Ekonomi dan Bisnis
Vol.11, No.2, 2024, 172-187
DOI: 10.35590/jeb.v11i2.6933
P-ISSN 2356-0282 | E-ISSN 2684-7582

Received : 27 November 2023
Revised : 06 September 2024
Accepted : 06 September 2024

Analysis of the Sustainable Livelihood of Fishing Communities During High Wave Season with the Sustainable Livelihoods Approach (Study in Glondong Gede Village, Tambakboyo District, Tuban Regency)

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Abstrak

Tujuan: Penelitian bertujuan untuk mengetahui penghidupan berkelanjutan masyarakat nelayan di Desa Glondong Gede Kecamatan Tambakboyo Kabupaten Tuban dengan menggunakan pendekatan Sustainable Livelihood Approach.
Desain/metodologi/pendekatan: Penelitian ini menggunakan pendekatan kualitatif dengan metode pengumpulan data melalui kuisioner yang kemudian dilakukan penghitungan dengan metode Multidimensional Scaling Rapfish.
Temuan: Hasil penelitian ini menunjukkan bahwa terdapat dua aspek yang menjadi kekuatan utama dalam penghidupan berkelanjutan nelayan yakni aspek fisik dengan nilai indeks keberlanjutan sebesar 77.96 dan aspek sosial dengan nilai indeks keberlanjutan sebesar 81.84.
Keaslian/nilai: Penelitian berfokus pada wilayah dan masyarakat tertentu dengan pendekatan spesifik (SLA dan Rapfish), sehingga kontribusi kontekstual dan lokal yang khas masyarakat nelayan di Desa Glondong Gede Kecamatan Tambakboyo Kabupaten Tuban
Jenis makalah: Artikel ini merupakan studi kasus untuk mengetahui penghidupan berkelanjutan masyarakat nelayan di Desa Glondong Gede Kecamatan Tambakboyo Kabupaten Tuban.

Kata Kunci: Masyarakat Nelayan; Penghidupan Berkelanjutan; Multidemensional Scaling Rapfish.

Abstract

***Purpose**: This study aims to examine the sustainable livelihood of fishing communities in Glondong Gede Village, Tambakboyo District, Tuban Regency, using the Sustainable Livelihood Approach (SLA).*
***Design/methodology/approach**: This research employs a qualitative approach with data collected through questionnaires. The data were then analyzed using the Multidimensional Scaling Rapfish method to assess the sustainability index.*

Cite This As: Royali, 2024. Analysis of the Sustainable Livelihood of Fishing Communities During High Wave Season with the Sustainable Livelihoods Approach (Study in Glondong Gede Village, Tambakboyo District, Tuban Regency). *Ekonomi dan Bisnis*, 11(2), 172-187 doi.org/10.35590/jeb.v11i2.6933

Findings*: The results indicate that two main aspects serve as the strengths of sustainable livelihoods among the fishing communities: the physical aspect, with a sustainability index score of 77.96, and the social aspect, with a score of 81.84.*
Originality/value*: This study provides contextual and local insights specific to the fishing communities of Glondong Gede Village. It uniquely combines the Sustainable Livelihood Approach (SLA) with the Rapfish method, a combination rarely applied in similar research.*
Paper type*: This article is a case study aimed at understanding the sustainable livelihoods of fishing communities in Glondong Gede Village, Tambakboyo District, Tuban Regency.*

Keywords*: Fishing Communities; Sustainable Livelihood; Multidimensional Scaling Rapfish.*

Introduction

Indonesia has aquatic resources that are a major contributor to diverse and abundant natural resources, so that aquatic resources, including the sea, have high economic value (Royali & Awalia, 2023). In essence, people who live in coastal areas or mountains depend on the natural resources that exist around, namely water or land resources. Indonesia has 62% of the water area, so that aquatic resources, especially the sea, affect the economy of the Indonesian people, one of which is in the aspect of fishing at sea. Coastal residents depend on marine resources for their livelihoods, so most coastal residents work as fishermen to look for fish because their habits and skills are obtained from their ancestors. To continue to get maximum catches, fishermen will generally move the location of the catch which is estimated to still store marine products (Royali & Awalia, 2023).

Tuban Regency is located on the northern coast of East Java and has 65 km of coastline including Tuban, Palang, Tambakboyo, Jenu, and Bancar Districts. Based on these geographical conditions, Tuban Regency has very abundant marine resources. Tambakboyo District is a sub-district in Tuban Regency which was established in 2001 with as many as 18 villages. Tambakboyo District is located on the north coast and this makes the residents of the area dependent on marine resources and work as fishermen. There are several villages whose residents are employed as fishermen, including the villages of Glondong Gede, Sobonotoro, Kenanti, Gadon, Tambakboyo, and Paboyan. Glondong Gede Village is one of the villages with the majority of its population as fishermen spread across two hamlets, namely, Glondong Hamlet and Satrian Hamlet. Based on data obtained from the village government, there are around 315 fishermen.

