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Analysis of Sustainability and Land Suitability Requirements of Areas for Sustainable Vannamei Shrimp Farming in Ponds

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ABSTRACT

Sustainable fisheries management and the use of aquatic resources, by implementing an ecosystem approach in a sustainable manner, can improve the economy and food security. The Pacific white shrimp, known as the vanname shrimp (*Penaeus vannamei*), is one of the leading fisheries export commodities. The production in ponds fluctuates greatly, and there are even ponds that have closed due to losses. Therefore, this study aimed to analyze the sustainability, land suitability requirements and economic of an area for sustainable vannamei shrimp farming. The research locations are in six districts in Indonesia and six of the vannamei shrimp farming industries, namely Rhee Sumbawa, ANK Probolinggo, NIM Situbondo, TKM Pacitan, UTSerang, and MT Pesisi Selatan. Research time: September 2023 - June 2024. Data analysis used Rapfish-MDS (Rapid Appraisal for Fisheries-Multidimensional Scaling), Microsoft Excel, and comparative analysis with the standard. The analysis of sustainability status is divided into five dimensions, namely ecological, economic, social, technological, and institutional. Key factors to increase productivity and sustainability are reservoir management, cultivation areas, human resource capacity development, technology, and institutions. The attributes that leverage the improvement of sustainability are water quality, pollution levels, soil quality, the area of mangrove forests, production levels, access to capital, cooperation with shrimp farmers, technology suitability, and business management. The results showed land suitability analysis shows six locations suitable for intensive vannamei shrimp cultivation. The average index value is 69.33, which means that the six locations have a moderately sustainable status. The highest index of sustainability was found in UTAUP. Economic analysis of UTAUP farms showed a profit of U$ 56,932 per hectare over four cycles. This location can be used as a pilot shrimp farming management system in ponds. The management of shrimp farming on land that is suitable by applying sustainable elements would increase economic benefits and food security continuously.

INTRODUCTION

Fisheries and aquaculture resources from marine and inland waters provide food and nutrition and are an important source of income for 820,000,000 people worldwide, from collection, product processing and post-harvest handling, marketing, and deployment **(Mehana, 2022)**. Global shrimp production is forecasted to reach 5.7 million tonnes this year and 6.1 million next up from 5.4 million in 2023 **(Fletcher, 2024)**. The high global demand has led to various efforts to increase shrimp production and sustainability. In 2021, world shrimp production was estimated to reach 5 million tonnes and to rise to 7 million tonnes by 2030 **(Zulfikar, 2023)**. While the contribution of the vannamei shrimp farming production in Indonesia in 2021 was 768,836 tonnes/year, and in 2023 it was 764,240 tonnes/year **(MMF, 2024)**. However, this production fluctuates, and some farmers have experienced losses. Obstacles to sustainability include decreased water quality, disease, environmental pollution, conflict, human resource skills that are still inadequate in addition to the use of inappropriate technology **(Hernandez *et al.*, 2013)**. Problems of pathogen attack and environmental management that have an impact on the poor environment caused production failure in the vannamei shrimp **(Anderson *et al.*, 2017; Wahyudi *et al.*, 2022)**.

Disposal of aquaculture waste, water pollution, institutions, and inappropriate technology have an impact on the acute economic losses of aquaculture itself **(Farkan *et al.*, 2017; Wahyudi *et al.*, 2022)**. This condition has a strong interaction between the environment and aquaculture activities that can have an impact on self-pollution and disease transmission **(Anderson *et al.*, 2017)**. The management of the vannamei shrimp farming must be able to produce sustainably. Sustainable shrimp farming should meet the needs of the present and future without compromising the ability of future generations. It consists of ecological, economic, social, technological **(Valenti *et al*., 2011)**, and institutional aspects **(Putri *et al.*, 2019; El Kifaf *et al.*, 2023)**. Likewise, the application of sustainable shrimp farming technology is a technology that prioritizes intensification, efficiency, and minimization of land and resource use **(Rubel *et al.*, 2019)**.

Sustainability of shrimp culture is strongly influenced by land suitability, so that the selection of locations must be in accordance with the requirements of land suitability of shrimp farming **(Farkan *et al.*, 2017)**. This interdisciplinary framework of shrimp farming must be linked to sustainability status by the management of the pond company **(Nurdinsyah, 2020)**. Through this analysis, the sustainability of coastal areas for shrimp farming and the priority activities that should be undertaken to increase sustainable production can be determined.

