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Ecological and Socio-economic Sustainability of Ornamental Fish Business in Minapolitan Area of Blitar Regency, East Java, Indonesia

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Abstract: Minapolitan is a concept of sustainable development policy based on the fisheries area. Blitar Regency as a center of fish ornamental fish cultivation and the Minapolitan area since 2011. During the implementation process as well as the policy output stage, an evaluation is needed to determine the sustainability status of the Minapolitan area development policy from the ecological and socio-economic dimensions; and what the most sensitive attribute play a role in the multidimensional sustainability using Multi-Dimensional Scaling Method. The main finding that the ornamental fish business in Blitar Regency is sustainable category. The most sensitive attribute contributes to the multidimensional sustainability is fisheries resource fertility, rainfall, fish cultivation benefits, water quality, and environmental knowledge. The strategy to keep the sustainability status, for example maintaining water quality as well as implementing Good Aquaculture Practices (GAP) to keep fisheries resource fertility, diligently moving a certain size ornamental fish to the aquarium to avoid the unstable rainfall, creating consumer satisfaction and improving environmental knowledge.

1. Introduction

Indonesian fisheries management continues to improve and its contribution needs to be continued to prosper the business actors in the fisheries sector, especially farmers and fishermen. The Ministry of Maritime Affairs and Fisheries (MMAF) has issued a strategic policy in the efforts to develop the region-based marine and fisheries sector with the Minapolitan concept [1]. Minapolitan is a regional concept of maritime and fisheries economic development based on integrated principles, efficiency, quality and acceleration. In simple terms, the Minapolitan area can be interpreted as an area with an economic wheel drive in the fisheries sector [2].

East Java has an area dubbed the golden triangle of ornamental fish: Tulungagung, Kediri and Blitar. Blitar Regency is the center of the best and largest production of koi fish in Indonesia. Blitar produces 40 million koi fish per year, with an area of 200 hectares of special cultivation of koi fish. Blitar was designated as a minapolitan area for koi ornamental fish based on the MMAF Decree Number: KEP.32 / MEN / 2010 concerning the Determination of Minapolitan Area, precisely in Nglegok District with considered superior of koi fish and the only Minapolitan Koi in Indonesia. To improve the quality and productivity of koi fish, Sub Raiser Ornamental Fish was built in the Minapolitan region as a producer



of koi fish seeds and breeders. Blitar Regency won the 11th Jawa Post Award event in the category of Economic Growth Sector (Minapolitan Supporting Economic Growth) [3].

Some of the approaches used in the Minapolitan policy are dominated by the economic approach, namely superior commodity approaches, efficiency and effectiveness, optimization of fisheries resource potential as economic resources, economic clusters, and integration of all development potential [3]. These economic approaches have raised new challenges, namely increasingly massive ecological damage, affecting the carrying capacity and availability of fisheries natural resources, so that the sustainability of businesses in this region is less guaranteed [3]. Uncontrolled ecological factors will decline the sustainability level of the minapolitan area, for example fishery resources fertility that are not maintained will disrupt growth of phytoplankton and fish, so fish farmers need to control water quality regularly and frequently changes the water to keep the fertility. The distance between the location of ornamental fish cultivation and the settlement is an obstacle to control water quality regularly and quickly, especially if there is a sudden change in rainfall, the handling of fish becomes slow and results in reduced water quality and fish mortality. Besides that, lack of environmental knowledge causes unfriendly behavior towards the environment of fish farming. While, the erratic rainfall causes fish reproduction failure, and declining water quality contributes to the failure of fish production. These environmental factors affect the sustainability of ornamental fish business in the minapolitan area.

Minapolitan clearly targets sustainable fisheries development with the concept of the blue revolution for increasing fisheries production to increase people's income that is fair and equitable [4]. The development of the Minapolitan area based on a sustainable development policy [5], are development emphasising a balance between preservation of natural resource environment and socio-economic benefits. The concept of sustainable fisheries and marine development is also according to [2] that sustainable fishery systems consist of some aspects, including ecological and socio-economic sustainability. It is not different with [1], that the study of potential aquaculture areas must consider aquatic environment and socio-economic.