Table 1. Number of Fishing Professions

Glondong Gede Village	**Amount**
Dusun Glondong	200
Dusun Satrian	115

Source: Tambakboyo District in Numbers, 2023

Based on table 1 above, there are 315 people who work as fishermen in Glondong Gede Village, which are cantrang fishermen, paying minitrol fishermen, and bubu fishermen. Fishermen in Glondong Gede Village in the process of looking for fish or going to sea still use simple equipment such as canoes, boats, motorboats, and motorboats. Fishermen's marine products that can be used are fish, crustaceae, gastropod groups and other seafood (Tambakboyo District in numbers, 2023).

Table 2 below, shows that the income of fishermen in Glondong village is large for fishermen who have boats, the income is greater than that of fishermen who are around Rp. 1,500,000 every month, while for fishermen who have their own boats, which is around Rp. 3,000,000 every month depending on the fish obtained and weather conditions. Based on empirical studies and facts, the problems faced by fishermen in Glondong Gede Village are other than simple equipment. Weather factors will also affect fishermen's income. During the months of December, January,

and February, the fishermen in Glondong Gede Village experience special obstacles in the form of natural fluctuations or natural disturbances such as bad weather, large waves, strong winds and the social environment so that fishermen in Glondong Gede Village can only go to sea during the east and west wind seasons. As a result of this natural fluctuation, the fishing community experiences economic problems, including income uncertainty because fishermen cannot go to sea so that the people in Glodong Gede village switch jobs as construction workers, making boats, farmers, livestock and others to meet their daily needs. So in this study, it aims to analyze the livelihood strategies of the fishermen in Gondang Gede Village with the Sustainable Livelihoods Approach (SLA) approach. The term in sustainable livelihoods approach (SLA) refers to the efforts made by an individual or a family to achieve life expectancy. SLA itself refers to the activities that each individual/community needs to shape their lives by using their abilities/competencies and ownership of the resources they have to achieve the expected level of life.

Table 2. The Income of Fishermen in Glondong Gede Village

Type of Fishermen	**Income (Rp)**	**Amount**
Fisherman who owns a boat	Rp. 3.000.000	128
Fishermen laborers	Rp. 1.500.000	187
Total		**315**

Source: Primary Data, 2023

Literature Review and Hypothesis Development

The Sustainable *Livelihood Approach* is a method used to understand and overcome poverty and improve welfare by considering various aspects that affect people's lives. This approach puts humans at the center of attention and focuses on how they manage their assets to achieve sustainable livelihoods. This approach focuses on livelihood assets, vulnerability contexts, policies; institution; and processes, livelihood strategies, and livelihood outcomes. This focus on society is equally important both at a higher level when discussing the achievement of goals such as poverty alleviation, economic renewal or sustainable development and at the micro or community level where in some cases this approach is already widely used.

Sustainable livelihood is interpreted as a strategy to survive and improve welfare by managing and utilizing various assets or resources owned. It encompasses a wide range of activities, abilities, and assets that individuals or households use to meet their living needs. Livelihood strategies are usually designed to strike a balance between meeting current needs and long-term sustainability (Saragih et al., 2007). This approach identifies various barriers that can hinder individuals or communities from achieving sustainable livelihoods. These barriers can vary depending on the social, economic, and environmental context in each region. Identifying these barriers can help design more targeted and effective interventions to improve the well-being and resilience of individuals and communities, while ensuring the long-term sustainability of their livelihoods. (Saragih et al., 2007).

Sustainable livelihood resources reflect the ability to pursue livelihoods that can vary depending on social policies, both customary policies and community policies, as well as the strength of each resource owned by a family or individual, as well as real conditions in society that include natural and environmental conditions. According to (Morse et al., 2009) the sustainable livelihoods approach involves several types of resources used in running sustainable livelihoods. All of these resources serve to identify the level of vulnerability as well as as a means to achieve sustainable livelihoods.

Aspects of natural resources

Natural resources are everything that can be found in nature and used by humans to meet the needs of life, such as water, air, soil, forests, minerals, and energy, which play an important role in supporting the sustainability of human life, the economy, and technological development. (Sconess, 1998). Natural resources that exist around the community and are important for life, such as agricultural land, forests, groundwater quality, mining products, beaches, rivers, and other natural resources, can provide great benefits. However, if these natural resources are used excessively and continuously, it will cause natural damage and disturb the balance of the ecosystem.

a. Financial aspects

   Financial resources that can be used to achieve livelihood goals, such as income, savings, credit, and other financial assets. Financial capital provides economic flexibility and security (Sconess, 1998). Without government policies, the poor have difficulty in having resources and accessing official financial institutions to obtain loans that are used for their purposes, so they often have to borrow money from loan sharks at high property rental prices.