MATERIALS AND METHODS

Research period and site

This study was conducted from September 2023 to June 2024 in vannamei shrimp farming units in 6 district locations, namely 1. RHEE in Rhee Coastal Sumbawa, West Nusa Tenggara Province, 2. Anugrah Nusantara Kraksaan (ANK) Probolinggo, East Java Province, 3. NIM Windu Prima (NIM) Situbondo, East Java Province, 4. Tambak Karya

Muda Pacitan (TKM) East Java Province, 5. UTAUP (AUP) in Coastal Banten Bay, Serang, Banten Province, and 6. Mayang Taurai (MT), Pasir Selatan, West Sumatra Province. The study location map is shown in Fig. (1).

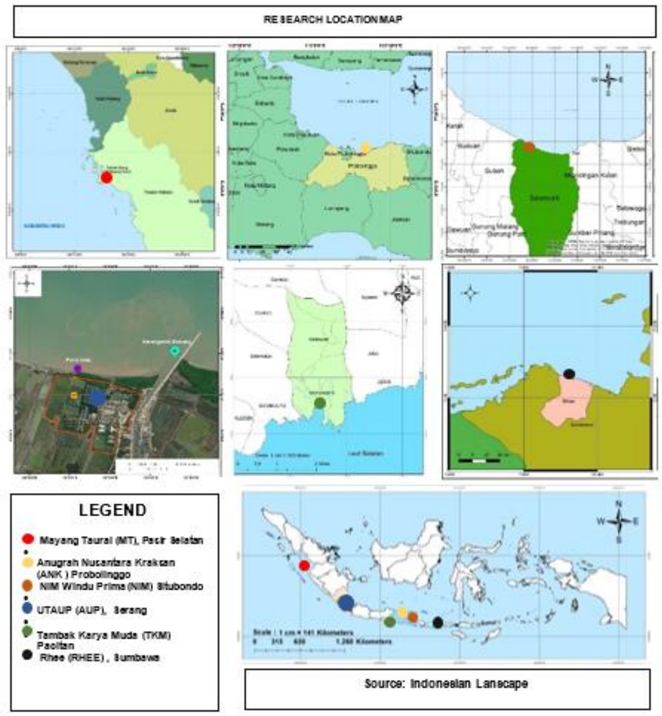

Fig. 1. Study location map

Data collection methods

This study used a descriptive, comparative, and quantitative method. The initial activity to calculate sustainability included determining the dimensions and attributes, followed by assessing the parameters for each attribute based on references and assigning values. Sustainability and land suitability data are obtained by conducting field and laboratory measurements as well as observing environmental parameters that affect sustainability. The results of the thorough research are strengthened by references to produce five dimensions of sustainability: ecological, economic, social, institutional, and technological **(Ramadhantya *et al.,* 2022; Akdeniz *et al.,* 2023; El Kifaf *et al.,* 2023)**. Sustainability attributes include ten ecological, ten economic, nine social, and ten technological factors, along with nine institutional aspects. These attributes encompass ecological, topographic, soil, water quality, climate, biological, and infrastructure facilities aspects **(Farkan *et al.,* 2017; Morales *et al*., 2022; Akdeniz *et al*., 2023)**.

Measurement of water, soil, and environmental parameters of land suitability was carried out in the field and in the laboratory. Temperature, pH, and dissolved oxygen levels in water samples were monitored on a daily basis, whereas ammonia (NH_3) levels were assessed weekly. The tools and materials used to measure soil and water quality include ammonia (NH_3-N) levels, determined using the Amoniak test kit (Hanna HI3826), and pH levels measured with a digital instrument (Transter Senz pH). Temperature was measured using a glass alcohol thermometer with a range of 10-150°C. Chemical parameters, such as dissolved oxygen (DO) and alkalinity, were measured *in situ* using a YSI 556 NPS Water Quality Checker. Salinity was measured with an Atago refractometer, and total organic matter (TOM) was analyzed in the laboratory.

