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Allocative Efficiency of Pontianak Siam Orange Farming in Sambas Regency, Indonesia

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Abstract. In Sambas Regency, 95% of the oranges are contributed by Siame oranges. Citrus farmers have a dilemma in that they don't know whether or not production elements are used effectively. The purpose of this study is to identify the production and farming efficiency parameters for Siamese oranges. The study was carried out in Sambas Regency's Tebas District, a hub for Siam production. A survey method is employed in the research. There are 100 Siam orange growers who responded, and purposeful sampling was used to collect the data. Data is handled using SPSS version 21 for the analysis of the Cobb-Douglas production function. The Marginal Value Product and the Mean Factor Production Price (Px) are compared in a factor efficiency analysis. The findings indicated that the usage of production elements, such as land, family labor, labor performed by people outside the family, the quantity of urea fertilizer, SP-36 fertilizer, NPK fertilizer, and insecticides are all ineffective. This calls for a reduction in the utilization of all production factors.

1 Introduction

Bananas, durians, oranges, mangoes, pineapples, and mangosteens are annual fruit and vegetable commodities that significantly contribute to horticulture production. In 2021, 2.51 million tons of oranges were produced, a 7.67% (208.77 thousand tons) decrease over 2020. In 2021, the household sector consumed 1,153,43 thousand tons of oranges, up 29.95% (265,81 thousand tons) from the previous year. Orange consumption is a household activity at 31.58%. With plants generating 18.51 million trees, Siamese orange production will reach 2,717,447 tons in 2022. The nations of East Java, North Sumatra, Bali, and West Kalimantan produce the most oranges. North Sumatra Province contributed 14.73%, and East Java Province 43.37%. West Kalimantan provided roughly 4.79%, and the province of Bali contributed 5.03% [1].

One of Indonesia's orange production centers is in Sambas district. In 2011 and 2021, the Pontianak Siam citrus produced in Sambas declined by an average of 1% per year [2]. Pest assaults, a lack of farmer capital and land, poor agricultural practices, and a low degree of technology adoption by farmers are the factors that caused the reduction in Siam Pontianak

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orange production for more than 10 years [3]. The development of Siam Pontianak oranges in West Kalimantan, on the other hand, is significantly impacted by the issue of production efficiency. Production efficiency can be caused by technical efficiency, allocative efficiency and/or price factors. When production expenses are kept to a minimum at a given output level or are equivalent to a certain set of inputs used to maximize production levels, production efficiency can be said to reflect the efficient resource input for each output [4].

The approach model commonly used to measure production efficiency is the Cobb-Douglas production function. Research on orange production in Batanghari Regency shows that organic fertilizer and labor have a significant effect on Siamese orange production. The variables of production trees, organic fertilizers and chemical fertilizers are relatively efficient, while the variables of pesticides and labor are inefficient [5]. The variables of labor, manure, irrigation have a significant effect on orange production in Tamilnadu, India. Increasing the use of labor will increase orange farming income [6]. DEA analysis is one of the methods that can be used to determine the efficiency of orange production. This research shows that the spread of nematodes and corticosteroids, also the price of water inputs are the main factors that could affect the efficiency of citrus production in West Nubaria, Egypt. Besides, other research also mentioned that marketing problems, including the selling price of the product, the setting of the selling price, and the remote market location also affect the economic efficiency of oranges [7].

Farmers will improve the total amount of oranges produced by using the appropriate production parameters in the most effective and efficient combinations. Unfortunately, there are still many farmers that lack information and/or understanding of how these production parameter's function and could be applied practically on the field. Based on their practices and skills, farmers apply production factors. The nature of farming, which depends on nature and is supported by risk factors such as the use of input factors (such as chemical fertilizers that are not as recommended) as well as pests and diseases, which cause high opportunities for production failures, is still a problem for farming production [8].

Farming efficiency is a measure to measure the success of the production process [9]. The efficiency of a farm is achieved when the process uses the least amount of input to produce the lowest-cost output. Production efficiency will be difficult to achieve if the use of production facilities is not appropriate. For this reason, it is necessary to study the efficiency and use of production factors in Pontianak Siam Orange farming.

