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EFFECTIVENESS OF IMPLEMENTING BIOFLOC TECHNOLOGY ON THE INCOME OF NILE FISH FARMERS *(Oreochromis niloticus)* IN GORONTALO PROVINCETHROUGH THE SWOT APPROACH

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Abstract
The study aims to (1) determine the effectiveness of the application of biofloc technology on the income of tilapia fish farmers. (2) determine strategies to increase the effectiveness of the application of biofloc technology on the income of tilapia fish farmers. This study is a quantitative study. The subjects in this study were 70 people. The data source is primary data through questionnaires. Data analysis is quantitative descriptive analysis, simple regression and SWOT. The results of the study show that (1) the effectiveness of the application of biofloc technology by tilapia fish farmers in Gorontalo Province is in the fairly good criteria. The income of tilapia fish farmers in Gorontalo Province is in the good category. The results of simple regression found that the effectiveness of the application of biofloc technology has a positive and significant effect on the income of tilapia fish farmers in Gorontalo Province with a determination coefficient (size of influence) of 27.60%. Positive test results mean that the application of increasingly effective biofloc technology will be able to increase the income of tilapia fish farmers in Gorontalo Province. (2) The strategy to increase the effectiveness of the application of biofloc technology on the income of tilapia fish farmers in Gorontalo Province is in quadrant 2, namely the Diversification strategy. This strategy emphasizes that optimization of strengths in reducing various threats and challenges in tilapia cultivation with biofloc technology to increase income can be focused on (1) improving product quality to meet market demand, (2) strengthening partnerships and access to capital & (3) developing distribution and marketing networks (social capital).

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Biofloc; Tilapia; Income; Cultivation

INTRODUCTION

The Gorontalo Provincial Government through the Maritime Affairs and Fisheries Service is implementing the development of aquaculture by implementing activity programs that refer to three areas of aquaculture development, namely, freshwater fish cultivation, brackish water fish cultivation and seawater fish cultivation.

Utilization of the potential for developing aquaculture has been carried out through the development of aquaculture businesses in the form of fish farming systems, fish seeding, preparation of aquaculture facilities and infrastructure, management of fish and environmental health. The aquaculture commodities that have experienced the most increase in districts/cities in Gorontalo Province include vaname shrimp, tiger shrimp, tilapia, catfish, carp, grouper, snapper, gourami and seaweed, and various existing technologies, one of which is biofloc technology.

Biofloc technology is a cultivation technique through environmental engineering that relies on oxygen supply and the use of microorganisms that can directly increase the digestibility of feed. Biofloc itself comes from the word bios which means "life" and floc "lump" so biofloc is a collection of various organisms (bacteria, fungi. Algae, protozoa, worms, and others), which are combined in lumps (floc), Suprapto and Lagian, 2013. This biofloc is one of the technologies that can improve the economy of fish farmers in Gorontalo province.

The purpose of this study is to analyze the effectiveness of the application of biofloc technology on the income of tilapia fish farmers and to analyze strategies to increase the effectiveness of the application of biofloc technology on the income of tilapia fish farmers.

Biofloc is a fish farming technology, namely a farming technique through environmental engineering that relies on oxygen supply and the use of microorganisms that can directly increase the digestibility value of feed.types of fish that can be cultivated are catfish, tilapia, patin, etc. This technique is applied because it can boost higher harvest productivity. In addition, the biofloc method also reduces land use to be not too large and also saves water. So that biofloc is an effective and economical solution to meet the nutritional needs of the community and fisheries businesses, (Frendy et.al. 2016). Biofloc technology is the right technology for intensive tilapia culture by considering the nature of tilapia which is able to live at high densities and has a wide tolerance to water quality conditions. Usually fish are kept by farmers as a side business, and some even make it their main business because it has the potential to increase the economy of small communities. (Anisa Puspitasari, et al. 2020).

Tilapia is one of the leading fishery commodities with increasing market demand, so its productivity must be continuously driven with various intensive aquaculture system technologies (Maryam 2010). With the existence of this biofloc cultivation technology, it greatly helps the community in Gorontalo Province, who want to cultivate fish but do not have a large area of land, so with this biofloc, the community can cultivate fish with a narrow area and can improve the economy of the community in Gorontalo Province.Tilapia is one of the leading fishery commodities with a continuously increasing level of market demand, so its productivity must be continuously boosted with various intensive aquaculture system technologies (Maryam, 2010).

