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ANALYSIS OF THE PRODUCTIVITY OF AQUACULTURE BUSINESS IN FLOATING NET KARAMBA IN CIRATA RESERVOIR (CASE STUDY OF MARGALAKSANA VILLAGE, CIPEUNDEUY DISTRICT)

Analisis Produktivitas Usaha Perikanan Budidaya dalam Karamba Jaring Apung di Waduk Cirata (Studi Kasus Desa Margalaksana Kecamatan Cipeundeuy)

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ABSTRACT

Productivity is a concept that describes the relationship between output (production results) and input used (land area, seeds, feed) as one of the efforts that can be made to encourage growth and development in the fisheries and marine sectors. This study aims to analyze the level of productivity and factors that influence the productivity of fisheries cultivation efforts in Floating Net Cage (KJA) in Cirata Reservoir, West Bandung Regency. This study uses a case study method with a sampling technique using the purposive sampling method. The data collection technique is assisted by observation and interview methods with questionnaires, then the data obtained is analyzed using a quantitative descriptive approach. The results of the study showed that the level of productivity per unit area was 14.683 kg/yr/m^2 and productivity per unit cost was IDR 19.016/kg. The Financial Analysis carried out produced a profitable R/C ratio value of 1,17. Factors that significantly affect cultivation productivity include land area, seed quality, feed conversion, and length of experience, while the age variable did not show a significant effect on productivity.

Keywords: Cirata Reservoir, Finance, KJA, Productivity

ABSTRAK

Produktivitas merupakan sebuah konsep yang menggambarkan bagaimana hubungan antara output (hasil produksi) dengan input yang digunakan (luas lahan, benih, pakan) sebagai salah satu upaya yang dapat dilakukan untuk mendorong pertumbuhan dan perkembangan di sektor perikanan dan kelautan. Studi ini bertujuan untuk menganalisis tingkat produktivitas dan faktor-faktor yang mempengaruhi produktivitas usaha perikanan budidaya dalam Karamba Jaring Apung (KJA) di Waduk Cirata, Kabupaten Bandung Barat. Penelitian ini menggunakan metode studi kasus dengan teknik pengambilan sampel menggunakan metode purposive sampling. Teknik pengumpulan data melalui metode observasi dan wawancara dengan bantuan kuesioner, selanjutnya data yang telah diperoleh dianalisis dengan menggunakan pendekatan

deskriptif kuantitatif. Hasil penelitian menunjukkan bahwa tingkat produktivitas per satuan luas sebesar 14,683 kg/th/m^2 dan produktivitas per satuan biaya sebesar Rp. 19.016/kg. Analisis Finansial yang dilakukan menghasilkan nilai rasio R/C yang menguntungkan yakni sebesar 1,17. Faktor-faktor yang secara signifikan memengaruhi produktivitas budidaya meliputi luas lahan, kualitas benih, konversi pakan, dan lama pengalaman, sedangkan variabel usia tidak menunjukkan pengaruh yang signifikan terhadap produktivitas.

Kata Kunci: Finansial, KJA, Produktivitas, Waduk Cirata

INTRODUCTION

The fisheries sector has a significant contribution to the Indonesian economy, both as a source of food, employment, and state revenue. One of the sub-sectors that has shown rapid development is fisheries cultivation, especially freshwater fish cultivation. Based on data from the Ministry of Maritime Affairs and Fisheries (2024), Indonesia's total fisheries production in 2023 was recorded at 24.7 million tons, an increase of 11.2% compared to 2022 which reached 22.2 million tons. Of the total production, aquaculture production contributed around 16.9 million tons or 41% of the total national fisheries production.

West Java is one of the main provinces producing red tilapia and carp in Indonesia. The West Java Maritime Affairs and Fisheries Service (2024) noted that in 2023, West Java produced 279,208 tons of tilapia or around 20% of the total national production. Meanwhile, carp production reached 173,036 tons, which is equivalent to around 35% of the total national production. Cirata Reservoir is one of the centers of red tilapia and carp production in West Java, located in the border area between Cianjur, Purwakarta, and West Bandung Regencies.

Cirata Reservoir was built in 1988 in the Citarum River Basin (DAS) area and functions primarily as a source of electricity generation for the islands of Java and Bali (Kusumawardhani, 2017). In addition to being a power plant, Cirata Reservoir is also used for fish farming using the Floating Net Cage (KJA) system, which covers an area of 1,225,000 m^2 with a total of 25,059 KJA units. Margalaksana Village, Cipeundeuy District, West Bandung Regency is one of the villages directly adjacent to Cirata Reservoir. Most of the people in Margalaksana Village work as red tilapia and carp cultivators from floating nets with a total of 10,152 KJA.

