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SUSTAINABILITY STATUS OF FRESH WATER WHITE SHRIMP (*Litopenaeus vannamei*) CULTIVATION IN GLAGAH DISTRICT, LAMONGAN REGENCY, EAST JAVA

STATUS KEBERLANJUTAN BUDIDAYA UDANG VANAME (*Litopenaeus vannamei*) AIR TAWAR DI KECAMATAN GLAGAH, KABUPATEN LAMONGAN, JAWA TIMUR

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ABSTRACT

Glagah District is the main area for white shrimp culture with freshwater rearing media in Lamongan Regency, so it is necessary to conduct research to determine the sustainability status of freshwater white shrimp culture in Glagah District. The research locations are in seven villages, namely Soko, Pasi, Margoanyar, Glagah, Jatirenggo, Bapuhbaru, and Karangturi. Sustainability status can be measured by considering five aspects of sustainability which include ecology, economy, social, technology, and institutions. In this study, the analysis was carried out using the RAPFISH (Rapid Appraisal for Fisheries) application with the Multi Dimensional Scaling (MDS) method. This study adopted a quantitative descriptive method, with data collection conducted through a survey. The results of the analysis using the Multidimensional Scaling (MDS) approach to 20 cultivation attributes in the ecological, economic, social, technological and institutional dimensions yielded the following sustainability indexes: 52.23% for the ecological dimension, 58.51% for the economic dimension, 78.47 % for the social dimension, 53.77% for the technological dimension, and 40.46% for the institutional dimension. With an average sustainability index value of 56.69%, it can be concluded that the freshwater white shrimp culture in Glagah District is quite sustainable.

Keywords: fresh water, culture, sustainability status, white shrimp.

ABSTRAK

Kecamatan Glagah merupakan kawasan utama budidaya udang vaname dengan media pemeliharaan air tawar di Kabupaten Lamongan, sehingga perlu dilakukan penelitian untuk mengetahui status keberlanjutan budidaya udang vaname air tawar di Kecamatan Glagah. Lokasi penelitian berada di tujuh Desa, yaitu Soko, Pasi, Margoanyar, Glagah, Jatirenggo, Bapuhbaru, dan Karangturi. Status keberlanjutan dapat diukur dengan mempertimbangkan lima aspek keberlanjutan yang meliputi ekologi, ekonomi, sosial, teknologi, dan kelembagaan. Dalam kajian ini, analisis dilakukan menggunakan bantuan aplikasi RAPFISH (*Rapid Appraisal for Fisheries*) dengan metode *Multi Dimensional Scaling* (MDS). Penelitian ini mengadopsi metode deskriptif kuantitatif, dengan pengumpulan data dilakukan melalui survei. Hasil analisis menggunakan pendekatan Multidimensional Scaling (MDS) terhadap 20 atribut budidaya dalam dimensi ekologi, ekonomi, sosial, teknologi, dan kelembagaan menghasilkan indeks keberlanjutan sebagai berikut: 52,23% untuk dimensi ekologi, 58,51% untuk dimensi ekonomi, 78,47% untuk dimensi sosial, 53,77% untuk dimensi teknologi, dan 40,46% untuk dimensi kelembagaan. Dengan nilai rata-rata indeks keberlanjutan sebesar 56,69%, dapat disimpulkan bahwa budidaya udang vaname air tawar di Kecamatan Glagah termasuk cukup berkelanjutan.

Kata kunci: air tawar, budidaya, status keberlanjutan, udang vaname.

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INTRODUCTION

The Lamongan Regency area has a suitable ecology and geography to support the development of aquaculture business activities (Utojo et al., 2012). In 2020, the value of rice-pond fishery production in Lamongan Regency was 47,953 tons. This value is the largest in East Java when compared with other districts/cities (BPS East Java, 2021). To date, Glagah District, Lamongan Regency, has experienced developments in several aquaculture commodities, such as vaname shrimp, milkfish, tilapia, goldfish and tawes fish (Rokhmawati and Sardjito, 2019).

One of the fishery commodities that is very popular to cultivate in Glagah District is vaname shrimp. Vannamei shrimp cultivation carried out in Glagah District is unique in that it is carried out in low salinity or fresh water. This type of shrimp can live in fresh water because it has a very wide tolerance for salt levels (eurihaline), from 0-45 ppt (Sudradjat and Wedjatmiko, 2010). Cultivating vaname shrimp at low salinity can be a solution for people who want to cultivate vaname shrimp, but are far from coastal areas. Problems that are often experienced in freshwater vaname shrimp cultivation activities can be caused by several things such as ecological, social, economic, fisheries policies and cultivation technology used (Putri et al., 2019). This can certainly affect the sustainability of cultivation activities.