b. Human resource aspects

   The human resource aspect in the sustainable livelihood approach includes various factors related to the potential and skills of individuals in supporting the sustainability of their livelihoods. These include education, skills, work experience, health, access to social and financial services, and capacity to participate in economic and social activities. This approach emphasizes the importance of strengthening human resources so that communities can manage natural and economic resources sustainably, improve their quality of life, and reduce economic uncertainty (Sconess, 1998)

c. Social aspects

   The social resource aspect in the sustainable livelihood approach refers to the social networks, relationships, and support that individuals or communities have to manage resources and improve the sustainability of their lives. The main elements in the social aspect are social networks, social cohesion, participation in decision-making, social security, and community empowerment (Sconess, 1998). The coordination of these actions includes the norms that prevail in the local community, social institutions, confidence levels, potential conflicts, and other factors. This lack of social resources leaves the poor vulnerable, as they lack the necessary social support (such as social institutions) to help them achieve a decent life.

d. Physical aspects

The physical aspect of *sustainable livelihood* refers to the conditions and access to natural resources, infrastructure, and the physical environment that support sustainable survival for individuals or communities. The physical aspect refers to all the basic infrastructure and production goods necessary to support human life. It includes equipment and facilities such as roads, ports, airports, as well as markets in a broad sense, water sources, and health services. All of these play an important role in influencing an individual's ability to achieve a decent standard of living. Meanwhile, physical capital refers to all other facilities and facilities used to increase the productivity of economic activities. This includes everything from machinery and equipment to buildings and other production infrastructure that enable more efficient and effective production and service processes (Wijayanti et al., 2016).

The relationship of the five livelihood assets, namely physical, social, human, financial, and natural aspects, can help identify which aspects need to be optimized and have a dominant influence on a person's livelihood strategy. By understanding these aspects holistically, one can formulate an effective livelihood strategy, which involves different levels and combinations of activities and choices taken to achieve a goal. This approach places communities at the center of development, emphasizing the importance of supporting them in managing their own resources rather than simply receiving services from the government or using resources without considering the impacts. Good governance principles and sustainable resource management are key to supporting people's livelihoods. However, the underlying motivation for providing support should be based on a deep understanding of the needs and aspirations of the community, so as to determine the right type of support and provide a basis for evaluating its success. Thus, this approach emphasizes the importance of being based on community needs and oriented towards sustainable outcomes. (Morse et al., 2009).

Research Method

The methods in this study include qualitative and quantitative (Bungin, 2008). In this study, case studies were used as a method to analyze the data. The case study analysis technique was chosen because it can be applied in the context of a wide community such as villages, sub-districts, sub-districts, districts, and so on. In using case study analysis techniques, researchers have the freedom to organize the structure of the writing based on the domain being researched as well as to develop the domain explored according to the researcher's wishes (Cendrakasih et al., 2021). To find out the dominance of measuring the sustainable livelihood of fishing communities during high waves, the researcher used *the Rapfish* Multidimensional Scaling *(MDS)* calculation method with Excel software. *Mutidimensional Scaling Rapfish* is a nonparametric multivariate statistical analysis tool used to analyze problems consisting of many variables or called multivariables (Cendrakasih et al., 2021). There are several stages in *the analysis of Mutidimensional Scaling Rapfish*, namely:

1. Determination of attribute indicators, this indicator is an aspect of the concept of sustainable livelihood. These aspects include, natural resource aspects, human resource aspects, financial aspects, physical aspects, and social aspects.
2. Provide an assessment of each aspect using an ordinal scale of 0-2. This was filled out through a questionnaire to the fishermen's respondents.
3. To make a composition of the weighting index of *the Sustainable Livelihood Approach capital index* with the categories of bad, medium, and good.

Next, a monte carlo analysis is performed to see the sustainability status and sensitivity analysis to see the dominance of influence in each attribute on that aspect.

Table 3. Multidimensional Scaling Index Value

Value	Category
0-25	Poor (Not Sustainable)
26-50	Less (Less Sustainable)
51-75	Enough (Fairly Sustainable)
76-100	Good (Highly Sustainable)

Source: Cendrakasih, 2021

Result and Discussion

Based on the results of identification and empirical facts in the field, it can be explained that each aspect has different sustainability potentials as follows:

a. Natural Resources Aspects

The control of natural resources has a very significant role in human life, not only in terms of economic value, but also in social, cultural, and even political contexts. Natural resources play an important role in the development of human civilization, so that each individual has their own concept and view in their management and utilization (Hikmat, 2011). For the people of Glondong Village, the asset of control over natural resources in the form of the sea, therefore the sea is an important natural resource asset for fishermen in Glondong Village.