The cultivation of red tilapia and carp in KJA has encouraged the growth of related industries, such as the provision of fish feed, fish seeds, and transportation and distribution services for harvested products. Efforts to improve production quality and cultivation efficiency have made Margalaksana Village one of the main centers for red tilapia and carp production through the Floating Net Cage (KJA) system in West Bandung Regency. Behind the significant economic contribution, farmers still face a number of challenges in the Cirata Reservoir waters, West Bandung Regency, namely fluctuations in fish feed prices, declining water quality, and KJA issuance policies.

The challenges that occur in the Cirata Reservoir, West Bandung Regency require an approach to further support red tilapia and carp cultivation activities in the Cirata Reservoir and improve the sustainability of the reservoir and the welfare of local communities. According to Firmansyah et al. (2021), analyzing fisheries productivity is one of the approaches to encourage growth and development in the fisheries and marine sectors. Based on the background description, the purpose of this study is to analyze the level of productivity and factors that influence the productivity of fisheries cultivation efforts in the Floating Net Cage (KJA) system in Margalaksana Village, Cipeundeuy District. The findings of this study are expected to be used as recommendations and provide real contributions to the development of the fisheries cultivation sector, especially in order to increase the productivity and welfare of farmers in the Cirata Reservoir area.

METHODS

This research was conducted in Cirata Reservoir, West Bandung Regency, with the case study location in Margalaksana Village, Cipeundeuy District, during the period from August 2024 to April 2025. The method used in this study was a case study, involving 70 respondents consisting of red tilapia and carp farmers in the Floating Net Cage (KJA) system. Sampling was carried out by purposive sampling, which is a sample selection method based on certain criteria or considerations (Sugiyono, 2019).

This study uses primary data and secondary data as data collection techniques. Primary data were collected through observation and interviews using a questionnaire as an auxiliary instrument. The information obtained includes the characteristics of respondents, general conditions of cultivation in Floating Net Cage (KJA), productivity per unit area and costs, financial analysis, and various factors that influence the level of productivity of fisheries cultivation businesses. Meanwhile, secondary data was obtained from literature sources such as scientific journals, books, and relevant documents from related agencies or institutions, and function as supporting data in this study.

The data analysis method applied in this study is quantitative descriptive analysis, an approach that aims to describe, study, and explain a social phenomenon objectively based on numerical data without conducting hypothesis testing (Sulistyawati et al., 2022). Based on the parameters used, data analysis in this study includes measuring productivity levels, identifying factors that influence productivity, and financial analysis.

Productivity Level Analysis

According to Sinungan (2018), the analysis of aquaculture productivity includes two approaches, namely productivity per unit area and productivity per unit cost which are formulated as follows:

$$\text{Productivity per Unit Area (Kg/yr/m}^2\text{)} = \frac{\sum \text{Production per year } \left(\frac{\text{kg}}{\text{yr}}\right)}{\sum \text{Land area (m}^2\text{)}}$$

Furthermore, to analyze productivity per unit cost can be calculated using the following formula:

$$\text{Productivity per Unit Cost (IDR/Kg)} = \frac{\text{Cost } \left(\frac{\text{IDR}}{\text{yr}}\right)}{\sum \text{Production } \left(\frac{\text{Kg}}{\text{yr}}\right)}$$

These two parameters are used to evaluate the efficiency of aquaculture in Floating Net Cages (KJA).

Analysis of Productivity Factors

a) Multiple Linear Regression Analysis

According to Wardhana and Iba (2024), multiple linear analysis is used as an analysis of influential factors between independent variables and dependent variables with the following equation:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \in$$

Where:
Y = Productivity (Kg/yr/m^2)
X1 = Land Area (m^2)
X2 = Seed Quality (production (kg) per number of seeds (kg))
X3 = Feed Conversion (production (kg) per number of feed (kg))

X4 = Age of Cultivator (years)
X5 = Length of Experience (years)
∈ = Error

b) Normality Test

The normality test in this study was carried out using the Kolmogorov-Smirnov nonparametric statistical method (K-S Test) to determine whether the data used is normally distributed or not. According to Dewi et al. (2024), this test uses two basic hypotheses as follows:
- H0 : Data is normally distributed.
- H1 : Data is not normally distributed.