Sustainability in shrimp culture, especially freshwater vaname shrimp, is very necessary to meet the demand for shrimp consumption in both local and export markets. The sustainability status of aquaculture refers to Alder et al., (2000), who explained that sustainability can generally be measured by including ecological, socio-economic, cultivation technology and institutional components. Kusvita (2013) said that the ecological conditions in cultivation areas can be seen from the quality of the water, how often disease attacks occur and the level of risk of disasters. Economic conditions in cultivation areas can be viewed from the ease of getting access to capital, the stability of harvest prices and the feasibility of the business. Social conditions in cultivation areas can be observed from the education level of the cultivators and how often conflicts occur between cultivators. The technological conditions in cultivation areas can be seen from the cultivation techniques used by cultivators. Institutional conditions in cultivation areas can be seen from the existence of cultivator groups, as well as regulations that support cultivation activities. Therefore, this research was carried out with the aim and objective of exploring information regarding the sustainability status of vaname shrimp cultivation in freshwater environments, as well as providing input regarding the sustainable management of freshwater vaname shrimp cultivation in Glagah District, Lamongan Regency.

RESEARCH METHODS

Research Time and Location

This research took place in the period July to August 2020 and was carried out in the rice fields owned by shrimp farmers located in Glagah District, Lamongan Regency.

Research Type

The quantitative descriptive technique approach is the type of research used in this study.

Respondent Determination

In this study, the cultivator respondents were sampled twice, at different times. Choosing a representative sample of communities is the first step. 29 villages were included in the study area, and a subdistrict's sample area represented 25% of those villages. As a result, 7 villages were chosen as sample research locales. The second step was individual sampling, with quota sampling as the sample method. Because the population of growers that cultivate vaname prawns is not yet known with precision, this research uses quota sampling. The research sample quota determined was 53 people. Respondents consisted of 50 people from cultivators and 3 people from the Lamongan Regency Fisheries Service.

Data Collection

The data used in this study is divided into two categories: primary data and secondary data, which include a range of quantitative and qualitative topics. Five main aspects of sustainability—ecological, economic, social, technological, and institutional—are summed up in the data. A variety of techniques, including observation, documentation, questionnaire-assisted interviews, and direct measurement of several parameters in the field, were used to collect primary data. On the other side, secondary data is gathered through literature studies, which also incorporate information from relevant institutions, past study findings, and numerous other library sources.

Data analysis

The assessment of sustainability status in this research applies an analysis method known as Multi-Dimensional Scaling (MDS). In this analysis, an ordination technique assisted by RAPFISH (Rapid Appraisal for Fisheries) software was used. The data analysis process involves combining primary and secondary data, which is then identified in five dimensions, namely ecological, economic, social, technological and institutional.

Alder et al. (2000), said that the RAPFISH analysis procedure consists of several stages as follows: The initial stage is determining the attributes, where this research involves 20 attributes which are divided into 5 dimensions to be analyzed, namely 4 attributes for the ecological dimension, 4 attributes for the economic dimension, 4 attributes for the social dimension, 4 attributes for the technological dimension, and 4 attributes for the institutional dimension. These attributes are displayed in Table 1.

Table 1. Dimensional Attributes of Sustainability of Freshwater Vaname Shrimp Cultivation

No	Dimensions	Attribute	Scores and Grading			Information
			Score	Good	Bad	
1.	Ecology	1. Water quality (temperature, pH, DO, Nitrite, Ammonia nitrate, Total phosphate)	0;1;2;3	3	0	IPj (>10.0) heavily polluted [0], IPj (5.1-10.0) is moderately polluted [1], IPj (1.1-5) is lightly polluted [2], IPj (0-1.0) good condition/not polluted [3].
		2. Shrimp survival rate	0;1;2;3	3	0	Very low (10-20%) [0], Low (21-50%)[1],

