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DETERMINANTS AND PRODUCTION EFFICIENCY OF COCOA FARMING IN MELAYA SUB-DISTRICT, JEMBRANA REGENCY

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Abstract
Cocoa is a leading plantation commodity in Indonesia that contributes significantly to foreign exchange. However, productivity—particularly in Melaya Sub-district, Jembrana Regency, Bali Province—remains low. This study aims to analyze the simultaneous and partial effects of land area, labor, capital, and number of trees on cocoa production, assess the efficiency of production inputs, and determine the scale of cocoa farming operations in Melaya Sub-district. This research adopts a quantitative associative approach with cocoa farmers selected through proportionate stratified random sampling. Data were collected through observation and interviews. The data analysis includes descriptive statistics, Cobb-Douglas regression, classical assumption tests, significance tests, input efficiency analysis, and determination of economic scale. The findings reveal that, simultaneously, land area, labor, capital, and number of trees significantly influence cocoa production. Partially, land area, labor, and capital have a significant positive effect, while the number of trees does not significantly affect cocoa production. Efficiency analysis indicates that land, labor, and capital are still efficient and can be increased, whereas the number of trees is inefficient and should not be increased. The analysis of economic scale shows that cocoa farming in Melaya operates under decreasing returns to scale. These findings imply the need to improve input management to sustainably enhance cocoa farmers' productivity and welfare.
Keywords: land area, labor, capital, number of trees, cocoa production, production efficiency.

INTRODUCTION

Indonesia, as an archipelagic nation rich in natural resources and supported by diverse geographical conditions, is recognized as one of the world's centers of agricultural biodiversity. Stretching from Sabang to Merauke, the Indonesian archipelago encompasses a wide range of climates and soil types, making it ideal for various forms of agriculture, including cocoa—one of the country's main export commodities. Cocoa not only contributes to national foreign exchange earnings but also serves as a livelihood for millions of farmers in regions such as Sulawesi, Sumatra, and Bali. In 2023, Indonesia exported 339.99 thousand tons of cocoa with a value of USD 1,197.7 million, ranking sixth among the world's top cocoa producers, according to the International Cocoa Organization (ICCO) 2022/2023 (BPS, 2023).

The agricultural sector plays a strategic role as a driver of economic development, providing raw materials, employment, and national food security. According to Charles et al. (2018), the success of economic development depends heavily on the advancement of the agricultural sector, both in terms of supply and demand. Data from Statistics Indonesia (BPS, 2023) indicate that the agricultural sector employed 39.45 million people, or 28.21% of the total national workforce—the highest compared to other sectors such as trade (18.99%) and manufacturing (13.83%). However, economic shifts toward the industrial and service sectors have reduced agriculture's contribution to Gross Domestic Product (GDP), creating both challenges and opportunities to enhance the sector's competitiveness (Suwarta, 2023).

Cocoa, as a leading plantation commodity, is well suited to Indonesia's. climate and soil conditions, making it a vital contributor to the national economy (Puspita et al., 2015). Although national cocoa production reached 641,700 tons in 2023, this figure represents a 1.37% decline from the previous year (650,612 tons), with peak production recorded in 2018 at 767,280 tons (BPS, 2023). Approximately 94% of Indonesia's cocoa exports consist of processed products such as cocoa liquor, cocoa butter, and cocoa powder, targeting major markets like Malaysia, the United States, and the Netherlands. Meanwhile, the domestic market—especially the cocoa processing industry in Java—remains a promising absorber of raw cocoa beans (BPS, 2023).

At the regional level, Bali Province contributed 4,897 tons of cocoa in 2023, accounting for only 0.76% of total national production, with Jembrana Regency being the province's largest cocoa-producing area, yielding 3,112 tons (BPS, 2023). Data show that the agriculture, forestry, and fisheries sector in Jembrana significantly contributed to the region's Gross Regional Domestic Product (GRDP), peaking at 22.73% in 2021, underscoring its critical role in the local economy (BPS Jembrana, 2023). However, cocoa productivity in Melaya Sub-district, Jembrana, has declined despite an 11.7% increase in land area—from 1,456.63 ha in 2021 to 1,627.33 ha in 2023—indicating potential inefficiencies in input utilization (Jembrana Sectoral Statistics, 2023).