RESEARCH METHODS

This research was conducted from May to June 2024. The location of this research took place in two districts in Gorontalo Province, namely Boalemo Regency and Bone Bolango Regency. This research uses a survey method. The survey method is a study that measures existing symptoms without investigating why these symptoms exist (Mudlofar, 2021). Survey research is a type of research that takes samples from one population and uses a questionnaire as the main data collection tool, the number of samples taken was 75 people from 228 tilapia farmers using biofloc technology. This is in accordance with the opinion of Ashari (2011), regarding sampling techniques. If the number of subjects is less than 100, it is better to take all of them, but if the number of subjects is large, 10-15% or 20-25% can be taken. The subjects taken are 25%.

The data sources used in this study are primary data and secondary data. Primary data sources are the main data sources, namely the results of in-depth interviews with informants. As the purpose of the case study requires a detailed, in-depth, comprehensive study of a particular object that is usually relatively small over a certain period of time, including its environment, the informants in the study were specifically selected based on purposive sampling (purposeful sampling) with the consideration that the selected informants are considered to have clear knowledge of the problems to be studied (Umar, 2002: 131).

Secondary data sources are supporting data related to the focus of the research needed to complete the primary data. Secondary data are in the form of documents related to the development of institutional capacity of the Community Supervisory Group, including Laws, Government Regulations, Regional Regulations, Standard Operating Procedures (SOP), activity reports and others that are relevant to this research.

The data required in this study was collected through three stages, namely observation, interviews and documentation.

1. Observation

Observation is part of data collection. Observation means collecting data directly from the field. The data observed can be a description of attitudes, behavior, behavior, actions, the whole interaction between humans. Observationis an activity of direct observation and recording of research objects systematically with monitoring and evaluation sheets, to obtain data and facts about the actual situation.

2. Interview

Interview is a two-way communication or conversation conducted by the interviewer and informant to find information relevant to the research objectives. Interview is used as a technique in data collection, if the research will conduct a preliminary study to find the problems that must be studied. Interviews are conducted using a list of questions. Sampling is done by conducting interviews or filling out questionnaires with respondents and collecting data or references from agencies related to the research to facilitate analysis, then data tabulation is carried out then the data is analyzed based on the objectives to be achieved with the analysis tools that have been determined. Interviews which are often also called or oral questionnaires, are a dialogue conducted by the interviewer to obtain information from the interviewee. The results of the interview and filling out the questionnaire are then analyzed using the SWOT method (strengths, weaknesses, opportunities, threats).

3. Documentation

Documentation is a technique for collecting data and research variables by searching in notes, books, newspapers, magazines, news in electronic media and others. The use of this documentation is in order to strengthen supporting data or as a comparative reference in a writing. Documentation in this study is to help collect data from the research location by processing data obtained from the results of documentation. The use of this documentation is in order to strengthen supporting data or as a comparative reference in a writing.

Data analysis to determine the characteristics of fish entrepreneurs and farmer profiles used qualitative descriptive analysis. The data is displayed in the form of tables or images, including: age, education level, business experience, cultivation techniques. Meanwhile, to formulate business development strategies, SWOT (Strength, Weaknesses, Opportunities, Threats) analysis is used which will make it easier to formulate various new strategies by grouping each problem into a table (Rangkuti, 2006). The method used in this study is descriptive research, which aims to create objects systematically, factually, and accurately regarding the facts and characteristics of a particular population or area (Singarimbun, 1987). Using descriptive analysis, namely the method used is descriptive through field surveys in data collection.