No	Dimensions	Attribute	Scores and Grading			Information
			Score	Good	Bad	
						Medium (51-80%) [2], High (81-100%) [3].
		3. Disease attack	0;1;2;3	3	0	Very often (≥ 5 times in one year) [0], Frequent (3-4 x in one year) [1], Rarely (1-2 x in one year) [2], Never [3].
		4. Potential for catastrophe	0;1;2;3	3	0	Very often (≥ 5 times in one year) [0], Frequent (3-4 x in one year) [1], Rarely (1-2 x in one year) [2], Never [3].
2.	Economy	1. Access to capital	0;1;2;3	3	0	None [0], Available but it is difficult [1], Available and it's rather easy [2], Available and easy [3].
		2. Product price fluctuations	0;1;2;3	3	0	Very High (≥ Rp.9,000) [0], High (Rp.6,000-Rp.8,000) [1], Medium (Rp.3,000-Rp.5,000) [2], Low (Rp. 1,000-Rp. 2,000) [3].
		3. Ease of market	0;1;2;3	3	0	Very difficult (cultivators sell themselves to markets far away) [0], Difficult (cultivators sell themselves to markets that are quite close) [1], Easy (cultivators sell directly to middleman) [2], Very easy (middlemen take the cultivator's harvest) [3].
		4. R/C Ratio	0;1;2,3	3	0	R/C < 1 (loss) [0], R/C = 1 (equal) [1], R/C > 1 (profit) [2], R/C ≥ 2 (very profitable) [3].
3.	Social	1. Education level	0;1;2;3	3	0	Not attending school [0], Elementary school [1], Middle school [2], ≥ High school [3].
		2. HIPPA (*Himpunan Petani Pemakai Air* or Association of Water User Farmers)	0;1;2;3	3	0	Not working [0], Recently formed [1], There is, but it doesn't run well [2], There is, and it's running well [3]
		3. Frequency of conflict	0;1;2;3	3	0	Very often (>10 times in one year) [0], Frequent (6-10 times in one year) [1], Rarely (1 - 5 times in one year) [2], Never [3].
		4. Understanding of the CBIB	0;1;2;3	3	0	Don't Know [0], Little Know [1], Know but haven't implemented [2],

No	Dimensions	Attribute	Scores and Grading			Information
			Score	Good	Bad	Know and have implemented [3]
4.	Technology	1. Cultivation technology	0;1;2;3	3	0	Traditional [0], Traditional plus [1], Semi intensive [2], Intensive [3],
		2. Availability of shrimp eggs	0;1;2;3	3	0	Not available [0], Few available (1-4 place providing shrimp eggs) [1], Available (5-9 place providing shrimp eggs)[2], Widely available (≥10 place providing shrimp eggs) [3].
		3. Quality of shrimp eggs	0;1;2;3	3	0	Bad (Local Shrimp eggs /F1, are diseased) [0], Rather good (Local Shrimp eggs)[1], Good (Shrimp eggs F1 backyard) [2], Very good (Shrimp eggs F1 are certified) [3]
		4. Water quality management	0;1;2;3	3	0	Never done [0], Rarely done (1-2 times in 1 cycle) [1], Sometimes done (3-4 times in 1 cycle) [2], Always done (Every day for 1 cycle) [3].
5.	Institutional	1. Shrimp cultivation group	0;1;2;3	3	0	None [0], Newly formed [1], Available but not active [2], Available and active [3].
		2. Counseling from related agencies	0;1;2;3	3	0	Never [0], Rarely (1-2 times in one year) [1], Often (3-4 times in one year) [2], Very often (5-6 times in one year) [3]
		3. Regulations that support cultivation activities	0;1;2;3	3	0	No rules [0], Newly formed [1], Available but not effective [2], Available and effective [3]
		4. Land use zoning documents	0;1;2;3	3	0	No rules [0], There are regulations, but they are still in the drafting stage [1], There are regulations and they have not been implemented [2], There are regulations and they have been implemented [3].

Source: Kusvita (2013)

The second stage is an ordinal assessment of attributes (filling in scores) based on the sustainability criteria associated with each dimension. After that, in the third stage, RAPFISH analysis was carried out using the MDS method approach to determine ordination and calculate stress values. The fourth stage carried out an assessment of the index and sustainability status of

freshwater vaname shrimp cultivation both in each dimension individually and in a multidimensional context. This assessment refers to the sustainability criteria listed in Table 2. The fifth stage is carrying out a sensitivity analysis (leverage analysis) to identify which attributes have a sensitive impact on the level of sustainability. Then, in the sixth stage, a Monte Carlo analysis is carried out which aims to evaluate the stability of the ordination results that have been obtained. The final stage is to prepare the sustainability status.

