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The Effect Of Area Area, Production, And Number Of Workers On The Productivity Of Oil Palm Plantations In Indonesia In 2014-2023

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Abstrak: *This study aims to analyze the effect of area, total production, and total labor on the productivity of oil palm plantations in the 10 main oil palm producing provinces in Indonesia during the period 2014-2023. The research method used is a quantitative approach with a panel data regression model. The best model selection used Chow, Hausman, and Lagrange Multiplier tests, which resulted in the Fixed Effect Model (FEM) as the most suitable model. The results of the analysis show that area has a negative and significant effect on productivity, production has a positive and significant effect, while labor has no significant effect. The coefficient of determination (R^2) of 80.21% indicates that the independent variables in this study are able to substantially explain variations in productivity. This finding indicates that there is a need to optimize land and labor management to improve the efficiency of the oil palm plantation sector in Indonesia.*

Keywords: *productivity, oil palm, area, production, labor*



INTRODUCTION

Palm oil is one of Indonesia's leading commodities that has a strategic role in the national economy. As one of the largest producers of Crude Palm Oil (CPO) in the world, Indonesia continues to experience growth in this sector, both in terms of area, production, and labor involved. The success of the palm oil industry is not only demonstrated through its contribution to gross domestic product (GDP) and export earnings, but also in the creation of jobs for millions of people in the agriculture, processing, and distribution sectors.

Indonesia's oil palm plantation area reached 15.4 million hectares in 2023. In comparison, Malaysia has a much smaller oil palm plantation area of around 5.65 million hectares. However, despite having almost three times the land area, Indonesia's palm oil productivity still lags behind that of neighboring Malaysia. By 2022, Indonesia's palm oil productivity will only reach 3.31 tons of CPO per hectare per year, while Malaysia is able to reach 3.56 tons of CPO per hectare/year.

This difference indicates that a large land area does not necessarily increase productivity, so it is necessary to further examine how other factors, such as the amount of production and the number of workers involved, contribute to increasing the efficiency of oil palm production. Indonesia's total oil palm production is higher than Malaysia's, but when calculated on a per hectare basis, there is still a significant gap. This raises questions regarding the effectiveness of the use of such a large area of land, whether the expansion of land that continues to occur has been accompanied by optimization of production per hectare.

Based on data from the Central Bureau of Statistics (BPS, 2023), the national oil palm plantation area has increased significantly from 10.9 million hectares in 2014 to 16.8 million hectares in 2023, which implies that Indonesia's oil palm plantation area has grown by 56% in a decade.

Riau Province has the largest plantation area, reaching 3.49 million hectares, followed by Central Kalimantan (2.04 million hectares) and North Sumatra (2.02 million hectares). This

increase in area has a direct impact on national palm oil production, which will reach 46.99 million tons in 2023, with the largest contribution coming from Riau (8.79 million tons) and Central Kalimantan (4.97 million tons).

Despite continued land expansion, productivity growth per hectare remains a major challenge facing the palm oil sector. This difference in productivity shows that larger land area is not always directly proportional to an increase in optimal yields. This indicates that there are other factors that influence production efficiency, such as plantation management, selection of superior seeds, and effective labor distribution patterns. Several studies have also shown that palm oil productivity in Indonesia is often influenced by soil conditions, planting patterns, maintenance intensity, and the application of modern technology in oil palm cultivation.

In addition to production factors and area, the palm oil sector also depends on labor, as the industry is one of the largest labor-intensive sectors in Indonesia. Based on data from the Palm Oil Plantation Fund Management Agency (BPDPKS, 2023), the sector absorbs more than 16 million workers, with 2.4 million of them being independent smallholders. However, a large workforce is not always directly proportional to increased productivity.

Many previous studies have discussed the factors that influence the productivity and growth of the palm oil industry in Indonesia. Yamani et.al. (2024) found that land area, total labor, and oil palm production have a positive and significant influence on the Gross Domestic Regional Product (GDRP) of the plantation subsector in South Labuhanbatu Regency. The regression results showed that the three independent variables contributed 87% to the GRDP of the plantation subsector, with all variables showing significance at a probability level of less than 0.05%.

Meanwhile, Pranata & Afrianti (2020) also found that labor has a positive and significant effect on oil palm productivity in Afdeling I of Adolina Plantation PT Nusantara IV. In addition, rainfall, number of rainy days, and fertilizer use also have a positive effect on



productivity, while theft of fresh fruit bunches has a negative impact. This study confirms that labor is an important factor in increasing oil palm yields.