RESULTS AND DISCUSSION

1. Effectiveness of Biofloc Technology Application on Tilapia Fish Farmers' Income

Income is the amount of income in currency that can be generated by an individual or a country in a certain period. Income as total income during a certain period. Household income has a major influence on the level of consumption, both on an individual scale and on the overall economy, (Fitriyanti 2023). The results of the analysis of respondents' answers through descriptive statistics of the tilapia fish farmer income variable showed that the score of the tilapia fish farmer income variable in Gorontalo Province was 84.73% which was in the good category. This shows that there has been success in implementing biofloc technology for tilapia fish farming, effective management, support from various parties, and good market access. By continuing to improve cultivation practices and utilizing existing support, the income of these farmers is expected to continue to increase in the future.

a. Effectiveness Variables of Biofloc Technology Application

The number of statements used to measure the influence of the effectiveness of the application of biofloc technology in this study was 4 statements in 70 respondents (n=70). Testing the validity of the statements is presented in table 1 as follows:

Table 1. : Results of Validity Test of Effectiveness Variables of Biofloc Technology Application

Statement	Validity			Reliability	
	rCount	rtable	Status (V/TV)	Cronbach Alpha	Status (R/TR)
1	0.725	0.198	Valid	0.650	Reliable
2	0.731	0.198	Valid		
3	0.833	0.198	Valid		
4	0.517	0.198	Valid		

Source: SPSS 21 processed data, 2024

In validity testing, a statement is said to be valid if r count is greater than r table. The r table value is obtained from the rho table where n = 70 and the significance level is 5%, then the r table value is 0.198. Thus, dOf the 4 statements used to measure the influence of the variable Effectiveness of the application of biofloc technology, all statements have a calculated r value greater than the r table of 0.198 so that it is said to meet the validity test and can be used for research data collection.

Based on the results for the variable Effectiveness of biofloc technology application, the reliability coefficient value or Cronbach's Alpha is greater than the predetermined benchmark value, namely 0.6 (0.650 > 0.6). This shows that the instrument Effectiveness of biofloc technology application in this study is reliable and can be used for further research.

b. Tilapia Fish Farmers Income Variables

The number of statements used to measure the influence of tilapia fish farmers' income in this study was 7 statements in 70 respondents (n=70). Testing the validity of the statements is presented in table 2 as follows:

Table 2. : Results of Validity Test of Tilapia Fish Farmers Income Variables

Statement	Validity			Reliability	
	rCount	rtable	Status (V/TV)	Cronbach Alpha	Status (R/TR)
1	0.824	0.198	Valid	0.735	Reliable
2	0.670	0.198	Valid		
3	0.594	0.198	Valid		
4	0.784	0.198	Valid		
5	0.726	0.198	Valid		
6	0.750	0.198	Valid		
7	0.242	0.198	Valid		

Source: SPSS 21 processed data, 2024

In validity testing, a statement is said to be valid if r count is greater than r table. The r table value is obtained from the rho table where n = 70 and the significance level is 5%, then the r table value is 0.198. Thus, dFrom the 7 statements used to measure the influence of the tilapia fish farmer's Income variable, all statements have a calculated r value greater than the r table of 0.198 so that it is said to meet the validity test and can be used for research data collection. Based on the results for the tilapia fish farmer's Income variable, the reliability coefficient or Cronbach's Alpha value is greater than the predetermined benchmark value,

which is 0.6 (0.735> 0.6). This shows that the tilapia fish farmer's Income instrument in this study is reliable and can be used for further research.

c. Effectiveness of biofloc technology application

The results of the descriptive analysis, namely the respondent's answer criteria approach to the effectiveness of implementing biofloc technology, are presented as follows:

Table 3: Descriptive Results of the Effectiveness Variables of Biofloc Technology Application

No	Biofloc Effectiveness								Criteria
	1	2	3	4	5	Current	Ideal	%	
1	1	2	24	42	1	250	350	71.43%	Pretty good
2	0	2	26	42	0	250	350	71.43%	Pretty good
3	0	2	23	41	4	257	350	73.43%	Pretty good
4	0	0	42	24	4	242	350	69.14%	Pretty good
Total	**1**	**6**	**115**	**149**	**9**	**999**	**1,400**	**71.36%**	**Pretty good**