Efficiency in the use of production inputs such as land, labor, capital, and number of trees is key to improving agricultural productivity. Research by Pakasi et al. (2011) emphasizes the importance of optimal input allocation to achieve maximum profit, while Imran and Indriani (2022) argue that production is a transformation process of inputs into outputs that requires efficient resource management. Production factors like land area have a significant impact on output, as demonstrated by Annas et al. (2021) in a study of rice farmers, where increased land area led to higher farmer incomes.

Optimizing production inputs not only enhances agricultural yields but also improves farmers' welfare. Research by Bintoro et al. (2023) shows that suboptimal input use or inadequate technology can result in low productivity. Therefore, this study aims to analyze the efficiency of cocoa production input use in Melaya Sub-district, Jembrana Regency, focusing on land area, labor,

capital, and number of trees, with the goal of providing recommendations to boost productivity and income among cocoa farmers.

RESEARCH METHODS

This study uses an associative quantitative approach to analyze the influence of independent variables such as land area, labor, capital, and number of trees on the amount of cocoa production in Melaya District, Jembrana Regency. Melaya District was chosen because it has an increasing trend in cocoa land area but its productivity is still relatively low. The study population was 2,130 farmers, with a sample of 117 farmers selected proportionally from 9 villages using the proportionate stratified random sampling technique. This study uses quantitative and qualitative data, both primary and secondary, collected through non-participant observation, structured interviews, and in-depth interviews.

The research variables consist of independent variables (land area, labor, capital, number of trees) and dependent variables (amount of cocoa production), with operational definitions adjusted for one harvest period (around 4 months). Quantitative data includes units such as are, man-days (HOK), million rupiah, tree trunks, and quintals. While qualitative data were obtained from interviews with farmers and extension workers. The selection of respondents was based on the sequential number of the farmer list in each village. The analysis technique of this study uses descriptive and inferential statistics. Descriptive statistics describe the characteristics of the data, such as average production, land area, number of labor, capital, and number of trees used by cocoa farmers. Inferential statistics in this study are multiple linear regression with the Cobb-Douglas production function model to measure the effect of production factors on output. The following is the regression model used in this study.

$$\text{Ln } Y = \beta_0 + \beta_1 \text{Ln}X_1 + \beta_2 \text{Ln}X_2 + \beta_3 \text{Ln}X_3 + \beta_4 \text{ Ln}X_4 + \mu \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Information:

Y = Total cocoa production (Quintal)
X1 = Land Area
X2 = Capital
X3 = Labor
X4 = Number of Trees
α = Constant
β = Regression Coefficient
μ = Peng Variabledisturb

In order for the regression model used to meet the BLUE (Best Linear Unbiased Estimator) assumption, a classical assumption test was carried out which includes: normality test with Kolmogorov-Smirnov, multicollinearity test by looking at the Tolerance and VIF values, heteroscedasticity test with the Glejser Test, and autocorrelation test with the Durbin-Watson Test.

The next stage is testing the influence of land area, labor, capital, and number of trees simultaneously on production. In this case, using the F Test

shows whether all independent variables entered in the model influence simultaneously on the dependent variable. If the F count> F table or significance value ≤ α (0.05) is obtained, it can be interpreted that the independent variables simultaneously influence the dependent variable or vice versa.

The next analysis is testing the influence of capital, labor, and raw materials partially on production. In this case, the t-test is used to test the level of significance of the influence between the independent and dependent variables.