Based on this description, this study aims to answer some important questions related to the productivity of the palm oil sector in Indonesia. Specifically, this study will examine how land area affects the productivity of palm oil producing provinces, as well as the extent to which output affects productivity. In addition, this study will also analyze the effect of labor on palm oil productivity at the provincial level. Furthermore, this study will examine the simultaneous influence of the three variables-acreage, production, and labor-on the productivity of palm oil producing provinces in Indonesia over the period 2014 to 2023. This study is expected to provide a comprehensive picture of the effectiveness of resource utilization in the palm oil industry, as well as a basis for more appropriate policy making in improving the efficiency and sustainability of the sector. By understanding the relationship between these variables, the results of this study can also serve as a reference in designing productivity improvement strategies, both through technical, managerial, and plantation-based regional development policies.

Productivity is a concept used to measure the efficiency of the production process to produce output. Broadly speaking, productivity can be defined as the ratio between production output and the amount of resources used. According to Griliches (1967), productivity is a key indicator to assess the efficiency of an economic system and the performance of the industrial sector, including the agricultural and plantation sectors.

Productivity is a very important aspect in the agricultural and plantation sectors because it reflects the effectiveness and efficiency of the production process (Isyanto 2012). It is necessary to distinguish between productivity and production, production is a process that aims to increase the use value of goods and services through the utilization of available production factors. Meanwhile, productivity reflects a combination of effectiveness and efficiency in resource utilization, and is

generally expressed as a ratio between the output produced and the inputs used (Abrori, 2023). Other factors that affect productivity in the plantation sector are human resources, technology application, land area, and environmental conditions (Dewi et al., 2017). Therefore, productivity improvement strategies must consider various aspects in order to provide optimal results.

Productivity is a concept used to measure the efficiency of the production process to produce output. Productivity can be influenced by several factors. Broadly speaking, productivity is affected by two factors, namely internal and external factors. External factors, for example, are influenced by competitors, consumer demand, and government regulations. Internal factors include labor, process, product, capacity, land area, and quality. These are all always related to the quality of the company's production (Sumanth, 1984).

In the context of agriculture, the size of the area determines the potential yield and diversification of crops that can be developed. Area or land, especially in agriculture or plantations, is the entire area used in the planting process. The amount or yield obtained by farmers depends on the area of land. In Indonesia, which is an agricultural country, land is an important factor because it can provide higher returns than other production factors (Mubyarto, 2004).

Area is one of the main factors in oil palm production. The more land area used, the greater the potential production that can be achieved. In the research of Zahara T et.al., (2021), land area has a significant effect on productivity. According to Mosher (1984), the productivity of the resulting farming business depends on the farmer's skills on the agricultural area or land resources owned.

Production is the process of creating goods and services that have added value to meet the needs of society. According to classical production theory, production levels are strongly influenced by the availability of production factors such as labor, capital, and technology (Samuelson & Nordhaus, 2005).



In the agricultural or plantation sector, capital is used to obtain production facilities and other expenses during the business process (Imran & Indriani, 2022). According to Sumanth (1984), productivity is a measure of efficiency that shows the ratio between the output produced and the inputs used. In the context of oil palm plantations, production describes the number of fresh fruit bunches produced, while productivity is usually measured by yield per hectare of land or yield per labor.

Labor is the main factor in the production process that plays a direct role in the creation of added value of a product. According to N. Mankiw (2011), the quality of labor determines the productivity of a company or region. Improving labor skills and education can significantly increase production efficiency and output.

Labor theory addresses the role of labor in the production process and how this factor affects productivity. In classical economic theory, labor is considered one of the main factors of production besides capital and land. Smith (1776), in his book *The Wealth of Nations* emphasized that division of labor increases productivity as workers become more skilled in specific tasks.

According to Ricardo (1817), labor has a close relationship with the theory of wages and productivity. He argued that increased labor productivity would lead to an increase in real wages, which in turn would improve workers' welfare and productivity levels.

The hypotheses of this study:

1. Area size is estimated to have a positive relationship with oil palm productivity.
2. Total production is estimated to have a positive relationship with palm oil productivity.
3. The amount of labor is estimated to have a positive relationship to the increase in oil palm productivity.

METHOD

This research uses a quantitative approach with the object of research, namely 10 provinces in Indonesia that have the largest palm oil income in Indonesia, namely Riau

Province, Central Kalimantan, West Kalimantan, East Kalimantan, South Kalimantan, Jambi, Aceh, North Sumatra, South Sumatra, and West Sumatra. While in this study using a period of 10 years, namely in 2014-2023. The data in this study were obtained from the official website of the Central Bureau of Statistics and supported by the official websites of central and regional agencies related to this research.