Table 2. Sustainability Status Index Category for Vaname Shrimp Cultivation

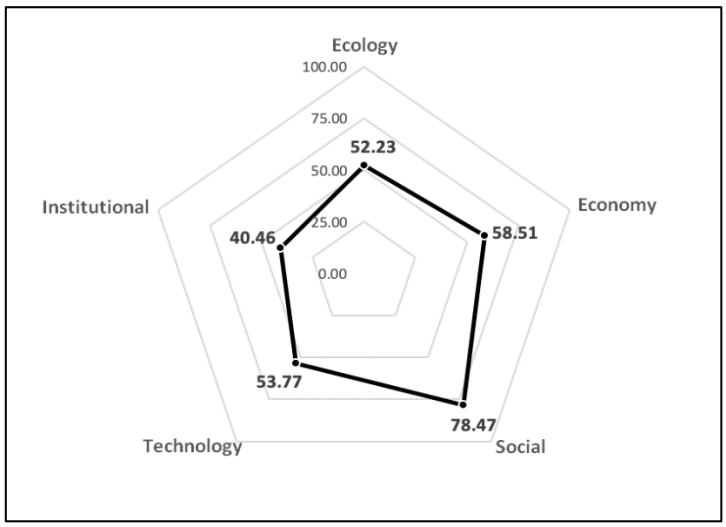
Index value (%)	Category	Description
0,00 – 25,00	Bad	Unsustainable
25,01 – 50,00	Not enough	Less sustainable
50,01 – 75,00	Enough	Quite Sustainable
75,01 – 100,00	Good	Sustainable

Source: Fauzi and Anna (2015)

RESULT AND DISCUSSION

Assessment of the level of sustainability in cultivation business activities can be seen from various dimensions related to the development of cultivation areas. The level of sustainability for freshwater vaname shrimp cultivation in Glagah District, Lamongan Regency, in this study was calculated through multidimensional scaling (MDS) analysis. This approach is multidimensional because it integrates all attributes related to the five dimensions being evaluated, namely ecological, economic, social, technological and institutional.

After analyzing the sustainability index of 20 attributes in cultivating freshwater vaname shrimp in Glagah District, it was found that the average value of the overall sustainability index was around 56.69%. This value is in the range of 50.01 to 75.00%, which indicates that the sustainability status of freshwater vaname shrimp cultivation in Glagah District can be considered quite sustainable. The multidimensional sustainability index is displayed in the form of a kite diagram in Figure 1. Based on this diagram, it can be concluded that in the social dimension, freshwater vaname shrimp cultivation in Glagah District is included in the sustainable category with a value of around 78.47%. Meanwhile, in the ecological, technological and economic dimensions, sustainability is quite well maintained with values of around 52.23%, 53.77% and 58.51% respectively. However, in the institutional dimension, sustainability is classified as poor with a value of around 40.46%.

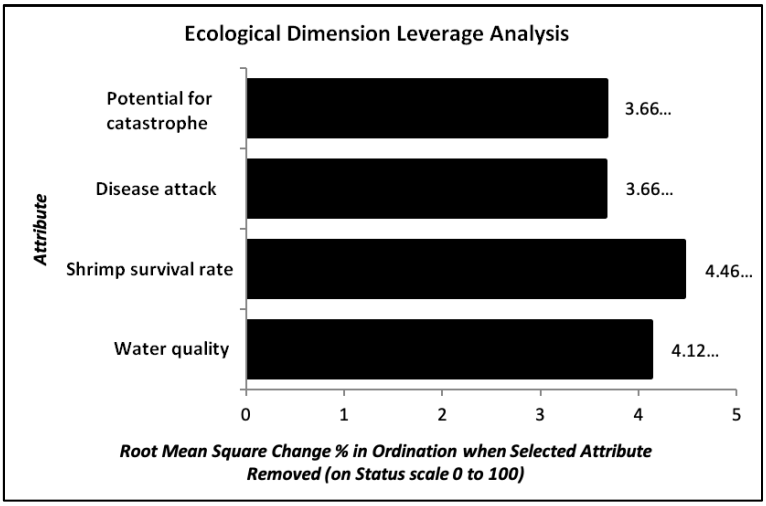


Source: Analysis Results (2022)

Figure 1. Sustainability Index for Freshwater Vaname Shrimp Cultivation Dimensions

Ecological Dimension Sustainability Status

In the ecological aspect, it can be seen that this dimension obtained a value of 52.23%, indicating a sufficient level of sustainability. The results of the Leveraging analysis reveal that the attributes that have a significant influence in this dimension are shrimp survival, with a score of 4.46, and water quality with a score of 4.12 (Figure 2). Shrimp survival is one of the crucial factors in cultivation activities. The survival rate (SR) can influence the level of productivity of vaname shrimp cultivation. The greater the SR value, the better. Based on survey results, the survival value of vaname shrimp cultivation in Glagah sub-district ranges from 40-55% for traditional and traditional plus systems, which is relatively low. Meanwhile, for semi-intensive systems, it ranges from 60-70% and is included in the medium category. According to Cahyono (2009), the benchmark for the success of vaname shrimp cultivation activities at low or fresh salinity is a high percentage of shrimp survival rate.