The analysis of the efficiency of the use of production factors is carried out by calculating efficiency by multiplying the production coefficient by the average output and its price, then dividing it by the average use of each production factor which is also multiplied by its price. This formula can be stated as follows (Suyana, 2016:88-89).

$$\mathrm{Ef} = \beta \frac{\hat{\mathrm{Y}}\mathrm{H_y}}{\dot{\mathrm{X}}\mathrm{H_{Xi}}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Information:

Ef = Economic efficiency
β = Variable regression coefficient
$\hat{\mathrm{Y}}$ = Averageoutput
$\mathrm{H_y}$ = Priceoutput
$\dot{\mathrm{X}}$ = Averageinput
$\mathrm{H_{Xi}}$ = Priceinput

Determining the efficiency of the use of production factors is carried out using the following criteria.

1) Ef < 1, means that the use of the i-th production factor is not efficient and is not at its maximum so it does not need to be increased.
2) Ef = 1, means that the use of the i-th production factor is efficient and maximum so that it does not need to be increased.
3) Ef > 1, means that the use of the i-th production factor is efficient but not yet optimal so it can still be improved.

The final stage is to determine the economic scale, based on the regression equation in the form of a Cobb-Douglas function.

1) If β1 + β2 + β3 + β4 > 1 then the amount of cocoa production in Melaya District is in a condition of increasing returns to scale.
2) If β1 + β2 + β3 + β4 = 1 then the amount of cocoa production in Melaya District is in a condition of constant returns to scale.
3) If β1 + β2 + β3 + β4 < 1, then the amount of cocoa production in Melaya District is in a condition of decreasing returns to scale.

RESEARCH DISCUSSION

Data Analysis Results

Descriptive Statistical Analysis Results

Table 1. Results of Descriptive Statistical Analysis

Variables	N	Min	Max	Mean	Std. Deviation
Y	117	1.30	20	5.694017	4.044713

X1	117	20	225	101.2393	65.85612
X2	117	25	180	57.73504	25.05594
X3	117	2	9	3.914530	1.831584
X4	117	90	1,060	474.4444	307.9225

Source: Eviews processing results, 2025

Based on Table 1, the number of observations in the study is 117 data. The number of independent variables in this study is four variables, namely land area (X1), labor (X2), capital (X3), and number of trees (X4) and one independent variable, namely the amount of production (Y).

The production quantity variable has an average value of 5.69. This means that the average amount of cocoa production in Melaya District, Jembrana Regency is 5.69 quintals. The production quantity variable has a minimum value of 1.30 and a maximum value of 20, which shows that the amount of cocoa production in Melaya District, Jembrana Regency is the lowest at 1.30 quintals and the highest is 20 quintals.

The land area variable has an average value of 101.23. This means that the average land area in Melaya District, Jembrana Regency is 101.23 ares. The land area variable has a minimum value of 20 and a maximum value of 225, which shows that the land area in Melaya District, Jembrana Regency is the lowest at 20 ares and the highest at 225 ares.

The labor variable has an average value of 57.73. This means that the average workforce in Melaya District, Jembrana Regency is 57.73 HOK. The labor variable has a minimum value of 25 and a maximum value of 180, which indicates that the workforce in Melaya District, Jembrana Regency is the lowest at 25 HOK and the highest at 180 HOK.

The capital variable has an average of 3.91. This shows that the average capital in Melaya District, Jembrana Regency is 3.91 million rupiah. The capital variable has a minimum value of 2 and a maximum value of 9, which shows that the use of capital in Melaya District, Jembrana Regency is the lowest at 2 million rupiah and the highest at 9 million rupiah.

The variable number of trees has an average of 474.44. This shows that the average number of cocoa trees in Melaya District, Jembrana Regency is 474.44 trees. The variable number of trees has a minimum value of 90 and a maximum value of 1,060, which shows that the number of cocoa trees in Melaya District, Jembrana Regency is the lowest at 90 trees and the highest at 1,060 trees.