This study uses the panel data regression analysis method because panel data regression itself is a regression model whose data observations are based on panel data. Then, panel data regression here is used to determine the effect between independent variables on the dependent variable with the data structure in the form of panel data itself (Gujarati & Potter, 2009). In this study, the calculation is also assisted by using E-Views 12 version software. The following is a form of panel data regression equation model, namely:

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it}$$

Description:

Y_{it}	: Productivity (Kg/Ha)
α	: Constant
X_1	: Total Area (Ha)
X_2	: Oil Palm Production (Ton)
X_3	: Total Labor (Person)
$\beta_1, \beta_2, \beta_3$: Regression Coefficient
i	: Province
t	: Year
ε	: Error Term

In panel data regression, a model test is conducted, which aims to find the best model with three methods, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The three methods are tested using the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test. Then after that, a classic assumption test is carried out which aims to ensure that the results of this study use valid data (Gujarati & Potter, 2009).

RESULTS AND DISCUSSION

Data Analysis Result

To see this effect, this study uses the panel data regression method. In panel data regression, the best model selection must be

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made between the Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM). This best model selection uses the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test.

Table 1. Chow Test Result

Effect Test	Statistic	d.f	Prob.
Cross-section F	5.078966	(9.87)	0,0000
Cross-section Chi-square	42.226340	9	0,0000

Source: Author's Processed Data (2025)

Based on the chow test, it explains that the probability value for Cross-section F and Cross-section Chi-square is 0.0000 which means that the value is smaller than alpha ($0.0000 < 0.05$). Thus, the results of the Chow Test can be concluded that the best model is the Fixed Effect Model (FEM) model.

Table 2. Hausman Test Result

Test Summary	Chi-Square Statistic	d.f	Prob.
Cross-section Random	9.931569	3	0.0192

Source: Author's Processed Data (2025)

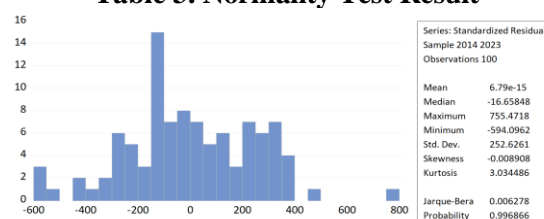
The results of the Hausman Test show the probability value of the Cross-section random is 0.6798 which means that the value is greater than alpha ($0.0192 < 0.05$). Thus, the results of the Hausman Test can be concluded that the best model is the Fixed Effect Model (FEM).

Then for the Lagrange Multiplier (LM) Test does not need to be done because the best model result is the Fixed Effect Model (FEM) model where the Lagrange Multiplier (LM) Test itself is carried out to determine the best model between the Random Effect Model (REM) and the Common Effect Model (CEM) so that no more tests are needed.

Classical Assumption Test

After determining which is the best model in panel data regression, the classical assumption test is carried out first. As stated by

Gujarati & Potter (2009), regression models, including panel data regression models such as the Fixed Effect Model (FEM) model, must still full fill classical assumptions so that the results of the estimation become BLUE (Best Linear Unbiased Estimator). In this study using classical assumption tests, namely normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test.

Table 3. Normality Test Result


Source: Author's Processed Data (2025)

The result of the normality test using the Jarque-Bera method above is a probability value (p-value) of 0.996866 which means that the value is greater than the alpha value ($0.996866 > 0.05$). Thus, the results of the normality test above can be concluded that this study is normally distributed.

Table 4. Multicollinearity Test Results

	Correlation		
	Total Area	Production	Labor
Total Area	1.000000	0.900575	0.780614
Production	0.900575	1.000000	0.787961
Labor	0.780614	0.787961	1.000000

Source: Author's Processed Data (2025)

The results of the above test show that the independent variables used in this study are considered not to have a high correlation value if the correlation value between the independent variables does not exceed 0.90 (Ghozali, 2013). The table above shows that the correlation value between the variables of Land Area and Production has a correlation value of 0.900575,



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which means that this value is not greater than the value of 0.90 ($0.900575 = 0.90$). Then for the variable Land Area and Labor has a correlation value of 0.780614 which means that the value is smaller than the value of 0.90 ($0.780614 < 0.90$). Then the last is between the Production and Labor variables has a correlation value of 0.787961 which means that the value is smaller than the value of 0.90 ($0.787961 < 0.90$). The interpretation of the results in the table above can be concluded that overall between the independent variables there is no multicollinearity problem.

