing the Blue Carbon Initiative Project are outlined as follows:

Community involvement in mangrove planting activities

Mangrove is a characteristic form of coastal plants, estuaries, or river estuaries, and deltas in protected areas in tropical and subtropical areas. So, mangroves are an ecosystem that is found between land and sea, and under suitable conditions, mangroves will form extensive and productive forests (Mulyadi and Fitriani, 2010). As a result of living near the coast, mangroves are often called coastal forests, tidal forests, brackish forests, or mangrove forests. Mangrove forests are called brackish forests because they grow on land that is always flooded with brackish water. It is called a mangrove forest because most of the vegetation is dominated by mangrove species.

The term mangrove comes from the Indonesian which is the name of one of the species that make up mangrove forests, which is *Rhizophora sp*. In order not to create a bias between mangroves and *Rhizophora* mangle, mangrove forest has been designated as the standard term to describe forests that have living characteristics in coastal areas (Mulyadi and Fitriani, 2010).

Mangrove planting activities are one form of mangrove forest rehabilitation and restoration efforts. Mangrove rehabilitation and restoration activities carried out in Sepatin Village prioritize communities who are part of the Sepatin Village Forest Farmer Group as planters. When the sale of fishery cultivation products experienced a significant decline due to the Covid-19 pandemic, the community expressed that their involvement in mangrove rehabilitation and restoration activities in the Mahakam Delta was able to generate additional incentives for the community. The provision of accommodation, consumption, and water transportation during the entire series of Blue Carbon Initiative Project activities has involved the participation of the Sepatin Village community, which has resulted in additional income.

In an effort to increase community participation in sustainable mangrove rehabilitation and restoration activities, the implementing team provided a mangrove seedling nursery facility measuring 18 meters x 18 meters, which can accommodate more than 50.000 seedlings (see figure 1). This nursery was built using ironwood poles and light steel roof supports. With the construction of this nursery, it is hoped that the Sepatin Village

community can participate in providing seedlings, especially for planting and maintenance activities in the area around the Mahakam Delta.

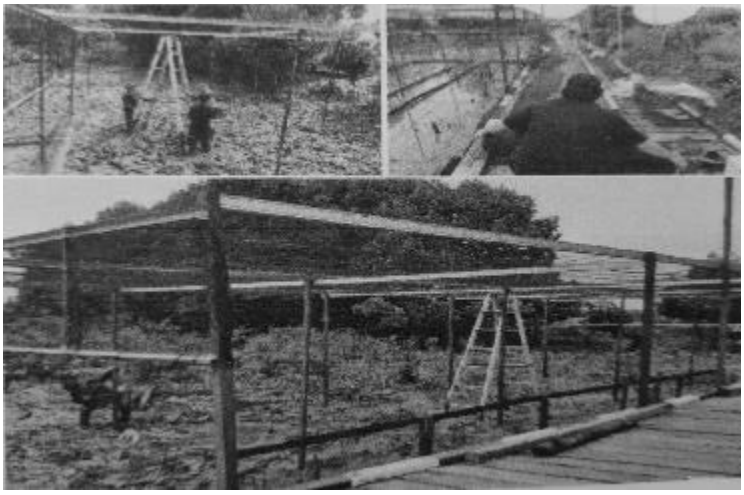

Figure 1.
Mangrove Nursery Bed Construction in Sepatin Village
Source: Research documentation, 2024

The nursery management appointed by the Village Government agreed that in the operationalization of the nursery facilities, residents from vulnerable groups, lower middle class, and women will be involved. Then, to maintain the quality of the seedlings produced, the implementing party has provided training on the ideal seed preparation procedure so that the quality of the seedlings is good and meets the standard qualifications for mangrove planting activities.

Currently, the remaining mangroves are only mangrove communities located around river mouths with a thickness of 10 to 100 meters, dominated by *Avicennia marina, Rhizophora mucronata, and Sonneratia caseolaris* species, which each have their own benefits (Mulyadi and Fitriani, 2010).

