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ANALYSIS OF GOLDFISH PRODUCTION EFFICIENCY (CASE STUDY: LAWE BULAN SUBDISTRICT SOUTHEAST ACEH DISTRICT)

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Abstract

Goldfish is in great demand by the people of Southeast Aceh because it is easily obtained in the market and becomes a typical dish. There is an increase in feed prices while output prices are fixed. So many farmers stopped producing but some survived. There is a difference in productivity between farmers who quit and farmers who stay. Farmers must improve production efficiency with the use of the right inputs so as to minimize costs and maximize profits. The study was conducted in Lawe Bulan District with the number of samples used as many as 40 farmers. The analysis used by DEA (Data Envelopement Analysis) to obtain Technical, Allocative and Economic Efficiency values and Tobit Regression Analysis to see the relationship between efficiency and farmer characteristics. The results of the DEA Analysis obtained a technical efficiency value of 0.757 or 75.5%. The allocative efficiency value was obtained at 0.919 or 91.9%. The Economic Efficiency Rate is 0.832 or 83.2%. The results of Tobit Regression are technically significantly positively related to the age of farmers. Allocative efficiency revealed a significant effect at the level of 5% and negatively related between allocative efficiency and education level. The results of the DEA analysis of the level of production efficiency have not been efficient. The Technical Efficiency score has an inefficiency of 24.5%. The allocative efficiency value of inefficiency was 8.1%. The Economic Efficiency score of inefficiency was 16.8%. The results of tobit regression there are sources of inefficiency of socioeconomic variables that become inefficienciesSuch as technical efficiency of education and number of dependents, allocative efficiency of age, education and experience, economic efficiency of experience variables and number of dependents.

Keywords**: *Goldfish, Effeciency Production, Data Envelopment Analysis***

1. INTRODUCTION

Fishery is an agricultural sub-sector which is one of the economic sources of the Indonesian people. In the Indonesian economy, the fishery potential is one of the supporting factors for the economy. Many fish are cultivated using fresh water (ponds), rice fields, cages and floating nets. Types of fish that are cultivated in fresh water are carp, tilapia, catfish and carp. Southeast Aceh Regency is one of the areas that is at a geographical point where there is no sea so that there are many people who practice freshwater fish farming. Goldfish is in great demand by the people of Southeast Aceh because goldfish has become a special dish and is widely used for certain occasions at an affordable price and easy to find in the market. Based on observations made to fish farmers that there was a very high increase in input (feed) prices while output prices remained constant. So that many farms are dead (not producing) for several periods. However, there are also farmers who survive and continue farming activities even though the costs are higher. Therefore, there is a difference in productivity between farmers who stop and farmers who survive to carry out goldfish farming. Optimum use of inputs (not too much and not too little) certainly has a big impact on the costs incurred by farmers. Therefore.

2. RESEARCH METHODS

2.1 Research Area Determination Method

The research area was determined purposively, namely Lawe Bulan District. The selection of the research location was carried out with the consideration that the area is one of the goldfish production centers in Southeast Aceh District.

2.2 Sampling Area

The number of carp farmers in Lawe Bulan District is 366 farmers. The sampling method used is non-probability sampling in the form of accidental sampling, namely the method of determining the sample by taking respondents who happen to be available or available in a place that is appropriate to the research context. The minimum sample size required in this study is 40 samples with the consideration that the number of research variables is 4 times 10 (Sugiyono, 2017). The number of samples in this study amounted to 60 respondents with an error rate of 15%.

2.3 Data Retrieval Method

The data used in this study are primary data and secondary data. Primary data was obtained by observing and direct interviews with respondents to carp farmers through a prepared questionnaire. Secondary data was obtained through related agencies such as BPS and the Southeast Aceh District Fisheries Service.

2.4 Data analysis method

In this study using a non-parametric approach to perform efficiency analysis. The non-parametric method will measure overall, technical and allocative efficiency. The inputs used in the research were land area, seeds, feed and labor. Data on farmer characteristics were collected to find the relationship between inputs and farmer characteristics with the overall level of efficiency. Characteristics of farmers in research are education, age, experience and number of dependents. Data processing uses a quantitative method, namely analysis of production efficiency using the Data Envelopement Analysis (DEA) and Tobit Regression approaches. Primary data will then be processed with the help of computer devices such as Microsoft Excel, MaxDEA and Tobit STATA programs.