Source: SPSS 21 Processed Data, 2024

Based on the results in table 3, it can be seen that the variable effectiveness of the application of biofloc technology by tilapia fish farmers in Gorontalo Province is located in a fairly good criterion with a variable score of 71.36%. This shows that the application of biofloc technology provides positive benefits in tilapia fish farming, where increased production results, reduced operational costs, increased fish quality, and positive impacts on the environment are some indicators of the success of this technology**.. With continuous support and assistance, biofloc technology is expected to continue to develop and provide greater benefits for tilapia farmers, especially in generating the expected income. Income is the amount of income in currency that can be generated by an individual or a country in a certain period. Income as total income during a certain period. Household income has a major influence on consumption levels, both on an individual scale and on the overall economy Reksoprayitno (2010). The application of biofloc technology in tilapia farming has shown great potential in increasing farmer income. This technology combines the principles of water quality management with the use of microorganisms to convert organic waste into useful biomass.**

These results are in line with the statement from Puspitasari, et al. (2020) that increased production, reduced operational costs, improved fish quality, product diversification, market support, and business sustainability are key factors that contribute to increased income. By utilizing this technology optimally, farmers can achieve greater profits and improve the economic welfare of farmers and fishermen. The effective application of biofloc technology also increases the sustainability of tilapia farming businesses. With good environmental management and efficient use of resources, farming businesses become more resilient to market fluctuations and environmental changes. This sustainability ensures that farmer incomes remain stable in the long term.

d. Income of tilapia fish farmers

The results of the descriptive analysis, namely the approach to the respondent's answer criteria, the income of tilapia fish farmers is presented as follows:

Table 4: Descriptive Results of Income Variables of Tilapia Fish Farmers

No	Income								Criteria
	1	2	3	4	5	Current	Ideal	%	
1	0	1	2	18	49	325	350	92.86%	Good
2	0	0	0	3	67	347	350	99.14%	Good
3	0	1	0	60	9	287	350	82.00%	Good
4	1	1	15	10	43	303	350	86.57%	Good
5	0	1	0	10	59	337	350	96.29%	Good
6	2	6	9	0	53	306	350	87.43%	Good
7	1	37	32	0	0	171	350	48.86%	Not good
Total	**4**	**47**	**58**	**101**	**280**	**2,076**	**2,450**	**84.73%**	**Good**

Source: SPSS 21 Processed Data, 2024

Based on the results in table 4, it can be seen that the income variable score of tilapia fish farmers in Gorontalo Province is 84.73% which is in the good category. This shows that there is success in implementing biofloc technology for tilapia fish farming, effective management, support from various parties, and good market access. By continuing to improve cultivation practices and utilizing existing support, the income of these farmers is expected to continue to increase in the future. Farmers can implement cleaner and safer cultivation practices, resulting in tilapia that are healthier and free from chemical residues (Simangunsong & Anam, 2022).

This income comes from various sources, including wages, income from assets such as rent, interest, or dividends, and transfer payments from the government, such as social benefits or unemployment insurance. The higher the income, the greater the ability to consume. Income is also allocated for physical needs, health, education, and savings, Reksoprayitno (2010). The results of the analysis of respondents' answers through descriptive statistics of the effectiveness variable of the application of biofloc technology obtained that the effectiveness variable of the application of biofloc technology by tilapia farmers in Gorontalo Province is located in fairly good criteria with a variable score of 71.36%.

These results are in line with the statement from Puspitasari, et al. (2020) that increased production, reduced operational costs, improved fish quality, product diversification, market support, and business sustainability are key factors that contribute to increased income. By utilizing this technology optimally, farmers can achieve greater profits and improve the economic welfare of farmers and fishermen. The effective application of biofloc technology also increases the sustainability of tilapia farming businesses. With good environmental management and efficient use of resources, farming businesses become more resilient to market fluctuations and environmental changes. This sustainability ensures that farmer incomes remain stable in the long term.

2. Strategy to Increase the Effectiveness of Biofloc Technology Application on Tilapia Fish Farmers' Income

The strategy to increase the effectiveness of biofloc technology application is a plan and steps that are systematically designed to optimize the use of biofloc technology in fish farming, so as to achieve maximum production results, efficient operational costs, and higher income for farmers. This strategy covers various aspects ranging from technical, managerial, to marketing. So the strategy to increase the effectiveness of biofloc technology application is a

comprehensive approach that involves various technical, managerial, and marketing aspects. With the implementation of the right strategy, tilapia farmers can achieve higher production, more efficient costs, and greater income, thus supporting the sustainability and economic welfare and income of the community, (Zain 2018).