Data processing method

Data processing was carried out using Rapfish-MDS multidimensional scaling (MDS) software, Microsoft Excel, and data on suitability of land requirements using comparative analysis. Rap-fish is a performance assessment method for various aspects that affect the sustainability of an activity **(Garlock *et al.,* 2024)**. These sensitive attributes are factors that affect sustainability and can be taken into consideration to formulate strategies and policies for shrimp farming development **(Suadi *et al.,* 2019)**. Sensitivity analysis aims to determine the main leverage attributes sensitive to changes in the value of the sustainability index. Monte Carlo analysis was used to assess aspects of uncertainty and the impact of random error and has a 95% confidence interval. The R^2 value was used to measure the ability of the model to explain variations in the dependent variable, while the stress value is a measure of the mismatch between the model and the actual data. Attribute assessment uses a scale of 0 to 4, which indicates low to very high categories. The lower the stress value and the closer to 0 (zero) the better. The position of sustainability status is based on categories in the range of 0-100% and correlation index 1-4 as in (Table 1).

Table 1. Sustainability index categories

Index	Correlation index	Category
0.00-25.00	1	Not Sustainable
25.01-50.00	2	Less Sustainable
50.01-75.00	3	Moderately Sustainable
75.01-100.00	4	Very Sustainable

Source: **Kavanagh (2001)** and **El Kifaf *et al.* (2023)**.

Data collection on land suitability requirements was carried out in the six research locations twice, namely in the rainy season and the dry season. Data were tabulated by creating a range. Analysis of land suitability requirements using comparative analysis is a study problem formulation comparing the existence of one or more variables in two or more samples that differ from the standard. The scheme of the research method mechanism is as in the abstract graphic in Fig. (2).

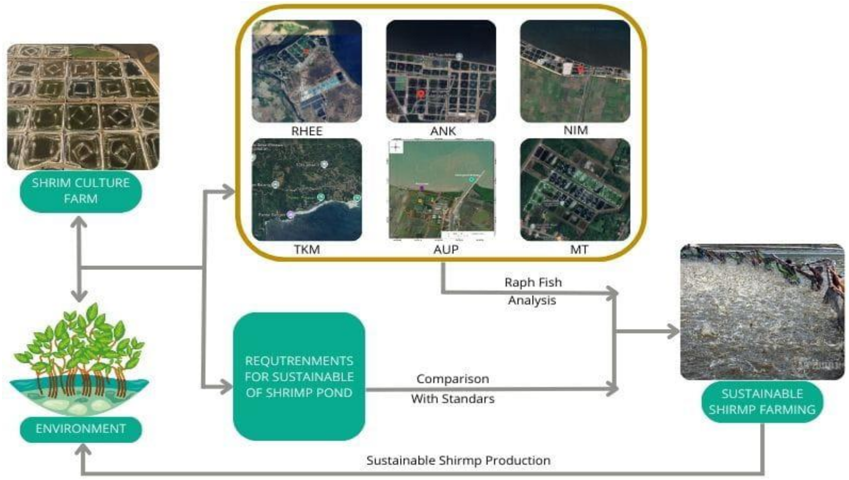

Fig. 2. Research scheme

RESULTS

Sustainability analysis was assessed based on ecological, economic, social, institutional, and technology dimensions.

1. Ecological dimension

The assessment attributes in the ecological dimension are the condition of mangrove forest, reservoirs, land availability, pollutants, mortality, production, water quality, soil quality, pests, and diseases. The results of Rapfish-MDS show a different sustainability index for each location, as presented in Fig. (3).

