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Analysis of Fishing Community Sustainability and Policy Scenario based on Sustainability Leverage Factors in Indonesia

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Abstract

Sustainable communities combine ecological, economic and social aspects of people's lives and pay attention to sustainability in the future. This study aims to explore how the sustainability of fisherman communities is posited in the framework of sustainable coastal development in Indonesia. This study used a mixed data collection method (including both qualitative and quantitative methods). The mixed method included observation, in-depth interviews and focus group discussions, structured interviews, and survey techniques. Quantitative data were analyzed using RAPFISH software and strengthened by the MONTE CARLO test. The results of the research showed that the economic dimension played an important role in the sustainability of fishing communities. However, it required a balance from other dimensions. The ecological dimension had a sustainability value in the poor category, which was 46.5, based on the value, ecologically, various efforts are necessary so that the fishery activities in Banten coastal areas can be sustainable. The economic dimension was in a good category, with a sustainability status value of 80.93, while the social dimension was in a fair category with a sustainability status value of 65.8. Sustainability status on the technology dimension was in a fair category, with a value of 62.22. On the institutional dimension, the value of sustainability status was 63.1 in a fair category. Community sustainability can still be improved by paying attention to leverage factors in each dimension. Policy scenarios based on sustainability leverage factors have been successfully formulated in accordance with the leverage factors of the economic, ecological, social, technological and institutional dimensions.

Keywords: *Fishing Community Sustainability, Policy Scenario, Leverage Factors.*

Introduction

Communities who live in coastal rural areas are important subjects of development in Indonesia. There are around 25,224 coastal villages consisting of 12,681 seaside villages and 12,543 non-seaside villages. The coastal villages surround Indonesia's water area of 6.4 million km (Kementerian Kelautan dan Perikanan, 2021). The majority of the coastal communities work as fishermen, fish cultivators, and salt farmers. To achieve the national goal to prosper the Indonesian people, the Indonesian government has formulated a National Long-term Development Plan for 2005-2025 with directions for marine and fisheries development. The long-term development missions related to the marine and fisheries development for coastal communities include: (1) a mission to achieve a competitive nation, in which coastal communities must have competitiveness, (2) a

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mission to realize a beautiful and sustainable Indonesia, which is related to the conservation of natural resources and coastal environment as well as sustainable resource management activities, (3) a mission to actualize Indonesia as an independent, advanced, strong, and national interest-based archipelago state, which is related to the development of facilities and infrastructures, improvement of human resource quality that can develop marine economy and coastal disaster management (Bappenas, 2021). The missions can be achieved by achieving a strong, sustainable, and competitive coastal economic structure. This condition can be manifested through coastal development efforts as part of sustainable and directed marine and fisheries development. In the medium-term development plan for 2020-2025, the Indonesian government set two scales of priority, namely (1) prioritizing a competitive economy by combining industrial, agricultural, marine, and service sectors and (2) developing business and investment. This shows the importance of advancing community capabilities to develop businesses for economic improvement. The Indonesian government's efforts to develop the marine and fishery sector encounters issues and challenges in both sectors. Issues in the fishery sector include: (1) sub-optimum production infrastructures, (2) limited fish resources, (3) production input problems, (4) low added value of the production capacity of the fish processing industries, and (5) low prosperity of fishery actors. In the marine sector, on the other hand, the issues consist of (1) regulation and permit systems, (2) marine governance regarding zone systems and illegal fishing practices, (3) sub-optimum quality and quantity of marine resources, (4) less proper management of institutions, and (5) innovation systems and marine knowledge and technology that have not been appropriate yet (Bappenas, 2021)

Coastal communities are one of the actors in marine and fisheries development. All efforts designed in the medium-term development plan for 2020-2025 are inseparable from the efforts to develop coastal communities. It is very important to develop communities where their economic, social, ecological, and cultural aspects can be integrated systematically and sustainably (Nayak, 2019; Franco & Tracey, 2019). The sustainable community model can conjoin all community life aspects and considers future sustainability.

The problem in the development of third world countries is development inequality, especially the economic sector is the focus of development, while the ecological and social sectors are considered less important. This is the cause of development in terms of sustainability is not achieved (Zang et al. 2018, Bennet et al. 2019, Chiengkul. 2019, Jimenez et al. 2021, Wang et al. 2021). This current study will answer whether the condition of community development is as it is assumed. Are there facts that show there are efforts to balance development in all sectors that are considered important for sustainability?

Said & Chuenpagdee (2019) argue that a holistic approach encompasses several sustainable development goals (SDGs), including livelihoods, economic growth, community sustainability, strong institutions and partnerships. Fisheries assessment and management have focused on insufficient consideration of social (including cultural), economic, institutional (governance) and environmental aspects (Stephenson et al, 2019. Apine et al, 2019. Haque et al, 2022).

Richmond & Casali, 2021 show that social capital can play a key role in the sustainability of fishing communities and fisheries policies can better consider and address the social capital of fishing communities. Asche et al, 2018 show three pillars of sustainability in fisheries, where economic, social, and ecological objectives are mutually reinforcing in fisheries management. The implication is that management-based systems must be accepted and social considerations must be addressed in the design of these systems. Richmond et al, 2019 assess fishing community sustainability around four broad categories: economics and markets; social and community; physical infrastructure and critical services; environment and regulation. The results of the research show

recommendations on how the fishing industry can be improved by adapting to various contexts and can provide real benefits to the community with community-scale planning and regulatory decisions that affect the community that are enforced.

Therefore, the purpose of this study was to answer questions on how the sustainability of fisherman communities is posited in the framework of sustainable coastal development in Indonesia by exploring fisherman communities in Indonesia by taking a case study of a selected fisherman community. This study is new and has not been reported by other authors yet.

This research needs to be carried out to see and analyze the facts of efforts to achieve sustainable development at the empirical level, especially in fishing community development activities. Research findings can become the basis for recommendations for developing development policy scenarios on a sustainability basis

Theoretical Background

Sustainable development (SD) is something that is agreed upon globally and is the goal of the development of countries in the world. Universally, sustainable development goals (SDGs) have been applied in the steps, strategies, models, and implementations of development in the world. Likewise, the marine and fishery sectors must implement sustainable development. Marine and fisheries development is closely related to coastal development; therefore, the majority of the development actor is coastal communities. Sustainable coastal development is a crucial agenda in the efforts of achieving sustainable development (Abubakar. 2019, Bennet et al. 2019, Hossain et al. 2020, Herrón et al. 2020)g

Social capital and community developments are essential factors and are efforts to develop a sustainable community to strengthen the social security system of the community. In the future, it is consequential to look at the factors and their impact on development collectively by developing collaborative capabilities through the application of appropriate community development concepts. The execution of collective community development is the common representation and the future of a community (Worral & D'Leary, 2019; Fedor, 2019). Rural development will depend on the organization of the community and the determination of community sustainability, for example, social organizing and economic organizing (economic zone) (Geri. 2020. MD Lalose & Taylor.2020). In the context of social security, social capital is related to economic growth. A proper social security system will eliminate poverty problems in the community (Thorgersen. 2020).

