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Research Paper

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### ABSTRACT

This research generally aims to determine and analyze the sustainable vaname shrimp agribusiness development model. Whereas specifically aims to examine the sustainability status of vaname shrimp agribusiness in Parigi Moutong Regency. The sustainability status will be analyzed using Rapfish with five dimensions developed at the research location which are based on considerations that can reflect existing conditions . The results of the research show that the sustainability of the use of vaname shrimp fishery resources in Parigi Moutong Regency from the five dimensions is shown in the kite diagram which overall is at an index value of > 50% indicating that The sustainability status of vaname shrimp agribusiness in Parigi Moutong Regency is good and quite sustainable . The government's efforts in overcoming problems in the sustainable management of vaname shrimp resources by cultivators and other stakeholders must be carried out in an integrated and well-coordinated manner by the Parigi Moutong Regency government with interested parties.

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## Introduction

Indonesia is one of the largest countries in the world, with a coastline of 81,000 km and more than 17,500 islands (Akrim, 2014; Hurtado One of the fisheries potentials that can

currently be managed and developed sustainably is in the cultivation sector, especially shrimp. Shrimp is one of the leading commodities in the fisheries agribusiness subsector which has high value and has a large export and domestic market that can be developed, namely shrimp, especially tiger shrimp ( *Penaeus spp .). monodon* ) and vaname shrimp ( *Litopenaeus stingray* ) . White shrimp ( *Litopenaeus stingray* ) is one of the white shrimp that is quite commercial (BBAP Situbondo, 2006; KKP 2021). Vaname in Indonesia is currently the mainstay of the aquaculture sector and is a priority for the development of aquaculture in Indonesia to improve the national economy. In the period 2012-2018, the contribution of shrimp export value to Indonesia's fisheries export value reached an average of 36.27% (BPS, 2019). This means that shrimp commodities have a very significant role in the performance of Indonesian fisheries commodity exports. In 2018, the volume of shrimp exports was recorded at 197.43 thousand tons with a value of USD 1,742.12 million (DJPB, 2019). In the 2019 period, shrimp production reached 517,397 tons and is targeted to increase by 250% in 2024 to 1,290,000 tons with a production value of 36.22 trillion in 2019 to 90.30 trillion in 2024 (KKP, 2021).

One of the leading fishery commodities that has quite high demand is shrimp. Shrimp is recorded as being in first place in Indonesian fishery exports with export volume contribution by 14.13 percent And mark export by 42 percent to balance sheet trading Indonesian fisheries (KKP, 2015; Mashari et al., 2019) . Indonesian shrimp exports generally consist of three types, namely fresh shrimp , frozen shrimp, and processed shrimp. However, only frozen shrimp and processed shrimp have export value. Enough big , each by 77.38 percent and 21.91 percent (UN Comtrade , 2018; Mashari et al., 2019). The production of the fisheries and marine sector of Central Sulawesi Province in 2022 reached 1,112,785 tons consisting of the marine capture sector of 149,776 tons with a production value of Rp. 3,602,358,452, public water fisheries production of 2,892 tons with a production value of Rp. 66,763,367, and aquaculture production of 960,117 tons (BPS of Central Sulawesi Province 2022).

Central Sulawesi Province, which has a coastline of 4,013 km, has a potential land area for developing shrimp ponds of around 42,095 ha. These ponds are spread along the coast of Tomini Bay, the coast of the Makassar Strait, the Sulawesi Sea, and Tolo Bay. The areas for developing shrimp pond cultivation are in Parigi. Moutong, Banggai, Banggai Islands, Morowali Buol and Donggala with an area of 8,280 ha. The expected contribution from Central Sulawesi Province includes vaname shrimp covering an area of 3,672 ha and tiger shrimp covering an area of 3,093 ha with an increase in shrimp production to around 14,000 tons in 2009. Through the revitalization program, the development of shrimp cultivation is directed through the application of proper fish/shrimp cultivation methods (CBIB). The implementation of CBIB will be aligned with the Indonesian National Standard (SNI), *Better Management Practices* (BMP) and *Good Aquaculture Practices* (GAP), the implementation of supervision and certification of good cultivation methods (DKP Central Sulawesi Province, 2009) .

Parigi Moutong Regency is one of the regencies in Central Sulawesi Province that has fisheries potential. Administratively, Parigi Moutong Regency is one of the regencies in Central Sulawesi Province that has fisheries potential. Moutong Regency has an area of 6,231.85 km<sup>2</sup> and a coastline of 472 km. Parigi Moutong Regency has the potential for pond

cultivation of 10,816 hectares spread across 16 (sixteen) sub-districts. Of this area, around 6,866 hectares (63.48%) have been utilized with a total production of 132,294.88 tons, including shrimp commodities of 4,626.65 tons and milkfish commodities of 5,874.45 tons (BPS Parigi). Moutong Regency, 2021). Based on this, the potential land can be developed into a vaname shrimp cultivation pond area in Parigi Moutong Regency. Moutong Regency.

The results of the research of the Central Sulawesi Province Marine and Fisheries Service (2017) showed that there were obstacles in the development of the shrimp agribusiness subsystem in Parigi, Moutong Regency. The obstacles in the upstream agribusiness subsystem include: (1) the gap in the area of utilization compared to the potential area of cultivation, namely the area of cultivation land is not comparable to the production results of vaname shrimp cultivation where traditional pond production ranges from 500-1,000 Kg/Ha and semi-intensive shrimp pond production ranges from 5-7 Tons/Ha while intensive shrimp cultivation reaches 40-60 Tons/Ha; (2) farmers have not yet obtained information about the suitability of land and water carrying capacity for cultivation; and (3) farmers have also not yet obtained access to superior seeds because superior seeds are obtained from outside Central Sulawesi Province, namely South Sulawesi Province and Bali Province, so that the farming community uses local seeds so that the quality and quantity of production are not optimal.