2 Research Methodology

2.1 Location and Time of Research

Tebas District was chosen as the research location, it is the center of Pontianak Siam orange production in Sambas Regency. Nine villages were selected as research samples, including Seret Ayon Village, Segedong Village, Pusaka Village, Mensere Village, Sungai Kelambu Village, Serumpun Buluh Village, Pangkalan Kongsi Village, Tebas Sungai Village, and Sejiram Village. Research time is from May to June 2021.

2.2 Data Processing and Sampling Procedure

A basic random sampling methodology was utilized in the sampling technique, and 100 respondents—or % of the population—were the result. Farmers who planted Pontianak Siamese oranges made up the sample in this study.

2.3 Data Processing and Analysis Techniques

Data collection through the use of a questionnaire. Data input is shown using tables. For Siamese oranges, data on farming input and output are required. The input variables include the area of the land parcel, the amount of work performed by family members and outside laborers, the annual amounts of urea fertilizer, NPK fertilizer, sp-36 fertilizer, and pesticides applied. The output data is the selling price of Siam Pontianak oranges.

2.4 Analysis of the Cobb-Douglas Production Function

The functional link between production components is described using Cobb-Douglas Production Function Analysis [10]. The independent variable (X) is the citrus farming production factor in Siam Pontianak. Income as a dependent or impacted variable (Y). When in use, the Cobb-Douglas function is translated into the following logarithmic equation:

$$Y = \beta_0 + \beta_1 X_1 + \in \quad (1)$$

where:
Y = variable dependent
β_0, β_1 = parameter
X_1 = varibel independent
$\in$ = random error

$$Ln\, Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 + \mu \quad (2)$$

Where :
Y was Pontianak Citrus Production (ton/ha)
X1 was the land area.
X2 was the Number of labor in the family (HOK/year)
X3 was the Number of labor outside the family (HOK/year);
X4 was the Number of Urea fertilizers (kg/ha)
X5 was the Number of SP36 fertilizers (kg/ha)
X6 was the Number of NPK fertilizers (kg/ha)
X7 was the Number of Pesticides (lt/ha)
A was Constanta intercept
bi =The estimator parameter, the elasticity of each production factor
μ = residual elements (residual)
The traditional premise is applied when analyzing multiple regression models. (William)

2.4.1 The residual normality test

The purpose of this test is to determine whether or not the residual values are normally distributed. Residual values in an effective regression model are normally distributed. A decision should be based on the distribution of data from diagonal sources on the Normal P-P Plot of standardized regression in order to identify it. The regression model is normal and suitable for predicting the independent variable, as well as vice versa if it spreads out and follows the diagonal line [11]. The One-Sample Kolmogorov-Smirnov test procedure is an additional method for determining normality. The following test criteria apply:

a. The data is normally distributed if the Asym Sig 2 tailed Significance value is greater than 0.05.
b. The data is not normally distributed if the Asym Sig 2 tailed Significance value is less than 0.05 [12].

2.4.2 The multicollinear test

A regression model's multicollinearities condition refers to the occurrence of a straight-line connection or a connection between independent variables. Regression models are said to have multicollinearity when some or all the independent variables have a purely linear function. Many co-existing linearities can be seen by observing the values of the Variance Inflation Factor (VIF) and Tolerance. If the VIF and Tolerance values are, respectively, below 10 and above 0, multicollinearity is not predicted to occur.

2.4.3 Test for Heteroscedasticity

When all the data in the observations of the regression model agree with the residual variance, this is known as heteroscedasticity. The technique for direction is Uji Glejser. Regressing variable-variable pairs against the absolute residual value is how the experiment is carried out. The multiplicative (value of all positive values) is the difference between the variable Y's initial value and its final value, and the residual is its difference. If there is a big difference between them

2.4.4 Autocorrelation test

The autocorrelation test is used to determine whether the errors on a time series of observations that are arranged chronologically have a linear relationship. If the investigated data is a time series, an autocorrelation test must be performed; otherwise, the condition must be met [13]. The Durbin Watson (DW) value can be used to perform an autocorrelation test. Autocorrelation does not occur when the DW is between 1,65 and 2,35, 1,21 and 1,21, or 2,35 and 2,79, and it occurs when the DW is between 1,21 and 2,79 [14].