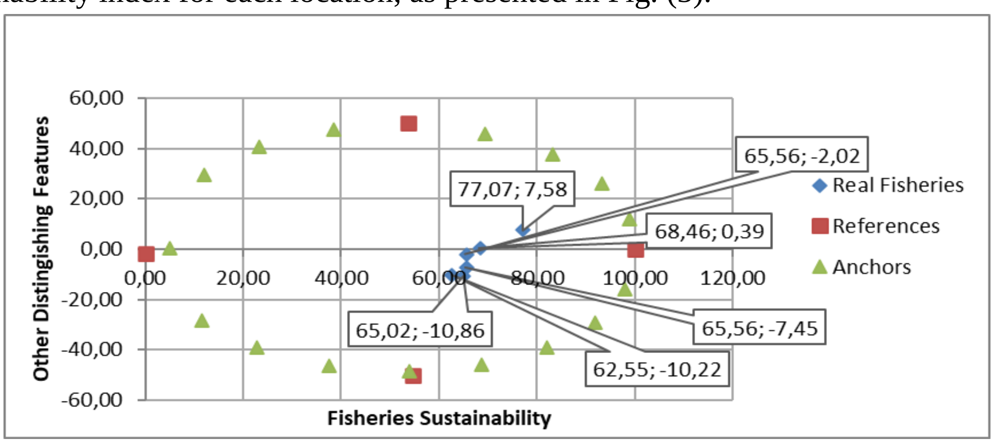

Fig. 3. Output of Rapfish ordination of ecological dimensions

The location with the highest ecological sustainability index was UTAUP at 77.07, and the lowest was 62.55. The sustainability index indicates a moderately sustainable status, and UTAUP is highly sustainable **(Kavanagh, 2001; El Kifaf *et al.*, 2023)**. Fig. (4) shows that the reservoir has the highest value, suggesting that the attribute has the most sensitive effect on sustainability. The second main lever was determined by halving the highest value and the attribute that has a value above the result. Therefore, the second lever attributes are water quality, pollution level, soil quality, mangrove forest area, production level, production capacity, and wastewater treatment plant, respectively.

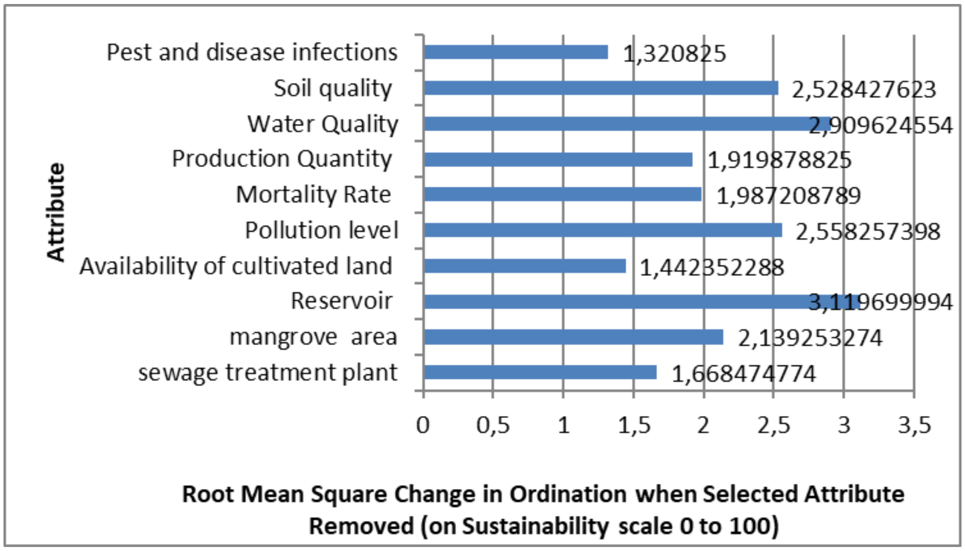

Fig. 4. The analysis results on the leverage of attributes of ecological dimension

The recapitulation of the results on ecological dimension is presented in Table (2).

Table 2. Ecological dimension sustainability index values

Company	Stress	R-squared	MDS	Montecarlo	Reduction
AUP Serang	0.17	0.94	77.07	76.25	0.82
ANK Probolinggo	0.17	0.94	68.46	68.46	0
MT Pasir selatan	0.17	0.94	65.56	65.41	0.15
TKM Pacitan	0.17	0.94	65.56	64.97	0.59
NIM Situbondo	0.17	0.94	65.02	64.76	0.26
RHEE Sumbawa	0.17	0.94	62.55	62.2	0.35
Average			67.37	67.01	0.36

Based on Table (2), the stress value of 0.17 is close to zero; hence, the size of the mismatch between the model and the actual data is considered very good. R^2 value represents the ability of the model to explain the variation in the dependent variable used. The value in the model is 0.94 or close to 1, suggesting the analysis results can present the model well. Stress and R^2 values indicated that the attributes used were accurate in assessing the sustainability index of intensive shrimp ponds in 6 locations. Furthermore, the results were strengthened by validating the model in Rapfish software through Monte Carlo analysis. The first method was executed by determining the difference between the value of Rapfish ordination with Monte Carlo. Based on the analysis results, the risk of error in the model was very small, as indicated by the difference below the maximum value of 5%. A total of 5 dimensions have stress values below 20% and close to 0 (zero). This indicates that the model is close to or similar to the real situation because the value of the mismatch is very small. Therefore, based on these two parameter values, the model on the analysis of the vannamei shrimp farming sustainability in 6 locations was considered good.