In the farming subsystem, farmers do not yet have good knowledge about how to cultivate according to recommendations, so that productivity per unit area is not optimal. In the downstream business subsystem, there is no processing industry that is able to absorb the production results of farmers consistently. In the supporting subsystem, farmers are faced with weak access to capital, trade and marketing systems. This condition shows that the development of the shrimp agribusiness system in Parigi is not optimal. Moutong Regency has not been integrated between subsystems. The status of sustainable management of natural resources, especially marine and fisheries, can be determined using various methods. One of them is the *Rapid Appraisal for Fisheries* (RAPFISH) method. This method is basically a fast calculation technique based on multidimensional *scaling* (MDS) (Fauzi and Anna, 2005). This study used the *Rapid Appraisal for Vaname Shrimp Agribusiness Sustainability* (RAPVANS) analysis method which is a replication of the Rapfish method. This was done to analyze the sustainability of the vaname shrimp agribusiness in Parigi Moutong. Moutong Regency, Central Sulawesi Province.

## **Method**

### **Isolation of Endophytic Bacteria**

2 cm long *Vanda* sp. orchid root explants were taken from various root positions, including near the rhizosphere, attached to the pot, on the surface of the media, and associated with. The research conducted is included in descriptive research, namely research that aims to highlight facts, conditions, variables, and phenomena that occur during the research and present what actually happened (Subana, 2005). In this study, the researcher did not control or manipulate the conditions that occurred during the research (Morissan, 2012). The data collection method in this study uses a survey study, especially

*an analytical survey.* Survey techniques are used to describe and explain the reasons for a situation and allow researchers to test the relationship between variables and draw conclusions from those relationships. This research was conducted in 12 sub-districts which are the centers of shrimp farming production in the coastal area of Parigi. Moutong Regency, Central Sulawesi Province. This research was conducted for 1 (one) year, namely from July 2023 to June 2024.

### **Method of collecting data**

Data collection consists of primary data and secondary data. Secondary data is obtained through literature and document studies from several related agencies as well as the results of previous research studies and field identification. While primary data is obtained from shrimp farming business actors who are used as respondents, broadly defined as actors in shrimp agribusiness activities in Parigi. Moutong Regency, starting from those engaged in the procurement and distribution of fisheries business production facilities (capture, cultivation, processing, marine tourism and services), environment), primary production activities, processing activities and marketing activities. The stages in this research consist of:

1. Determine the number of respondents. Overall, the main actors in fisheries and marine affairs (cultivators) in Parigi, Moutong Regency in 2022 have a population of 160 people. spread across 10 sub-districts and 12 villages and 16 farmer groups. From the number of shrimp farmers, based on the Slovin formula, the number of samples in this study was 62 people. Respondents from policy-making experts numbered 11 people.
2. Conducting a survey/field identification to find out real data and problems in managing vaname shrimp resources and then formulating the problems.
3. Data collection through literature studies sourced from reading materials, references and scientific journal publications, observations, in-depth interviews using questionnaire guidelines.

### **Data analysis**

data analysis method in this study uses the Sustainability Status Analysis approach using the *Multi Dimensional Scaling* (MDS) method, which is a simple approach that can be used to evaluate and determine the sustainability status and index through *sustainability comparisons*. vaname shrimp based on a number of easily scored attributes (Kavanag, 2004 Fauzi and Anna, 2002) with the RAPVANS (*Rapid Appraisal for Vaname Shrimp Agribusiness Sustainability*) approach. This method is a modification of the RAPFISH (Rapid Assessment Technique for Fisheries) program. where it is hoped that the results of this study can be used as a consideration in formulating policies for the development and advancement of coastal villages in Donggala Regency. Data analysis with MDS covers sustainability aspects from ecological, economic, social and institutional dimensions, as well as technology. This analysis includes ordination techniques in multivariate statistics with the *multidimensional scaling* (MDS) method that uses Euclidean distance as the basis for calculation. The analysis used to assess the sustainability of fisheries businesses in Donggala Regency uses *Rapfish*. with five dimensions developed at the research location based on considerations that can reflect existing conditions. From the results of these findings, research was conducted in the

form of model recommendations regarding shrimp agribusiness policies in supporting the shrimp agribusiness development model in Parigi Moutong Regency based on scientific evidence and information obtained at the research location.

The data collection stage for sustainability analysis uses the RAPFISH (*Rapid Appraisal of the Status of Fisheries*) algorithm with the Multi-dimensional Scaling (MDS) method, with the aim of determining the sustainability status of fisheries resource utilization based on the sustainability index assessed against two reference points, namely the "good" point, the "bad" point, the "bad" point, and the "bad" point.)" which is scored 100% indicates a value (for each attribute) that reflects conditions that support sustainable capture fisheries. and the "bad" point which is scored 0% indicates a value (for each attribute) that reflects conditions that do not support sustainable capture fisheries. The ordination technique (distance determination) in MDS is based on the *Euclidean distance* which in n-dimensional space can be written as follows:

$$d = \sqrt{(x_1 - x_2)^2 + y_1 - y_2)^2 + z_1 - z_2)^2 + \dots} \dots (1)$$

The configuration or ordination of an object or point in MDS is then approached by performing an *Euclidean distance regression* ( $d_{ij}$ ) from point i to point j with the origin ( $\delta_{ij}$ ) according to the following equation:

$$d_{ij} = \alpha + \beta \delta_{ij} + \varepsilon \dots \dots \dots (2)$$

In assessing the sustainability index of fisheries resource utilization, each category consisting of several attributes is given a score. The score is generally ranked between 0 and 2. The score results are entered into a matrix table with i rows representing fisheries resource utilization categories and j columns representing attribute scores.