2.4.5 Test t

The test in this regression is used to determine whether there is a statistically significant difference between the independent variable regression model and the dependent variable regression model.
Hypothesis:
Ho: There is no proof that X1, X2, or Y3 understand each other partially. Influence X1, X2, and Y3 in a thrifty way to benefit Y3
Conditions for making an offer:
If Significance > 0.05 (no effect), Ho is accepted.

2.4.6 Uji F

When independent and dependent variables are compared head-to-head, this tool is used to determine whether there are any appreciable differences between them.
Hypothesis:
Ho: There is no cooperative understanding between X1, X2, and Y3.
Hi: X1 and X2 agree on a particular point regarding Y3.
Criteria for evaluating a decision.
- Significancy Ho accepted > 0,05 (no effect)
- If Significancy 0,05, ho rejected (no effect)

2.4.7 Statistical Analysis (R Square)

The extent to which two significant variables, X and Y, influence one another is measured through data analysis. This analysis is used to comprehend the percentage contribution of the independent variable's influence on the dependent variable.

2.4.8 Allocative Efficiency Analysis of Production Factors

The Marginal Value Product (MVP) calculation is used to determine the degree of efficiency of the factors that influence production, where the Marginal Value Product (MVP) for input is equal to the input price X (Px) and is defined as follows:

$$\text{MVP}= {(b.Y.P_y)}/{XMVP} = P_x \quad (3)$$

$$(b.P_y)/X = P_x or\ (b.Y.P_y)/(X.P_x) = 1 \quad (4)$$

The marginal physical product (MPP) is multiplied by the item's price to produce the marginal value product (MVP). The marginal factor cost (MFC) is the cost of a single unit of input. The equality of MVO and MFC would allow one to determine the best use of a specific input [15].

$$\frac{MVP}{MFC} = 1 \quad (5)$$

Y, Py, X, and Px were used in this study as the average values in accordance with [16].

Where:
b was the coefficient of production elasticity and regression.
y = Siame production's standard deviation
Py was the Siame production's average production cost.
x = The typical number of Siame production factors
Px was equal to the average cost of the production factors.

Decision-making criteria [17]:
1. The research hypothesis is accepted if MVPx/Px 1, which indicates that the use of production factors is not effective.
2. The research hypothesis is accepted if MVPx/Px > 1, which indicates inefficient use of production factors.
3. If MVPx/Px = 1, the research hypothesis is disproved because the use of production factors is efficient.

3 Result and Discussion

3.1 Characteristics of Respondent

In the Sambas District, respondents' characteristics include age, farming experience, the number of families, and the education level of the household head. The average age of farmers was between 50.47 and 52.38 years, their average farming experience was between 24.28 and 26.75 years, they had an average of 4.06 to 4.35 family members, and their average education level was between 7.89 and 8.42 years.

3.2. Analysis of Pontianak Siam Orange Farming Production Factors

3.2.1 Test of Model Accuracy

The coefficient of determination, which expresses how much of the variation in the dependent variable is described by the independent variable included in the regression model, is calculated to assess the effectiveness of the model and to gauge the strength of the independent variable's influence on the dependent variable.

Table 1. Model Summary

Model	R	R-Square	Adjusted R Square	Std. The error in the Estimate
Production	0.941	0.885	0.876	0.26

The research model's R-value is 0.941 and its coefficient of determination (R squared) is 0.885, as shown in Table 1 above. This indicates that 88.5% of the dependent variable (production) is affected by the use of large variables (factors of production).

3.2.2 Standard hypothesis testing

In order to make sure the model can be used, the traditional assumption test for multiple linear analysis must be performed. The Normality Test, Multicollinearity Test, Heteroscedasticity Test, and Autocorrelation Test did not reveal any differences from the conventional assumptions in this study.

3.3 Pontianak's Siam Orange Production: Production Factors

The Cobb-Douglas Production Function is employed to examine the variables influencing the production of Pontianak Siamese oranges. Variable Y (production) is the dependent variable in a multiple linear regression analysis, and variable X is the independent variable. Land area, labor performed by family members, labor performed by people outside the family, and urea content make up the independent variable (X).