The test decision on the Kolmogorov-Smirnov test is as follows:
- If Sig.(p) or p-value >0.05 then H0 is accepted and H1 is rejected, meaning the data is normally distributed.
- If Sig.(p) or p-value <0.05 then H0 is rejected and H1 is accepted, meaning the data is not normally distributed.

c) Multicollinearity Test

The multicollinearity test is carried out to test whether there is a correlation between the independent variables in the regression model. According to Haslinda and Majid (2016), a good regression model must meet the assumption that the independent variables are not correlated with each other. The assumption regarding the existence or absence of multicollinearity in the data can be explained as follows:
- VIF value >10, then the data contains multicollinearity.
- VIF value <10, then the data does not contain multicollinearity.

d) Heteroscedasticity Test

The heteroscedasticity test is used to determine whether the variance of the error in the regression model is constant or not. One of the testing methods used is the Glejser test, which is by regressing the independent variable against the absolute value of the residual. The assumptions for determining the presence or absence of heteroscedasticity are as follows:
- If Sig.(p) or the p-value between the independent variable and the absolute residual >0.05, then there is no heteroscedasticity.
- If Sig.(p) or the p-value between the independent variable and the absolute residual <0.05, then there is heteroscedasticity.

e) Determination Coefficient Test

The adjusted R-squared (R^2) value listed in the model summary table is used to measure the coefficient of determination of the regression model (Ghozali, 2016). A low R^2 value indicates that the ability of the independent variable to predict the dependent variable is still limited. On the other hand, if the R^2 value approaches one, this indicates that the independent variable has high predictive power on the dependent variable.

f) Simultaneous Significance Test

Simultaneous significance testing is carried out using the F test with a significance level of 5% ($\alpha = 0.05$) to determine whether the independent variables simultaneously (together) have an effect on the dependent variable. According to Dewi et al. (2024), the hypothesis in the F test is formulated as follows:
- H0: The independent variables simultaneously have no effect on the dependent variable.

- H1: The independent variables simultaneously have an effect on the dependent variable.
The test decisions in the F test are as follows:
- If the significance value or p-value <0.05 then H0 is rejected and H1 is accepted, meaning that the independent variables have a simultaneous effect on the dependent variable.
- If the significance value or p-value >0.05 then H0 is accepted and H1 is rejected, meaning that the independent variables do not have a simultaneous effect on the dependent variable.

g) Partial Significance Test

This test uses a T test with a significance level of 5% (α = 0.05) to determine whether each independent variable partially (alone) has an effect on the dependent variable. According to Dewi et al. (2024), the hypothesis in the T test is as follows:
- H0: The independent variable partially does not affect the dependent variable.
- H1: The independent variable partially affects the dependent variable.

The results of acceptance or rejection in the F test are as follows:
- If the significance value or p-value <0.05 then H0 is rejected and H1 is accepted, meaning that the independent variable has a partial effect on the dependent variable.
- If the significance value or p-value >0.05 then H0 is accepted and H1 is rejected, meaning that the independent variable has a partial effect on the dependent variable.

Financial Analysis

a) Revenue

Revenue is the total income obtained from sales in a business unit. According to Andi & Max (2017), revenue can be calculated using the following formula:

$$TR = P \times Q$$

Where:
TR : Total Revenue (IDR)
P : Product Price (IDR)
Q : Production Quantity (IDR)

b) Total Cost

Total cost is the total cost incurred during the production process. According to Setiawan & Okatrina (2017), total cost is the result of fixed cost and variable cost expenditures which are formulated as follows:

$$TC = TFC + TVC$$

Where:
TC : Total Cost (IDR)
TFC : Total Fixed Cost (IDR)
TVC : Total Variable Cost (IDR)

c) Revenue Cost Ratio (R/C)

Revenue Cost Ratio (R/C) is one of the business analysis methods used to compare revenue with total costs incurred. According to Dwikurnia et al. (2017), the R/C calculation is formulated as follows:

$$R/C = \frac{\text{Total Revenue}}{\text{Total Cost}}$$

With the following conditions:
R/C < 1, meaning that the business is experiencing losses and is not worth continuing.
R/C = 1, meaning that the business is at break-even (no profit and no loss).
R/C > 1, meaning that the business is making a profit and is worth continuing.

Profit

Profit is the difference between the revenue obtained and the total costs incurred during the production process. Anandya et al. (2023) stated that profit can be calculated using the following formula:

$$Profit = TR - TC$$

Where:
TR : Total Revenue (IDR)
TC : Total Cost (IDR)

RESULTS

Respondent Characteristics

Based on the research results, it shows that out of 70 respondents, they are dominated by men with the characteristics presented in Table 1.