2. Economic dimension

The attributes related to the continuation status of the economic dimension include access to profit level, employment, cultivation area, amount of honorarium, ease of marketing, access to capital, capital ownership, price, other income, and labor availability. Analysis results of the economic dimension for each location are presented in Table (3). The highest index value was UTAUP at 86.38, and the lowest was TKM Pacitan at 70.15, demonstrating the level of economic sustainability status in several locations. According to **Muchtar *et al.* (2021)**, increasing productivity requires financial analysis as an evaluation material. Economic factors are important parameters of the socio-economic status of shrimp cultivation **(Ray *et al.*, 2021)**. The recapitulation of sustainability for the economic dimension is shown in Table (3).

Table 3. Rapfish analysis on economic dimension

Company	Stress	R-squared	MDS	Montecarlo	Reduction
AUP Serang	0.15	0.95	86.38	85.89	0.49
NIM Situbondo	0.15	0.95	84.16	83.78	0.38
ANK Probolinggo	0.15	0.95	75.82	75.53	0.29
RHEE Sumbawa	0.15	0.95	73.16	72.92	0.24
MT Pasir Selatan	0.15	0.95	72.64	72.07	0.57
TKM Pacitan	0.15	0.95	70.15	69.41	0.74
Average			77.05	76.6	0.45

The value of R^2, stress (0.15), and the difference between Monte Carlo and MDS demonstrate the accuracy in assessing the sustainability index of shrimp ponds in the economic dimension. Based on the analysis, all locations are considered sustainable. The cultivation area, with a score of 2.41, is a key attribute of economic sustainability. The second lever is access to capital, also with a value of 2.41, followed by wise marketing, which scored 2.23.

3. Social dimension

Social dimension attributes include aspects of education, environmental attention, security intrusion, improving human resources, cooperation with shrimp farmers, coordination with stakeholders, licensing status, and availability of an organisation platform. The analysis results for the attributes of the social dimension sustainability index are shown in Table (4).

Table 4. Results of Rapfish analysis on social dimension

Company	Stress	R-squared	MDS	Montecarlo	Reduction
AUP Serang	0.16	0.94	84.13	83.82	0.31
ANK Probolinggo	0.16	0.94	74.76	73.99	0.77
RHEE Sumbawa	0.16	0.94	72.49	71.87	0.62
NIM Situbondo	0.16	0.94	65.69	65.34	0.35
TKM Pacitan	0.16	0.94	63.46	63.04	0.42
MT Pasir Selatan	0.16	0.94	56.54	56.32	0.22
Average			69.51	69.06	0.45

The results showed that 6 shrimp farming locations were socially sustainable. The highest index value was found in the UTAUP location with an index value of 84.13, and the lowest was 56.54 at MTP with a fairly sustainable status.

The sensitivity analysis results showed that the attribute of increasing the capacity of human resources (HR) had the highest score of 5.23. The second lever attribute was cooperation with shrimp farmers, which had a score of 2.82, and coordination with stakeholders had a score of 2.82. R^2 value of 0.94 shows that the attributes used are accurate in assessing the sustainability index of shrimp farming in South Pesisir. The difference produced by Monte Carlo was also below 5%.

4. Technology dimension

Technology dimension attributes include stocking density of vannamei shrimp, good cultivation practices, land carrying capacity suitability, business success in 5 cycles, land suitability, accessibility of cultivation management, technology suitability, applications, and availability of infrastructure, as well as technology cost. Rapfish ordination analysis results for the technology dimension in 6 locations are shown in Table (5). The highest Rapfish ordination output was found in UTAUP at 81.51, while the lowest was TKM Pacitan at 52.18.

Table 5. Analysis results on the technology

Company	Stress	R-squared	MDS	Montecarlo	Reduction
AUP Serang	0.18	0.94	81.51	81.14	0.37
ANK Probolinggo	0.18	0.94	72.85	72.43	0.42
NIM Situbondo	0.18	0.94	70.08	69.84	0.24
RHEE Sumbawa	0.18	0.94	70.54	70.23	0.31
MT Pasir Selatan	0.18	0.94	71.07	70.68	0.39
TKM Pacitan	0.18	0.94	52.18	52.04	0.14
Average			71.81	71.29	0.52

Based on the sensitivity analysis, the most influential attribute was the technology applied in the last 5 cycles with a score of 2.3. The second-level attribute was technology suitability with a score of 2.2, followed by land suitability at 1.93. R^2 value was below 20%, stress was below 1, and Monter Carlo difference was below 5%. Therefore, it was concluded that this analysis was accurate.