Comparing the t-count with the t-table with a confidence level of 5% (0.05) will show the impact of each production (X1) on the level of production (Y). The table below shows the findings of the regression analysis on Siam Pontianak oranges. The multiple regression equation shown in the table is as follows:

$$LnY= 5.931-0.112\ LnX1+0.019\ Ln\ X2+ 0.114\ LnX3-0.033\ LnX4+0.217\ LnX5+0.486\ LnX6+0.171\ LnX7.$$

Table 2. Multiple Regression Analysis of Siam Orange Farming Pontianak

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std Error			
Production	5.931	0.534		11.109	0
Land area	-0.112	0.090	-0.078	-1248.000	0.215
Labor in the family	0.019	0.128	0.120	0.151	0.880
Labor outside the family	0.114	0.056	0.167	2.017*	0.047
Urea fertilizer	-0.033	0.072	-0.320	-0.459	0.647
SP36 fertilizer	0.217	0.760	0.207	2.85*	0.050
NPK fertilizer	0.486	0.076	0.480	6.408*	0.000
Pesticide	0.171	0.780	0.132	2.187*	0.031

The study's findings provide the following explanation of how much a variable's addition or elimination can impact the production of Siam Pontianak oranges as shows in Table 2.

3.3.1 Land area (X1)

Production of Pontianak Siam oranges is negatively correlated with land area. Fruit production from Siam Pontianak orange farming will decrease the more confined the land is for orange farming. According to the findings of a study done in the Tebas District, the average size of the land parcels managed by respondents' farmers is 0.65 ha, ranging from

0.085 to 2.72 ha. Farmers own a medium-sized amount of land, but the level of production is not yet at its best. According to research, a person's property provides the majority of the land used for Siam Pontianak orange farming [18].

At the 95% level of confidence, the probability value for the land area is -0.215, indicating that the land area production factor has no discernible impact. With a regression coefficient value of 0.112, it is possible to estimate that by reducing the land area production factor by 1%, the increase in overall production will be 0.112%. Since the average land area is already at its maximum, the production factor of land area has little impact on the volume of production. The majority of the Siam Pontianak orange growers have an average plot size of 1.22 ha, of which 0.56 ha are planted in rice and 0.65 ha are dedicated to growing oranges.

The findings of this study are consistent with research on the cultivation of pineapples in southern Benin. The area factor and pineapple production in this study had a negative correlation [19]. Production of pineapples was impacted by the reduction in land area. In Ogun state, Nigeria, land area is also inversely related to cassava production [20].

3.3.2 Labor in the family (X2)

Family farming (family farms) heavily relies on the labor of farmers and their families living in the farmer's home. Family workers are essential to the farming industry's success. Since most farmers have very little capital, family labor can take the place of labor outside the family. Family work can reduce overall energy costs.

At the 95% confidence level, the probability value of 0.88 indicates that the production factor of family labor has no appreciable impact on output. The findings of this study are consistent with earlier studies. In the Ethiopian region, labor within the family is positively correlated with and affects potato production.

3.3.3 Labor outside the family (X3)

Labor is a significant human resource factor. To produce the desired output or product, labor serves as managers and drivers of production factors. An adult male workforce, a female workforce, and a child workforce are used to calculate the size of the workforce. According to the analysis of the probability value's results, which came out to be 0.047, the contribution of non-family labor to production is significant at a 95% level of confidence. This research is consistent with other studies. In the Swaziland region of Manzini, employment outside the family has a significant positive impact on organic vegetable production at the 1% level [21]. The production of potatoes in Molo is influenced favorably by outside labor.

3.3.4 Urea Fertilizer (X4)

The total amount of urea fertilizer used over the course of a year at one location, or at various locations, constitutes the urea fertilizer production factor. According to the analysis of the probability value of 0.647, there is a 95% probability that the production factor of urea fertilizer has no discernible impact on output. The use of urea fertilizer is excessive, according to the negative urea fertilizer regression value of -0.033. These outcomes are consistent with studies on the cultivation of rice in Ghana's eastern region. Rice production is decreased when urea fertilizer is used excessively [22].