The ALSCAL method optimizes the squared distance (squared distance =  $d_{ij}$ ) to the square (origin =  $0_{ijk}$ ), which in five dimensions (i, j, k) is written in a formula called S-Pressure as follows:

$$S = \sqrt{\frac{1}{m} \sum_{k=i}^m \left[ \frac{\sum_i \sum_j (d_{ijk}^2 - o_{ijk}^2)^2}{\sum_i \sum_j o_{ijk}^4} \right]} \dots \dots \dots (3)$$

here the squared distance is the *weighted Euclidean distance*, or written:

$$d_{ijk}^2 = \sum_{a=1}^r w_{ka} (x_{ia} - x_{ja})^2 \dots \dots \dots (4)$$

This software is a development of the MDS that is available in SPSS software, for the rotation process (*flipping*) and several sensitivity analyses that have been combined into one software. Through MDS, the position of the sustainability point can be visualized in two dimensions (horizontal and vertical axes). To project these points on a horizontal line, a rotation process is carried out, with the extreme point "bad" given a score of 0% and the extreme point "good" given a score of 100%. The position of the sustainability status studied will be between the two extreme points. This value is an index of the sustainability of fisheries resource utilization in Parigi Moutong at this time. Moutong Regency. The value of the agribusiness sustainability index (B) is presented in the form of a score with a basic scale range of 0-100. If the shrimp agribusiness studied has  $B > 50$  then it is included in the "sustainable" category and if  $B < 50$  then it is included in the "not yet sustainable" category. Following Kavanagh and Pitcher (2004), in this study four categories of sustainability status

were compiled, namely if  $B < 24.9$  then the fishery is included in the "unsustainable" category, if  $25 < B < 49.9$  then it is included in the "less sustainable" category, if  $50 < B < 74.9$  then it is included in the "quite sustainable" category, and if  $B > 75$  then it is included in the "sustainable" category.

## **Results and Discussion**

### **Isolation and Characterization of Endophytic Bacteria**

A total of 29 he coastal area of Parigi, Moutong Regency is a strategic location as a shrimp farming location with potential natural resources, social and economic. The current potential can be increased with sustainable area management to support vaname shrimp agribusiness activities. The sustainability of shrimp agribusiness in Parigi, Moutong Regency needs to be studied more deeply regarding production and marketing so that it can provide income for farmers and regional development. In general, farmers depend on shrimp farming in 12 sub-districts in Parigi, Moutong Regency. The sustainability of this shrimp farming business will contribute to poverty alleviation efforts while preserving the environment. Therefore, the sustainability of shrimp farming must be assessed from various aspects of the problem including ecological, economic, social, institutional, and technological dimensions. The attributes of each dimension are determined based on the availability of data in the field.

### **Ecological Dimension of Sustainability Status**

The ecological dimension is the main indicator in assessing sustainability status and is a description of the quality of the environment and fishery resources and the natural processes in it, whether or not it is able to sustainably support every economic activity carried out in relation to the ecological factors of shrimp farming management. The definition of this dimension in the context of sustainable shrimp development and management is described in 10 (ten) attributes, namely; Pond pollution, suitability of pond land, carrying capacity of pond area, water quality, waste management, pond management, disease attacks, mangrove rehabilitation, production quality and pond productivity. Operationally, these attributes can describe the condition of shrimp fishery resources currently managed in Parigi Moutong Regency.

The Ecological Dimension of Sustainability Status refers to an assessment of how well a system, sector, or development activity maintains environmental balance and preserves natural ecosystems over the long term. This dimension emphasizes the carrying capacity and resilience of the environment in supporting human activities. Common indicators include water, soil, and air quality, biodiversity conservation, levels of pollution, efficiency in the use of natural resources, and the ecosystem's ability to regenerate naturally. A strong ecological sustainability status indicates that natural resources are managed responsibly without exceeding environmental limits. Conversely, excessive ecological pressure can lead to environmental degradation, which ultimately undermines economic productivity and social well-being. Therefore, the ecological dimension serves as a fundamental pillar in sustainability assessments, as the long-term success of development depends on the protection and sustainable functioning of natural ecosystems.