Table 1. Respondent Characteristics

Characteristics	Total (people)	Percentage (%)
Age (Year)		
20-25	4	6%
26-30	6	9%
31-35	8	11%
36-40	16	23%
41-45	8	11%
46-50	17	24%
51-55	11	16%
Total	**70**	**100%**
Level of Education		
Elementary School	26	37%
Junior High School	22	31%
Senior High School	20	29%
College	2	3%
Total	**70**	**100%**
Length of Cultivation Experience (Years)		
1-10	33	47%
11-20	32	46%
21-30	5	7%
>30	0	0%
Total	**70**	**100%**

Source: Primary Data Analysis (2025)

Based on Table 1, all respondents in this study were aged between 16 and 55 years, indicating that the respondents were included in the productive age group of cultivators Mulyadi et al. (2015). The majority of respondents had an elementary school education background, namely 26 people with a percentage of 37%, while college graduates were the

group with the lowest percentage, namely 2 people with a percentage of 3%. In addition, most cultivators had 1 to 10 years of cultivation experience. In this study, cultivation experience refers to the length of time respondents have worked in managing and carrying out fish cultivation activities.

General Condition of Red Tilapia and Carp Cultivation Business

Land Area

The land area for red tilapia and carp cultivation in Floating Net Cages (KJA) in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, varies between 784 m² to 2,352 m², with an average land area owned by farmers of 980 m². Data on the frequency distribution of the land area owned by farmers are presented in Table 2.

Table 2. Land Area

Land Area (m^2)	Total (people)	Percentage (%)
<784	0	0%
784 - 1421	53	76%
>1421	17	24%
Total	**70**	**100%**

Source: Primary Data Analysis (2025)

Seeds

Provision of red tilapia seeds in Cirata Reservoir, Margalaksana Village, District Provision of red tilapia seeds in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, the majority of farmers maintain their own seeds in the Cirata Reservoir KJA, but for the provision of carp seeds, farmers must buy seeds imported from outside the region, namely Subang. The size of the seeds used by fish farmers in Margalaksana Village, Cipeundeuy District, West Bandung Regency is red tilapia 3-5 cm and carp 5-8 cm. Furthermore, the stocking density of red tilapia and carp seeds is 100 - 200 kg of fish seeds per KJA unit. The red tilapia seeds purchased by farmers are priced at 32,000 / kg, while the carp seeds are priced at 35,000 / kg.

Feed

Feeding is done 3 to 5 times a day, namely in the morning, afternoon, and evening. The farmers of red tilapia and carp in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, generally use artificial feed in the form of pellets with various brands. The brands of pellet feed are Turbo T89, Comfeed, Newhope Aquafeed, Laju, SPF, PAE, Artha, Mentari and Hipro Vite 781. The majority of farmers use Turbo T89 feed produced by CP Prima.

Production

The production or harvest of red tilapia and carp in Floating Net Cages (KJA) in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, ranges from <12,000 kg/year to> 21,000 kg/year. In one year, this cultivation activity can carry out 3 to 4 harvest cycles, with each cycle requiring a maintenance period of 3 to 4 months. Data on the number of cultivators based on annual production results are presented in Table 3.

Table 3. Number of Cultivators Based on Production Results (kg/year)

Production (Kg)	Total (people)	Percentage (%)
<12,000	16	23%
12,000 – 21,000	37	53%
>21,000	17	24%
Total	**70**	**100%**

Source: Primary Data Analysis (2025)

Selling Price

Red tilapia and carp in Margalaksana Village are sold to dealers containing 4 to 5 fish per kg. Red tilapia is sold at a price of IDR 27,000/kg and carp is sold at a price of IDR 24,000/kg. After harvest, the harvest obtained will be sold by dealers using a single-level channel distribution channel, namely the dealer will provide red tilapia and carp to distributors to various regions such as Jakarta, Semarang and Surabaya, then the distributor will provide it to consumers and the distribution system used is direct order.

Labor

Cultivation activities in Floating Net Cages (KJA) in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, consist of three main activities, namely pond preparation, maintenance, and harvesting, which are carried out by workers. Farmers generally employ between 2 and 4 workers to support the cultivation process. The wages received by workers each month are IDR 1,500,000 to IDR 2,000,000/person each month. The number of wages received is influenced by the number of KJA ponds managed, but there are also many farmers who do not have workers and manage their own KJA.

Productivity Level Analysis

Productivity Level per Unit Area

Based on the calculation results, the productivity value per unit area is 14.683 kg/yr/m^2. The productivity value per unit area shows that from 1.00 m^2 of land area owned by floating net cage farmers in Margalaksana Village will produce 14 kg/yr/m^2.