Purba and Poedjirahajoe's research (2011) stated that as the planting age increases, the mangrove density level will increase. Conversely, the thickness of the mangrove mud will decrease as the planting age increases.

Therefore, rehabilitation and restoration of mangrove forests is one of the efforts that can reduce the carbon dioxide content of the atmosphere, as one of the factors causing global climate change. The mangrove forest ecosystem can anchor carbon dioxide, so that mangrove forests have a role in mitigating climate change because they are able to reduce carbon dioxide, absorb carbon from the atmosphere, and store it in their parts (Purba and Poedjirahajoe, 2011).

The important functions of mangrove forests include as biofilters, binding agents and pollution traps (Mulyadi and Fitriani, 2010), playing an important role in reducing the negative impacts of natural disasters such as tsunamis and hurricanes, also functioning as a breeding ground for marine biota of economic value (Kumar et.al, 2015), protecting the coast from abrasion, keeping the coastline stable, and acting as a filter for salt water to become fresh (Dixon, 2001). Mangrove plants also produce various bioactive components as secondary metabolic substances that have the potential as herbal medicines (Rodiani et.al, 2023).

Rehabilitation efforts are expected to be able to restore the important function of mangrove forests in coastal areas. Even research by Duryat and Rodiani (2023) states that conservation and rehabilitation of mangrove forests are crucial in maintaining the role of mangroves for the preservation of nature.

In order for rehabilitation goals to be achieved, the active involvement of coastal village communities is essential. Said by Ghufran and Kordi (2012) that the mangrove forest ecosystem has important benefits in supporting human life, both directly and indirectly, namely in the form of increasing community income, foreign exchange for the region (village, sub-district, district/city, province) and the country.

However, by replanting mangroves in the Sepatin Village area, further studies are needed on the level of success of the mangroves that have been planted using forest plant growth analysis methods, including measuring the percentage of mangrove growth, including environmental factors that influence the growth of these mangrove plants.

Based on the regulation of the Minister of Forestry of the Republic of Indonesia Number P.70/Menhut-II/2008, the success of mangrove forest rehabilitation is declared successful if the percentage of growth is equal to or more than 70 percent and is declared less successful if the percentage of growth is less than 70 percent.

Most of the mangrove forest rehabilitation efforts carried out throughout the world have very low success (Duryat and Rodiani, 2023). Lewis and Brown (2014) stated that the failure of mangrove conservation and rehabilitation efforts was caused by two main things, namely the planting project was too simplified and did not comply with silvicultural principles, and forced mangroves to grow on land in tidal mudflats, which are below average sea level, where mangroves naturally would not be able to grow.

Some efforts that can be made so that mangrove growth is successful from mangrove planting activities that have been carried out include carrying out planned follow-up maintenance of plants with adequate budget support. When good and correct rehabilitation/planting techniques have been provided to the community through training, but if without the support of a sustainable budget for mangrove plant maintenance efforts, then there will always be a chance that mangrove growth will not be successful.

Therefore, the implementation of mangrove planting and maintenance in the context of mangrove forest rehabilitation and restoration efforts still requires dominant government intervention. As Syamsi in Fitriadi et.al, (2005) stated that without government intervention, development will not be successful or at least will not run smoothly. However, in the Blue Carbon Initiative Project, the implementing party (the Faculty of Forestry, Mulawarman University and the Pertamina Foundation) have collaborated with the Sepatin Village Government and provided opportunities for the community to participate. The opportunity to participate is one of the three requirements needed for the community to be able to play an active role in development. Opportunity is a chance available for the community to be able to participate in an activity (Slamet and Amba, 1998).

The role of the community in maintaining the preservation of mangrove forests is very essential and is a fundamental pillar for the preservation of mangrove forests (Suraningsih, 2020). With the rehabilitation of mangrove forests, the condition and function of degraded forests, the condition and function of degraded forests can be strategically restored (Mustofa, 2018).