The development of distribution and marketing networks or social capital is also key in optimizing the application of biofloc technology to increase the income of tilapia farmers in Gorontalo Province. Strong social capital, such as relationships with collectors, wholesalers, and access to local and national markets, can help farmers expand their market reach. Farmers need to actively build and maintain this network to ensure that farmer products can be distributed well and reach end consumers in a timely manner. In addition, participation in associations or farmer groups can also open up opportunities for collaboration and sharing information on market trends, prices, and effective marketing strategies. By utilizing digital technology, such as e-commerce or online marketing platforms, farmers can expand their market outside the region, even nationally, thereby increasing sales volume and income. The development of a good distribution and marketing network will ensure that tilapia products from Gorontalo can compete in a wider market. (Sri Ayu 2017).

a. SWOT analysis results

Analysis of strategies to increase the effectiveness of biofloc technology application on tilapia fish farmers' income in Gorontalo Province, namely the identification of internal and external factors, where there are strengths and weaknesses for internal factors while for external factors, namely opportunities and threats.

The internal strategic factors that are the strengths and weaknesses in the strategy to increase the effectiveness of the application of biofloc technology on the income of tilapia fish farmers in Gorontalo Province are as follows:

Table 5: Internal rating value factors (strengths and weaknesses)

No	Description	Actual Points	Weight	Rating	Score
1	Strength – 1	76.57%	0.076	2,000	0.152
2	Strength – 2	81.43%	0.081	4,000	0.324
3	Strength – 3	48.57%	0.048	1,000	0.048
4	Strength – 4	67.71%	0.067	1,000	0.067
5	Strength – 5	80.57%	0.080	2,000	0.160
6	Strength – 6	81.14%	0.081	3,000	0.242
7	Strength – 7	81.43%	0.081	3,000	0.243
8	Strength – 8	80.86%	0.080	2,000	0.161
Number of Strengths			**0.596**		**1,399**
1	Weakness – 1	52.86%	0.053	1,000	0.053
2	Weaknesses – 2	58.57%	0.058	2,000	0.117
3	Weaknesses – 3	61.14%	0.061	3,000	0.183
4	Weaknesses – 4	64.57%	0.064	3,000	0.193
5	Weaknesses – 5	87.14%	0.087	4,000	0.347
6	Weaknesses – 6	82.00%	0.082	4,000	0.327
Number of Weaknesses			**0.404**		**1.218**
IFAS Amount		**10.05**	**1,000**		
IFAS Score					**0.181**

Primary Data Processing Source, 2024

Based on Table 5, it can be seen that for internal factors, the strength score is 1.399 while for the weakness score is 1.218. So that these values can be known as the difference between internal and external factors, which is positive at 0.181 where the strength is greater than the weakness, which means that increasing the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province has various aspects of excellence.

The external strategic factors that become opportunities and threats in the strategy to increase the effectiveness of the application of biofloc technology on the income of tilapia fish farmers in Gorontalo Province are as follows.

Table 6. External rating value factors (opportunities and threats)

No	Description	Actual Points	Weight	Rating	Score
1	Chance – 1	78.86%	0.074	2,000	0.149
2	Chance – 2	81.71%	0.077	3,000	0.232
3	Chance – 3	76.86%	0.073	1,000	0.073
4	Chance – 4	78.57%	0.074	2,000	0.148
5	Chance – 5	46.00%	0.043	1,000	0.043
6	Chance – 6	76.57%	0.072	2,000	0.145
7	Chance – 7	89.14%	0.084	4,000	0.337
8	Chance – 8	80.00%	0.076	3,000	0.227
Number of Opportunities			**0.574**		**1,353**
1	Threat – 1	31.43%	0.030	1,000	0.030
2	Threat – 2	50.86%	0.048	3,000	0.144
3	Threat – 3	49.71%	0.047	2,000	0.094
4	Threat – 4	89.14%	0.084	4,000	0.337
5	Threat – 5	79.14%	0.075	4,000	0.299
6	Threats – 6	66.29%	0.063	3,000	0.188
7	Threats – 7	84.29%	0.080	4,000	0.318
Number of Threats			**0.426**		**1,410**
EFAS Amount		**10.59**	**1,000**		
EFAS Score					**-0.057**