Therefore, the sea is a natural resource asset for fishermen in Glondong Gede Village. So on average, usually fishermen in search of fish are around 7-50 miles. This explains that fishermen in looking for fish depending on the weather, if the weather is good, it may be up to 50 miles, while during bad weather it may be 7 miles and the fishermen in Glondong Gede Village depart after dusk and return home at 10 o'clock until noon and even until the afternoon. For fishermen's catch, it is 20 to 60 kilograms a day depending on weather conditions at sea and fishing equipment. And the fishermen stated that to meet their daily needs with fishermen, sometimes it is enough and not enough, depending on the catch.

b. Human Resources Aspects

This aspect includes the mastery or management of assets owned by humans, such as knowledge, skills, and experience. These assets are very important because they play a major role in determining how productive a person is in his or her

activities or work (Sconess, 1998). Human resource assets are partly related to the number of family members, education level and skills possessed by fishermen. The level of education of fishermen in Glondong Gede Village is mostly elementary school graduation and there are also high school graduates. Furthermore, the skills possessed by fishermen in Glondong Gede Village are obtained from their parents or hereditary from their families. Next, in the conditions of high waves, the fishermen could not go to sea, so the fishermen took advantage of the expertise from the results of interviews with fishermen in Glondong Gede Village, that fishermen have skills such as farmers, building ships and repairing ships, and builders. This is in line with the results of Rosyid's (2014) research which states that of the five livelihood assets that are important for fishermen in Glondong Gede Village, this is because during the high fishing period or when not at sea use non-fishermen's skills to meet their living needs. And for the experience of being a fisherman, it has been obtained from a young age and taught by his parents to become a fisherman so that the experience that fishermen have in Glondong Gede Village has averaged more than ten years.

c. Financial Aspects

The financial aspect is the assets owned by fishermen, the results obtained by fishermen, the number of family dependents, the amount of savings and the amount of household expenses and capital of fishermen (Sconess, 1998). The average income of fishermen in Glondong Gede Village received from fishermen is around Rp 100,000-800,000 per trip to sea. The income from the proceeds obtained from the fish middlemen will still be deducted for fuel costs and rental of fishing equipment recommendations. The amount of income obtained by fishermen depends on the fish produced and the area of the fishing area. Meanwhile, for fishermen who are shipwrights or not, ship owners get an income of around Rp. 50,000.00 – Rp. 60,000.00. Based on the results of the research through interviews with informants, it was said that the income received by fishermen was not only sourced from fishermen's activities but also from side workers such as rice farmers, market workers, construction workers, shipbuilding and repair services. Fishermen depend on their income from going to sea for daily consumption. So that when the income obtained is minimal, it must reduce consumption and vice versa. Most of the fishermen in Glondong Gede Village have two to three family dependents and on average still have dependents of children who are studying. The average fisherman in Glondong Gede Village does not have savings, if those who have savings must have run out during the high tide season or when they are not at sea. If there is an urgent need, the fishermen run to the savings and loan cooperative or to the bank and there is also a debt to their families. And for the expenditure of fishermen in Glondong Gede Village to buy gasoline on average Rp. 80,000.00 – Rp. 300,000.00

d. Physical Aspects

These aspects include access to fishing equipment, ownership of boats or boats, are very crucial resources for fishermen. This access allows them to carry out fishermen's activities effectively and productively (Sconess, 1998). From the results of interviews with informants, it can be concluded that the physical assets owned by fishermen in Glondong Gede Village for fishermen's equipment used when catching fish or helping fishermen in fishermen's activities include payang, trawl, mini, and nets. And for boat ownership, the average fisherman in Glondong Gede

Village has his own, while for fishermen who do not have boats, they are labor fishermen. And on average, fishermen have motorized vehicles and motorcycles are used for daily use, some are made to take their children at school and nada is also made to the rice fields. The physical aspect refers to any infrastructure, facilities, and other equipment that is used to support and increase productivity in various activities (Maurizka et al, 2021).

e. Social Aspects

Social aspects, such as social networks, relationships within the community, and support from other community members, are important assets in the daily lives of fishermen in the Glondong Gede Area. Social resources are related to community organizations in the community and family relationships between fishermen and fishermen (Sconess, 1998). The fishermen's group in Glondong Gede Village exists and is called the fishermen's harmony and the average fisherman joins the fishermen's group. For activities in the fishermen's group, there is compensation for fishermen when affected by disasters and there are sea alms activities in which there is tahlil and joint prayer. Next, for the benefit of the existence of the first group, it provides information on weather conditions and knowledge related to fishing patterns. Second, give permits for boats and fishing gear used in fishing. Third, providing insurance to fishermen who have an accident at sea and providing compensation to fishermen who die and sink ships.