The ocean is a natural resource that becomes the livelihood source for fisherman communities in the maritime sector. The resource has been utilized for generations for their livelihood. Satria (2015) states that an obstacle faced by fishermen is the marine resources that are open access. Therefore, fishermen must move around to gain maximum yield. Consequently, they face higher risks. Due to the risks, fishing activities are similar to hunting and gathering activities that have a high uncertainty level. The high risk does not diminish livelihood in the maritime sector. The maritime coastal community livelihood system currently employs various efforts to reduce the risk by employing modern fishing technology.

Abubakar (2019) opines that the utilization of fishing technology and social capital is fishermen's way to meet their livelihood. Major things related to livelihood are environmental sustainability and social sustainability. Environmental sustainability in the context of fisherman livelihood is how the coastal communities utilize marine resources by not damaging the existing resources so that they can be regenerated and used sustainably. Whereas, the context of social sustainability of the coastal communities is the relationship between individuals or groups to hold activities in the utilization of marine

resources that are either fixed or varied as an effort of maritime coastal community livelihood.

The roles of coastal villagers and government are essential in the realization of social security in the coastal communities' livelihood. Life in the archipelagic country that is maritime is by utilizing the sea as a source of life. Marine resources from the perspective of the economy have comparative advantages and their position can become positive advantages. Therefore, the utilization of marine resources requires regulations (Hezron, 2016).

Coastal communities utilize fishery resources in their daily activities, such as for consumption or to be sold or processed into fishery products. The communities use fishery resources to fulfil their daily necessities. In the economic aspect, factors that support coastal community's security and prosperity are, among others, government support in the utilization of fishery resources both in the capture fisheries and cultivation, tourism activities, shipping industry, fishing industry, and salt farming (Arifiani, 2016). The roles of government are vital in the efforts to achieve prosperity and social security of the coastal communities through marine economic policies aiming to make a sustainable sea the basis for economic development.

Methods

The research activity was carried out in Banten Village, Kasemen Sub-district, Serang City, Indonesia. The village is a coastal area in the working area of the Archipelago Fishing Port of Karangantu. The research was conducted from April to June 2022. The research location was purposively selected since it is one of the coastal villages. Secondary data were generated from the Fishery and Marine Department of the Banten Province, the Archipelago Fishing Port of Karangantu, and related journals and research results.

Qualitative and quantitative methods (mixed method) were selected as the research method. The qualitative method is a data collection technique in the form of observation, in-depth interviews, and focus group discussions (FGD). The quantitative method uses data collection techniques of structured interviews and surveys. The quantitative data analysis aimed to identify the sustainability status of fisherman communities in the Archipelago Fishing Port of Karangantu. Sustainability analysis was performed on five dimensions that consisted of ecology, economy, society, technology, and institution. The five dimensions were analyzed using the RAPFISH software and strengthened by the MONTE CARLO test to find out the most influential attribute as leverage.

The Rapfish (Rapid Apprisal for Fisheries) is an analysis method to multidisciplinary evaluate fisheries sustainability based on the ordination technique (assigning something in a measurable attribute order) with multi-dimensional scaling (MDS). MDS is basically a statistical technique that tries to transform a multi-dimension into a lower dimension (Fauzi dan Anna 2005). Score values were set based on the results of interviews with respondents that were analyzed using the Rapfish program. The values from the analysis result were then interpreted into 4 groups that illustrated the sustainability conditions, namely: 0-25 is very poor, 26-50 is poor, 51-75 is fair, and 76-100 is good.

Results

The research analyzed the sustainable community from the perspective of ecological, economic, social, technological, and institutional dimensions. The ecological dimension was analyzed using certain indicators, namely fishery potentials, sedimentation water quality, mangrove quality, level of pollution, and level of coastal land conservation. The economic dimension was analyzed from fisherman income, ownership of fishing gears,

savings, access to market, access to available resources, and the presence of economic assistance. Analysis of the social dimension included indicators of the level of education, population, availability of education facilities, social facilities, social interactions, social conflict management, and the utilization of local wisdom. The technological dimension was analyzed with the level of fishing technology, transportation modes, technology literacy, information technology infrastructures, ownership of information technology facilities, and ownership of transportation facilities. Indicators used in analyzing the institutional dimension comprised the roles of non-governmental organizations, the roles of governmental agencies, the roles of resource management institutions, partnership cooperation, the roles of educational institutions, the roles of religious institutions, and the economy. The output was a sustainability index of each variable and dimension that influenced the index.

Ecological Dimension

Figure 1 shows the rapfish ordination for the ecology dimension. Built upon the Rapfish analysis that was strengthened by the Monte Carlo analysis (Figure 2), the value of the community sustainability status based on the ecological dimension was 46.5. The value indicated that the ecological dimension was in the poor category since the value fell in the range of 26-50. Based on the value, ecologically, various efforts are necessary so that the fishery activities in Banten coastal can be sustainable.