Primary Data Processing Source, 2024

Table 6 shows that the value of the opportunity factor owned by the Strategy for increasing the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province is 1.353 and the threat factor is 1.410. So when compared, the opportunity factor is smaller than the threat score. This shows that there are various crucial challenges that can reduce the increase in the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province so that these threats must be addressed by optimizing various positive aspects both internally and externally in increasing the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province.

b. SWOT Matrix

The SWOT matrix is a situation analysis tool with the advantage of being able to provide very diverse results or implementations when applied by one party to another party even with

the same factors. In addition, the SWOT matrix also produces many feasible alternative strategies according to internal conditions, can maximize strengths and opportunities, reduce weaknesses and threats, and provide users with the flexibility to integrate various related information sources. The results of alternative strategies to develop strategies to increase the effectiveness of biofloc technology application on tilapia fish farmers' income in Gorontalo Province are presented in Table 4.18 as follows:

Table 7. : SWOT Matrix Strategy to increase the effectiveness of biofloc technology application on tilapia fish farmers' income in Gorontalo Province

Aspect	Internal	
External	**SO**	**WO**
	1. Optimizing Regional Potential and Infrastructure Support 2. Market Expansion and Use of Internet Technology 3. Improving HR Competence through Training and Education	1. Product Strengthening to Face Market Uncertainty 2. Security System Improvement and Risk Management 3. Advocacy for Supportive Policies and Regulations
	ST	**WT**
	1. Improving Product Quality to Meet Market Demand 2. Strengthening Partnerships and Capital Access 3. Network Development (social capital) Distribution and Marketing	1. Education and Capacity Development to Address Human Resource Weaknesses 2. Strengthening Group Institutions to Face Business Uncertainty 3. Provision of Access to Capital Assistance and Financial Assistance

Source: Primary Data Processing Source, 2024

Based on Table 7 shows 4 (four) alternative strategy cells that can be run by the strategy to increase the effectiveness of biofloc technology application on tilapia fish farmers' income in Gorontalo Province, namely the SO (Strength-Opportunities) strategy, the WO (Weaknesses-Opportunities) strategy, the ST (Strength-Threatsh) strategy, and the WT (Weaknesses-Threatsh) strategy. However, for the strategy to increase the effectiveness of biofloc technology application on tilapia fish farmers' income in Gorontalo Province, it is more ideal to use the SO (Strength-Opportunities) strategy because of the situation where the magnitude of the threat can be reduced by developing internal capacity (strength).

c. SWOT Diagram

The main purpose of applying this approach is to identify one of four typical patterns in the alignment of internal and external situations faced by the Strategy for increasing the effectiveness of the application of biofloc technology on the income of tilapia fish farmers in Gorontalo Province.

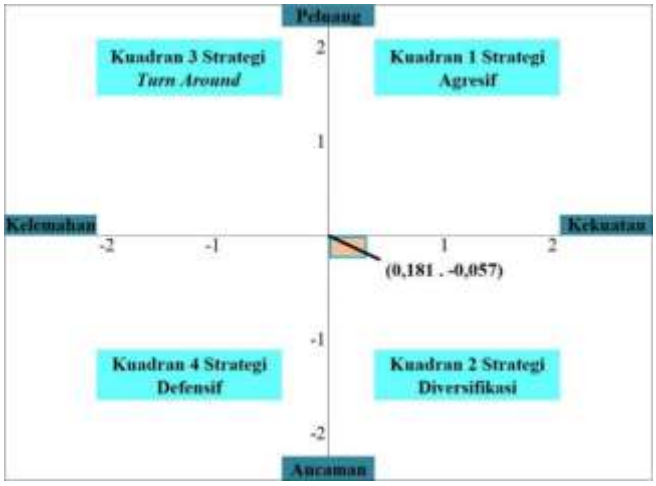
Based on the internal and external factors above, the coordinate points of the SWOT diagram can be arranged as in Table 8:

Table 8: External and Internal Analysis Coordinates

No	Description		Score
1	Internal Factors		
	a.	Strength	1,399
	b.	Weakness	1.218
	Difference		0.181
2	External Factors		
	a.	Opportunity	1,353
	b.	Threat	1,410
	Difference		-0.057
X,Y Coordinate Points			**(0.181 ; -0.057)**

Primary Data Processing Source, 2024

Based on Table 9, a description of the location of the strategy quadrant is presented in the following image:



SWOT Analysis Diagram

The SWOT diagram shows that the position of the strategy to increase the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province is in quadrant 2, namely the Diversification strategy. This strategy emphasizes that efforts to optimize the increase in the effectiveness of the application of biofloc technology on the income of tilapia farmers in Gorontalo Province can be focused on (1) improving product quality to meet market demand, (2) strengthening partnerships and capital access & (3) developing distribution and marketing networks (social capital).

Diversification in the application of biofloc technology for tilapia cultivation in Gorontalo Province includes strategies to improve product quality to meet diverse market demands. The quality of tilapia products greatly determines their competitiveness and selling value in the market. With biofloc technology, farmers can better control the cultivation environment, thus producing fish with better quality. This includes aspects of nutrition, taste, and product cleanliness. Improving product quality can be done by improving feed and nutrition management, as well as controlling pond environmental conditions more effectively using biofloc technology (Marisda & Anisa, 2019). Farmers can implement cleaner and safer

cultivation practices, thus producing tilapia that are healthier and free from chemical residues (Simangunsong & Anam, 2022). In the application of biofloc technology, strengthening partnerships and access to capital are key to supporting fish farmers (Darmayanti et al., 2024).

Diversification in the application of biofloc technology for tilapia cultivation in Gorontalo Province includes strategies to improve product quality to meet diverse market demand. The quality of tilapia products greatly determines their competitiveness and selling value in the market. With biofloc technology, farmers can better control the cultivation environment, thus producing fish with better quality. This includes aspects of nutrition, taste, and product cleanliness. Improving product quality can be done by improving feed and nutrition management, as well as controlling pond environmental conditions more effectively using biofloc technology (Marisda & Anisa, 2019).

Farmers can implement cleaner and safer farming practices, resulting in healthier tilapia that are free from chemical residues (Simangunsong & Anam, 2022). The diversification strategy in the application of biofloc technology focuses on improving product quality, strengthening partnerships and access to capital, and developing distribution and marketing networks. Through this strategy, tilapia farmers can maximize the potential of biofloc technology to increase cultivation effectiveness, optimize income, and expand market share (Kurnia et al., 2023).

This result is in line with the statement from Kurniati and Jumanto (2017) namely the strategy of developing a tilapia fish business using SWOT analysis states that this business is in the third quadrant so that it can carry out the WO strategy, including providing an overview of the tilapia fish business such as characteristics and business profiles to related parties (financial institutions) in order to get credit distribution with cheaper installment costs, expanding the marketing reach not only to the community around the cultivation location by improving the quality of the tilapia fish products produced, increasing the promotion of superior products to meet market demand, such as during the commemoration of independence day, regional birthdays, bazaar activities or exhibitions, and providing bonuses to employees if production sales increase to increase employee enthusiasm in optimizing the results of biofloc fish cultivation.

Based on the research results and discussion, it can be concluded thatThe effectiveness of biofloc technology application by tilapia fish farmers in Boalemo Regency and Bone Bolango Regency is in the fairly good criteria. The income of tilapia fish farmers in Boalemo Regency and Bone Bolango Regency is in the good category, and the Strategy for increasing the effectiveness of biofloc technology application on the income of tilapia fish farmers in Boalemo Regency and Bone Bolango Regency is in quadrant 2, namely the Diversification strategy. This strategy emphasizes that the optimization of strengths in reducing various threats and challenges in tilapia fish farming with biofloc technology to increase income can be focused on (1) improving product quality to meet market demand, (2) strengthening partnerships and capital access & (3) developing distribution and marketing networks (social capital).

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