Based on the results of the analysis using the eviews program, a regression equation can be prepared in the form of a Cobb-Douglas production function as follows.

$\ln\hat{Y}$ =2.011 + 0.539lnX1 + 0.324lnX2 + 0.162lnX3 – 0.048lnX4
Prob = (0.0000) (0.0000) (0.0000) (0.1307)
t = (17,013) (10,438) (6,3956) (-1,5223)
R2 = 0.9542 Fcount = 583.6712 Prob (F-Statistic) = 0.0000

Classical Assumption Test Results

To determine whether this model has fulfilled the classical assumption tests one by one as follows.

1) Normality Test Results

The value of Prob. Jarque-Berra in the regression model is 0.296729 greater than α = 0.05 which states that the residuals are normally distributed or pass the normality test. The regression model is suitable for further analysis.

2) Heteroscedasticity Test Results

Table 2. Results of Heteroscedasticity Test

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

F-statistic	0.915180	Prob. F(4,112)	0.4578
Obs*R-squared	3.703107	Prob. Chi-Square(4)	0.4477
Scaled explained SS	3.108097	Prob. Chi-Square(4)	0.5399

Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Date: 04/20/25 Time: 22:32
Sample: 1 117
Included observations: 117

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.082244	0.059537	1.381386	0.1699
LNX1	0.009493	0.017606	0.539185	0.5908
LNX2	0.021898	0.017258	1.268888	0.2071
LNX3	-0.021557	0.014132	-1.525403	0.1300
LNX4	-0.019384	0.017543	-1.104955	0.2715

R-squared	0.031650	Mean dependent var	0.091221
Adjusted R-squared	-0.002933	S.D. dependent var	0.062645
S.E. of regression	0.062737	Akaike info criterion	-2.657938
Sum squared resid	0.440823	Schwarz criterion	-2.539896
Log likelihood	160.4894	Hannan-Quinn criter.	-2.610014
F-statistic	0.915180	Durbin-Watson stat	2.081000
Prob(F-statistic)	0.457783		

Source: Eviews data processing results, 2025

The results of the heteroscedasticity test in Table 2 show that overall there is no heteroscedasticity because the Prob F-statistic value is greater than 0.05. The probability value of each independent variable (land area, labor, capital and number of trees) is greater than 0.05. This indicates that there is no heteroscedasticity problem in each variable in the regression model.

3) Multicollinearity Test

Table 3. Multicollinearity Test Results

Variance Inflation Factors
Date: 04/20/25 Time: 22:35
Sample: 1 117
Included observations: 117

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LNX1	0.001005	275.4097	4.737043
LNX2	0.000965	203.9687	2.181406
LNX3	0.000647	14.50051	1.328294
LNX4	0.000997	326.0854	4.606786
C	0.011489	105.3705	NA

Source: Eviews data processing results, 2025

Based on the test results in Table 3, it shows that the value at

Centered VIF column, shows the VIF value of the land area variable of 4.737, labor of 2.181, capital of 1.328, and number of trees of 4.606 is less than 10 so it can be concluded that the regression model is free from multicollinearity.

4) Autocorrelation Test

The DW value is 1.82. Since DW is in the range of DU < DW < 4 - DU, it can be concluded that there is no autocorrelation in the regression model being tested. This means that the residuals of the model are independent of each other, so that the classical assumption of no autocorrelation has been met.

Simultaneous Regression Coefficient Significance Test (F Test)

Table 4. Results of Model Feasibility Test (F Test)

No.	F-Statistic	Prob (F-statistic)	Critical Value	Model Evaluation
1	583.68	0.0000	0.05	Good (fit model)

Source: Eviews data processing results, 2025

Based on Table 4 for the model fit test, it can be seen from the F test that it can be said to be fit if Fcount> Ftable or the probability value of Fcount ≤ 0.05. Therefore, Fcount (583.68)> Ftable (2.45) and the probability value of 0.000 <0.05, then H0 is rejected and H1 is accepted, so it can be concluded that the regression model used is fit.