5. Institutional legal aspects

Assessment of institutional aspects includes the availability of associations, spatial regulation, law enforcement, availability of study institutions, coordination and implementation of management, business management, and employee organization. The analysis results showed that the highest legal and institutional dimensions were found in AUP at 86.47, while the lowest was TKM Pacitan at 52.18, falling in the category of sustainability, as shown in Table (6).

Table 6. Analysis result of institutional dimension

Company	Stress	R-squared	MDS	Montecarlo	Reduction
AUP Serang	0.18	0.94	86.47	85.98	0.49
ANK Probolinggo	0.18	0.94	58.14	57.68	0.46
NIM Situbondo	0.18	0.94	58.08	57.83	0.25
RHEE Sumbawa	0.18	0.94	57.86	57.45	0.41
MT Pasir Selatan	0.18	0.94	52.75	52.8	-0.05
TKM Pacitan	0.18	0.94	52.18	51.93	0.25
Average			60.91	60.61	0.30

The values of R^2, stress, and Monte Carlo difference in all dimensions were below the standard value. This shows that the error influence in the analysis of the institutional dimension was small, and the analysis process carried out repeatedly was relatively stable. Based on the results, study institutions were found to be the most sensitive attribute to sustainability with a score of 3.14. The second value as a lever was business management with a score of 3.09, followed by coordination and implementation of management with a score of 2.74.

6. Sustainability status of vannamei shrimp farming

To determine the level of sustainability and the relationship between parameters at the six sites, a kite diagram was used with the results shown in Fig. (5).

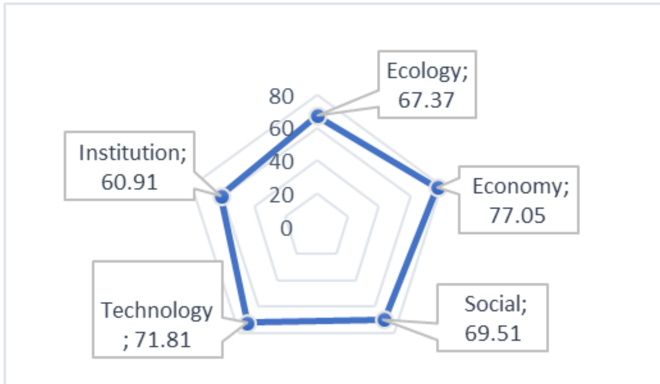

Fig. 5. Index and sustainability status of shrimp farming in ponds at six sites

Based on Fig. (5), it is evident that each parameter is interconnected to form a single goal: sustainability status. The average index value is 69.33, indicating that the six locations have a moderately sustainable status. To compare the sustainability status of each location, the data are processed in the image, which can be seen in Fig. (6).