2.5 DEA Analysis (Data Envelopment Analysis)

This study uses DEA Analysis (Data Envelopement Analysis) which aims to minimize costs and maximize profits. DEA analysis based on cost minimization or profit maximization can be used to measure allocative efficiency as well as overall efficiency. DEA analysis measures the relative efficiency of several work units embodied in a Decision Making Unit (DMU). Technical efficiency (TE) is measuring the ability to produce a certain level of output with the use of minimum input. DEA considerations for estimating technical efficiency using linear optimization for DMUs in group j are as follows:

$D^{N}(,x_j^t y_j^t) = \min\theta_j$

$st \_ \leq \Sigma_{j=1}^{N} \lambda_j^t x_{m.j}^t \theta_j^t x_{m.j}^t$, m = 1, ... , M

$\Sigma_{j=1}^{N} \lambda_j^t \_ y_{l.j}^t y_{l.j}^t \geq$, l =1, ... L

$\Sigma_{j=1}^{J} = 1\lambda_j$

$\lambda_j^t \quad \geq \quad$, for j = 1, ... N

Economic efficiency (EE) indicates minimum costs (C_j(w,y,Tc) to produce the amount of output (y), the price of the given input (w), and the input (x) of a number of inputs and technology are considered constant. DEA considers cost minimization for economic efficiency by obtaining cost minimization for DMUs in group J using linear optimization as follows:

$$\text{Min Cj(w,y,Tc)} = \lambda_j^t x_{m.j}^{t*} \Sigma_{m=1}^{M} w_m^t x_{m,j}^{t*}$$

$$\text{st\_}\Sigma_{j=1}^{N} \lambda_j^t x_{m.j}^t x_{m.j}^{t*} \leq 0 \quad , \quad m = 1, \dots, M$$

$$\Sigma_{j=1}^{N} \lambda_j^t \, y_{l.j}^t \geq 0 \quad , \quad l = 1, \dots, L$$

$$\Sigma_{j=1}^{J} \lambda_j = 1$$

$$\lambda_j^t \geq 0 \quad , \quad j = 1, \dots, N$$

So that economic efficiency can be formulated as follows:

$$ee_j = = \frac{C_j(w,y,T_c}{\Sigma_{m=1}^{M} w_m^t \; x_{m,j}^t} \frac{\Sigma_{m=1}^{M} w_m^t \; x_{m,j}^{t*}}{\Sigma_{m=1}^{M} w_m^t \; x_{m,j}^t}$$

Allocative efficiency (AE) shows the minimum cost of producing a certain level of output with a return to scale technology input price. Allocative efficiency (AE) can be calculated using technical efficiency and economic efficiency as follows:

$$AE_j = \frac{EE_j}{TE_j}$$

2.6 Tobit Regression Analysis

This study uses an analysis of the relationship between efficiency measures and the characteristics of farmers using the tobit model. The tobit model can be formulated as follows:

$$Oj = CiGi + \Sigma_{j=1}^{T} \varepsilon_j \qquad \text{If}_{=}CiGi + \Sigma_{j=1}^{T} \varepsilon_j < 1, = 1$$

O_j is the measure of efficiency (technical, allocative and economic) for each farmer, Cj is the estimated parameter and Gj is the explanatory variable. The tobit model will identify the factors associated with inefficiencies for different farming systems. The explanatory variables used in the Tobit model are education, age, experience and number of dependents. The tobit model is also used to analyze the relationship between efficiency and input use. The explanatory variables for the input analysis were land area, seed, feed and labour.

3. RESULTS AND DISCUSSION

Table 1 Use of Production Inputs in Carp Growing Farming

Variable	Average	std. Dev	Min	max
Production (Kg)	4,120	2699.6	1,000	12,000
Land area (Ha)	0.825	0.48	0.5	2
Spawn (Tail)	7,033	3808.85	2,000	17,000
Feed (Kg)	6,323	6392.08	1,500	30,000
Labor (HOK)	38.03	16	6	79

Source: Primary Data, 2022 (Processed)

3.1 Technical Efficiency

Technical efficiency that uses the assumption of Constant Return to Scale (CRS) is an analysis where the use of input will produce output in the same proportion. CRS is an assumption where there is full proportionality between the input and output of the DMU. The use of this assumption in technical efficiency will show how input and output in terms of quantity can describe a certain production condition. The distribution of respondent farmers based on CRS can be seen in table 2 as follows:

Table 2 Constant Return to Scale

Technical Efficiency	Number of people)	Percentage (%)
0.300 – 0.500	3	5
0.501 – 0.600	12	20
0.601 – 0.700	8	13
0.701 – 0.800	13	22
0.801 – 0.999	13	22
=1,000	11	18
Total	60	100
Average		0.757
Minimum		0.390
Maximum		1,000

Source: Primary data, 2022 (Processed)

The results of the research in Table 1 show that there are 11 respondent farmers who have a technical efficiency value = 1 or 18% of the 60 respondent farmers. Respondent farmers who have an efficiency value of <1 (inefficient) are 49 farmers or 82% of the total respondents. This shows that goldfish cultivating farmers who have an efficiency value equal to one (TE=1) have a lower percentage below 50% compared to farmers who have an efficiency value of less than one (TE<1). The technical efficiency score of carp farmers in Southeast Aceh District has an average value of 0.757 or 75.5%.