Some problems related to the environmental dimensions that occur in the mina-business operation of ornamental fish in the Minapolitan region are volatile. When the problems arise, and the fish farmer unable to overcome it, this will not guarantee the sustainability of the Minapolitan area. Evaluating the sustainability status of the Minapolitan area development is important to ascertain whether some of these ecological problems affect its sustainability. It can be carried out in the process and outcome stage. Based on these problems, this study purposes to analyze the sustainability status of the ecological dimension related to economic and social, and the most sensitive attribute of each factors play a role in contributing to the multidimensional sustainability index of ornamental fish cultivation.

2. Method

This quantitative research uses survey methods conducted in the Minapolitan area of koi ornamental fish, precisely in Blitar Regency of East Java Province, Indonesia. The population consisted of $\pm 2,540$ ornamental fish farmers, ± 30 human resources of MMAF in Blitar, ± 20 groups of ornamental fish farmers, fish traders and the community. The number of respondents was 122 people consisting of 53 ornamental fish farmers, 11 employees of the MMAF, 40 members of the community, 9 traders, and 5 group of ornamental fish farmers. Combination of all different respondents was conducted to obtain comprehensive data and information on the ecological and socio-economic sustainability. The sample was determined by disproportioned stratified purposive sampling techniques. The data collected is the three-dimensional attributes of the business sustainability, covering ecological and socio-economic dimensions. Collecting data uses observation, interviews, questionnaires, and documentation.

The data obtained were analyzed using multidimensional scaling analysis to answer the first and second objectives. Multi-Dimensional Scaling (MDS) method uses application of Rapfish 3.1 for windows in the R application. The Rapfish method is the latest technique developed by the University of British Columbia Canada which is an analysis to evaluate the sustainability of fisheries in a multidisciplinary manner. Rapfish is based on ordination techniques using MDS. MDS itself is basically

a statistical technique that tries to carry out multi-dimensional transformations into lower dimensions [6].

Stages of data analysis using MDS according to [7]: a). Determination of attributes; b). The evaluation stage of each attribute on an ordinal scale is to capture the level of sustainability of the ornamental fish business, each observed attribute is given a score that reflects the sustainability level. The score shows the value of "good" or "bad" which means "good" reflects favorable conditions, and "bad" reflects unfavorable conditions. c). Ordinal analysis on MDS to visualize through horizontal and vertical axes. With the rotation process, the point position can be visualized on the horizontal axis with the sustainability index value rated 0% (bad) and 100% (good). If the system under study has a sustainability index value greater than or equal to 50% ($\geq 50\%$), then the system is said to be sustainable, and not sustainable if the index value is less than 50% ($<50\%$); d). Compilation of indexes and sustainability status; e). The data obtained are then analyzed by using Rapfish software to evaluate the comparison of sustainability status. The results of the study provide practical guidance on the suitability of ordinal scaling associated with stress values. If the stress value is 20 (bad), 10 (enough), 5 (good), 2.5 (very good), and 0 (perfect).

Goodness of fit means the amount of S-Stress value calculated based on the value of S-Stress. A low value of Stress indicates good fit, while a high S value indicates bad fit. A good model according to Rapfish is if the stress value is smaller than 0.25 ($S < 0.25$). Then proceed with sensitivity analysis using leverage and monte carlo analysis to calculate aspects of uncertainty. Monte Carlo analysis is carried out at a 95% confidence interval. The results of the Monte Carlo analysis are then compared with the MDS analysis. Leverage analysis of the most sensitive attributes that have an influence on multidimensional sustainability after it was carried out with qualitative descriptive analysis to make a strategy for increasing sustainability. According to [8], the purpose of this analysis is to make a picture of painting systematically, factually and accurately about the facts, the characteristics and the relationships between the phenomena investigated.

3. Result and Discussion

The sustainability of the ornamental fish mina-business in Blitar Regency was analyzed by the MDS method which involved the three dimensions of the business sustainability.

3.1. Sustainability Status of Ornamental Fish Mina-Business in Minapolitan Area

The development of the ornamental fish business in Blitar Regency has been designated as a minapolitan area which has undergone several largely positive changes from three dimensions, namely ecology, economy, and social. However, there are those who question the sustainability status of the mina-business. This is because there is an outbreak of disease that kills ornamental fish when rainfall is high, water quality can decrease when fish farmers are late replacing water regularly because lack of time allocation for this business and environmental knowledge. Furthermore, the level of fisheries resources fertility also decreased. Of course this minapolitan activities were inseparable from the exploitation of natural resources to produce the economy. For this reason, this study intends to analyze the sustainability status of the particular ecological dimension that determines the sustainability of the socio-economic dimension.