Table 5. Heteroscedasticity Test Results

Variabl e	Coeffici ent	Std. Error	t- Statisti c	Prob .
C	195.316 3	66.944 97	2.9175 65	0.00 45
Total Area	- 0.01398 8	0.0828 71	- 0.1687 94	0.86 64
Producti on	0.00681 4	0.0261 02	0.2610 53	0.79 47
Labor	-6.31E- 06	0.0001 92	- 0.0329 02	0.97 38

Source: Author's Processed Data (2025)

The table above is the result of the heteroscedasticity test using the Glejser method. Based on the results of the heteroscedasticity test, it shows that the overall independent variable has a probability value greater than the alpha value (0.05). The Land Area variable has a probability value of 0.8664 which means greater than the alpha value ($0.8664 > 0.05$), then the Production variable has a probability value of 0.7947 which means greater than the alpha value ($0.7947 > 0.05$), and the last variable, namely Labor, has a probability value of 0.9738 which means greater than the alpha value ($0.9738 > 0.05$). Based on these results it can be concluded that in the selected model there is no heteroscedasticity problem.

Table 6. Autocorrelation Test Results

Statistics	Value	Interpretation
<i>Durbin-Watson Statistic</i>	2.0262 08	No Autocorrelation

Source: Author's Processed Data (2025)

The table above shows the results of the autocorrelation test using the Durbin-Watson value. According to Gujarati & Potter (2009), the ideal Durbin-Watson value to indicate the absence of autocorrelation is around 2. The table above shows that the value of Durbin-Watson is 2.026208 where it can be concluded that there is no autocorrelation problem in the regression model used in this study, because the value of Durbin-Watson is close to 2.

Based on the results of the classical assumption test as a whole, it can be concluded that the regression model in this study passes the classical assumption test itself. So the estimation results in this study can be said to be accurate, efficient, and valid for testing the hypotheses in this study. In addition, the regression model can also be said to be BLUE (Best Linear Unbiased Estimator).

Panel Data Regression Test

Table 7. FEM Regression Results

Variable	Coefficient	t-Statistic	Prob.
C	3378.488	28.04438	0.0000
Total Area	-0.706690	-4.738792	0.0000
Production	0.302635	6.443032	0.0000
Labor	-0.000177	-0.513023	0.6092
<i>R-squared</i>		0.802165	
<i>Adjusted R-squared</i>		0.774877	
<i>F-statistic</i>		29.39661	
<i>Prob(F-statistic)</i>		0.000000	

Source: Author's Processed Data (2025)

The table above is the result of the best model, namely panel data regression using the Fixed Effect Model (FEM) and based on the table above, the results of the calculation of the effect of independent variables, namely Land Area (X1), Production (X2), and Labor (X3) on



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Palm Oil Plantation Productivity (Y) which in the form of an equation is as follows:

$$Y_{it} = 3378.488 - 0.706690 X1_{it} + 0.302635 X2_{it} - 0.000177 X3_{it} + \varepsilon_{it}$$

T Test (Partial)

The T test or partial test is a test used to prove the hypothesis and also aims to find out significantly related to the influence between the independent variables on the dependent variable.

a. Oil Palm Plantation Land Area (X1)

Based on the T test results in the FEM regression results table, the calculated T value is -4.738792 with a significance level of 0.0000. This shows that the T count is greater than the T table (4.738792 > 1.98498) with a significance value smaller than the alpha value (0.0000 < 0.05) and also the coefficient value of the Land Area variable is -0.706690. Thus it can be concluded partially that, Land Area here has a negative and significant effect on the productivity of oil palm plantations. Then it can be interpreted that with a coefficient value of -0.706690 which is if the value of the land area increases by 1% while the value of other variables remains, the value of the productivity of oil palm plantations (Y) will decrease by 0.706690. So, it can be concluded that the higher the value of land area, the productivity of oil palm plantations will also decrease.

b. Oil Palm Plantation Production (X2)

Based on the T test results, it shows the T value of 6.443032 with a significance level of 0.0000. This shows that the T count is greater than the T table (6.443032 > 1.98498) with a significance value smaller than the alpha value (0.0000 < 0.05) and also the coefficient value of the Production variable is 0.302635. Thus it can be concluded partially that, Production here has a positive and significant effect on the productivity of oil palm plantations. Then it can be interpreted that with a coefficient value of 0.302635 which means that if the production value increases by 1% while the value of the other variables remains, the value of the productivity of the oil palm

plantation (Y) will increase by 0.302635. So, it can be concluded that the higher the production value, the productivity of oil palm plantations will also increase.

c. Total Oil Palm Plantation Labor (X3)

Based on the T test results, the T value is -0.513023 with a significance level of 0.6092. This shows that T count is smaller than T table (0.513023 < 1.98498) with a significance value greater than the alpha value (0.6092 > 0.05) and also the coefficient value of the Labor variable is -0.000177. Thus it can be concluded partially that, Labor here has a negative but insignificant effect on the productivity of oil palm plantations. Then it can be interpreted that with a coefficient value of -0.000177 which is if Labor increases by 1% while the value of other variables remains, the value of the productivity of oil palm plantations (Y) will decrease by 0.000177. So, it can be concluded that the higher the value of labor, the productivity of oil palm plantations will also decrease.