Source: Analysis Results (2022)

Figure 2. Ecological Dimension Supporting Attribute Values

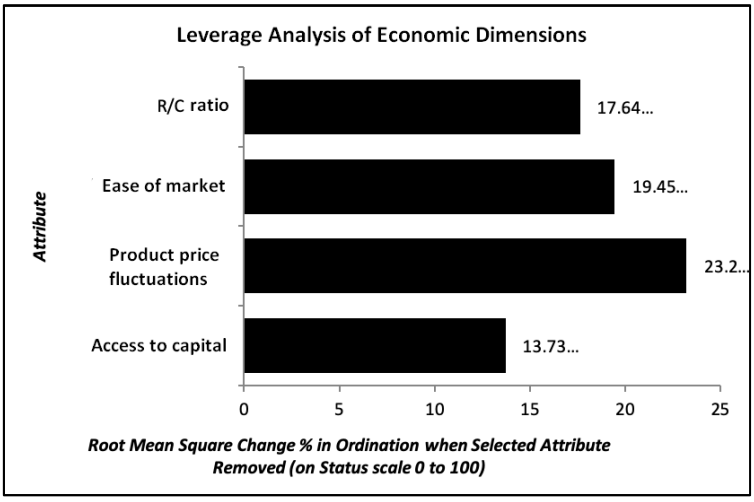
The low level of survival rate for vaname shrimp in traditional and traditional plus systems is influenced by several factors, one of which is that water quality management is not implemented

optimally. According to Sumarni (2016), water quality management in ponds has a very significant role in realizing the success of vaname shrimp cultivation. This is because the health, growth and development and survival of aquatic creatures are influenced by various factors such as the aquatic environment, disease-causing pathogens and the physical condition of aquatic biota that interact with each other. Cultivators with traditional and traditional plus cultivation systems tend to carry out simpler water quality management compared to semi-intensive systems. This causes the survival rate to be lower.

Water quality is closely related to shrimp survival rate. The better the water quality, the higher the survival rate. According to Cahyono (2009), the survival rate in vaname shrimp cultivation is influenced by abiotic and biotic factors. These abiotic factors include the physical components and chemical quality of water in an aquaculture pond water environment. By implementing good water quality management in aquaculture ponds, it is hoped that it can increase the SR value which will contribute to increasing the sustainability of cultivation activities through aspects of the ecological dimension.

Economic Dimension Sustainability Status

Sustainability in the economic dimension is shown in fairly sustainable criteria, reaching a value of 58.51%. In the Leveraging analysis process that has been carried out, it was found that the most sensitive attributes in this dimension are (1) product price fluctuations with the highest value of 23.2 and (2) ease of market with a value of 19.45 (Figure 3). Price fluctuations can be influenced by several factors. One of them is that the harvest time is at the same time and causes the stock of shrimp to be consumed on the market to be abundant (over supply), which has an impact on reducing product prices. According to Irawan (2007), the rise and fall in selling prices of fishery harvests basically arise due to an imbalance in the quantity of goods available, namely shrimp harvests, and consumer needs or demands. If the supply of shrimp harvest is excessive, then the selling price of shrimp will fall. On the other hand, if the supply of shrimp harvest decreases or decreases, the price of vaname shrimp commodities will increase.



Source: Analysis Results (2022)