Hydroponic plant cultivation training

In order to increase the independence of agricultural crops in Sepatin Village. One of the empowerment programs carried out is hydroponic plant cultivation training. Hydroponic is seen as an ideal alternative to overcome the limitations of agricultural land in Sepatin Village.

In the Blue Carbon Initiative Project, a hydroponic house was built with a size of 4 meters x 6 meters. The pump for flowing water is equipped with a solar-powered electric energy source (renewable energy). The Sepatin Village community was given training in

making and maintaining hydroponic installations (see figure 2), proper plant cultivation procedures and techniques for harvesting hydroponic cultivation results.

Hydroponic cultivation is the cultivation of plants that utilizes water (Dewantoro, 2020), without using soil as a medium and by emphasizing the fulfillment of nutritional needs for plants (Waluyo et.al, 2021). Hydroponics is also known as soilless culture. The Sepatin Village area which is a coastal area is suitable for the application of hydroponic cultivation, which brings advantages including: the success of plants to grow and produce is more guaranteed, more practical care and pest disturbances can be more controlled, fertilizer use is also more efficient, dead plants are also easier to replace with new plants, do not depend on the session and other natural conditions, can be applied to narrow or limited land, along with the selling price of hydroponic products which are higher than non-hydroponic products.

Figure 2.
Hydroponic Plant Cultivation Training Activities in Sepatin Village
Source: Research documentation, 2024

Hydroponic cultivation is one of the solutions to improve the welfare of coastal communities such as Sepatin Village, which has limited agricultural land in addition to helping preserve nature. Hydroponics was chosen as a method that is very suitable for use by the Sepatin Village community because it can reduce water needs, reduce the risk of unhealthy food, and environmental pollution.

Installation of solar powered street lights

The availability of electricity in Sepatin Village is still very limited. The only source of electricity that has been built and managed by the Village Government for the daily needs of the community comes from a solar power plant.

Figure 3.
Comparison of Road Conditions in Sepatin Village Before (Left Figure) and After (Right Figure) the Availability of Solar-Powered Street Lighting
Source: Research documentation, 2024

One of the mentoring provided through the community empowerment program in the Blue Carbon Initiative Project in the Mahakam Delta is the provision of renewable energy sources. In the first year of 2023, the implementing party focused first on installing 100-watt solar-powered street lights. With the presence of solar-powered lighting, the Sepatin Village community can obtain better lighting facilities compared to previous conditions, where at night the Sepatin Village area was very dark (see Figure 3).

Provision of rainwater harvesting facilities

Through the Blue Carbon Initiative Project, the program implementers also provide fresh water supply facilities (see figure 4), which are an important need for people living in coastal areas such as Sepatin Village. In Sepatin Village, there is no collective fresh water supply system, so residents are accustomed to independently collecting fresh water from rainwater. In the Sepatin Village Profile in 2023, it is known that all residents of Sepatin Village use rainwater reservoirs. However, for the lower middle class, purchasing fresh water is not yet affordable.

A further description of the clean and healthy living behavior of the Sepatin Village community is recorded in the 2023 Sepatin Village Profile that, generally, families in Sepatin Village have water closets that do not meet health standards, as many as 889 families. Meanwhile, the number of families that have healthy water closets is only 35 families. Sepatin Village also experiences environmental problems in the form of waste pollution.