Rapfish Multidimensional Scaling Calculation Results

Rapfish or *Rapid Apraisal for Fisheries* is one of the alternative approaches that can be used in a research. The goal of *Rapfish* is to evaluate or determine the status of sustainability. This technique was developed by the *University of British Columbia* located in Canada. In using *Multidimensional Scaling Rapfish* asset *assets Sustainable Livelihood* is a dimension in which there are attribute attributes that will be given a weight value by respondents with a weight of 0-2 where 0 means bad, 1 means medium, while 2 is good. After the questionnaire is completed, the data is collected in *Microsoft Excel* and processed with *Rapfish Software*, the results of *the Rapfish Ordinal, Monte Carlo Scater* and *Laverage Of attributes* will appear, which will display the sensitivity of each of the attributes entered. Calculation of Questionnaire Results using *Rapfish Software* included the *Sustainable Livelihood* asset framework into a dimension where there were several attributes that were weighted by each respondent. The sustainability index of process results using Rapfish has a scale range from 0 to 100. The range of such values is divided into several intervals: ranging from 0.00 to 25.00 indicates an unsustainable state; from 25.01 to 50.00 indicates a less sustainable state; from 50.01 to 75.00 indicates a fairly sustainable state; and from 75.01 to 100.00 indicates a continuous state. The pie chart below illustrates the yield limits of the Rapfish Ordination, with higher values indicating better sustainability parameters (Cendrakasih et al., 2021).

In identifying the level of sustainable livelihood of the fishing community due to high waves, it is focused on 5 aspects, namely: human resource aspect, natural resource aspect, social aspect, infrastructure aspect, and financial aspect. The purpose of the calculation is to measure and find out the strength of the strongest aspect used by fishermen in Glondong Gede Village during the high wave season

which causes fishermen to not be able to go to sea. So that they can find out the aspects used to survive sustainably by fishermen.

a. Natural resource aspects

Based on the results of identification in the field, it can be classified that the aspect of natural resources consists of the attributes of the catch, distance to the sea, and the length of time to sail to look for fish. Based on the results of the calculation of the Monte Carlo value, it was concluded that the sustainability status of the natural resource aspect was "Less Sustainable" because the index value was 49.05. This means that in the natural resources sector in the waters of Tuban Regency in general and especially in the Glondong Gede Village area, there is a lack of natural resource potential. This could be due to the simple fishing system and the lack of fisheries infrastructure facilities in Glondong Gede Village. The results of the sustainability status assessment were declared valid because they met the requirements based on the maximum voltage value of 25%, SQR (R^2) >90%, and the difference between the values of the two Rapfish and Monte Carlo indices <5% or 0.05 (Alvi et el, 2018). The stress values, SQR, and differences between the two Rapfish indices and the Monte Carlo Index can be seen in the following table.

Table 4. Monte Carlo Validation Model for the Sustainability of Natural Resources Aspects

Aspects	Stress	SQR	Sustainability	
			Rapfish Index	Monte Carlo
Natural Resources	21%	91%	49,05	49,99

Source: Processed data, 2024

Furthermore, the status of lack of sustainability in the aspect of natural resources is influenced by the level of sensitivity or contribution of the attributes being studied. The level of the relationship can be seen from the level of sensitivity values of each attribute. The level of sensitivity of attributes on the aspect of natural resources is presented in the following figure.

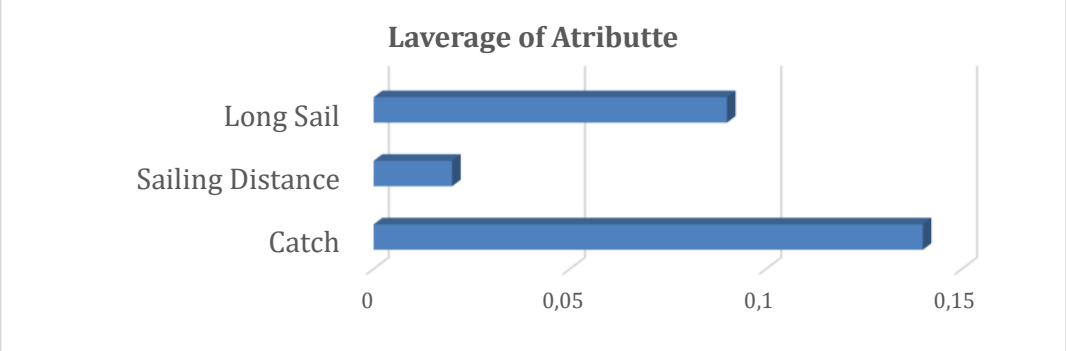

Figure 1. Laverage Value of Natural Power Dumber Aspect Attributes
Source: Processed data, 2024