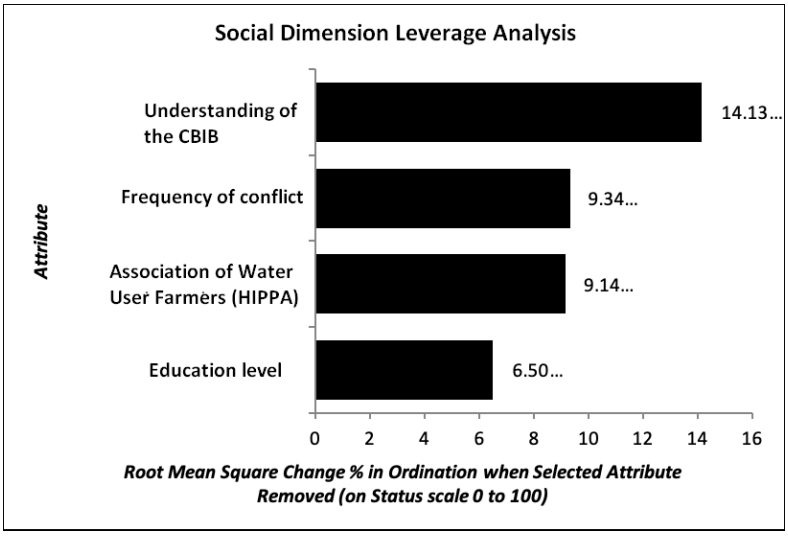
Figure 3. Economic Dimension Supporting Attribute Values

The volatility in the price of consumption-sized shrimp in Glagah District ranges from IDR 10,500 to IDR 15,500 per kilogram. These fluctuations are very high. Where the price of shrimp during normal conditions for size 100, which was initially IDR 55,500.00 per kilogram, can decrease to IDR 40,500.00 per kilogram when stock is abundant (over supply). Even though vaname shrimp experience very high price fluctuations, farmers still use vaname shrimp as their main commodity compared to other commodities such as milkfish, tilapia and goldfish, because the selling price of shrimp is higher and still profitable.

Market convenience is related to cultivators' access to selling their crops. Cultivators can sell their harvest to middlemen or sell it directly to fish markets. If cultivators can sell their harvests easily, it will support ongoing vaname shrimp cultivation activities, thereby supporting the sustainability of cultivation activities. According to Bambang (2019), Marketing is an activity to fulfill consumer needs and demands with the aim of providing profits for sellers. Marketing can be a source of income for farmers through sales transactions of the shrimp harvest they cultivate.

Social Dimension Sustainability Status

The social dimension occupies the main position in the sustainable category with an achievement of 78.41%. The results of the Leveraging analysis reveal that in this dimension, the most sensitive attributes are as follows: (1) understanding of CBIB with the highest value of 14.13, followed by attributes (2) conflict frequency of 9.34 and (3) Association of User Farmers Water (HIPPA) of 9.14. Details of the value of each attribute are presented in Figure 4. Good Fish Cultivation Practices (CBIB) is an approach that ensures the maintenance, growth and harvest of quality guaranteed fish in a controlled environment. This is done by focusing on aspects such as sanitation, seed quality, feed given, use of drugs, chemicals and biological elements. Apart from that, this approach is also committed to meeting fish health and welfare standards, as well as being responsible for environmental impacts and socio-economic aspects (Kusvita, 2013). The level of understanding of CBIB among shrimp farmers in Glagah District is still relatively low. Some cultivators do not know about the existence of CBIB and some already know, but have not implemented it. The difficulty of implementing CBIB for cultivating freshwater vaname shrimp in Glagah District is because the majority of cultivators still use traditional and traditional plus cultivation systems. And there are limited tools for measuring water quality. Apart from that, the lack of awareness among farmers about the importance of CBIB also has an impact on the difficulty of implementing CBIB in cultivating freshwater vaname shrimp in Glagah District.



Source: Analysis Results (2022)

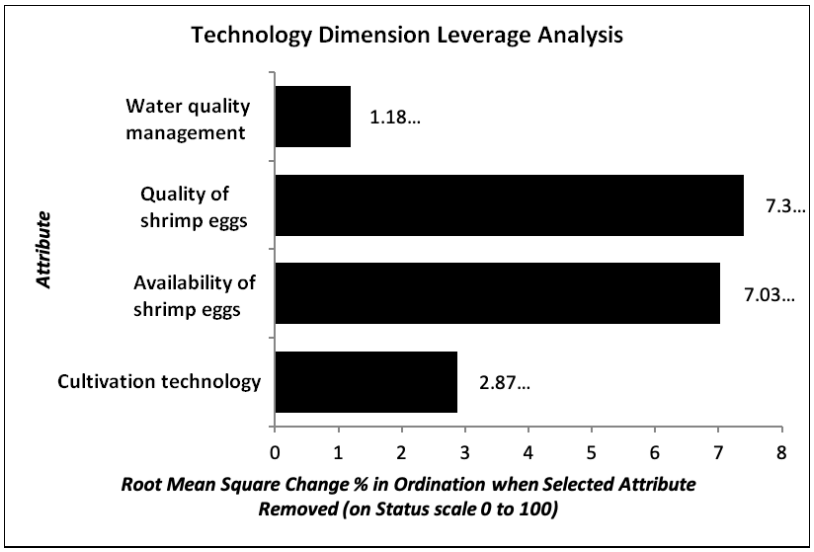
Figure 4. Nilai Atribut Pendukung Dimensi Sosial