Table 4. Productivity Level per Unit Area

Production (Kg/yr)	Land Area (m^2)	Productivity (Kg/yr/m^2)
1,235,650	81,732	14.683

Source: Primary Data Analysis (2025)

Productivity Level per Unit Cost

Based on the calculation results, the productivity value per unit cost is IDR 19,016/kg. The productivity value per unit cost shows that producing 1 kg of fish requires a cost of IDR 19,016.

Table 5. Productivity Level per Unit Cost

Production (Kg/yr)	Cost (IDR/yr)	Productivity (IDR/kg)
1,235,650	IDR 23,761,857,000	19,016

Source: Primary Data Analysis (2025)

Analysis of Productivity Factors
Multiple Linear Regression Analysis
a) Productivity per Unit Area

The results of multiple linear regression analysis using the help of the Minitab version 21 statistical program, obtained from the regression model described in Table 6.

Table 6. Results of Multiple Linear Regression Analysis on Productivity per Unit Area

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	24.69	1.76	14.05	0.000	
X_1 Land Area	0.00012	0.00049	2.48	0.016	1.08
X_2 Seed Quality	-1.690	0.395	-4.27	0.000	5.32
X_3 Feed Conversion	0.30	4.04	0.07	0.941	5.18
X_4 Age	0.0428	0.0251	1.70	0.093	1.22
X_5 Length of Experience	-0.0662	0.0347	-1.91	0.061	1.28

Source: Primary Data Analysis (2025)

The table above presents the results of the regression equation analysis of productivity per unit area in the cultivation of red tilapia and carp in the Floating Net Cage (KJA) system in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency. The multiple linear regression equation for the productivity per unit area variable is as follows:

$$Y_1 = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \in$$
$$Y_1 = 24.69 + 0.00012\ X_1 - 1.690\ X_2 + 0.30\ X_3 + 0.0428\ X_4 - 00662\ X_5 + \in$$

b) Productivity per Unit Cost

The results of multiple linear regression analysis using the help of the Minitab version 21 statistical program, obtained from the regression model are presented in Table 7.

Table 7. Results of Multiple Linear Regression Analysis on Productivity per Unit Cost

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	25789	838	30.76	0.000	
X_1 Land Area	0.115	0.234	0.49	0.626	1.08
X_2 Seed Quality	-131	189	-0.69	0.490	5.32
X_3 Feed Conversion	-6806	1929	-3.53	0.001	5.18
X_4 Age	-8.0	12.0	0.67	0.504	1.22
X_5 Length of Experience	-44.6	16.6	-2.69	0.009	1.28

Source: Primary Data Analysis (2025)

The table above presents the results of the regression equation analysis of productivity per unit cost in the cultivation of red tilapia and carp in the Floating Net Cage (KJA) system in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency. The multiple linear regression equation for the productivity variable per unit area is as follows:

$$Y_2 = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \in$$
$$Y_2 = 25789 + 0.115\ X_1 - 131\ X_2 - 6806\ X_3 - 8.0\ X_4 - 44.6\ X_5 + \in$$

Normality Test

Based on the results of the Kolmogorov-Smirnov test, a value of 0.116 was obtained for productivity data per unit area and 0.150 for productivity data per unit cost. Both values are

greater than 0.05 (P-Value > 0.05), which indicates that the data used in this study are normally distributed.

Table 8. Results of the Normality Test for Productivity per Unit Area and Productivity per Unit Cost

P- Value	Productivity per Unit Area	Productivity per Unit Cost
	0.116	0.150

Source: Primary Data Analysis (2025)

Multicollinearity Test

The results of the multicollinearity analysis show that the Variance Inflation Factor (VIF) value for all independent variables is below 10. Based on these results, it can be concluded that there are no symptoms of multicollinearity in the regression model of productivity per unit area or productivity per unit cost, so that the regression model used can be categorized as a good model.

Table 9. Results of Multicollinearity Test of Productivity per Unit Area and Productivity per Unit Cost

Productivity per Unit Area		Productivity per Unit Cost	
Model	VIF	Model	VIF
X_1 Land Area	1.08	X_1 Land Area	1.08
X_2 Seed Quality	5.32	X_2 Seed Quality	5.32
X_3 Feed Conversion	5.18	X_3 Feed Conversion	5.18
X_4 Age	1.22	X_4 Age	1.22
X_5 Length of Experience	1.28	X_5 Length of Experience	1.28

Source: Primary Data Analysis (2025)

Heteroscedasticity Test

The results of the heteroscedasticity test show that all independent variables have a P-Value greater than 0.05 (P-Value > 0.05). Based on these results, it can be concluded that there are no symptoms of heteroscedasticity in the regression model for productivity per unit area or productivity per unit cost.