Based on the conditions of the value of the attributes that appear, decision-making can be made using the law of middle values. The law of the middle value is an attribute that is larger than the middle value and they can all be used to make a decision on the value of leverage attributes that can be used to select attributes that are the priority of a particular level of influence analysis. The middle value law can be used if the value of the attribute is relatively equal or the value of one of the attributes with the value and analysis can be done using only one attribute with the highest value. So it can be concluded that the increase or decrease in the aspect of natural resources is greatly influenced by the catch. High wave conditions in the Java Sea affect fishermen's fisheries in Glondong Gede Village, Tambakboyo District, Tuban Regency.

b. Human resource aspects

Human resource aspects include: experience of being a fisherman, side jobs, fishermen's skills and expertise, and the level of education of fishermen. Based on the results of the calculation of the Monte Carlo value, it was concluded that the sustainability status of the human resource aspect is "Quite Sustainable because the index value is 63.42. This means that in the human power sector, especially fishermen, it is enough to have strong sustainability potential. It could be due to skills and expertise in the field of fisheries and non-fisheries fishing which is used as capital during high waves that cause fishermen not to go to sea so that fishermen can take advantage of skills and expertise other than fishermen such as building coolies, craftsmen, and motorcycle taxi drivers. The results of the sustainability status assessment were declared valid because they met the requirements based on the maximum voltage value of 25%, SQR (R^2) >90%, and the difference between the values of the two Rapfish and Monte Carlo indices <5% or 0.05 (Alvi et el, 2018). Stress values, SQR, and differences between the two Rapfish & The Monte Carlo Index can be seen in the following validation tables of human resource aspects.

Table 5. Monte Carlo Model of Validation of Sustainability of Human Resources Aspects

Aspects	**Stress**	**SQR**	**Sustainability**	
			Rapfish Index	**Monte Carlo**
Human Resources	21%	92%	63,42	60,15

Source: Processed data, 2024

Furthermore, the status of sufficient sustainability in the aspect of human resources is influenced by the level of sensitivity or contribution of the attributes studied. The level of the relationship can be seen from the level of sensitivity values of each attribute. The level of sensitivity of attributes on the aspect of natural resources is presented in the following figure.

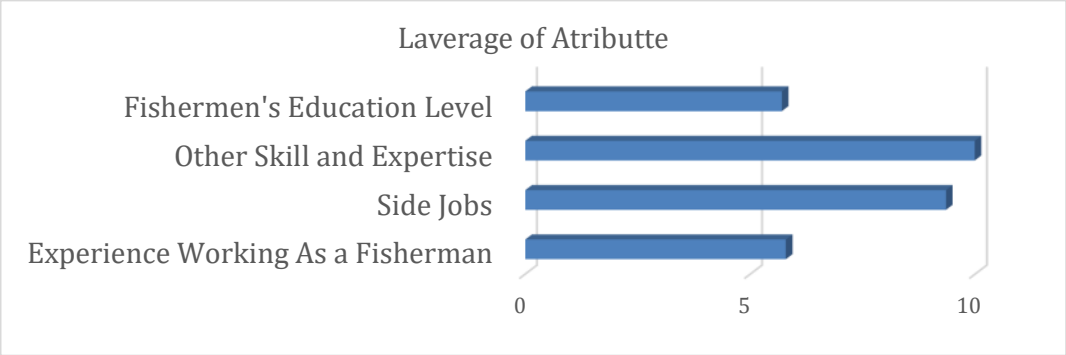

Figure 2. Laverage Of Natural Resources Aspect Attributes
Source: Processed data, 2024

Based on the conditions of the value of the attributes that appear, decision-making can be made using the law of middle values. The law of the middle value is an attribute that is larger than the middle value and they can all be used to make a decision on the value of leverage attributes that can be used to select attributes that are the priority of a particular level of influence analysis. The middle value law can be used if the value of the attribute is relatively equal or the value of one of the attributes with the highest value and the analysis can be performed using only one attribute with the highest value. So it can be stated that the increase or decrease in the aspect of human resources is greatly influenced by the skill attributes possessed by fishermen.

c. Financial aspects

In the financial aspect, it has several attributes which include: capital, household expenses, savings, and fishermen's income. Based on the results of the calculation of the Monte Carlo value, it was concluded that the sustainability status of the financial aspect is "Less Sustainable because the index value is 36.18. This means that the financial system does not have strong sustainability potential. This is difficult because in the end, financial strength must be supported by a strong natural power and a strong prosperity power. In the wake of high waves in Java, it causes fishermen not to go to sea, thus having an impact on the financial condition of fishermen. The results of the sustainability status assessment were declared valid because they met the requirements based on the maximum voltage value of 25%, SQR (R^2) >90%, and the difference between the values of the two Rapfish and Monte Carlo indices <5% or 0.05 (Alvi et el, 2018). The stress values, SQR, and differences between the two Rapfish indices and the Monte Carlo Index can be seen in the following financial aspect validation table.