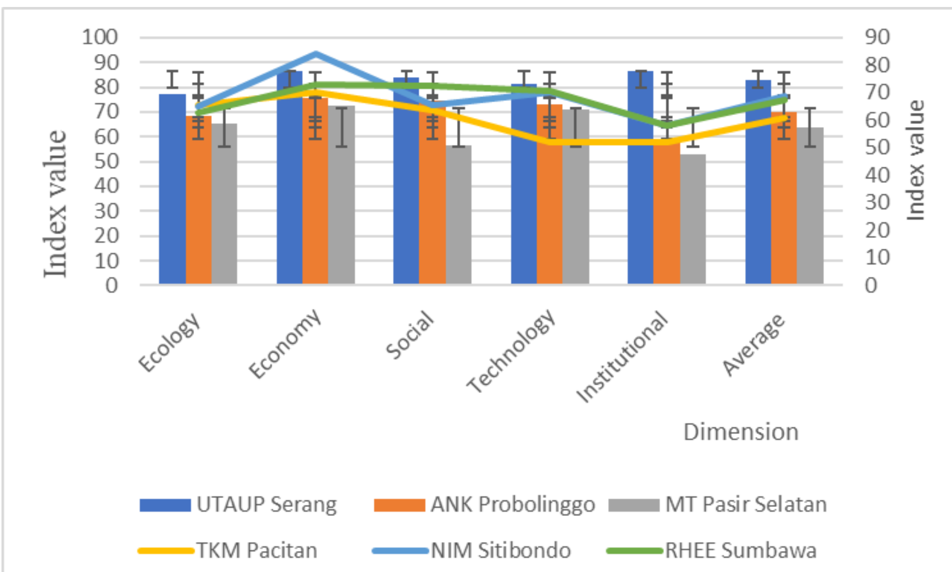

Fig. 6. Sustainability index values

Based on Fig. (5), it is known that UTAUP has an index value of 83.112, which means very sustainable. The other five locations have values between 60.706 and 70.006, which means moderately sustainable.

7. Land suitability requirements

Land suitability analysis results were compared to sustainability analysis. According to **Ray *et al*. (2021)**, important aspects to consider in the evaluation of land suitability for aquaculture include water resources, soil quality, and availability of infrastructure. Environmental sustainability is supported by the suitability of land for vannamei shrimp farming. Measurements and comparisons with environmental standards are shown in Table (7).

Table 7. Results of land suitability measurements

Parameter/ Location	RHEE	ANK	NIM	UTAUP	MTP	KM	Standard	References
Environmental water quality								
Temperature (ºC)	29±1	29±1	28±2 -	28± - 31	29±-1	29±2	28±3	**(Anjaini *et al.*,2024)**
DO (mg/L)	3,5 ±05	3,5± 0,5	3,5± 0,5	3,5± 0,5	3,5± 0,5	3,5± 0,5	3,5± 0,5	**(Boyd, 2017)**
Salinity (g/L)	33±3	29±3	29±3	29±3	29±3	29±3	29±3	**(Pratiwi *et al.*, 2024)**
pH	7,9±0,5	7,9±0,5	7,9±0,5	7,9±0,5	7,9±0,5	7,9±0,5	7,6±0,8	**(Supriatna *et al.*, 2020)**
Alkalinity (g/L)	120	120	120	120	120	120	100-150	**(Ariadi *et al.*, 2021)**
TOM (mg/L)	80	70	87	75	93	80	<90	**(Supriatin *et al.*, 2024)**
H_2S (mg/ L)	0,001	0,004	0,001	0,007	0,001	0,006	0,0087	**(Pratiwi *et al.*, 2024)**
NH_3(mg/L)	0,001	0,001	0,001	0,001	0,001	0,001	≤ 0,001	**(Anjaini *et al.*, 2024)**
				Soil				
pH	6,5	6	6-8	6	6	6,5	6-7	**(Boyd, 2017)**
Texture	SC	SC	SC	SC	SC	SC	SC	**(Pratiwi *et al.*, 2024)**
		Biology						
Mangrove (m)	10	20	50	600	400	10	200	**(Muqsit *et al.*, 2018)**
				Accessibility				
Road Access (m)	10	50	10	50	15	100	500	**(Farkan *et al.*, 2017)**
Electricity	Availabe	Availabe	Availabe	Availabe	Availabe	Availabe	Availabe	**(Farkan *at al.*, 2017)**
Marketing	easy	easy	easy	easy	easy	easy	easy	**(Farkan *et al.*, 2017)**
coastal distance	200	400	600	200	200	200	100	**(Farkan *et al.*, 2017)**
Water source	good	good	good	good	good	good	good	**(Renitasi and Musa, 2020)**
Safety	safe	safe	safe	safe	safe	safe	safe	**(Farkan *et al.*, 2017)**

8. Economic analysis

Financial analysis calculations were conducted on the current cycle during observation and the previous four cycles. The percentage of success was calculated based on the financial analysis of the 4 cycles that had been carried out divided by the number of profit achievements per current cycle. The results of the financial analysis calculation are shown in Table (8).

Table 8. Financial analysis of vannamei shrimp farms in six locations

Company	Profit per Ha Current cycle (U$)	Success percentage of the previous 4 cycles	Estimated profit for 4 cycles (U$)
RHEE	19,053	50	38,106
ANK	7,438	60	17,850.69
NIM	-12,475	50	fluktuatif
TKM	13,909	50	27,817
UT AUP	15,814	90	56,932
MT Pesisir	5	60	12.63

Description: Rate of one U$ = Rp 15,840

DISCUSSION

Based on the analysis of five provinces and six locations, the sustainability index varied. In the ecological dimension, the key factor that must be maintained is water quality. To support water quality, it is essential to provide adequate reservoirs that can reduce organic waste from cultivation and external pollutants. Aquaculture pollution has a significant impact on shrimp farming and can lead to self-pollution of aquaculture effluents **(Wahyudi *et al.*, 2022; Pratiwi *et al.*, 2024)**. Reservoirs are an effective method for purifying aquaculture effluent contamination **(Hernandez *et al*., 2013; Pazmino *et al.*, 2024)**.