The Determinant Coefficient (R2) aims to determine how far the influence of the independent variable (independent variable) on the dependent variable. If the R2 value is higher (approaching one) it means the stronger the relationship between the independent variable and the dependent variable. In this study, the value of R2 is 0.954224 or 95 percent. This means that 95 percent of the variation in the amount of cocoa production in Melaya District, Jembrana Regency is influenced by variations in land area, labor, capital, and number of trees, while the remaining 5 percent is influenced by other factors not included in the research model.

Partial Regression Coefficient Significance Test (t-Test)

1) Testing the Influence of Land Area (X1) on the Amount of Cocoa Production in Melaya District (Y)

It is known that the probability value for the land area variable is 0.0000 < 0.05 or the calculated t value = 17.013 > t table = 1.658, so H0 is rejected and H1 is accepted, it can be concluded that the land area partially has a positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency.

2) Testing the Influence of Labor (X2) on the Amount of Cocoa Production in Melaya District (Y)

It is known that the probability value for the labor variable is 0.0000 < 0.05 or the calculated t value = 10.438 > t table = 1.658, then H0 is rejected and H1 is accepted, it can be concluded that labor has a partial positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency.

3) **Testing the Influence of Capital (X3) on the Amount of Cocoa Production in Melaya District (Y)**

It is known that the probability value for the capital variable is 0.0000 < 0.05, the calculated t value = 6.3956 > t table = 1.658, so H0 is rejected and H1 is accepted, it can be concluded that capital partially has a positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency.

4) **Testing the Influence of the Number of Trees (X4) on the Amount of Cocoa Production in Melaya District (Y)**

The coefficient value is -0.048 and the probability value is 0.1307 > 0.05, this means that H0 is not rejected and H1 is not accepted, so it can be concluded that the number of trees partially does not have a positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency.

Analysis of Production Input Usage Efficiency

1) To calculate the efficiency of land area production factors, the following formula can be used:

$$\text{Ef} = 0{,}536\ \frac{5{,}694 \text{ x } 4.500.000}{101{,}667 \text{ x } 60.000}$$

$$\text{Ef} = 0{,}536\ \frac{25{,}623{,}000}{6{,}100{,}020} = 2{,}252$$

The test results obtained a value of Ef > 1, so it can be concluded that the production factor (land area) is still efficient and its use can still be increased.

2) To calculate the efficiency of labor production factors, the following formula can be used:

$$\text{Ef} = 0{,}324\ \frac{5{,}694 \text{ x } 4.500.000}{57{,}744 \text{ x } 100.000}$$

$$\text{Ef} = 0{,}324\ \frac{25.623.000}{5.774.400} = 1{,}437$$

The test results obtained a value of Ef > 1, so it can be concluded that the production factor (labor) is still efficient and its use can still be increased.

3) To calculate the efficiency of capital production factors, this can be done by:
using the following formula:

$$\text{Ef} = 0{,}162\ \frac{5{,}694 \text{ x } 4.500.000}{3{,}915 \text{ x } 0{,}02}$$

$$\text{Ef} = 0{,}162\ \frac{25.623.000}{0{,}0783} = 53{,}013$$

The test results obtained a value of Ef > 1, so it can be concluded that the production factor (capital) is still efficient and its use can still be increased.

4) To calculate the efficiency of the production factor, the number of trees can be done by:
using the following formula:

$$\text{Ef} = -0{,}048\ \frac{5{,}694 \text{ x } 4.500.000}{474{,}444 \text{ x } 20.000}$$

$$\text{Ef} = -0{,}048\ \frac{25.623.000}{9.488.880} = -0{,}00013$$

The test results obtained a value of Ef < 1, so it can be concluded that the production factor (number of trees) is not efficient, so there is no need to increase its use.

Determining Economies of Scale

Economies of scale are as follows.