Table 6. Monte Carlo Sustainability Validation Model Financial Aspects

Aspects	**Stress**	**SQR**	**Sustainability**	
			Indeks Rapfish	**Monte Carlo**
Finance	16%	92%	36,18	37,99

Source: Processed data, 2024

Furthermore, the status of lack of sustainability in the financial aspect is influenced by the level of sensitivity or contribution of the attributes studied. The level of the relationship can be seen from the level of sensitivity values of each attribute. The level of sensitivity of attributes on the aspect of natural resources is presented in the following figure.

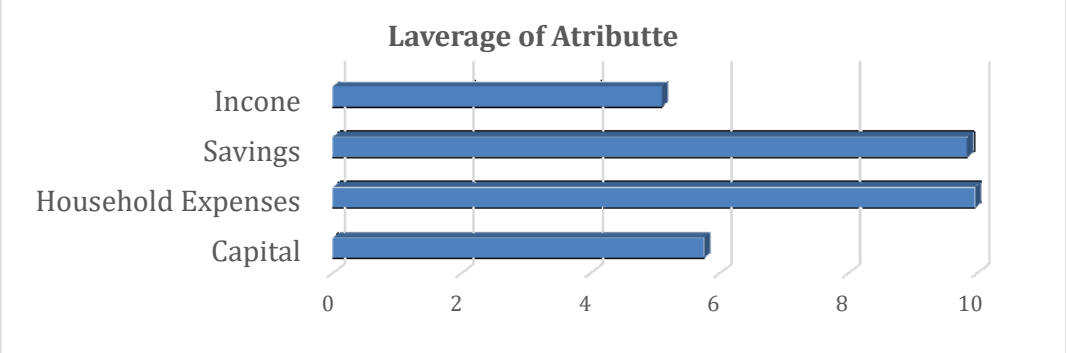

Figure 3. Laverage Of Financial Attributes
Source: Processed data, 2024

Based on the conditions of the value of the attributes that appear, decision-making can be made using the law of middle values. The law of the middle value is an attribute that is larger than the middle value and they can all be used to make a decision on the value of leverage attributes that can be used to select attributes that are the priority of a particular level of influence analysis. The middle value law can be used if the value of the attribute is relatively equal or the value of one of the highest attributes and the analysis can be performed using only one attribute with the highest value. So it can be stated that the increase or decrease in the financial aspect is greatly influenced by household expenditure. The more expenditure is made, the more financial decline there will be. Furthermore, fishing households can save and reduce the consumption of daily necessities during the high wave season to survive.

d. Physical aspects

Attributes in the physical aspect consist of dock infrastructure, fishing equipment, and fishing boat ownership. Based on the results of the calculation of the Monte Carlo value, it was concluded that the sustainability status of the physical aspect was "Good Sustainable" because the index value was 77.99. This means that the physical aspect has strong sustainability potential. This is very reasonable, because basically the physical aspect is the same as the infrastructure owned by fishermen, the better the quality and completeness of fishermen's equipment, eating directly will increase fishermen's catches. So that with abundant catches, fishermen can have savings so that during the high wave season they can use these savings for other business capital. The results of the sustainability status assessment were declared valid because they met the requirements based on the maximum voltage value of 25%, SQR (R^2) >90%, and the difference between the values of the two Rapfish and Monte Carlo indices <5% or 0.05 (Alvi et el, 2018). Stress values, SQR, and differences between the two Rapfish & The Monte Carlo Index can be seen in the following physical aspect validation table.

Table 7. Monte Carlo Physical Aspect Sustainability Validation Model

Aspects	Stress	SQR	Sustainability	
			Rapfish Index	Monte Carlo
Physical	19%	93%	77,99	75,37

Source: Processed data, 2024

Furthermore, the good status of sustainability in the physical aspect is influenced by the level of sensitivity or contribution of the attributes studied. The level of the relationship can be seen from the level of sensitivity values of each attribute. The level of sensitivity of attributes on the aspect of natural resources is presented in the following figure.