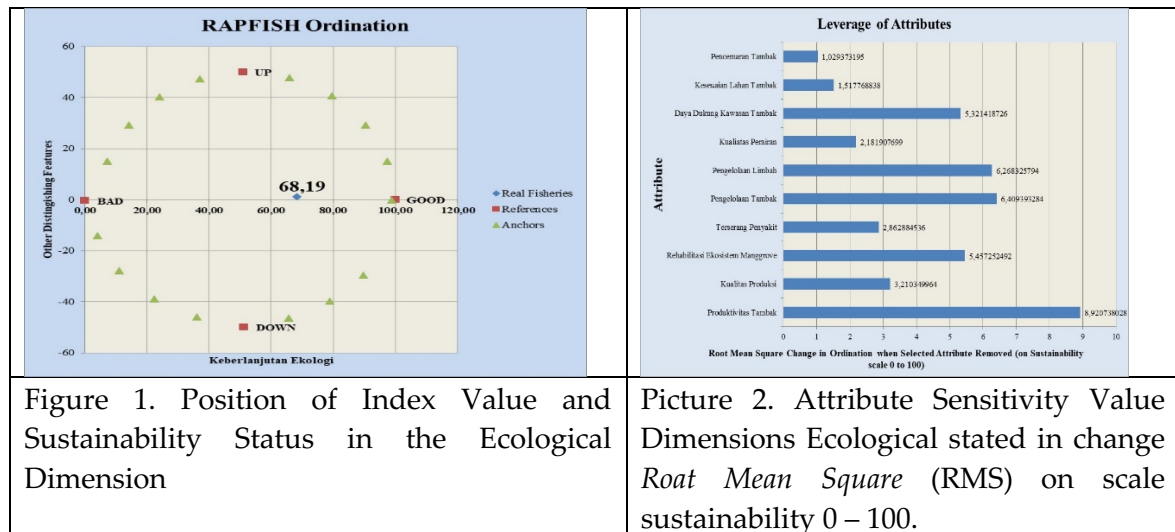


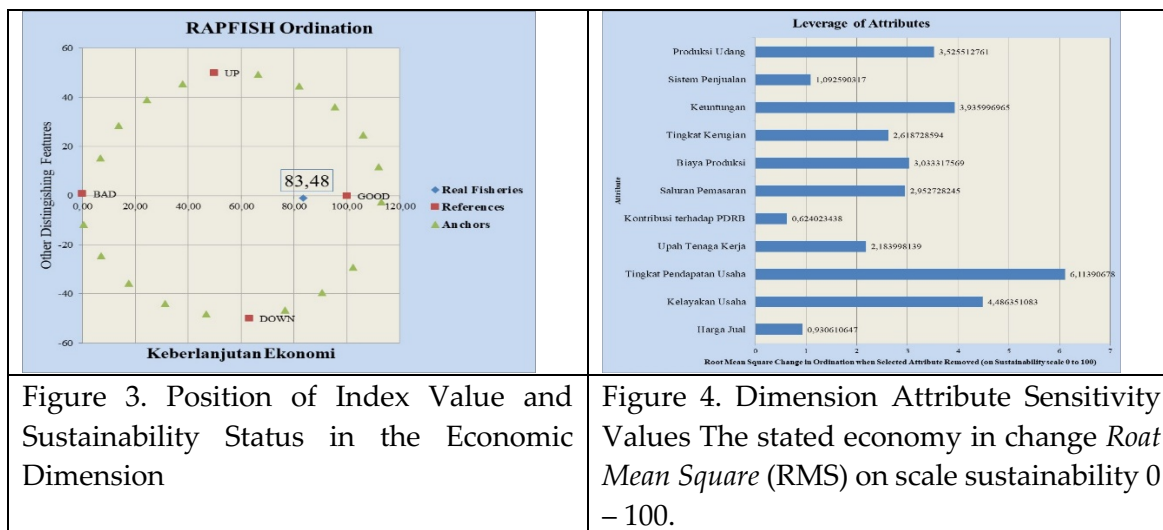
Figure 1. Position of Index Value and Sustainability Status in the Ecological Dimension

Picture 2. Attribute Sensitivity Value Dimensions Ecological stated in change Root Mean Square (RMS) on scale sustainability 0 – 100.

*Tiger shrimp* ordination shows the sustainability index value for the ecological dimension of 68.19. This value is in the range of 50.00 - 75.00 (Figures 1 and 2). With these conditions, it can be said that the management of shrimp resources carried out by farmers in Parigi Moutong Regency has been running well. When viewed from the ecological dimension, it is in a fairly sustainable status. Sensitivity analysis aimed at seeing how it affects the sustainability score in the ecological dimension of resources using *the leverage analysis method* on 10 attributes obtained 3 (three) sensitive attributes, namely pond productivity, pond management, waste processing are the most sensitive attributes in the sustainability of shrimp management on the coast of Parigi Moutong Regency. Changes in the 3 *leverage factors* will easily affect the increase or decrease in the sustainability index value based on the ecological dimension. The *leverage analysis* above shows that the pressure attribute in the waters has the highest RMS value, namely 8.92. This can be interpreted that this attribute has the greatest influence on *the sustainability* of shrimp resource management in terms of ecology. This is supported by the area of ponds owned and the level of production that always increases every year according to the data in table 4.1 of production produced in 2022 and the previous year. In addition, the abilities and expertise possessed by the cultivators are quite good and have followed the government's efforts to use good fish farming methods (CBIB) and regulate cultivation time.

### Economic Dimension of Sustainability Status

*This* dimension describes whether a shrimp resource management activity in Parigi Moutong Regency can obtain economically viable results in the long term and sustainably. In this dimension, 11 (eleven) attributes were developed that can describe the condition of shrimp farming management at the research location, namely: sales system, shrimp marketing, shrimp production, labor wages, total income, production costs, profits, business feasibility, loss rate.



Rapfish software in the economic dimension shows a sustainability index value for the economic dimension of fishermen of 83.48. This value is in the range of 75.00 - 100.00 in the sustainability category with a very good sustainability status as shown in Figure 2. The results of the *leverage analysis* shown in Figures 3 and 4 show that the business income level attribute has the highest RMS value of 6.11, followed by the business feasibility attribute with an RMS value of 4.48. This can be interpreted that these attributes have the greatest influence on the sustainability of shrimp farming management in terms of the community's economy. The study of the economic dimension is intended to allocate shrimp resources with economic carrying capacity efficiently, namely how the use of these resources can increase profits in monetary terms and increase the growth of business units while maintaining economic growth. In general, a fairly good level of business income can contribute to the fish farming community, this is due to very high capital ownership and business development.