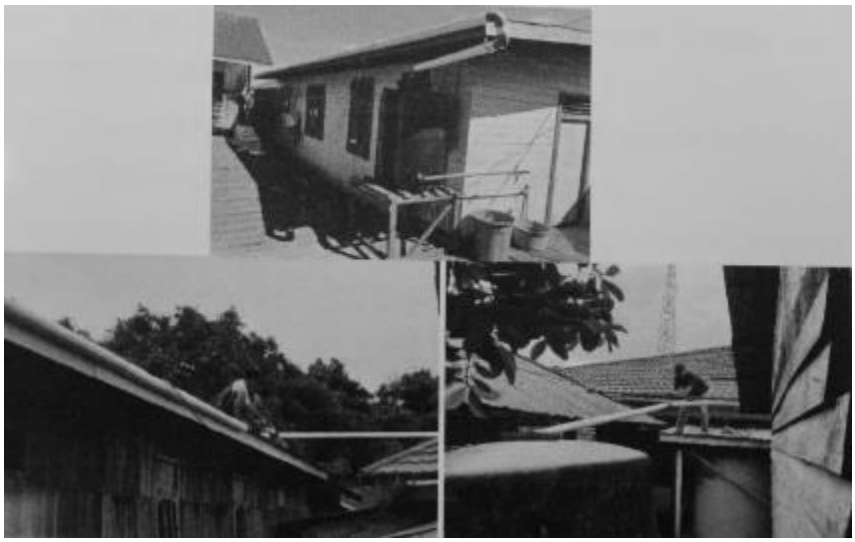

Figure 4.
Activities to Install Water Gutters at Rainwater Harvesting Installations in Religious Facilities and Homestays
Source: Research documentation, 2024

Indicators of Achievement of Community Empowerment Activities

In implementing the Blue Carbon Initiative Project in the Mahakam Delta, specifically for Sepatin Village, the technical team from the Faculty of Forestry of Mulawarman University surveyed to measure the community satisfaction index for each activity that was carried out in the program.

A Community Satisfaction Index (CSI) survey of Sepatin Village Community Empowerment Program activities of the Blue Carbon Initiative Project was conducted with a score of 80,49, with the average score at 3,22 (see Table 1).

Table 1.
Results of the Calculation of the Satisfaction Index Survey of the Sepatin Village Community Towards the Blue Carbon Initiative Project Community Empowerment Activities

Element	Number of N	N/Element	N Weighted	CSI
1	137	3.43	0.340	
2	128	3.20	0.320	
3	127	3.18	0.318	
4	129	3.31	0.330	
5	126	3.15	0.315	
6	123	3.15	0.310	
7	129	3.31	0.330	
8	129	3.23	0.320	
9	122	3.13	0.310	
10	125	3.13	0.310	
			3.22	**80.49**

Source: Research analysis result, 2024

Survey results on 10 elements of community satisfaction (see Table 2) indicate that the opinions of each respondent vary greatly, ranging from a score of 0 to 4. The results of the community satisfaction index survey show that the majority of respondents consider that community empowerment activities in the Blue Carbon Initiative Project that have been implemented are capable of providing a significant impact. This can be seen from the respondent's answers, which were dominant in scores 3 and 4.

Table 2.
The Value of Each Element in the Sepatin Village Community Satisfaction Index Survey Regarding the Blue Carbon Initiative Project Community Empowerment Activities

No.	Service Elements	Value
1	Mangrove planting activities	3.43
2	Program implementation	3.20
3	Clarity of information	3.18
4	Communication	3.31
5	Community involvement	3.15
6	Effectiveness of increasing community income	3.15
7	Suitability to community needs	3.31
8	Competency of service personnel	3.23
9	Quality of physical facilities	3.13
10	Effectiveness of programs to improve mangrove forest ecosystems	3.13
	Average	**3.22**

Source: Research analysis result, 2024

The achievement of the Community Satisfaction Index (CSI) value of 80,49, which is included in the good category (B), indicates that the community has a good response to all community empowerment programs that have been carried out. Through the Blue Carbon Initiative Project, of all the elements of satisfaction assessed, community involvement in mangrove seedling planting activities has achieved the highest value (3,43). On the other hand, there are still two elements that are still lacking, namely the element of physical facility quality and the effectiveness of the program in improving the mangrove forest ecosystem, each of which has a value of 3,13. So these two elements need to be prioritized for improvement.