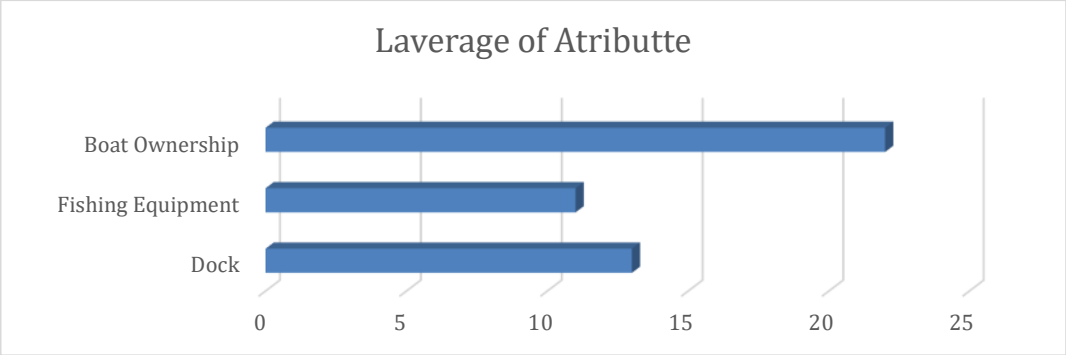

Figure 4. Laverage Of Physical Aspect Attributes
Source: Processed data, 2024

Based on the conditions of the value of the attributes that appear, decision-making can be made using the law of middle values. The law of the middle value is an attribute that is larger than the middle value and they can all be used to make a decision on the value of leverage attributes that can be used to select attributes that are the priority of a particular level of influence analysis. The middle value law can be used if the value of the attribute is relatively equal or the value of one of the attributes with the highest value. Based on the results of the calculation of the highest attribute value, namely the attribute of boat ownership, it means that the increase or decrease in catch and other sources of income is greatly influenced by the ownership of fishing boats.

e. Social aspects

The social aspect consists of several attributes which include, marketing the catch, the level of fishermen's harmony, empowerment, and the benefits of fishermen groups. Based on the results of the calculation of the Monte Carlo value, it was concluded that the sustainability status of the social aspect was "Good Sustainable" because the index value was 81.84. This means that the social aspect has strong sustainability potential. This is very reasonable because basically rural people have a very high sense of concern. During the high wave season in the Java Sea, it causes fishermen not to go to sea, of course, this has an impact on fishermen's income. The existence of social power through fishermen groups can be a great

capital for fishermen to be able to survive in order to meet daily needs. The results of the sustainability status assessment were declared valid because they met the requirements based on the maximum voltage value of 25%, SQR (R^2) >90%, and the difference between the values of the two Rapfish and Monte Carlo indices <5% or 0.05 (Alvi et el, 2018). Stress values, SQR, and differences between the two Rapfish & The Monte Carlo Index can be seen in the following table validating social aspects:

Table 8. Monte Carlo Validation Model for Sustainability of Social Aspects

Aspects	Stress	SQR	Sustainability	
			Rapfish Index	Monte Carlo
Social	14%	93%	81,84	79,99

Source: Processed data, 2024

Furthermore, the good status of sustainability in the social aspect is influenced by the level of sensitivity or contribution of the attributes studied. The level of the relationship can be seen from the level of sensitivity values of each attribute. The level of sensitivity of attributes on the aspect of natural resources is presented in the following figure.

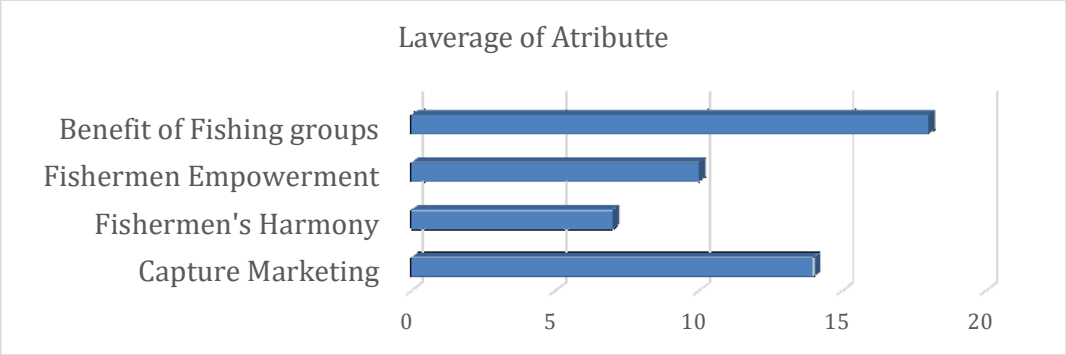

Figure 5. Laverage Of Social Aspect Attributes
Source: Processed data, 2024

Based on the conditions of the value of the attributes that appear, decision-making can be made using the law of middle values. The law of the middle value is an attribute that is larger than the middle value and they can all be used to make a decision on the value of leverage attributes that can be used to select attributes that are the priority of a particular level of influence analysis. The middle value law can be used if the value of the attribute is relatively equal or the value of one of the attributes with the highest value. Based on the results of the calculation, it was found that the attributes of the benefits of the fishermen group can be used for interpretation, so it can be stated that even though the fishermen do not go to sea which has an impact on the fishermen's income, with the strength of social capital, especially the strong solidity of the fisherman group, it can be used as capital to help each other between members of the fishermen group so that they can survive.

Conclusions

Based on the results of the research, the conclusion obtained from the results of calculations and information in the field is that the condition of the livelihood asset with the highest asset control in Glondong Gede Village is a social asset. In addition, the value of controlling physical assets and human resource assets is also quite high so that they can be used and improved in the implementation of livelihood strategies when not looking for fish due to the high wave season.

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