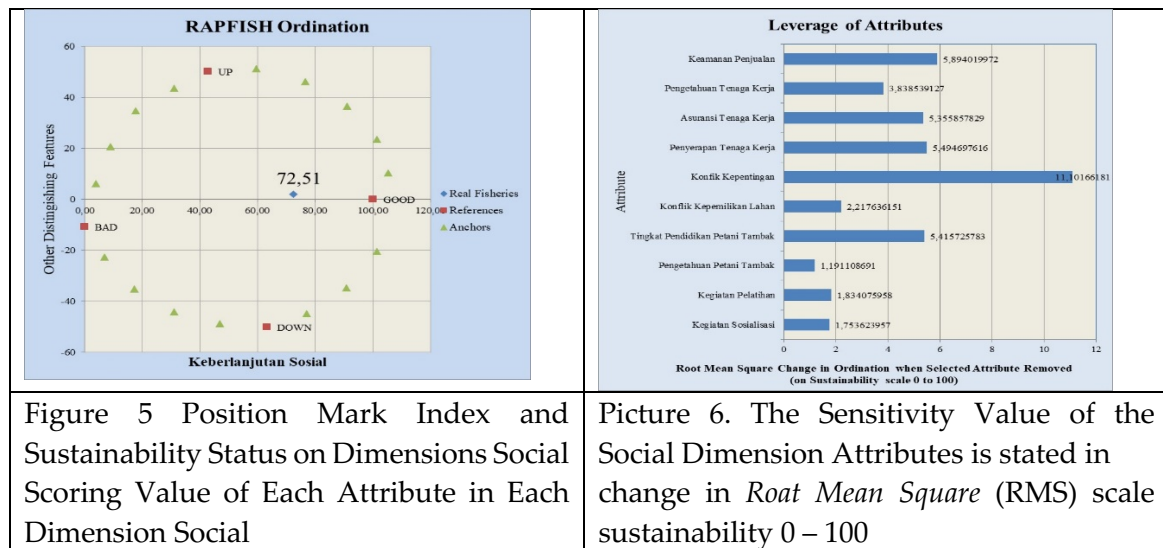
Based on the research results, it is known that the level of income obtained from shrimp sales fluctuates due to price manipulation. In the last year, the applicable price according to size (Size 50-100) reached between Rp . 51,000 – Rp . 73,000. This shows that if production is large, it will have implications on the income obtained. In general, the economic activities of shrimp farmers on the coast of Parigi Moutong Regency are fluctuating because in addition to prices, they also depend on the productivity of pond production. If productivity is high, the level of farmer income will also increase, but people's purchasing power is low and vice versa. The amount of income from this business determines the welfare of the farmers who play an important role in conditioning economic growth in the coastal area of Parigi. Moutong Regency. Utilization of shrimp resources is directed to improve the welfare of farmers, improve the community's economy, create jobs and generate local income from the fisheries and marine sectors. In an effort to increase profits and income in the shrimp farming business management area, the involvement of the government, especially the local government, is greatly needed, both in terms of providing fisheries production facilities, improving skills in fishing and cultivation activities to handling harvests and post-harvest. In addition, the role of the agribusiness and agro-industry sectors needs to be continuously encouraged so that they are able to provide added

value for the main actors supported by adequate marketing of production results and processed products. With strong support from the government, it is hoped that the benefits obtained by the community will also increase.

### Social Dimension of Sustainability Status

Understanding a society that is highly environmentally conscious, working in groups will result in ease of management of meaningful utilization end on sustainability social . Evaluation of the attributes developed in the social dimension is translated into 10 ( ten ) attributes that are technically operational and describe the social conditions of the community in the management and sustainability of the business currently being run in Parigi, Moutong Regency, including training activities, socialization activities, knowledge of pond farmers, education level of pond farmers, labor absorption, land ownership conflicts, conflicts of interest, sales guarantees, labor insurance , and labor knowledge. *Rapfish* software on the social dimension shows a social dimension sustainability index value of 72.51. This value is in the range of 50.00 - 75.00, a sustainability category with a fairly sustainable status as shown in Figures 5 and 6. Based on the results of the *leverage analysis*, it can be seen that the conflict of interest attribute has the highest RMS value, which is 11.10, followed by sales and employment security, each with an RMS value of 8.35 and 5.73. This can be interpreted that these attributes have the greatest influence on *the sustainability of shrimp resource management from the social dimension*.

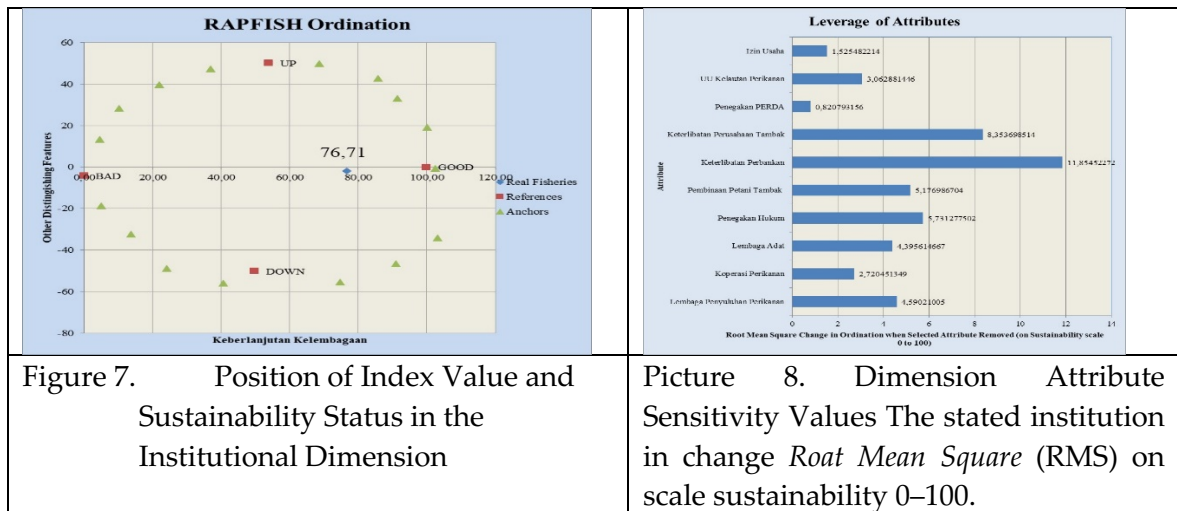
It is known that the aquaculture area in Parigi Regency, Moutong Regency, which is managed by the coastal community is very important, especially since the majority of the area is inhabited by fishermen, most of the land is owned by people from outside the area, and the majority of the workforce is not from the surrounding area.