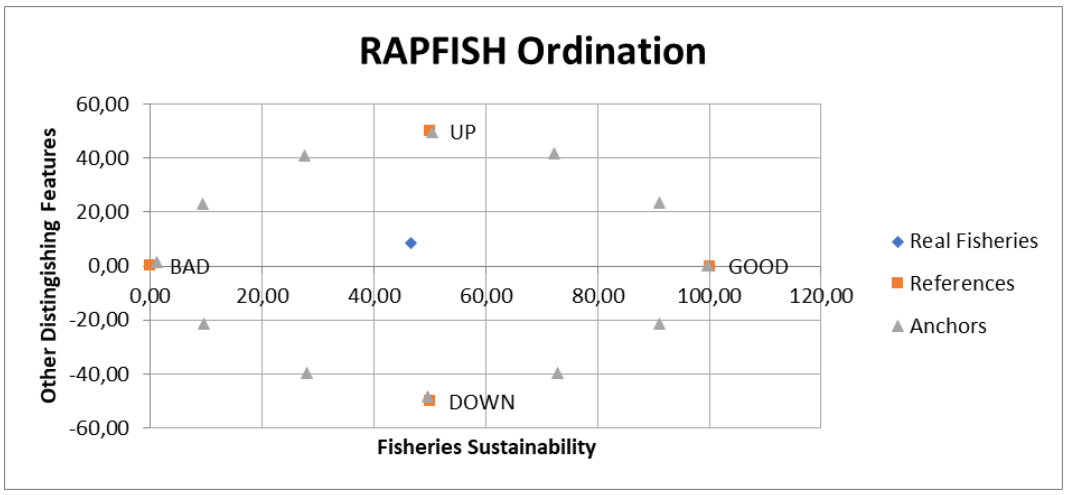

Figure 1. Rapfish Ordination For Ecology Dimension

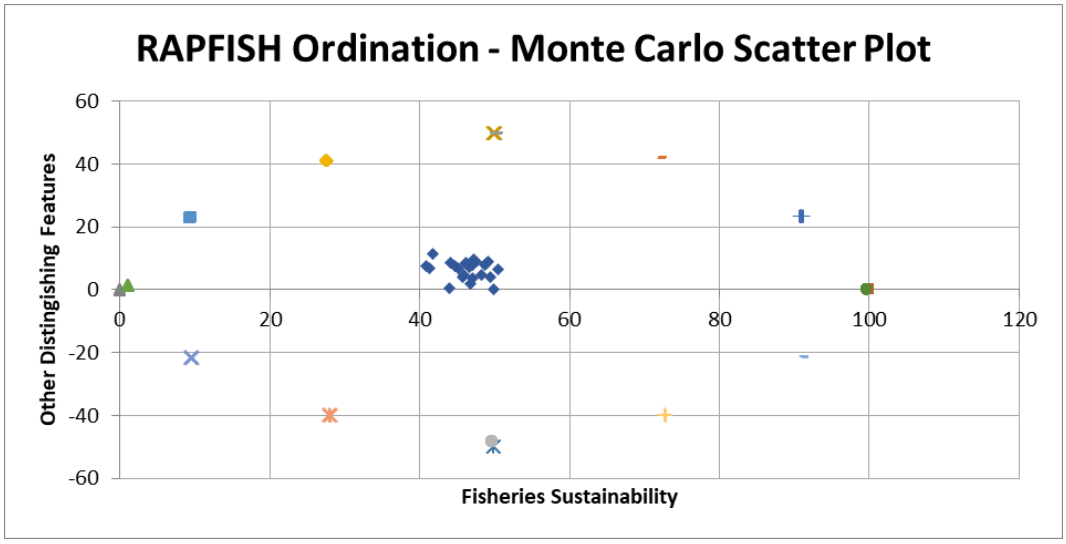

Figure 2. Monte Carlo analysis for Ecological Dimension

According to the result of the leverage analysis on the ecological dimension (Figure 3), two attributes that required attention are mangrove conditions with a value of 6.4 and fishery potentials with a value of 2.6. Mangrove is one of the vital issues in the Banten Bay area. Crude oil spills and human activities induce mangrove destruction of 60%. Restoration efforts are continuously performed including replanting damaged mangroves. Mangroves play an important role in the fish life cycle in the sea. This beach plant serves as a shelter and food provider for fish larvae.

Next, fishery potential in Banten Bay should be a concern so that the fisherman community's sustainability is maintained. The fishery potentials in Banten Bay are disturbed due to numerous fishing fleets (±346 fishing fleets) with various fishing gears, such as bubu, payang, gillnets, boat lift nets, and fixed lift nets, that conduct their fishing activities in the area. A relatively significant pressure causes a decrease in the quality of fish caught. Consequently, fishermen catch fish farther away and get smaller fish over the years.

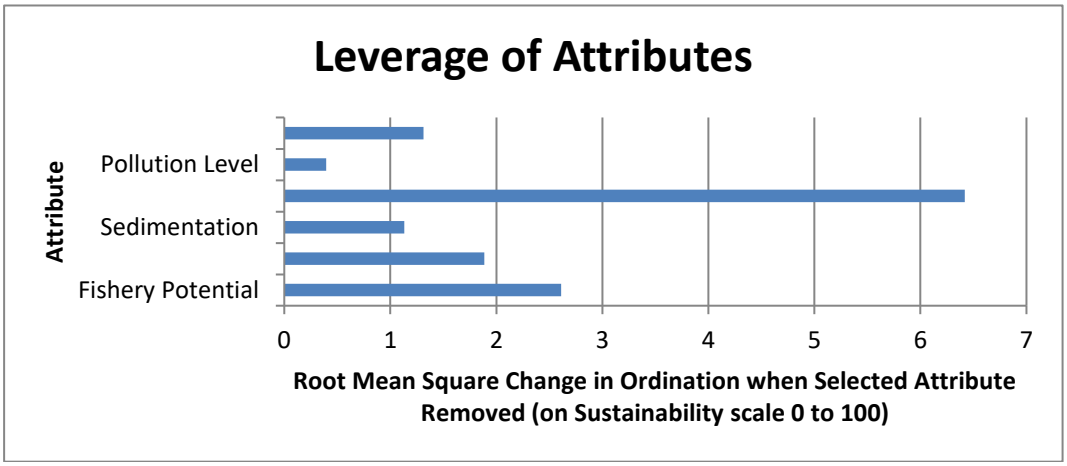

Figure 3. Leverage Attributes on The Ecological Dimension

Economic Dimension

The Rapfish analysis that was strengthened by the Monte Carlo analysis (Figures 4 and 5) resulted in a value of sustainability status based on the economic dimension of 80.93. The value suggests that the economic dimension was in a good category since the value was within the range of 76-100.

Based on the score, the efforts of maintaining community sustainability are economically in a good condition since the fishery sector is a sector that absorbs a relatively substantial number of workers. Even during the covid-19 pandemic in Indonesia, the fishery sector in the Archipelago Fishing Port of Karangantu is a relatively unaffected sector (Hamzah & Nurdin 2021).