The social conditions of an area can influence the sustainability of cultivation activities. A conducive social environment can facilitate the running of cultivation activities. The social conditions in Glagah District are conducive to cultivation activities. This can be observed from the survey results which show minimal conflict between one cultivator and another. The running of the HIPPA (Association of Water User Farmers) program also influences the high value of the social dimension of sustainability status. With the HIPPA program, farmers can avoid conflicts due to competition for water, and needs related to pond irrigation can be resolved properly. Apart from that, the implementation of the HIPPA program also shows that cultivators have high awareness of the importance of maintaining social relations between people. Social engagement is an integrated element in maintaining sustainability. When cultivation activities develop, social problems often arise which are characterized by conflict because several community groups feel dissatisfied (Montolure, 2016).

Technology Dimension Sustainability Status

Sustainability in the current technological dimension can be considered sufficient with an achievement of 53.77%. The results of the Leveraging analysis also show that there are attributes that are quite sensitive in this dimension, namely (1) quality of fry with a value of 7.30 and (2) availability of fry with a value of 7.03. Details of the values for each technology dimension attribute are presented in Figure 5. The selection of fry is one of the determining factors in increasing the success of vaname shrimp cultivation. The quality of the fry greatly determines the growth and survival rate of the shrimp being kept. The quality of the fry can be seen from the health and type of fry. Health can be seen from disease-free examination results. The health level of the fry used by shrimp farmers in Glagah District cannot be known with certainty because there is no laboratory testing by the fry provider. So farmers see the level of health only based on physical characteristics, such as active movement of the fry and a high survival rate of the fry during the rolling process. Quality fry can be recognized from a number of distinctive signs, such as a transparent body,

unbroken food in the intestine, agile swimming activity with the head facing downwards, complete organs and a tail that develops when it reaches the PL10 stage, and its ability to respond to vibrations. by twisting his body (SNI 01-7252, 2006).



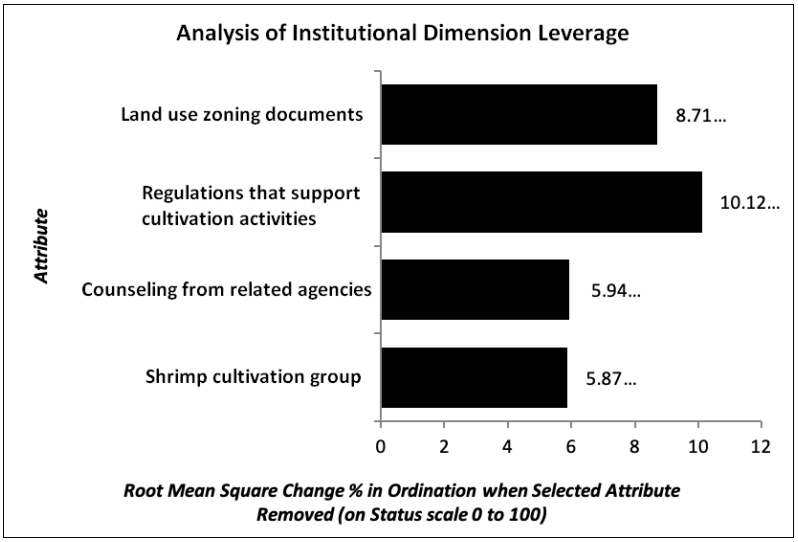
Source: Analysis Results (2022)

Figure 5. Technology Dimension Supporting Attribute Values

The good type of fry is superior shrimp seed called F1, while the fry used by vaname shrimp cultivators in Glagah District are the ordinary or local type which comes from home hatcheries in the northern coastal areas of Lamongan and Tuban Regencies. The fry must go through a process of rolling and acclimatization to salinity into fresh water before being spread into ponds. The quality of the fry used by cultivators is not good. This can of course affect the survival rate which results in low productivity. The availability of fry in Glagah District is very adequate. This can be seen from the large number of freshwater vaname shrimp spinners spread across Glagah District.

Sustainability Status of Institutional Dimensions

The current condition of sustainability in the institutional dimension can be considered less sustainable with an achievement of 40.46%. According to the results of the Leveraging analysis, there are attributes that are quite sensitive or sensitive to influence in this dimension, namely (1) regulations that support cultivation activities with a value of 10.12 and (2) land use zoning documents with a value of 8.71. Details of the values for each attribute are presented in Figure 6.