Table 10. Results of the Heteroscedasticity Test for Productivity per Unit Area

Term	Coef	SE Coef	T-Value	P-Value
Constant	3.73	1.86	2.01	0.049
X_1 Land Area	0.00047	0.00051	0.91	0.364
X_2 Seed Quality	-0.371	0.190	-1.96	0.055
X_3 Feed Conversion	0.012	0.134	0.09	0.928
X_4 Age	0.0463	0.0270	1.72	0.091
X_5 Length of Experience	-0.0692	0.0374	-1.85	0.069

Source: Primary Data Analysis (2025)

Table 11. Results of Heteroscedasticity Test of Productivity per Cost Unit

Term	Coef	SE Coef	T-Value	P-Value
Constant	1304	502	2.60	0.012
X_1 Land Area	-0.171	0.140	-1.22	0.227
X_2 Seed Quality	107	113	0.95	0.348
X_3 Feed Conversion	-1546	1156	-1.34	0.186
X_4 Age	-7.75	7.18	-1.08	0.284
X_5 Length of Experience	13.07	9.93	1.32	0.193

Source: Primary Data Analysis (2025)

Coefficient of Determination Test

Productivity per Unit Area

The results of data processing show that the coefficient of determination (R^2) is 66.08%. This indicates that the independent variables in the model are able to explain the variation of the dependent variable (Y_1), namely productivity per unit area, by 66.08%. Meanwhile, the remaining 33.92% is influenced by other factors that are not included in this research model.

Table 12. Results of the Coefficient of Determination Test of Productivity per Unit Area

Model Summary			
Model	R-sq	R-sq(adj)	R-sq(pred)
7.63822	68.54%	66.08%	1.12%
a. Responsen: Y_1			
b. Continuous Predictors: X_1, X_2, X_3, X_4, X_5			

Source: Primary Data Analysis (2025)

Productivity per Unit Cost

The results of data processing show that the coefficient of determination (R^2) is 55.95%. This indicates that the independent variables in the model are able to explain the variation of the dependent variable (Y_2), namely productivity per unit area, by 55.95%. Meanwhile, the remaining 44.05% is influenced by other factors not included in this research model.

Table 13. Results of the Productivity Determination Coefficient Test per Unit Cost

Model Summary			
Model	R-sq	R-sq(adj)	R-sq(pred)
4034,90	59.14%	55.95%	0.00%
a. Responsen: Y_2			
b. Continuous Predictors: X_1, X_2, X_3, X_4, X_5			

Source: Primary Data Analysis (2025)

Simultaneous Significance Test

Based on the results of data analysis, it is known that the independent variables simultaneously have a significant effect on the dependent variable (Y_1), namely productivity per unit area and the dependent variable (Y_2), namely productivity per unit cost. This is indicated by a significance value of 0.000 which is smaller than the significance limit of 0.05 ($p < 0.05$).

Table 14. F Test of Productivity per Unit Area

ANOVA					
Model	DF	Adj SS	Adj MS	F-Value	P-Value
Regession	5	283.529	56.7059	20.62	0.000
a. Responsen: Y_1					
b. Continuous Predictors: X_1, X_2, X_3, X_4, X_5					

Source: Primary Data Analysis (2025)

Table 15. F-Test of Productivity per Unit Cost

ANOVA					
Model	DF	Adj SS	Adj MS	F-Value	P-Value
Regession	5	57994987	11598997	18.53	0.000
a. Responsen: Y_1					
b. Continuous Predictors: X_1, X_2, X_3, X_4, X_5					

Source: Primary Data Analysis (2025)

Partial Significance Test

Productivity per Unit Area

The results of data analysis show that the Land Area variable (X_1) has a significant effect on productivity per unit area (Y_1), with a significance value of 0.016 <0.05. The relationship between the two variables is positive. Furthermore, the Seed Quality variable (X_2) is also proven to have a significant effect on productivity per unit area (Y_1), with a significance value of 0.000 <0.05. The effect shown by this variable is also positive.