$\beta 1 + \beta 2 + \beta 3 = 0.539 + 0.324 + 0.162 + (-0.977)$

$= 0.97$

Since $\beta 1 + \beta 2 + \beta 3 + \beta 4 < 1$, it can be concluded that the amount of cocoa production in Melaya District, Jembrana Regency is in a condition of decreasing returns to scale.

Discussion of Research Results

The Influence of Land Area on the Amount of Cocoa Production in Melaya District, Jembrana Regency

The results of the analysis show that, land area partially has a positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency. Because the results of this study show a regression coefficient value of land area of 0.539, it means that if the land area increases by 1 percent, the amount of cocoa production in Melaya District, Jembrana Regency will increase by 0.539 percent assuming other variables, namely labor, capital, and the number of trees are constant. Support for this finding is also seen based on the results of an in-depth interview on March 6, 2025 with one of the farmers who is experienced in the cocoa sector in Melaya District, which shows that farmers realize that the wider the land managed, the greater the opportunity to increase the number of cocoa trees planted optimally. Adequate land area provides flexibility in management and allows efficient use of planting space, thus supporting increased production results.

This finding is in line with Rahim et al. (2012:33) who stated that the wider the land cultivated, the greater the production. Research by Kusuma (2021), Mappigau & Halim (2022), and Priantini & Jember (2021) also shows that land area is an important factor that has a positive effect on production in various agricultural commodities.

The Influence of Labor on the Amount of Cocoa Production in Melaya District, Jembrana Regency

The results of the analysis show that partially, labor provides a real contribution in increasing the amount of cocoa production. Because the results of this study show the value of the regression coefficient of labor of 0.324, meaning that if the land area increases by 1 percent, thenThe amount of cocoa production in Melaya District, Jembrana Regency has increasedby 0.324 percent assuming other variables, namely land area, capital, and number of trees are constant. Based on an in-depth interview with one of the farmers who has been involved in cocoa farming for a long time, it shows that adequate labor supports the smooth running of the production process, especially in important stages such as pruning, fertilizing, and harvesting. Labor also plays a role in

ensuring that garden maintenance activities are carried out on time, so that plants can grow optimally and produce maximum fruit.

These results are supported by Rivai et al. (2023), who found that labor has a positive influence on rice production. Suratiyah (2015) also emphasized the importance of the role of labor in seasonal farming activities. In addition, research by Juliyanti & Usman (2018), Wicaksono (2022), and Sulferi (2016) concluded that labor contributes significantly to increasing the productivity of the agricultural sector.

The Influence of Capital on the Amount of Cocoa Production in Melaya District, Jembrana Regency

The results of the analysis show that partially, capital has a positive and significant effect on the amount of cocoa production in Melaya District, Jembrana Regency. Because the results of this study show a regression coefficient value of capital of 0.162, it means that if the land area increases by 1 percent, the amount of cocoa production in Melaya District, Jembrana Regency will increase by 0.162 percent with the assumption that other variables, namely land area, labor, and number of trees are constant. Support for these results is also seen from an in-depth interview conducted on May 4, 2025 with one of the Heads of the Cocoa Farmer Group, that capital is an important element to finance all stages of production, from purchasing seeds, fertilization, to plant maintenance. The availability of sufficient capital allows farmers to access quality agricultural inputs and apply better cultivation technology, thus having a positive impact on crop yields.

This is reinforced by Arifin (2015:94) who stated that increased production can be achieved through optimal use of capital. Research by Ardhiyansah et al. (2024), Susanti & Budhi (2022), and Prapnuwanti & Sudiana (2019) also shows that capital has a significant effect on increasing production and farmer income.