### Institutional Dimension Sustainability Status

The institutional dimension of society (main actors and business actors) describes how the institutional system at that level regulates human and environmental activities in

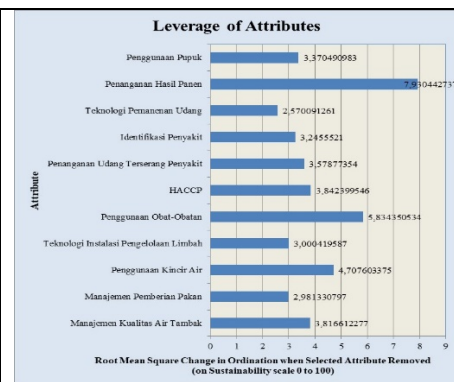
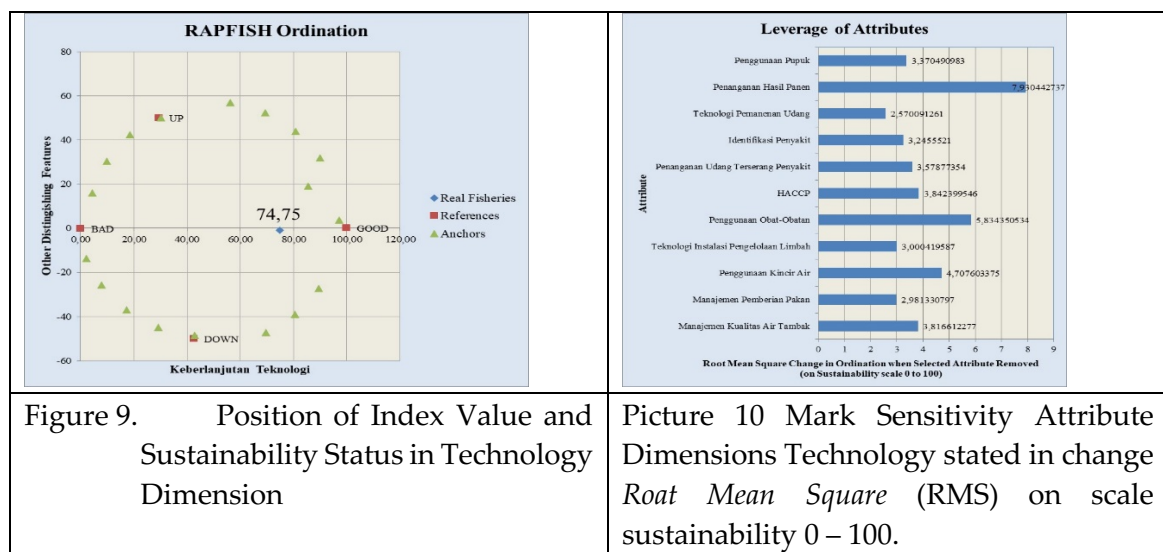
the utilization of fishery resources contained therein. The better the regulation is carried out, the greater the possibility that every economic activity carried out in the fisheries sector can run in the long term and sustainably. Aquaculture business activities cannot be separated from the social conditions of the farming community and other business actors who carry out activities to utilize these resources. This dimension is also a description of how the institutional system operates and whether or not an activity can utilize economic resources. In this dimension, 5 (five) attributes are developed that can describe the institutional conditions in the efforts of farming communities.



*Rapfish* in this institutional dimension shows the sustainability index value for the institutional dimension of 76.71. This value is in the range of 75.00 - 100.00, the sustainability category with very good sustainability status. Based on the results of the leverage analysis, it can be seen that the banking involvement attribute has the highest RMS value of 11.85, followed by the involvement of fish farming companies and law enforcement with RMS values of 8.35 and 5.73 respectively. This can be interpreted that these attributes have the greatest influence on *the sustainability of* shrimp resource management from the institutional dimension. The existence of banking and fish farming companies in Parigi, Moutong Regency has an impact on the sustainability of shrimp farmers' businesses. By considering the source of financing in business management, farmers expect credit from banks in their efforts to develop their businesses. In addition, shrimp farming results are also expected to be directly processed by the company. This is a follow-up to the business being pursued, so that the marketing results are quickly purchased by the shrimp farming company. This will provide fast income for every farmer in Parigi Moutong Regency. Awareness of the importance of regulations that have been prepared by technical agencies, both in price regulation, healthy seeds, control of cultivation land, so that every business actor (farmer) does not do things that are detrimental to their business, including the security and protection of their business.

## Sustainability Status of Technology Dimension

*Technology* The sustainability dimension is an effort driven by economic motives and the fulfillment of needs to improve community business operations. This dimension is a reflection of the degree of utilization of fishery resources in the use of technology. Evaluation of the attributes developed in the technology dimension is translated into 11 (eleven) operational technical attributes that describe the condition of the technology used and the facilities available. Support for coastal businesses in Parigi Moutong Regency includes the use of fertilizers, harvest handling, shrimp marketing technology, disease identification, handling of sick shrimp, HACCP, use of medicines, waste treatment installation technology, use of water wheels, feed management and pond water quality management.



*Rapfish* software on the Technology dimension, shows the sustainability index value for this dimension of 74.75. This value is in the range of 50.00 - 75.00. The sustainability category with a fairly sustainable status is shown in Figures 9 and 10. Sensitivity analysis on the technology dimension using the *leverage analysis method* on 11 attributes of the technology dimension, obtained three sensitive attributes ( Figure 9.10 ), namely handling of harvest results, use of drugs and use of water wheels. Changes in *these 3 leverage factors* will easily affect the increase or decrease in the sustainability index value of the technology dimension.