Source: Analysis Results (2022)

Figure 6. Value of Supporting Attributes for Institutional Dimensions

Making policies or regulations related to vaname shrimp cultivation activities in Glagah District has a great influence on the sustainability of cultivation activities. Several policies that have been implemented by the government based on the Lamongan Regency Fisheries Service Strategic Plan (2021), include: (1) increasing the provision of facilities and infrastructure to support fisheries cultivation, (2) expanding access to training and empowerment facilities for more fish farmers, and (3)) maximizing the role and function of the Fish and Environmental Health Laboratory in efforts to overcome Fish Pests and Diseases (HPI). However, it turned out that these policies did not have a direct impact on shrimp farmers, resulting in a low value of the sustainability status index in the institutional dimension.

Based on the RT/RW of Lamongan Regency (2020), Glagah District is included in the development of the Minapolitan area for aquaculture and Glagah District is the Minapolis area. In this way, the existence of ponds in Glagah District can avoid land conversion and receive full support from the government regarding the development of the fisheries sector. With this support, it is hoped that the fisheries sector in Glagah District can develop further and be sustainable so that it can increase the sustainability index in the institutional dimension.

In order to test the feasibility of the results of the study regarding the sustainability status of freshwater vaname shrimp cultivation in Glagah District, Root Mean Square analysis was carried out on certain statistical parameters, such as stress and coefficient of determination (r2). Table 3 displays the stress and r2 values resulting from Root Mean Square analysis.

Table 3. Results of Root Mean Square Analysis of Sustainability Dimensions

Parameter	Dimensi				
	Ecology	Economy	Social	Technology	Institutional
Stress	0,245	0,167	0,167	0,218	0,188
r^2	0,885	0,927	0,943	0,911	0,920
Iterasi	3	3	3	3	3

Source: Analysis Results (2022)

Table 3 shows that each dimension in the study has a stress value that is lower than the limit set at 0.25, and is in accordance with previous research (Kavanagh and Pitcher, 2004). The smaller the stress value, the more valid the analysis results will be. Apart from the stress value, other assessments also apply to the coefficient of determination (r2) with the calculation results showing an r2 value between 0.885 - 0.943. The closer this value is to 1.0, it indicates that the analysis results are better (Kavanagh and Pitcher, 2004). From the results of the Monte Carlo analysis with a confidence level of 95%, a relatively small difference in the MDS value calculation was found in the Rapfish analysis. According to Wigiani et al. (2019), this small difference shows that the scoring of each attribute is evaluated accurately, so that errors during the analysis process can be minimized. Apart from that, this also shows that data input errors and lost data can be avoided. The difference in MDS values found in the Monte Carlo test ranges from 0.17 to 2.15, which proves the high accuracy of the Rapfish analysis results.

CONCLUSION AND SUGGESTION

Conclusion

Results of sustainability analysis using the Multidimensional Scaling (MDS) approach to 5 dimensions consisting of ecological, economic, social, technological and institutional. The social dimension is included in the sustainable category with a value of 78.47%, followed by the ecological, technological and economic dimensions which are in the moderately sustainable category with respective values of 52.23%, 53.77% and 58.51%. These four dimensions can be further optimized by considering the most sensitive attributes in each dimension in order to improve its sustainability status. Meanwhile, the institutional dimension is included in the less sustainable category with a value of 40.46%, so further evaluation and action needs to be carried out so that its sustainability status can be improved. The overall average value of the sustainability index is 56.69% or in the range 50.01-75.00%, which means that the sustainability status of freshwater vaname shrimp cultivation in Glagah District is quite sustainable.

Suggestion

Cultivators are expected to be able to manage cultivation by paying attention to sensitive attributes in the ecological, economic, social, technological and institutional dimensions. In the ecological dimension, implementing optimal water quality management can improve shrimp survival. In the economic dimension, expanding the marketing network can be implemented to anticipate oversupply which has an impact on price fluctuations, so as to maintain price stability. In the social dimension, utilizing conducive social conditions can be used to socialize and implement CBIB. In the technological dimension, disease screening through laboratory tests and the use of F1 fry can be applied by fry providers, in order to improve the quality of the fry. In the institutional dimension, increasing the role of fisheries instructors can be done to socialize and monitor programs or policies that have been launched by the government through related agencies so that they can run effectively.

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