The sustainability index value of the ornamental fish mina-business in all dimensions as in Figure 1. Based on the results of the Rapfish analysis using MDS and Monte Carlo, the value of the sustainability index of ornamental fish mina-business is included in the category of good or sustainable in ecological, economic, and social dimensions, respectively 81.33; 76.45; and 81.52 (Table 1).

The reference for the basis of determining the goodness of the results in MDS is that the Stress value is less than 0.25 (Table 1), meaning that the error effect on the valuation of an attribute is very small, so it can be ignored, and the value of determination coefficient (R^2) produced by each dimension of sustainability ranges from 0.89 - 0.90 (Table 1). This shows that the attributes used in measuring the sustainability status of the MDS analysis with Rapfish have explained $\pm 90\%$ of the current system.

Table 1. The Result Sustainability Analysis (Rapfish: Monte Carlo, R^2 and Stress Value) of Ornamental Mina-Business in Minapolitan Area.

Dimensions	Sustainability Index Value		Difference	R-Square (R^2)	Stress Value (S)
	Rapfish	Monte Carlo			
Multidimensional	78.46	78.46	0	0.89	0.15
Ecology	81.33	81.33	0	0.90	0.13
Economic	76.45	76.45	0	0.89	0.15
Social	81.52	81.52	0	0.89	0.15

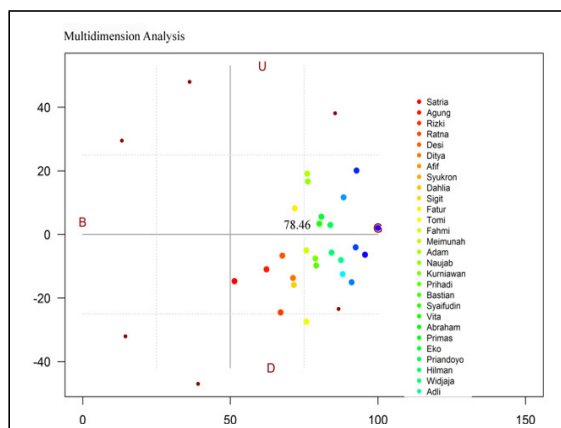


Figure 1. Sustainability Index of Ornamental Mina-Business in Multidimensional (Source: Research Results, 2018).

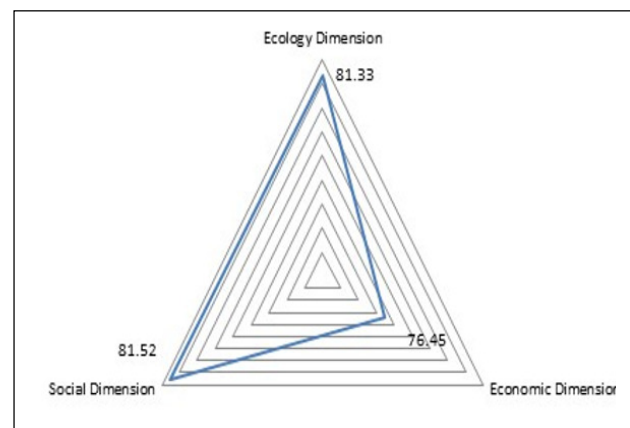


Figure 2. Kite Diagram of the Sustainability Index in Each Dimension in Blitar Regency (Source: Research Results, 2018).

Figure 1 shows a combination of three dimensions used to measure the sustainability of ornamental fish mina-business in Blitar. The average and multidimensional sustainability index value of the business in Blitar Regency is 79.77 and 78.46, or at the interval of 70.00 - 100.00, which means it is sustainable. Based on multidimensional sustainability index (Figure 1) and sustainability of each dimension using kite diagram (Figure 2), the index gets out or approaches the number 100, shows the sustainability status that is getting better. The level of sustainability of mina-business is generally composed of fifteen attributes in three dimensions, where each dimension has five attributes. Broadly speaking, the multidimensional sustainability index and each dimension is presented in the kite diagram.

3.2. Analysis of Sensitive Attribute of Each Factor Contribute to the Multidimensional Sustainability of Ornamental Fish Mina-Business in Blitar Regency.

Leverage analysis is used to analyze the most sensitive attribute of each factor contribute to the multidimensional sustainability of the ornamental fish mina-business in Blitar. Based on leverage analysis, it turns out that each attribute in the ecological dimension has different effects on the magnitude of the sustainability index value. Furthermore, sensitive attributes, namely some attributes that have high leverage value compared to other attributes, of course have significant influence on the sustainability index value.