During the implementation of the Blue Carbon Initiative Project, it was also found that the Sepatin Village community, most of whom are fisherman, actually has other potential that can be developed to become a source of income that is greater that what they currently get. The method is to utilize waste from unsold fisheries catches, such as Papai Shrimp, shrimp heads, baby squid, baby crabs, and *bete-bete* fish.

So far, the Sepatin Village community has only caught and sold shrimp, squid, and crabs in certain types and sizes, even though it is enough to meet export needs. In addition, the waste from their catch has never been thought of as further processed into various products with added value. For example, for shrimp heads, Papai shrimp and *bete-bete* fish, which can be processed into shrimp paste, shrimp terrace, or fish flour.

But to be able to realize this, of course, the community needs to be given appropriate knowledge, skills, and assistance. Then it is necessary to implement training on processing fishery waste into packaging and marketing it. If the Sepatin Village community has been equipped with sufficient skills, then this can increase the opportunity to improve community welfare.

From the implementation of the community empowerment program in Sepatin Village, the effectiveness of the program in rehabilitating the mangrove forest ecosystem still requires the following improvement efforts: (1) Conducting community empowerment activities by involving more Forest Farmer Groups; (2) Holding special training for women's groups; (3) The variety or type of mangrove seed training needs to be developed; (4) The installation of solar-powered electricity sources on road facilities needs to be continued or its watt capacity increased.

Mangrove forests have a very important ecological, economic, and social role in supporting the development of coastal areas. Rehabilitation activities are also a priority before the negative impacts of the loss of mangrove forests become more widespread and

unmanageable. Mangrove forests can be lost due to various natural events such as tsunamis, abrasion, intrusion, ebb and flow, as well as pollution and the spread of disease, in addition to the conversion of land functions by humans.

Tides are one of the factors that greatly determine the zoning, growth, and distribution of mangrove life. Tides also help the lives of fish and other communities in living of fish and other communities in living and associating with the mangrove ecosystem in the waters (Makaruku and Aliman, 2019).

Davis and Natarina (1995) stated that mangrove forests have the following functions and benefits: 1) Habitat for rare animals, 2) Protection against natural disasters, 3) Sedimentation of mud, 4) Addition of nutrients, 5) Binding of toxins, 6) Natural resources in the area (in-situ) and outside the area (ex-situ), 7) Transportation, 8) Source of germplasm, 9) Recreation and tourism, 10) Educational and research facilities, 11) Maintaining natural processes and systems, 12) Carbon absorption, 13) Maintaining microclimate, 14) Preventing the development of acid sulfate soil.

Therefore, the rehabilitation and restoration efforts of mangrove forests in the Mahakam Delta area, where Kalimantan has 688.000 hectares of mangrove forests or the equivalent of around 20 percent of Indonesia's mangrove forest area, are important matters in the protection and preservation of nature. The Faculty of Forestry and the Pertamina Foundation, as the implementers of the Blue Carbon Initiative Project, have taken part in the rehabilitation and restoration efforts of mangrove forests through the Sepatin Village community empowerment program properly.

Conclusion

The community empowerment program, which is part of the Blue Carbon Initiative Project for the Mahakam Delta, has been implemented well in Sepatin Village. The forms of activity in the community empowerment program include community involvement in the rehabilitation and restoration of mangrove forests, training in hydroponic plant cultivation, installing solar-powered street lights, and providing rainwater harvesting facilities.

A significant finding from this research is that the Sepatin Village community empowerment program within the framework of the Blue Carbon Initiative Project for the Mahakam Delta can improve its sustainability by developing village potential, such as untapped fishery products to be processed into value-added products. Efforts to further develop this potential need to be accompanied by community empowerment activities in the form of providing training on fishery product processing and efforts to open marketing channels so that the economic welfare of the Sepatin Village community can increase, as well as rehabilitate and restore mangrove forests in the Mahakam Delta area more optimally.

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ORCID ID

[1]Fajar Apriani https://orcid.org/0000-0001-6914-7164

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