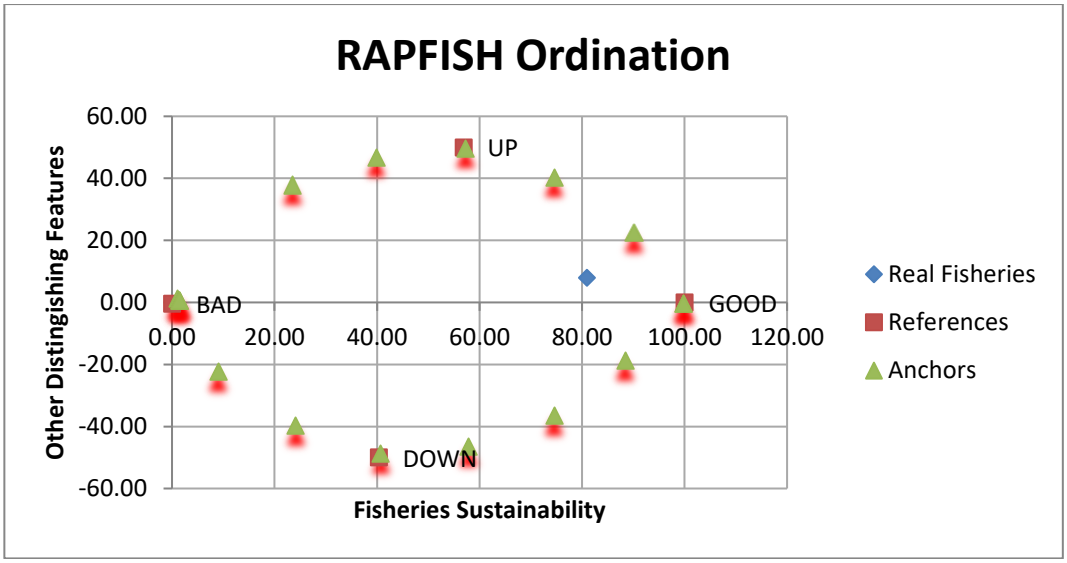

Figure 4. Rapfish Ordination for Economic Dimension

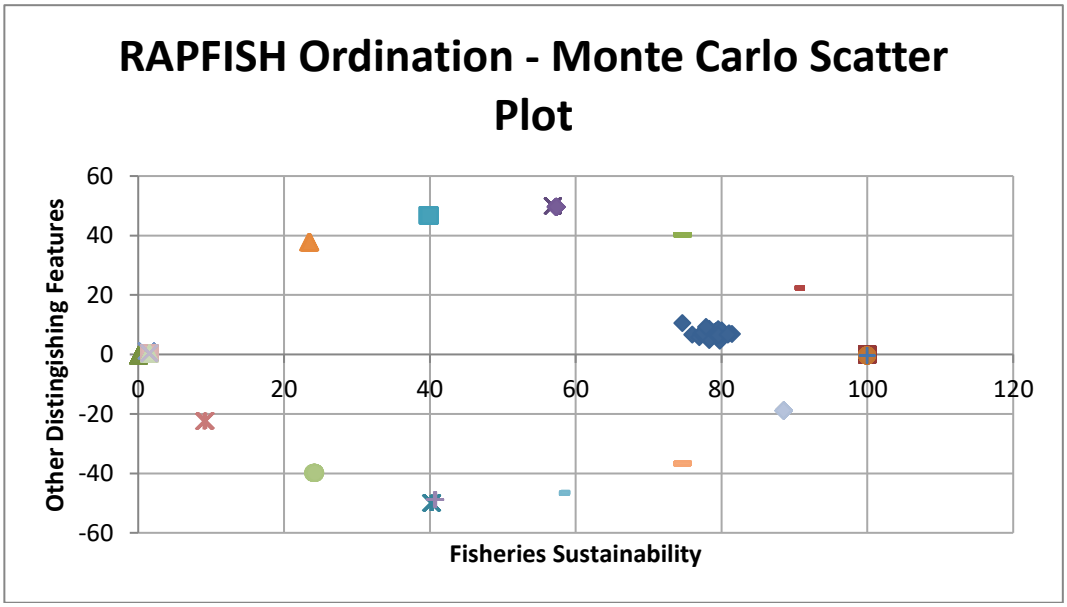

Figure 5. Monte Carlo Analysis for Economic Dimension

Referring to the leverage analysis result on the economic dimension (Figure 6), two attributes that require attention are economic aids with a value of 6.6 and access to markets with a value of 9.1. The values imply that economic assistance to farmers in the Archipelago Fishing Port of Karangantu is not equal. Economic aid is urgently needed because there are no fishing institutions that are capable of managing famine funds as was done by the Archipelago Fishing Port of Palabuhan Ratu or the Archipelago Fishing Port of Pekalongan through the village unit cooperative of Mina (Hamzah et al 2015; Wibowo et al 2014). In both ports, fishermen sell their fish in an auction managed by each village unit cooperative of Mina. Each transaction is charged with retribution intended for regional income, fishery port revenue, village unit cooperative, and Social Funds used during famine season. The access has the highest value, which was 9.1, because fishermen were tied to middlemen. Subsequently, fish caught must be sold through the middlemen as a recompense for their assistance in financing the fishermen's fishing supplies. The condition, however, makes fishermen unable to be independent in accessing the market for the caught fish. The result of the interview and observation during the research suggests that crab fishermen had to stop their fishing activities since the

middlemen who used to buy their crabs no longer bought them. Even if they sold their crabs, they received a very low price.

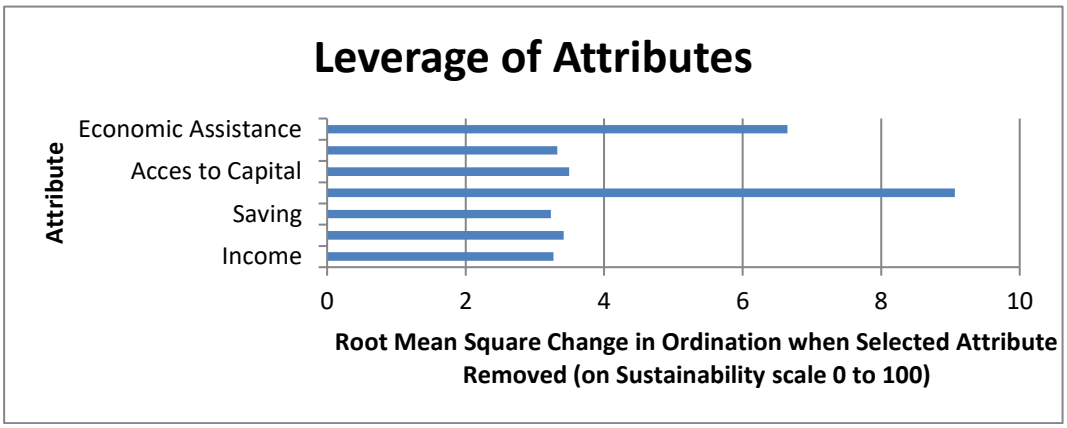

Figure 6. Leverage attributes on the Economic Dimension

Social Dimension

Based on the results of Rapfish analysis that was strengthened by Monte Carlo analysis (Figures 7 and 8), the value of the sustainability status in the social dimension was 65.8. The value was in the fair category. Considering the leverage analysis on the social dimension (Figure 9), 4 attributes had relatively high leverage, namely the level of education of the fisherman community with a value of 4.9, social facilities with a value of 4.7, social interaction with a value of 4.5, and total population with a value of 4.3. These values suggest that enhancing the fisherman community's sustainability requires consideration of the four attributes.