3.2.1. Sustainability of Ecological Dimension

Based on the results of the MDS analysis, the sustainability index value of ecological dimension obtained was 81.33 (Table 1 and Figure 2), this shows that the ecological dimension sustainability index of the business in Blitar district is categorized as sustainable. Attributes that are examined give an

influence on the level of sustainability in the ecological dimension consisting of five attributes, including: rainfall per month, the environment knowledge, water quality of ornamental fish, fertility of fishery resources, and distance of business location to the settlement.

The sensitivity of each ecological dimension attributes can be shown in figure 3. Based on Figure 3, the ecological dimension attribute that greatly influences or becomes the leveraging factor for the sustainability of ornamental fish mina-business is the fertility of fisheries resources. In fact, the fertility is still relatively fertile with evidence of pH ranging from 7-8. This fertility of fisheries resources can affect fish growth. Fish farmers need to maintain the fertility of fishery resources by checking water regularly and frequently making water changes. This in line with [9], that at pH ranges from 7-9 supporting the development of phytoplankton and will have an impact on fish growth.

3.2.2. Sustainability of Economic Dimension

The sustainability index value of economic dimension resulted from MDS analysis was 76.45 (Table 1 and Figure 2), this shows that the economic dimension index of the business sustainability is categorized as sustainable. Examining attributes that give an influence on the economic sustainability index consisting of five attributes, including consumer dependence level, profits of ornamental fish farming, ornamental fish markets availability, development of potential business of ornamental fish cultivation; and availability of fisheries human resources.

Figure 4 shows that the leverage analysis on the attributes of the economic dimension greatly influences the sustainability index value, namely the profit in the business of ornamental fish mina-business which has a leverage value of 7.39. This is because the benefits obtained have not yet been used as a business development tool because profits can be a driving force for businesses to be more advanced and in an effort to increase profits, so extension activities in the fisheries sector need learning in managing financial management. This is reinforced by the opinion of [10], that profits in carrying out a business can affect the sustainability of the economic dimension because profit is one of the driving forces of a business.

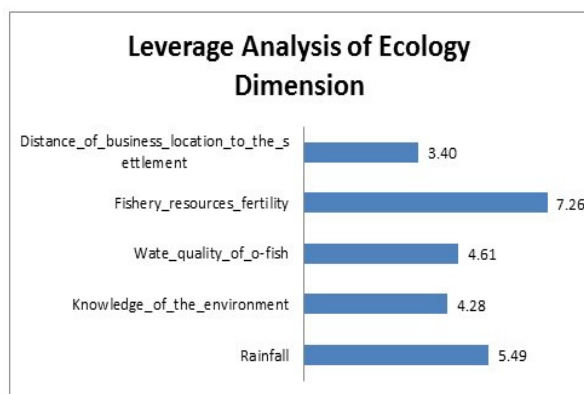


Figure 3. Leverage Analysis of Ecology Dimension (Source: Research Results, 2018).

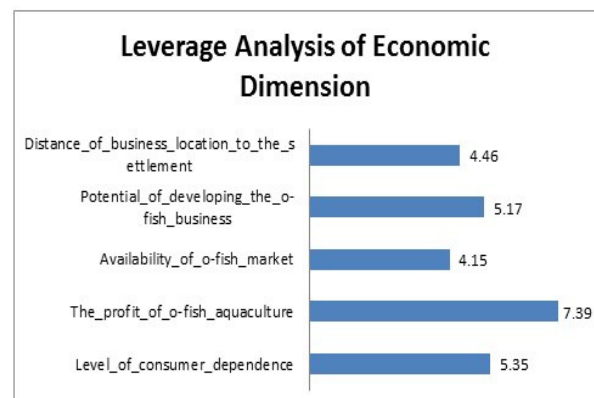


Figure 4. Leverage Analysis of Economic Dimension (Source: Research Results, 2018).

3.2.3. Sustainability of Social Dimension

Measuring sustainability of the ornamental fish business from social dimension resulted the index value was 81.52 (Table 1 and Figure 2), having meaning that the social dimensions of sustainability are good criteria or sustainable. There are five attributes examined give an influence on the level of sustainability, including: the level of formal education, the frequency of conflicts, time allocated for ornamental fish farming, cooperation the ornamental fish mina-business; and community participation in the management of ornamental fish farming.