3.3.5 SP36 Fertilizer (X 5)

The amount of SP-36 fertilizer is 0.005 based on the probability value of the production factor, which indicates that SP-36 fertilizer has a significant impact on production at a 95% confidence level. This indicates that a 1% addition results in a 0.005% increase in production. When compared to no fertilization up to a dose of 4%, the doses of N, P, and K fertilization increased the number of fruits harvested per tree by 31.5%, fruit weight by 50.8%, and reduced loss by 14%.[23]. Farmers need to apply the quality and quantity of each fertilizer to achieve higher yields, indicating that the fertilizer coefficient has a positive and very significant impact on palm oil output [24].

3.3.6 NPK Fertilizer (X6)

According to the analysis of the probability value of the NPK production factor, which came up as 0.000, the production factor in the amount of NPK fertilizer has a 95% confidence level significant impact on production. The production will increase by 0.486% by adding 1% of the NPK fertilizer production factor, according to the regression coefficient value of 0.486. Pontianak Siamese oranges are fertilized with NPK fertilizer in the same way that melons are. In the Kulon Progo district, there is a significant and positive correlation between the use of NPK fertilizer and rising melon production. [25]

3.3.7 Pesticide (X7)

The amount of pesticide obtained is 0.031, which indicates that the production factor of pesticide has a significant impact on production at a 95% confidence level based on the probability value of production factors. The regression coefficient value is 0.171, which indicates that adding 1% of the pesticides production factors will result in an increase in production of 0.171%. The product of the Pontianak Siam orange shops is significantly impacted by the pesticide operation, which is gratefully identified. This is consistent with the findings of Kulon Progo's investigation into melon products [26].

Pesticide development is one of the tools used in the Siam Pontianak citrus farming industry to control plant diseases and pests. Pests and diseases can affect the roots, stems, branches, twigs, leaves, blooms, leaf shoots, and fruit of the Pontianak citrus plant. The use of pesticides can be used to control pests and plant diseases, preserving output. To maintain output, determine whether using pesticides is necessary. Use must be consistent with the dosage and symptoms of the pest attack. When these pesticides are used excessively compared to the recommended dose, pests, and plant diseases develop resistance to them.

3.4 Analysis of the Effectiveness of the Use of Production Factors

The Marginal Value Product (MVP) of the Pontianak Siamese orange production factors has not yet shown any effectiveness. (Table 3). Family labor, outside labor, sp36 fertilizer, npk fertilizer, and pesticides are examples of inefficient production factors. This condition occurs if the difference between MVP and each price is greater than 1. If there is a negative relationship between land area, urea fertilizer price, and MVP, then each production factor is inefficient.

3.4.1 Outside workforce

The use of factors of production of labor outside the family is not efficient because the value of the Marginal Product (MVP) of those factors of production when compared to the price of the labor force (Px3) is 169.41 or more (MVP/Px3>1). By adding one additional unit of labor until the MVP of labor equals the price of labor, efficiency can be attained. The labor regression coefficient for the production of Siam Pontianak oranges is 0.114, according to Table 3. The cost of labor per day is IDR 80,000.

Table 3. Efficiency Analysis of Pontianak Citrus Production Factors

Production Factors	B	Y	X	Py	Px	MVP	MVP/PX	Explanation
Production factors	-0.112	10,907	0.65	10,900	3,000,000	-13.315.266	-4.44	No efficient
Labor within the family	0.019	10,907	146.19	10,900	80,000	2.258.840	28.24	Not yet efficient
Non-Family Labor	0.114	10,907	112.62	10,900	80,000	13,553,038	169.41	Not yet efficient
Urea fertilizer	-0.033	10,907	330.53	10,900	2.670	-3,923,248	-1,469.38	No efficient
SP36 fertilizer	0.217	10,907	264.42	10,900	3.500	25,798,327	7,370.95	Not yet efficient
NPK fertilizer	0.486	10,907	195.42	10,900	4.540	57,778,742	12,726.60	Not yet efficient
Pesticides	0.171	10,907	6.79	10,900	141.390	20,329,557	143.78	Not yet efficient