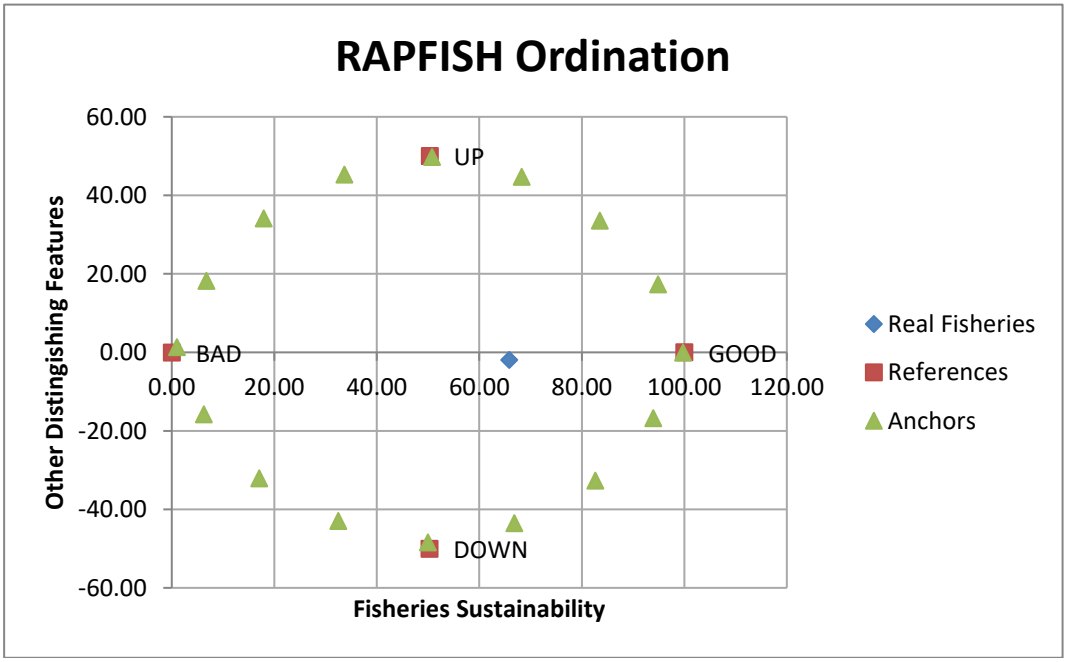

Figure 7. Rapfish Ordination for Social Dimension

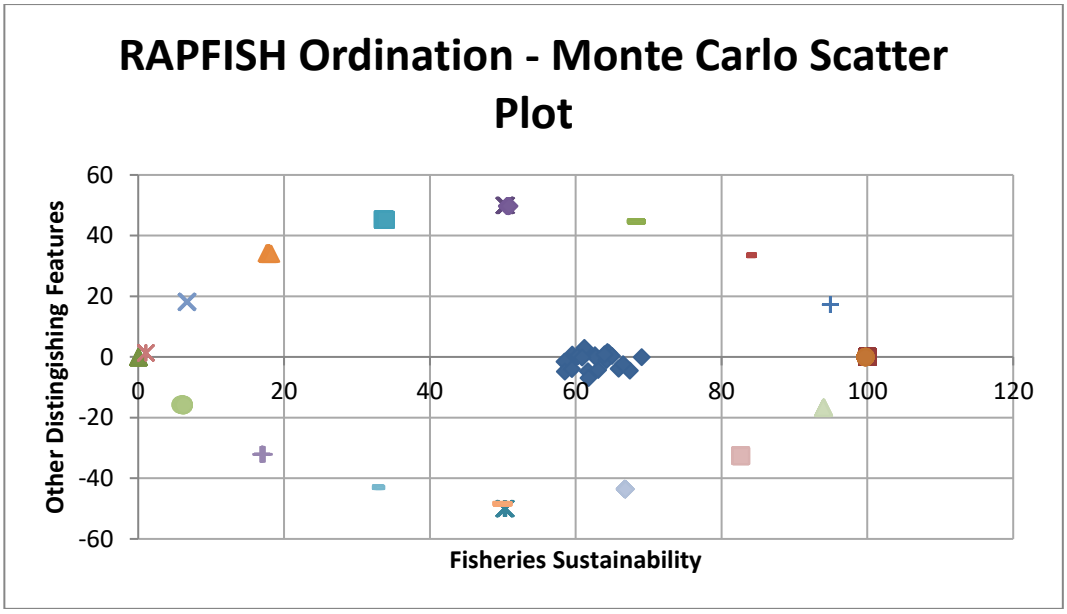

Figure 8. Monte Carlo Analysis for Social Dimension

The level of education of most fisherman communities was junior to senior high school (87.2%), whereas the remaining 12.8% were able to continue their education to the advanced level. Nearly all fishermen's children help their fathers to go to the sea when they grow up and become fishermen. If their children are girls, they will help in marketing or processing dry fish (Hamzah & Nurdin 2020). Social facilities, such as parks, community health centers, and others are not available in the fisherman's housing area. This is due to the crowded housing condition. Lands available are no longer able to accommodate more buildings.

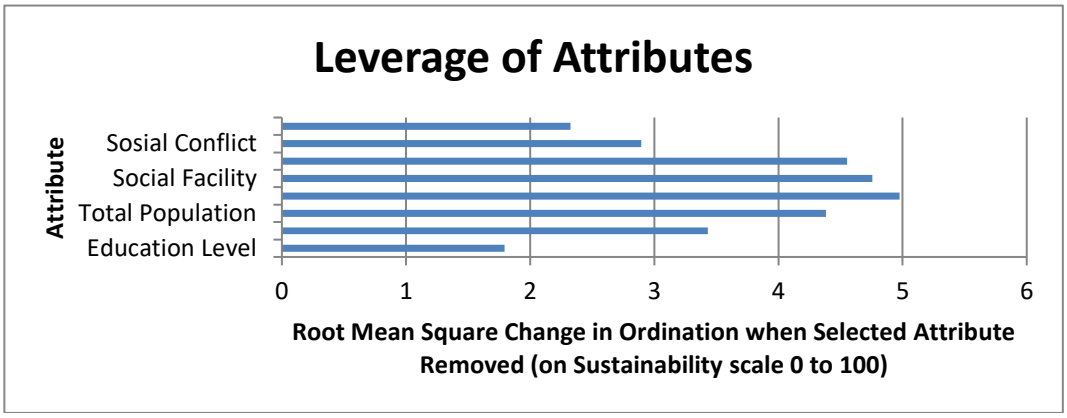

Figure 9. Leverage attributes on the Social Dimension

Technological Dimension

The results of the Rapfish analysis that was strengthened by the Monte Carlo analysis (Figures 10 and 11) indicate that the value of sustainability status in the technological dimension in the sustainability efforts of fisherman communities in the Archipelago Fishing Port of Karangantu was 62.22. The value shows that based on the technological dimension, the communities' sustainability status was in the fair category.

According to the leverage analysis results on the technological dimension (Figure 12), two attributes that become the leverage are technological infrastructures and the application of environmentally friendly fishing technology, with a value of 4.5 and 3.9, respectively. This implies that efforts in improving the sustainability status of the

fisherman communities in the Archipelago Fishing Port of Karangantu must consider and pay attention to the two attributes.