Aquaculture in intensive system ponds is considered sustainable in the ecological dimension when the cultivation location is suitable, with optimal water and soil quality, adequate mangrove forests, low pollution levels, and a low frequency of disease infections. In UTAUP ponds, mangrove forests, located more than 200 meters from the shoreline, grow in the sewer and around the reservoir. According to **Pazmino (2024)**, mangrove forests serve as filters for water entering the pond, preventing fish or shrimp diseases caused by viruses and bacteria. Some animals, including oysters, colonize the tree roots, absorbing waste from shrimp farming **(Muqsith *et al.*, 2018)**. **Widiyanti *et al.* (2021)** stated that a minimum mangrove area of 9.6 m^2 is needed to absorb organic waste generated by aquaculture activities. The ecological dimension indicators at UTAUP pond had the highest index of 77, indicating that shrimp farming in this location was considered highly sustainable.

In the economic dimension, locations, including UTAUP, demonstrated high sustainability, as indicated by financial viability. Factors such as land availability, price, market accessibility, and access to capital are crucial considerations. Long-term shrimp farming requires stable productivity, consistent sales, and reliable market partners **(Long *et al.*, 2020; Cheney, 2024)**. In the social dimension, to improve sustainability, efforts should focus on enhancing human resources, strengthening coordination between stakeholders and farmers, and ensuring security. The human resource factor is critical for business success **(Suryadi *et al.*, 2021)**, and a reliable security system is essential for the sustainability of shrimp farming.

The technology dimension at the six locations was generally sustainable, with UTAUP ponds falling into the very sustainable category. Of the 28 cultivation cycles, only four were less successful, but there were no financial losses. Appropriate technology and effective management are key levers for sustainability. Sustainable shrimp farming requires technology that focuses on intensification, efficiency, minimizing land and resource use, and ensuring biosecurity **(Rubel *et al.*, 2019)**.

In the institutional dimension, five locations were rated as moderately sustainable, with UTAUP being the only one categorized as very sustainable. The most important aspect is the role of institutions that foster sustainable technological innovation, whether from the government or private companies. Institutional or organizational support is necessary for effective aquaculture unit management. The highest average index value was found in the economic dimension (77.05), while the lowest was in the institutional dimension (60.91). This indicates a need for development and improvement in the lower-rated attributes, while maintaining the high-rated attributes.

The analysis also confirmed that the land was suitable for shrimp cultivation, a finding supported by Rapfish analysis, which showed that all six locations have a sustainable status. The condition of the UTAUP pond is illustrated in Fig. (5). To enhance sustainability, it is crucial to increase understanding of the attributes, dimensions, and practices of sustainable shrimp cultivation **(Wigiania *et al.*, 2019; Tohari *et al.*, 2020; Viera-Romero *et al.*, 2024)**.

Fig. 5. Location of UTAUP shrimp farming farms

Economic analysis of UTAUP ponds has a greater level of profit. This is due to the higher level of sustainability.

CONCLUSION

The sustainability status of vannamei shrimp cultivation ponds in environmental, economic, social, technological, and institutional dimensions across 6 locations was in the sustainable category, with only one location falling in the very sustainable category: the UTAUP. Sustainability status was strengthened by suitable land for cultivating vannamei shrimp in ponds. The analysis demonstrated the level of coastal areas sustainability for shrimp farming and the priority activities that must be carried out to increase sustainable production. Economic analysis showed that locations that are sustainable and have suitable land are more favorable.

Author contributions

Mochammad Farkan and Triyanto: Conceptualization, methodology, resources, data collection, formal analysis, software, investigation, visualization, writing—review & editing.
Ratna: Resources, data curation, writing—review & editing, supervision.
Ani Leilani: Data collection, investigation, supervision, writing—review & editing.

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Declaration of competing interest

The authors declare no conflict of interest.

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