3.2 Allocative Efficiency

Allocative efficiency using the VRS model is one of the assumptions that can be used to measure production efficiency. The VRS assumption that uses the BBC model is an assumption where the existing technical efficiency is the result of the convexity constraint and the CCR model assumes CRS so that the results ignore the assumption of proportions in CRS (Cooper et.al, 2007). VRS is an assumption where the existing DMUs are at a certain scale, each DMU may have different productivity and be considered efficient. (Benicio and De Melo, 2015). The distribution of respondent farmers based on VRS is presented as follows:

Table 3 Verbal Rating Scale

No.	Allocative Efficiency	Number of people)	Percentage (%)
1.	0.500 – 0.600	5	8
2.	0.601 – 0.700	3	5
3.	0.701 – 0.800	6	10
4.	0.801 – 0.900	-	-
5.	0.901 – 0.999	3	5
6.	=1,000	43	72
	Total	60	100
	Average		0.919
	Minimum		0.500
	Maximum		1,000

The research results in Table 2 show that 43 farmers or 72% of 60 farmers are at full technical efficiency (EA=1). The number of farmers who are not efficient only consists of 17 farmers or 28% of the total number of farmers. This shows that the majority of farmers have production efficiency that is higher than the average value obtained of 0.919 or 91.9%.

3.3 Economic Efficiency

Economic efficiency is a method used to measure how the condition of the scale of the production process is carried out. The EE value is obtained from the division between the value of the technical efficiency of the CRS model and the allocative efficiency of the VRS model to determine the condition of the economic efficiency of farmers. The use of economic efficiency in the production process will provide information about whether a farm is already at full efficiency scale or not. Economic efficiency in this study is used to determine whether carp farmers have used inputs correctly or are there other factors that affect the production of carp farming in Lawe Bulan District, Southeast Aceh Regency. The data regarding the economic efficiency of all carp farmers in Southeast Aceh District are as follows:

Table 4 Data On Economic Efficiency

No.	Economic Efficiency	Number of people)	Percentage (%)
1.	0.500 – 0.600	9	15
2.	0.601 – 0.700	3	5
3.	0.701 – 0.800	10	17
4.	0.801 – 0.900	13	22
5.	0.901 – 0.999	14	23
6.	=1,000	11	18
	Total	60	100
	Average		0.832
	Minimum		0.500
	Maximum		1,000

Source: Primary Data, 2022 (Processed)

Based on the results of Table 3, the economic efficiency of carp farmers in Southeast Aceh District has a different distribution. The majority of carp farmers are at economic efficiency of 0.901-0.999 with 14 farmers or 23% of all farmers. The number of farmers who are in a state of full efficiency in economic efficiency reaches 11 people or 18% of the total farmers. From the data obtained, it can be seen that farmers have an average value of economic efficiency of 0.832 or 83.2%. Thus it is necessary to increase economic efficiency by 16.8% of all farmers.

3.4 Tobit Regression Analysis

Further analysis of the DEA analysis was carried out to determine other factors that affect the production efficiency of carp rearing farming in Lawe Bulan District. Observations regarding production inputs that can affect the production efficiency of respondent farmers such as; land area, feed seeds and labor that need to be done to find out the right follow-up policy. The following are the variables used in the Tobit regression to determine the production input variables that affect the production efficiency of carp grow-out farming, which can be seen in the following table:

Table 5 Tobit Regression Analysis

Variable	TE	AE	ee
Land area	-0.002	-0.014*	0.003
Seeds	0.010	0.012	0.003
Feed	0.001	0.033	-0.004
Labor	0.002	-0.008	0.003*
constant	0.641	1,363	0.172

*) Real at α : 10%

Source: Primary Data 2022 (Processed)

Based on Table 4, the estimation results reveal a significant positive relationship between labor and economic efficiency. This shows that farmers are right in using the amount of labor that aims to increase efficiency and minimize production costs. in this study the average amount of labor used by farmers is 38 HOK. The results of this study are in accordance with Fajriani's research (2018), where the labor variable has a significant effect on the efficiency of red tilapia production in Klaten Regency. Allocative efficiency estimation results reveal a significant effect at the 10% level and a negative relationship between allocative efficiency and land area. The results of this study are in contrast to Fajriati's research (2018), where in tilapia aquaculture the pond area does not significantly affect the efficiency of red tilapia production in Klaten Regency.