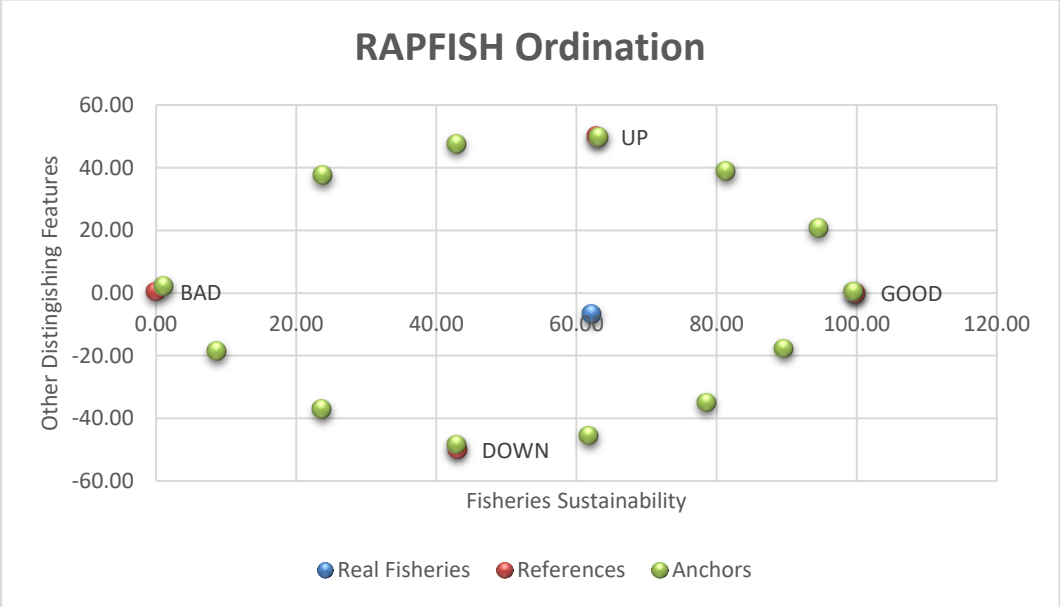

Figure 10. Rapfish Ordination for the Technology Dimension

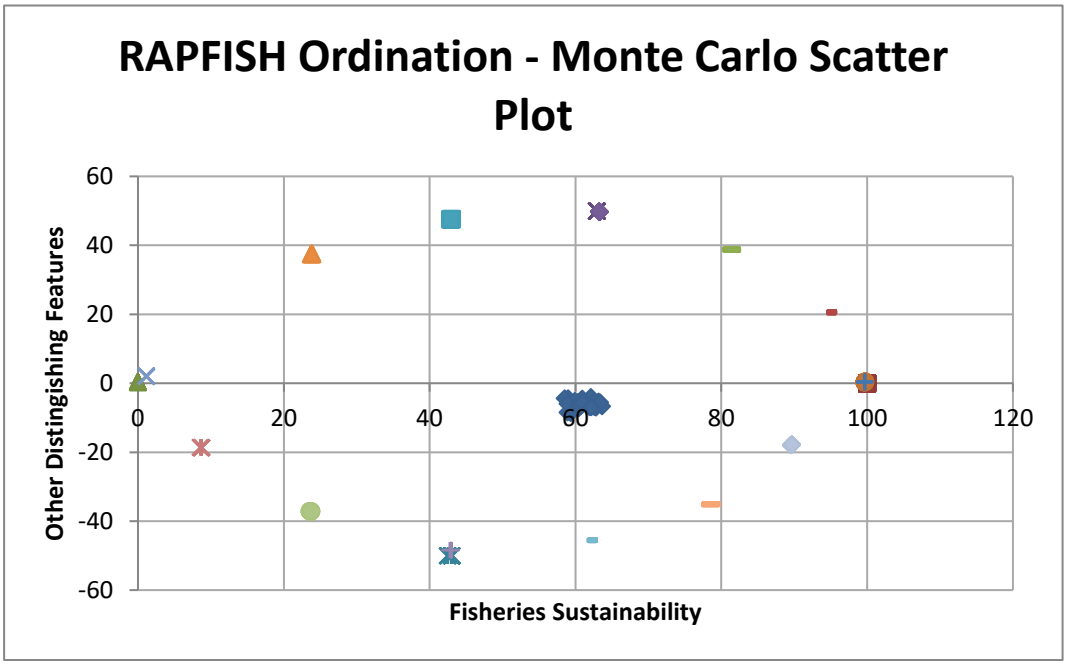

Figure 11. Monte Carlo Analysis for the Technology Dimension

Information technology infrastructures for fishermen are absolutely necessary to be used for searching fishing areas and connecting fishermen to buyers directly. In several cases, fishermen can connect to investors so they can downscale their dependency on the middlemen.

Another important attribute is the utilization of environmentally friendly fishing technology that needs to be implemented. Fishermen, to date, have a principle that to generate more profit, they need to catch more fish of various sizes. This principle will disturb ecosystem stability. Revitalization of the marketing system in the port is a necessity that is capable of changing the fishermen's paradigm from catching as many as

possible to generate more profit to catching in a sufficient amount and in the set size to get a big profit.

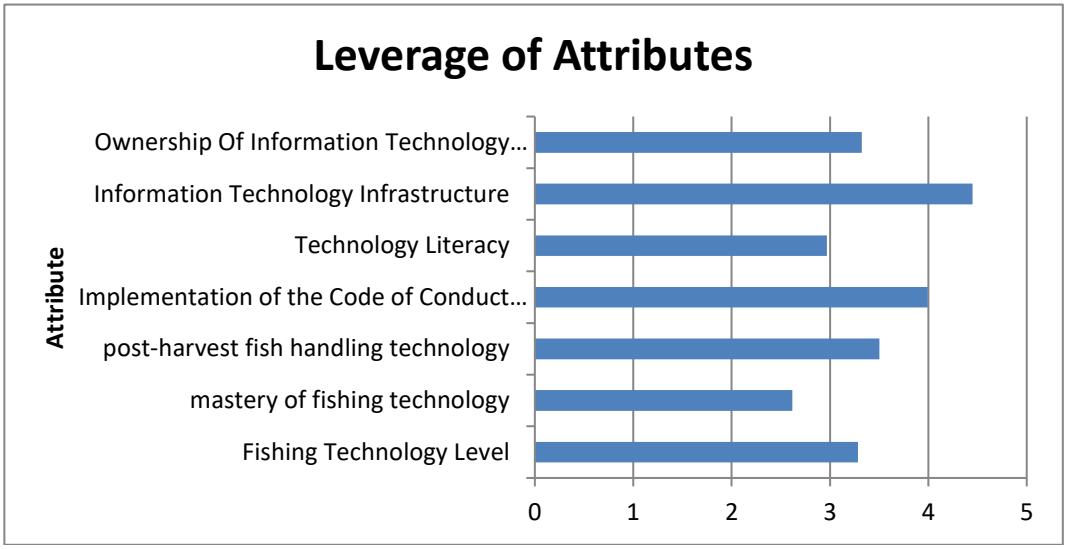

Figure 12. Leverage attributes on the Technology Dimension

Institutional Dimension

Based on the Rapfish analysis result that was strengthened by Monte Carlo analysis (Figures 13 and 14), the value of the sustainability status of the institutional dimension was 63.1, or in a fair category. Referring to the leverage analysis in the institutional dimension (Figure 15), it can be seen that the roles of universities had a value of 4.9 or had a vital role as a generator for the fisherman community's sustainability in the Archipelago Fishing Port of Karangantu. University as an institution can provide various improvements to fishing methods and technology used by the fishermen from not environmentally friendly to environmentally friendly. Banten Province, which is known as a religious province, can not neglect the roles of religious institutions (with a value of 4.4) if they want the fishing communities to have sustainability.