Social dimension attributes that most sensitive contribute to the sustainability the ornamental fish mina-business is the allocation of time for ornamental fish farming (Figure 5). This is because the

allocation of the business time of the respondent is not carried out in full time with 4 hours per day. Efforts that have been made by farmers to overcome and maintain water quality by checking water quality regularly before starting other activities in a controlled manner so that the growth and quality of fish can be maintained properly. Respondents still lack the understanding of the importance of caring for ornamental fish intensively to make it more qualified. It requires full time availability to treat ornamental fish. This is consistent with the opinion of [11], that management of fish farming requires such as recording data on fish growth, the frequency of feeding and water quality which is constantly monitored so that aquaculture activities require full time in maintaining the health and quality of fish.

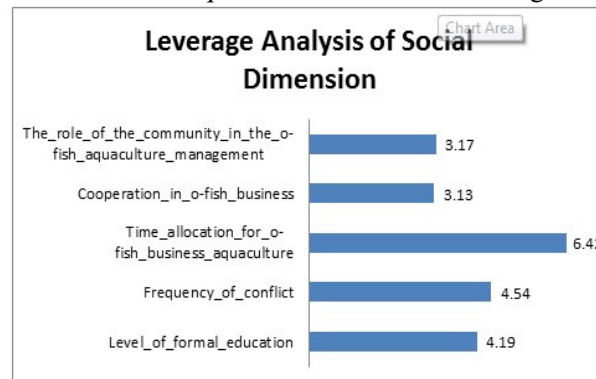


Figure 5. Leverage Analysis of Social Dimension

3.2.4. Multidimensional Sustainability

Analysis of multidimensional sustainability of the mina-business in Blitar Regency is 78.46 (Figure 1), which means it is sustainable. The four attributes with the highest leverage value of each sustainability dimensions are analyzed using multidimensional leverage, the results are presented in Figure 6. It can be seen that the four attributes with the highest leverage value are the most sensitive attributes may affect to change the level of multidimensional sustainability of ornamental fish business in minapolitan area. These attributes are fishery resource fertility, monthly rainfall, the profit of ornamental fish aquaculture, and knowledge of the environment.

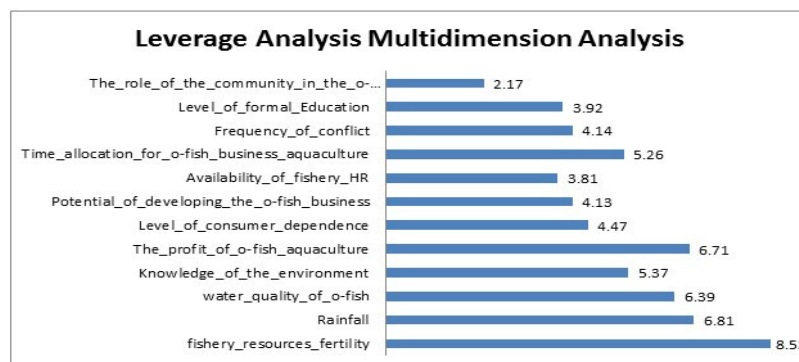


Figure 6. Leverage Multidimensional Analysis

It is important for fish farmers to keep sustainability status of their mina-business. They can maintain the fertility of fisheries resources by regularly replacing water and cleaning ponds to maintain water quality so as to maintain the fertility of fisheries resources, thereby reducing the impact of fish deaths, increasing fish growth. Increasing their environmental knowledge is also important to maintain the sustainability and fertility of the waters. One of the keys to successful in farming of ornamental fish or others is the water quality of clean and fertile water so that it can grow phytoplankton while supporting fish growth.

4. Conclusion

Sustainability status of the ornamental fish mina-business in Blitar Regency is a sustainable category. The most sensitive attribute of each factor contributes to the multidimensional sustainability status is fisheries resource fertility, rainfall, fish cultivation benefits, water quality, and environmental knowledge. The strategy may keep the sustainability status, for example maintaining water quality by checking and changing the water regularly as well as implementing Good Aquaculture Practices (GAP) to keep fisheries resource fertility, so that the growth and quality of fish can be maintained properly, diligently moving a certain size ornamental fish to the aquarium to avoid the unstable rainfall, create consumer satisfaction and improving knowledge of aquaculture environment.

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