## Multidimensional Sustainability Status

Utilization of Coastal Areas for Shrimp Agribusiness Management in Parigi, Moutong Regency is dynamic, and currently community activities including fishing, cultivation, product processing, marine tourism and other environmental services are still and are ongoing in several coastal areas of Parigi, Moutong Regency. The results of the *Rapid Appraisal for Vaname Shrimp Agribusiness Sustainability* (Rap-VANS) sustainability analysis on the utilization of the area source Power fishery specifically shrimp on the coast of Parigi beach Moutong . Regency Moutong of the five dimensions are shown in the kite diagram (

Figure 5 ) which overall is at number 2 ( two ) between 50 – 75 % and 75 – 100% which shows that the sustainability status of the business agribusiness shrimp with management support Shrimp resources on the coast of the Regency Moutong very good . Regency Moutong is at on good status And Enough sustainable . This index value is obtained based on an assessment of 53 attributes from five dimensions of sustainability, namely ecological, economic, social, institutional and technological dimensions . Sensitive attributes that contribute to the sustainability index value can be improved by making improvements to several attributes (variables) that influence the increase in the sustainability index value, both in the ecological, economic, social, institutional and technological dimensions. Attributes that need to be immediately improved are attributes that are sensitive to the sustainability index value of fisheries resources, without ignoring attributes that are not or less sensitive to the influence based on the results of the *Leverage analysis* .

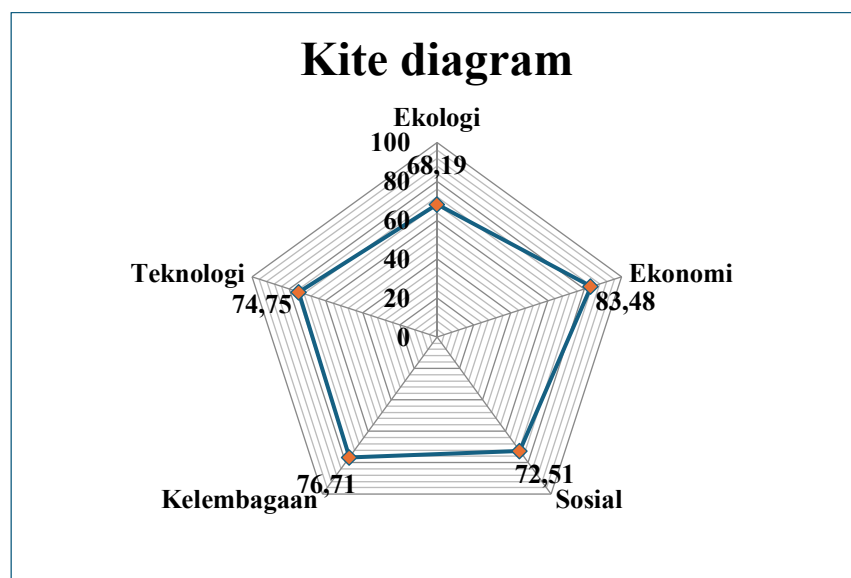


**Figure 1. Multidimensional Sustainability Kite Diagram of Agribusiness shrimp in Parigi Moutong Regency**

In the context of development Agribusiness Shrimp in Parigi Moutong Regency, there needs to be a benchmark to determine whether the sustainability status is supported by shrimp resource management. experience improvement or decline from management activities carried out, including attribute improvements in each dimension. One of the benchmarks commonly used to assess regional sustainability in the future is by establishing indicators of agribusiness sustainability. Based on needs, this study analyzes the sustainability of shrimp agribusiness with the support of fishery resources developed through the five dimensions above. The achievement of indicators that support the improvement of status in the ecological dimension can in principle be achieved by making improvements to the attributes in the ecological dimension, especially attributes that are sensitive to increasing the sustainability index value. These attributes include pond productivity, pond management, and waste management. Based on this, in an effort to support the development of sustainable shrimp agribusiness, what needs to be done is to

maintain and increase the productivity of pond land, of course there needs to be control efforts by farmers by monitoring the land, including pond water quality and cleanliness of the pond environment. Pond waste in the form of water discharge during harvesting can also be observed. Of course, by doing these things, the productivity of the pond land can be maintained.

Sustainability indicators in the economic dimension can be achieved through improving attributes in the economic dimension. Attributes that need to be improved immediately are to maintain efforts to increase farmer income in order to anticipate the sustainability of their business. Viewed from an economic aspect, the main objective of developing shrimp agribusiness is of course with the support of feasibility and profit indicators from the business, of course providing space for them to further develop their business, either by expanding the cultivation area or equipping it with cold storage facilities (to maintain quality and store shrimp commodity production results before being sold). Therefore, the role of the Government is also important to provide more adequate supporting facilities needed for business activities, so that the quality and quality of products produced by farmers can be maintained, including its role in terms of shrimp commodity prices, both at the provider level and at the collector or export trader level.

Ssocial, achievement of sustainability indicators in this dimension can be achieved by improving attributes such as conflict of interest, sales security and employment. In the area Coast Paris Regency Moutong , with With the existence of shrimp farming efforts, there are still many conflicts of interest in an area, especially in terms of land use, because most of the land belongs to outsiders (not the local community). Therefore, efforts to reduce frequency of conflict between main actors and joint law enforcement or regulations in the management of fisheries resources. This is done in an effort to increase the index value and sustainability of fisheries resources, especially shrimp. Sustainable shrimp development policy in Parigi Moutong The district area is very much needed considering that this area has great potential to be developed in the fisheries sector. Therefore, the role of the government is very much needed through the creation of regulations for the management of fisheries resources. so that it can reduce the level of conflict that occurs. Not to mention the issue of sales security, because there is interference from collectors as extensions of the company so that investors who are actually the families of the land owners cannot buy the shrimp production from the land. Then, the majority of the workforce are not local residents but rather people employed by the owners who come from outside the area or village where the pond is located.