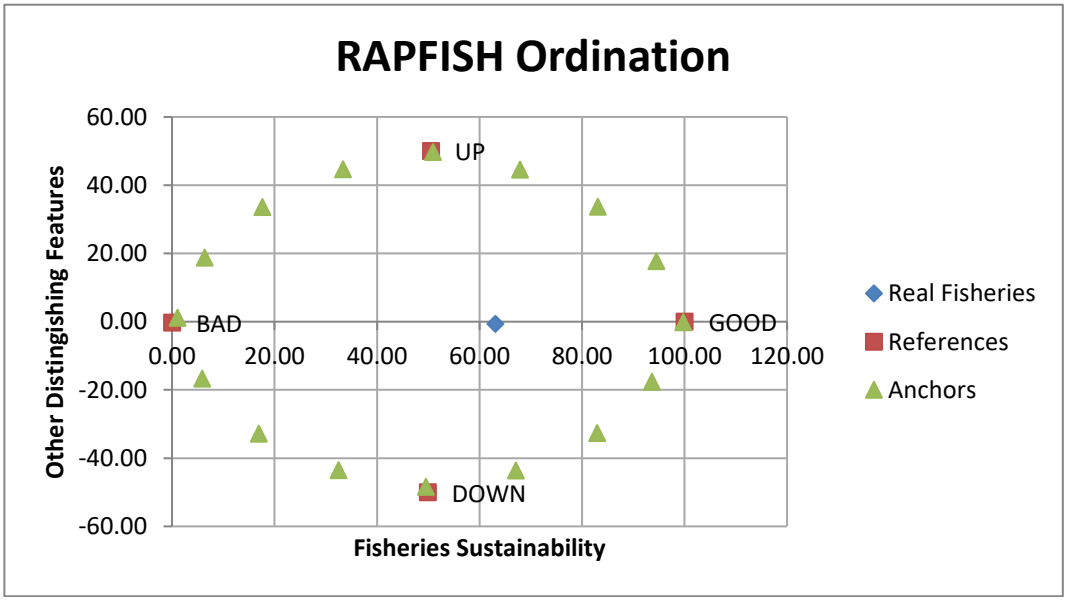

Figure 13. Rapfish Ordination for the Institutional Dimensions

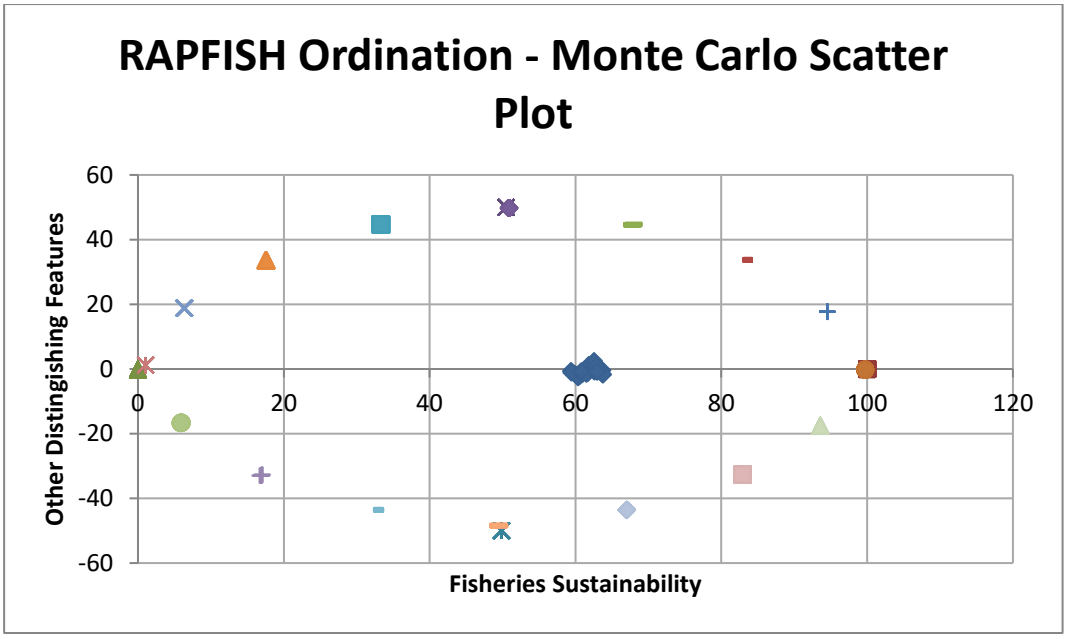

Figure 14. Monte Carlo Analysis for the Institutional Dimensions

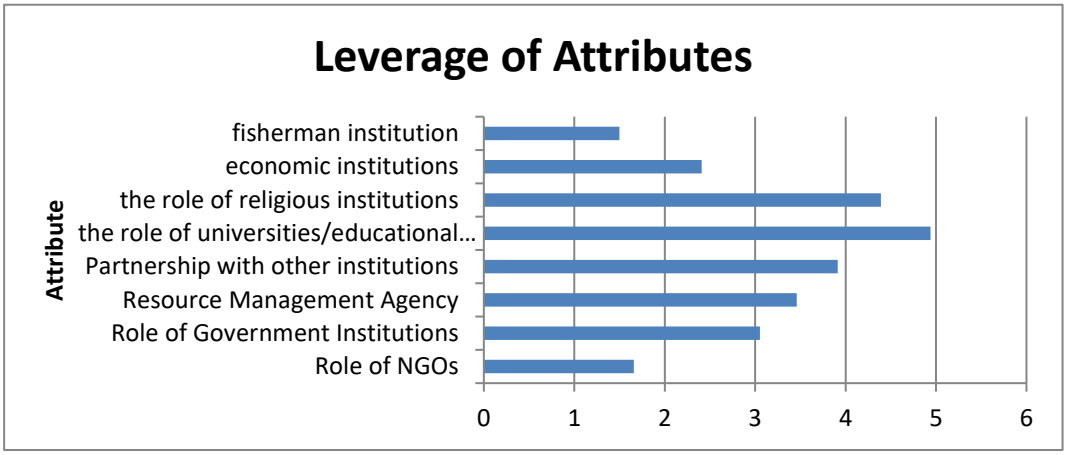

Figure 15. Leverage attributes for the Institutional Dimensions

Nevertheless, fisherman institutions are also important since they come from the fisherman communities (bottom-up) instead of top-down so that they are able to grow organically. The fisherman institutions can be a forum for the fishermen to channel their aspirations thus their complaints and issues can be easily conveyed to the related authorities. The institutions can also serve as a tool to reduce dependency on middlemen and inequality in economic assistance from the government.