3.4.2 SP-36 Fertilizer Production Factor

Since the Marginal Value Product (MVP) of the SP-36 fertilizer production factor is 7,370 or greater when compared to the SP-36 fertilizer price (Px5), the use of the SP-36 fertilizer production factor is not efficient. achieved by adding one SP-36 fertilizer unit at the SP-36 fertilizer's cost. In Table 3, it is shown that the SP-36 fertilizer's regression coefficient is 0.217 with an average application rate of 264.42 kg per hectare, the average annual production of Pontianak Siamese oranges being 10,907 kg per ha, the cost of SP-36 fertilizer being IDR.3,500 per kg, and the cost of Pontianak Siamese oranges being IDR.925,470 per hectare. Because farmers disregard the advice, SP-36 fertilizer use is still ineffective. The fertilizer dosage must be increased by about 150 kg/ha since the recommended Sp36 fertilizer rate for oranges is 415 kg per hectare per year. In Pontianak Siam Orange cultivation, SP-36 fertilizer's efficacy has not yet been optimized. The use of SP-36 fertilizer is currently ineffective because the ratio of input costs (NPM) to the selling price is greater than one, according to a study on the productivity of potatoes in the Karo Regency [27].

3.4.3 NPK Fertilizer Production Factor

The use of the NPK fertilizer production factor is not efficient because the Marginal Value Product (MVP) of the factor is 12,726 or more than one (MVP/Px6>1) when compared to the price of the NPK fertilizer (PX6). Reducing the amount of NPK fertilizer by one unit, or the cost of the NPK fertilizer, will increase efficiency. The price of NPK fertilizer is IDR 4,500, the cost of NPK fertilizer is IDR 887,207 per hectare, and the price of Pontianak citrus per kg is IDR 10,900. Table 3 shows that the regression coefficient of NPK fertilizer is 0.486 with an average amount of fertilizer of 195.43 kg per hectare per year. Farmers have not complied with the recommendations, so the use of NPK fertilizer is not yet effective. The fertilization dose must be increased by 554 kg/ha because the recommended amount of NPK fertilizer is 750 kg per hectare per year. The Siam Pontianak orange farmers' use of NPK fertilizer is not yet effective. Research on the application of NPK fertilizer to rice plants in West Seram Regency, Maluku Province, led to the discovery of this condition. When the MVP/PX ratio is greater than 1, it is inefficient. Based on the findings of the research, the local government recommended increasing the fertilizer doses [28].

3.4.4 Pesticide Production Factors

The use of pesticide production factors is inefficient because their Marginal Value Product (MVP) is greater than one (MVP/Px7>1) when compared to pesticide prices (PX7). One additional unit of a pesticide can be added to increase efficiency by ensuring that the pesticide's MVP is equal to its cost. The findings revealed that the average amount of pesticide used over a year was 6.79 liters, the average amount of oranges produced per hectare was 10,907 kg, and the price of pesticide was IDR 141,390 per liter, while the cost of Siamese oranges was IDR 10,900. Pests and plant diseases can be managed by farmers using the proper production factors. Pests and plant diseases can be managed by farmers using the proper production factors. Pest and disease control is thought to be easiest and most effective when pesticides are used. In Pontianak Siamese orange farming, the product's marginal value from pesticides is greater than its price, which is greater than 1. According to research on the Rwandan soybean industry's efficiency, the marginal value product ratio is 1.92, which indicates that the industry is not yet efficient. To combat pest and disease attacks that could harm production, more pesticides were used [29].

4 Conclusion

Utilizing land area, family labor, outside family labor, urea fertilizer, SP-36 fertilizer, NPK fertilizer, and pesticides at the same time as other production factors for Pontianak citrus farming has a significant impact on the production of the industry. While land area, family labor, and urea fertilizer only have a minor impact on the final product of Pontianak citrus farming, factors affecting the production of labor performed outside the family, SP-36 fertilizer, NPK fertilizer, and pesticides have a significant impact.

Family labor, outside family labor, urea fertilizer, sp-36 fertilizer, NPK fertilizer, and pesticides are the factors of production that are used most effectively in the Siam Pontianak citrus farming industry. This means that the use of production needs is not effective.

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