Table 16. T-Test of Productivity per Unit Area

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	24.69	1.76	14.05	0.000	
X_1 Land Area	0.00012	0.00049	2.48	0.016	1.08
X_2 Seed Quality	-1.690	0.395	-4.27	0.000	5.32
X_3 Feed Conversion	0.30	4.04	0.07	0.941	5.18
X_4 Age	0.0428	0.0251	1.70	0.093	1.22
X_5 Length of Experience	-0.0662	0.0347	-1.91	0.061	1.28

Source: Primary Data Analysis (2025)

Productivity per Unit Cost

The results of data analysis show that the Feed Conversion variable (X_3) is proven to have a significant effect on productivity per unit cost (Y_2), with a significance value of 0.001 <0.05. The relationship between these variables is negative or inversely proportional. In addition, the Length of Experience variable (X_5) also shows a significant effect on the dependent variable, namely productivity per unit cost (Y_2), with a significance value of 0.009 <0.05. The relationship formed from this variable is also negative.

Table 17. T-Test of Productivity per Unit Cost

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	25789	838	30.76	0.000	
X_1 Land Area	0.115	0.234	0.49	0.626	1.08
X_2 Seed Quality	-131	189	-0.69	0.490	5.32
X_3 Feed Conversion	-6806	1929	-3.53	0.001	5.18
X_4 Age	-8.0	12.0	0.67	0.504	1.22
X_5 Length of Experience	-44.6	16.6	-2.69	0.009	1.28

Source: Primary Data Analysis (2025)

Financial Analysis

Revenue

Based on the calculation results, it is known that the average production of red tilapia cultivation in Floating Net Cages (KJA) reaches 1,800 kg per year. With a selling price of IDR 27,000 per kilogram, the total income obtained by the cultivators reaches IDR 48,600,000 each year.

Table 18. Income from Red Tilapia Cultivation Activities in KJA

Production (Kg/year)	Selling Price (IDR)	Revenue (IDR/year)
1,800	27,000	48,600,000

Source: Primary Data Analysis (2025)

Based on the calculation results, it is known that the average production of red tilapia cultivation in Floating Net Cages (KJA) reaches 900 kg per year. With a selling price of IDR 24,000 per kilogram, the total income obtained by the cultivators reaches IDR 21,600,000 each year.

Table 19. Income from Carp Cultivation Activities in KJA

Production (Kg/cycle)	Selling Price (IDR)	Revenue (IDR/cycle)
900	24,000	21,600,000

Source: Primary Data Analysis (2025)

Total Cost

Based on the data obtained, the investment cost incurred reached IDR 68,460,000. Meanwhile, the total cost, which is the sum of fixed costs and production costs (variable costs), for the cultivation of red tilapia and carp in Floating Net Cages (KJA) in Margalaksana Village, Cipeundeuy District, West Bandung Regency, is IDR 59,742,000 per year per unit.

Table 20. Total Cost of Cultivating Red Tilapia and Carp in KJA

No	Type	Volume	Unit	Unit Price	Total Cost (IDR)
Investment Costs					
1	Bamboo	30	Unit	10,000	300,000
2	Iron	40	Unit	127,000	5,080,000
3	Plastic Drum	30	Unit	260,000	7,800,000
4	Tin Drum	8	Unit	150,000	1,200,000
5	Net	80	Kg	130,000	10,400,000
6	Outer Anchor	6	Unit	-	-
7	Inner Anchor	8	Unit	20,000	160,000
8	Rope	4 rolls	Kg	880,000	3,520,000
9	Floating House	1	Unit	-	25,000,000
10	Boat	1	Unit	-	15,000,000
Total Cost (IDR)					**68,460,000**
Equipment Depreciation Cost					
No	**Type**	**Technical Age (Years)**			**Total Cost (IDR)**
1	Bamboo	2			100,000
2	Iron	12			370,000
3	Plastic Drum	12			540,000
4	Tin Drum	5			150,000
5	Net	12			758,000

6	Outer Anchor	12			0
7	Inner Anchor	12			7,000
8	Rope	12			147,000
9	Floating House	12			5,000,000
10	Boat	12			2,000,000
Amount of Depreciation Cost (IDR)					**9,072,000**
Fixed Cost (Unit/Year)					
1	Depreciation				9,072,000
2	Labor				4,800,000
Total Fixed Costs (IDR)					**13,782,000**
Production Cost (Unit/Year)					
No	**Type**	**Volume**	**Unit**	**Unit Price**	**Total Cost (IDR)**
1	Red Tilapia Seeds	210	Kg	32,000	6,720,000
2	Carp Seeds	90	Kg	35,000	3,150,000
3	Feed	3000	Kg	11,200	33,600,000
4	Electricity/Solar/Generator	-	-	-	1,200,000
5	Gasoline/Diesel	96	Liter	12,500	1,200,000
Total Cost (IDR)					**45,870,000**
Total Cost Amount (IDR)					**59,742,000**

Source: Primary Data Analysis (2025)

Revenue Cost Ratio (R/C)

The calculation results show a R/C ratio of 1.17. Based on this value, it can be concluded that the cultivation of red tilapia and carp in floating net cages (KJA) in Margalaksana Village, Cipeundeuy District, West Bandung Regency provides benefits so that the business is considered feasible to continue.