The tobit model is also used to analyze the relationship between efficiency and socio-economics. The explanatory variables for the socioeconomic analysis are age, education, experience and number of dependents. The tobit model will identify the importance of each input for efficiency analysis. The tobit model will also indicate which inputs are underused or overused. The following are the variables used in the Tobit regression to determine the factors that influence the production efficiency of carp rearing farms described in the Tobit regression analysis results table using Tobit STATA analysis.

Table 6 Tobit STATA analysis

Variable	TE	AE	ee
Age	0.003*	0.001	0.003
Education	-0.002	-0.059**	0.006
Experience	0.009	0.017	-0.006
The number of dependents	-0.011	0.033	-0.012
Constant	0.850	2,393	0.723

*) Real at α : 10%

**) Real at α : 5%

Based on Table 5, the estimation results in terms of technical efficiency reveal a significant positive relationship between technical efficiency and farmer age. This means that farmers who are productive and physically strong can easily adopt innovation and technology and can overcome problems in carp production. The results of this study are in accordance with research conducted by Riani (2016), where the age variable has a significant effect on the technical efficiency of milkfish pond farming in North Aceh District.

Allocative efficiency estimation results reveal a significant effect at the 5% level and a negative relationship between allocative efficiency and education level. The length of a person's education level is considered a proxy for the farmer's managerial ability. The longer time spent in education is thought to encourage farmers to increase production efficiency. This phenomenon indicates that the higher the farmer's education, the higher the ability to adopt innovation and technology and use production inputs proportionally. The results of this study are in accordance with research by Riani (2016), where the variable level of education is a significant factor in the technical inefficiency of milkfish in North Aceh District.

4. CONCLUSION

Based on the results of the research that has been done, the following conclusions can be obtained: The production efficiency level of carp rearing farming in Southeast Aceh District is not yet efficient as seen from the results of the DEA analysis. The Technical Efficiency value obtained is 75.5% where there is still an inefficiency of 24.5%. The allocative efficiency value obtained is 91.9% where there is an inefficiency of 8.1%. Economic Efficiency score with an overall efficiency score of 83.2% where there is an overall inefficiency of 16.8%. Based on the results of the tobit regression coefficient, there are variables of production factors which are a source of production inefficiency in carp rearing farming in Lawe Bulan District, Southeast Aceh Regency. Variable sources of production factors that become inefficiency are: (1) In terms of technical efficiency, land area is variable, (2) In allocative efficiency, land area and labor are variable, (3) Feed is variable in economic efficiency.

Based on the results of the tobit regression coefficient, there are sources of socio-economic variables that become production inefficiencies in carp rearing farming in Lawe Bulan District, Southeast Aceh Regency. sources of socio-economic variables that become inefficiencies are (1) In terms of technical efficiency the variables of education and number of dependents, (2) In allocative efficiency the variables of age, education and experience, (3) In terms of economic efficiency the variables of experience and number of dependents.

REFERENCES

Banker, R.D, et al. 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopement Analysis. Journal of Management Science. Volume 30: 1078-1092.

Berkelaar, M, et al. 2021. MaxDEA 8 Ultra Manual. Diakses dari http://maxdea.com

BPS. 2018. ¬¬Kabupaten Aceh TenggarDalam Angka. Badan Pusat Statistik Aceh Tenggara.

BPS Lawe Bulan. 2018. Kecamatan Lawe Bulan Dalam Angka. Badan Pusat Statistik Lawe Bulan.

Coelli, T.J., et al. 2005. An Introduction to Efficiency and Productivity Analysis (2nd Edition). New York. Springer Science and Business Media.

Cooper, W.W., et al. 2011. Handbook on Data Envelopment Analysis, 2nd Edition. New York. Springer Science + Business Media, LLC.

Huguein, J.M. 2012. Data Envelopement Analysis (DEA): A Pedagogical Guide for Decision Maker and Public Sector. Lausanne: IDHEAP.

Riani, dkk. 2016. Analisis Efisiensi Teknis Tambak Ikan Bandeng di Kabupaten Aceh Utara. Jurnal Agrisep Vol 17, No. 1.