Kite Diagram

The values of sustainability status from the results of Rapfish Analysis of each dimension were then positioned in the form of a Kite diagram to facilitate the understanding of sustainability status illustration holistically as presented in Figure 16.

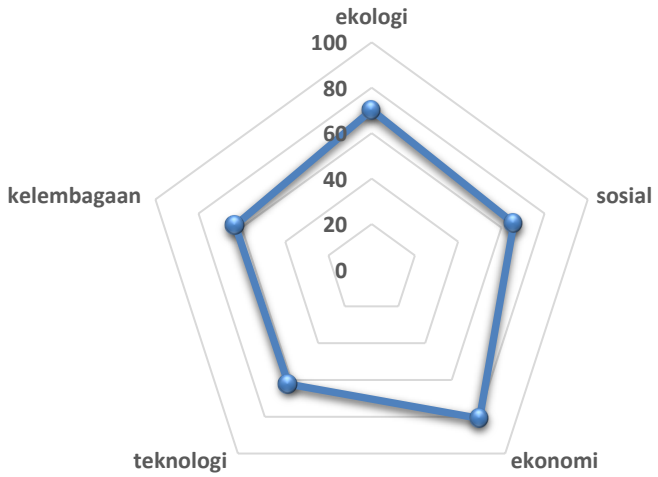

Figure 16. Kite diagram for Ecological, Economic, Social, Technology and Institutional Dimensions

The kite diagram indicates that the value of the economic dimension is the largest among other dimensions. This suggests that the economic dimension plays a significant role in the fishing community's sustainability. However, it requires balance from other dimensions. The leverage factors in the institutional dimension consisting of technology, society, and ecology must be positioned as vital as or even more vital than the economic dimension. The institutional aspect contains a leverage factor that requires an improvement to becoming a generator of sustainability, namely partnership with universities and other related institutions regarding innovation and new technology disseminated to the communities. Additionally, in terms of the cultural side of the religious community, it is necessary to strengthen religious norm systems that have a positive influence on motivation to develop business. The technology dimension needs further handling regarding technology infrastructures and the application of environmentally-friendly fishing technology. The technology application will support sustainability in the ecological dimension. The fact of mangrove destruction in the research location is an indication of ecological threats toward the local coastal areas. Communities and governments must pay attention to these leverage factors to administer improvement efforts. The improvement of mangrove and coastal ecologies will affect the improvement of fishery potential since it will increase ecological carrying capacity to improve fishery potential. Improvement is also needed in the leverage factors of social dimension that consist of the community's level of education and the presence of social facilities and social interaction that provides positive things to economic interaction in the community. Improvement in formal and informal community education could enhance the knowledge and skills of fishermen which means an increase in community capacity in coastal resource management and social facility that could promote positive interaction between communities.

In the economic dimension, two attributes play as leverage factors that need consideration, namely economic aid and market access. An empirical fact shows that fisherman communities demand support in fishery business capital. An economic (capital) issue that leads to less development in the fishery business and becomes one of the causes of poverty in the community includes challenges in gaining capital assistance. Fishermen are trapped in a binding credit scheme or capital share; hence, they must share their business profit with several parties. Fishermen, sometimes, receive a small portion of the profit that keeps them in poverty. Likewise in the access to the market related to fishery commodity produced. The attachment to the bad capital aspect also continues to the limited market access. Financiers who provide capital to the fishermen usually create

an initial and binding agreement that fishermen must sell their fish catches and fish farming yields to them at predetermined prices that tend to harm fishermen. These facts must be addressed immediately to achieve the sustainability of fishing communities. Achieving the sustainability of fishing communities related to balance in the ecological, economic, social, technology, and institutional dimensions thus requires (1) the involvement of communities and related stakeholders, (2) the existence of regional government policies as a foundation for coastal resource management focusing on ecological, economic, social, technology, and institutional dimensions so they can be integratively improved, (3) the provision of opportunities for partnership and cooperation with external parties, (4) driving the community altogether and participative, and (5) paying more attention on leverage factors of each dimension to achieve community sustainability.

Policy Scenario based on Sustainability Leverage Factors

Based on the sustainability analysis, especially from the sustainability leverage factors in ecological, economic, social, technological, and institutional dimensions, several recommendations are proposed for sustainable coastal development policies, namely:

1. In the ecological dimension, it is necessary to improve awareness of the coastal ecosystem through harder efforts in conserving the coast, maintaining the environment and pollution, and activating pro-ecological coastal development activities. A balance between economic interest and ecological interest is not two contradictive matters, yet must be sought to run synergistically.

2. In the economic dimension, there needs to be an effort to enhance the utilization of marine resources by opening more access to the existing resources for the fisherman communities. A problem faced by the fishermen currently is capital that hinders their increase in income since they are trapped in the fishery business with imbalanced profit sharing. Another problem that must be solved is that only a few fishermen own fishing gears; therefore the dependency of small fishermen on fishermen who own fishing gears is high and this requires economic assistance to overcome it.

3. In the social dimension, the currently created social harmony is a supporting factor to enhance other sustainability dimensions; however, it still can be increased by developing educated communities that are capable of utilizing local wisdom and creating social harmony. Build social facilities that can strengthen community interaction so that they can build communities together, collaboratively and participatively.

4. In the technological dimension, the level of fishing technology must be improved. The utilization of transportation, communication, and information technology can actually be the leverage factor for the economic dimension. This needs encouragement from the local government since this dimension is often neglected. Local governments can create collaborative programs between government-universities-other research institutions-communities to produce fishing technologies that are based on local advantages and are useful for economic and ecological sustainability.

5. In the institutional dimension, the basic things are how to improve cooperation between the fisherman community's economic institutions and other institutions and improve the performance of coastal resource management institutions to increase the sustainability index from the institutional dimension.

CONCLUSION

The ecological, social, economic, technological and institutional dimensions had an average sustainability value of 68.4. The economic and ecological dimensions had a relatively good sustainability value. Community sustainability can still be improved by paying attention to the leverage factors in each dimension. Policy scenario based on the

sustainability leverage factors includes efforts to maintain the coastal environment, maintain environment and pollution and activate pro-ecological coastal development activities, improve access and utilization of marine resources, increase ownership of fishing gears and economic assistance, enhance education and social harmony, improve the mastery and utilization of transportation, communication, and information technology, enhance economic institution cooperation, and performance improvement the coastal resources management institutions.

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