The Influence of the Number of Trees on the Amount of Cocoa Production in Melaya District, Jembrana Regency

The results of the multiple linear regression analysis of the t-test on the variable Number of Trees (X4) showed that the number of trees did not have a significant effect on the amount of cocoa production in Melaya District, Jembrana Regency. This shows that changes in the number of trees are not strong enough to be used as a basis for statistical conclusions in influencing the amount of cocoa production in the context of this study. Mathematically, the negative coefficient indicates that the addition of the number of trees is actually followed by a decrease in production, but the relationship is not statistically significant. This is likely due to other factors such as excessive planting density, uneven tree age, or less than optimal cultivation practices on land with a large number of trees. Based on in-depth interviews conducted with the coordinator of agricultural extension workers in Melaya District, the results showed that a large number of trees does not always increase production, because the quality of planting and tree arrangement is more important. Adding trees without paying attention to planting distance can reduce light

intensity, increase humidity, and trigger disease. In addition, the mixing of old and young trees causes inequality in results due to differences in productivity phases. This explains why the variable number of trees did not statistically have a significant effect on cocoa production in this study.

This finding is in line with the research of Jagoret et al. (2017) which states that tree density is not always positively correlated in agroforestry systems. Research by Sarlan (2019), Yanti et al. (2018), Carica et al. (2022), and Faradila & Syafmen (2023) also shows that the number of trees does not have a significant effect on production results if not supported by good cultivation practices.

Analysis of Production Input Usage Efficiency

The test results obtained that the efficiency value of the production factors of land area, labor, and capital were classified as inefficient. This can be seen from the efficiency value of the three production factors where the land area, labor, and capital are at a number greater than 1 (one), which means that the use of production factors of land area, labor, and capital is still and can still be increased. According to Suratiyah (2015), viewed from an efficiency perspective, the wider the land that is cultivated, the higher the production and income per unit area. The area of land will determine the scale of the business which will ultimately affect efficiency. In addition, farmers need to strive for agricultural intensification to increase their production results, namely with the five agricultural efforts which include the use of superior seeds, irrigation, fertilization of the right type, dose, time and method. These results are in line with Sarlan (2020) who stated that efficiency greater than 1 indicates that the use of land area production inputs is still efficient and its use can still be increased. In Banyumas, land use in semi-organic rice cultivation is also still efficient (Surosos et al., 2016). These findings are in line with research in Pekalongan which emphasizes the importance of optimizing production factors by farmers, including land use (Muhyidin, 2010).

Economies of Scale

Based on the sum of the regression coefficients of all production factors in the form of land area, labor, and capital, a value of 0.97 was obtained. The calculation results found that the amount of cocoa production in Melaya District is in a condition of decreasing returns to scale or decreasing returns. This can be seen from the regression coefficient of production factors (input) which has a value of less than 1. This means that if the three independent variables are partially multiplied, the growth rate of cocoa production (output) will be smaller than the growth rate of input usage. This result is in line with research (Dewi & Saskara, 2023), that partially the variables of labor, land area, and capital experience a condition of decreasing returns to scale, therefore, to achieve the expected increase in production, farmers can make maximum use of production factors.

CONCLUSION AND SUGGESTIONS

This study concludes that simultaneously, the production factors of land area, labor, capital, and number of trees have a significant effect on cocoa production in Melaya District, Jembrana Regency. Partially, land area, labor, and capital show a positive and significant effect, while the number of trees does not have a significant effect. The efficiency analysis indicates that land area, labor, and capital are used efficiently, but the number of trees is in an inefficient condition. Cocoa farming in this area is in a condition of decreasing returns to scale, indicating that additional input no longer produces a proportional increase in production.

To increase productivity, farmers are advised to optimize production factors by reducing the number of inefficient trees, while increasing land area, labor, and capital allocation. The government is expected to provide support through fertilizer assistance, drilled wells, agricultural tools, and access to low-interest credit such as KUR, with agricultural extension workers playing an active role as information facilitators. Extension workers also need to assist farmers in managing the number of trees, emphasizing the quality of garden arrangement and uniformity of plant age. Further research is recommended to include additional variables to deepen the analysis of factors influencing cocoa production.

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