Sustainability indicators in this institutional dimension can be carried out through the involvement of banks, including fish farming companies and law enforcement. The existence of banking in providing business credit for cultivators is very necessary considering that to develop and expand a business, additional capital is needed by each cultivator. However, in general, farmers still rely on personal capital for development considering that the land they own is still around 1 - 2 hectares. Including the existence of shrimp farming companies that always prepare shrimp production results, of course providing space for farmers to market their cultivation products. The group was formed with the aim of strengthening institutions and human resources , in an integrated manner

so as to be able to manage fishery resources sustainably, increase the productivity and competitiveness of fishermen (Zakiah, 2011). Technology dimension, the achievement of sustainability indicators in this dimension can be achieved by improving attributes such as the level of technological mastery, availability of databases, and support for facilities and

infrastructure. In Parigi Moutong Regency Area, most of the main actors (shrimp farmers) still use simple technology so that it is necessary to carry out mentoring and training efforts in introducing more advanced technology, including the existence of supporting facilities and infrastructure for fisheries businesses which are still very minimal such as cold storage (containers) and TPI in each coastal district. The mastery of technology for the existing workforce is still relatively low and access to fisheries information is still lacking. This condition greatly affects the sustainability of the business in supporting the development of shrimp agribusiness in the future. Humans with the ability to develop technology, it is hoped that it can provide solutions to obstacles in the management of fisheries resources which aim to maintain or even increase land productivity so that it can provide high economic value has the potential to increase community income. The ability of each attribute to explain and contribute to the sustainability of the system is assessed by looking at the coefficient of determination ( $R^2$ ) in each dimension analyzed. According to Kavanagh (2001) in Fauzi and Anna (2002), the uncertainty aspect is caused by several factors, including the impact of errors due to lack of information, the impact of variations in scoring due to differences in assessment, data entry errors and high stress values obtained. Determination of the index value and multidimensional sustainability status of fisheries resource utilization performance is carried out by multiplying the index values of each dimension presented in table 1.

**Table 1. Rap-VANS Analysis Results for Stress Values and Determination Coefficient ( $R^2$ )**

| Size          | Index Value | Emphasize   | $R^2$          | Number of Iterations |
|---------------|-------------|-------------|----------------|----------------------|
| Ecology       | 68.19       | 0.172       | 0.936<br>years | 2                    |
| Economy       | 83.48       | 0.146 years | 0.958          | 2                    |
| Social        | 72.51       | 0.192       | 0.932          | 2                    |
| Institutional | 76.71       | 0.159       | 0.952          | 2                    |
| Technology    | 74.75       | 0.162       | 0.947<br>years | 2                    |

Source: Research Results, 202

Index value 68.19.78 - 83.48 is categorized as sufficient & good Voltage value < 0.25 means compliance  $R^2$  value 95% or >95%: very good contribution

The stress value refers to Alder *et al* (2000) in Fauzi and Anna, (2002) which states that the stress value is said to be good if the value is less than 25% ( $S < 0.25$ ), while the coefficient of determination ( $R^2$ ) shows a very significant value, namely an average of 0.95 with a

confidence interval of 95%. From the table above, it can be seen that not all dimensions support the sustainability of shrimp farming businesses significantly. The two main dimensions that support sustainability are the economic and institutional dimensions. The accuracy of the support of these dimensions for sustainability is evidenced by the stress value and determination coefficient obtained. This means that all attributes that are indicators in this study can reflect the original data or *goodness of fit values* in the MDS, and can explain the conditions and status of the sustainability of shrimp agribusiness on the coast of Parigi Moutong. Moutong Regency. Table 4.13 shows that the MDS index value does not change much with *the Monte Carlo analysis results* which are within the 95% confidence interval. It can be ascertained that the assessment errors, the influence of score variations, the stability of the repeated MDS analysis process or errors in entering or losing data *donot affect*.

**Table 2. Differences in Sustainability Index Values in Monte Carlo Analysis and Rap-VANS Analysis**

| Size          | RAPF FISH | MONTE CARLO | Difference (MDS-MC) |
|---------------|-----------|-------------|---------------------|
| Ecology       | 68.19     | 60.05       | 8.14                |
| Economy       | 83.48     | 81.27       | 2.21                |
| Social        | 72.51     | 70.48       | 2.03                |
| Institutional | 76.71     | at 70.30    | 6.41                |
| Technology    | 74.75     | 66.39       | 8.36                |

Source: Research Results, 2025

The management of fishery resources, especially shrimp, by farmers in the coastal area of Parigi, Moutong Regency based on the five dimensions studied can be said to be in a promising and sustainable condition (good and quite sustainable). Therefore, improvements and efforts to improve attributes that provide high sensitivity values and have negative impacts must be carried out, so that the index value and sustainability status will be better. Government efforts to overcome the above problems must be carried out in an integrated and well-coordinated manner by the Parigi Regional Government. Moutong Regency Government with interested parties.

## Conclusion

The sustainability assessment of vannamei shrimp agribusiness in Parigi Moutong Regency indicates that the sector holds significant potential to support regional economic development, while also facing important environmental, social, and institutional challenges. The results suggest that economic aspects, particularly production performance and market opportunities, contribute positively to agribusiness sustainability. However, environmental factors such as water quality management, waste handling, and disease control remain critical issues that require continuous improvement to ensure long-term viability. Furthermore, social and institutional dimensions play a decisive role in strengthening sustainability. Farmer capacity, access to technology, institutional support,

and effective governance significantly influence the resilience of vannamei shrimp agribusiness systems. Strengthening stakeholder collaboration, improving best management practices, and promoting environmentally responsible aquaculture are essential strategies to enhance sustainability. Overall, integrated and adaptive management approaches are necessary to ensure that vannamei shrimp agribusiness in Parigi Moutong Regency can develop in a sustainable manner, balancing economic growth with environmental protection and social well-being.

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