Table 21. R/C ratio of Red Tilapia and Carp Cultivation Activities in KJA

Total Revenue	Total Cost	R/C Ratio
IDR 70,200,000	IDR 59,742,000	1.17

Source: Primary Data Analysis (2025)

Profit

The calculation results show that the profit obtained from the difference between the total income and the total costs incurred in the cultivation of red tilapia and carp in Floating Net Cages (KJA) in Margalaksana Village, Cipeundeuy District, West Bandung Regency reached IDR 10,458,000.

Table 22. Profit from Cultivation Activities in KJA

Total Revenue	Total Production Cost	Profit
IDR 70,200,000	IDR 59,742,000	IDR 10,458,000

Source: Primary Data Analysis (2025)

DISCUSSION

Based on the data that has been obtained and analyzed, the productivity value per unit area is 14.683 Kg/yr/m^2. The productivity value per unit area shows that from 1.00 m^2 of land area owned by KJA farmers in Margalaksana Village, it will produce 14 Kg/yr/m^2. According to Arum (2022), this value can be assumed that the higher the production produced from 1 m^2

of land, the higher the productivity, conversely, the lower the production results from 1 m^2 of land, the lower the productivity.

Based on the data that has been obtained and analyzed, the productivity value per unit cost is IDR 19,016/kg. The productivity value per unit cost that has been obtained means that producing 1 kg of fish requires a cost of IDR 19,016. This productivity value can be interpreted that the increase in costs incurred tends to be inversely proportional to the productivity value, namely the greater the cost, the lower the productivity obtained.

Based on the data in Table 16, the Land Area variable (X_1) is proven to have a significant effect on productivity per unit area (Y_1) with a significance value of 0.016 <0.05. The effect shown is positive, which means that every 1 unit increase in land area will increase productivity by 0.00012. This is in line with the findings of Andayani (2016) which states that land area has a positive and significant impact on the success of cultivation. Increasing land area allows for additional capacity of cultivated seeds so that it can increase productivity. In addition, according to Martinez et al. (1999), land for aquaculture in developing countries is often treated as an unlimited input factor.

The seed quality variable (X_2) shows a significant effect on productivity per unit area (Y_1), which is indicated by a significance value of 0.000 <0.05. The effect given is negative or inversely proportional, which means that a 1 unit increase in seed quality will reduce productivity by 1.690. This finding is in line with the research of Zaldi et al. (2023) which states that the quality of fish seeds is related to the productivity of pond cultivation. This negative effect is caused by poor seed quality which extends the maintenance period because fish growth becomes slow and inefficient. This extension of the maintenance period has implications for increasing feed requirements that must be met by farmers (Hikmayani et al., 2012).

Based on the data in Table 17, the feed conversion variable (X_3) has a significant effect on productivity per unit cost (Y_2), as indicated by a significance value of 0.001 <0.05. This effect is negative or inversely proportional, meaning that every 1 unit increase in feed conversion will reduce productivity by 6.806. Research by Sudarmadji et al. (2011) stated that excessive feeding can cause inefficiency in cultivation activities. Therefore, the amount of feed given needs to be adjusted to the actual needs of the fish being cultivated so that efficiency can be achieved.

The variable length of experience (X_5) was shown to have a significant effect on productivity per unit cost (Y_2), with a significance value of 0.009 <0.05. This effect is negative or inversely proportional, meaning that every one unit increase in length of experience will reduce productivity by 44.6. The study by Antwi et al. (2017) showed that an increase in the annual experience of farmers was associated with a decrease in productivity of 0.3 units. Furthermore, Esmaeili (2006), as cited in Antwi et al. (2017), stated that young and less experienced farmers tend to be more productive than older and experienced farmers. This is because older farmers are generally more conservative in adopting new innovations that can increase productivity.

CONCLUSION

Based on the research results, the productivity of fisheries cultivation in Cirata Reservoir, Margalaksana Village, Cipeundeuy District, West Bandung Regency, obtained a productivity value per unit area of 14.683 kg/yr/m^2 and productivity per unit cost of IDR 19,016/kg. Factors that significantly affect cultivation productivity include land area, seed quality, feed conversion, and length of experience, while the age variable does not show a significant effect on productivity.

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