F Test (Simultaneous)

Based on the results of the Fixed Effect Model (FEM) regression, it shows that the calculated F value is 29.39661 which is greater than the F table value of 2.699393 (29.39661 > 2.699393) and with a significance value of 0.0000 which is smaller than the alpha value (0.0000 < 0.05). Thus it can be concluded that, the variables of Land Area (X1), Production (X2), and Labor (X3) simultaneously have a significant effect on the Palm Oil Plantation Productivity variable (Y).

Coefficient of Determination

R-squared (R²) here aims to determine how much variation in the value of the dependent variable can be explained by the independent variable. Based on the results of the Fixed Effect Model (FEM) regression, it shows that the value of R-squared (R²) is 0.802165 or 80.2165%. Thus, it can be concluded that the independent variables or variables of Land Area (X1), Production (X2), and Labor (X3) can explain and influence Palm Oil Plantation Productivity (Y) by 80.2165%,

for the remaining 19.7835% is influenced by other variables or factors not used in this study.

Discussion

Effect of Oil Palm Plantation Land Area on Oil Palm Plantation Productivity

Based on the results of the study stated that the Palm Oil Plantation Land Area has a negative and significant effect on the Productivity of Palm Oil Plantations. These results are not in accordance with the hypothesis in this study, where the hypothesis in this study was made on the basis of previous research and also the theory of Sumanth (1984) that productivity itself can be influenced by two factors, namely internal factors and external factors. Internal factors include product, process, land area, labor, and quality. While external factors are influenced by competitors, consumer demand, and government regulations, where this research focuses on internal factors only.

Mubyarto (2004) also stated that Indonesia is an agricultural country where land is an important factor because it can provide greater yields than other factors of production. In addition, it also contradicts Maryam (2002) who states that land area is one of the factors of production that cannot be replaced by other factors of production, or it can be said that the land area itself has special characteristics. The nature in question is land which has a strategic position in terms of production itself, especially in the plantation and agricultural sectors. Land itself is an absolute rule for farmers in order to produce oil palm.

However, the results of this study contradict the theory related to productivity. The results in this study are supported by previous journals and there is also a theory that states that land area itself is one of the important factors in economic activities, especially in the agricultural and plantation sectors. Optimal land area can increase productivity in the agricultural and manufacturing sectors (Fakayode et.al., 2008). In this statement, it is clear that land will increase productivity if it can be optimized. The case in this study can be said that the existing land management is not optimal so that many oil palm fields cannot

produce optimal harvests. This is also supported by previous research which states that the more land used, the more inefficient the land (Yeni & Muslim, 2024). This is also based on the idea that the size of the land will result in farmers being unable to manage and cultivate their land efficiently.

Effect of Oil Palm Plantation Production on Oil Palm Plantation Productivity

The results of this study state that the total production of oil palm plantations has a positive and significant effect on the productivity of oil palm plantations. These results are in accordance with the hypothesis in this study where the hypothesis is based on previous research where the majority of previous studies state the same thing, namely production has a positive and significant effect on the level of productivity of the oil palm plantation itself. It is also in line with the theory used in this study, where the theory states that productivity itself can be influenced by two factors, namely internal factors and external factors. Internal factors include products, processes, land area, labor, and quality. While external factors are influenced by competitors, consumer demand, and government regulations (Sumanth, 1984). This discussion focuses on the internal focus in accordance with the variables in this study.

Thus production here is closely related to productivity itself. As is the case with the results of this study, where when the production of oil palm increases, the productivity level of the oil palm plantation itself will also increase. Furthermore, the results in this study are also in line with previous research which states that the amount of production will determine the success of a plantation where success will be achieved if the output obtained is maximized (Raharjo, 2020). In addition, according to Aswan Novita et.al. (2024) production also has a very positive and significant effect on oil palm productivity, it is proven that the higher the level of production in a unit of land will also increase the productivity of the oil palm plantation itself.

Effect of Oil Palm Plantation Labor on Oil Palm Plantation Productivity



In this study obtained results stating that the number of workers in oil palm plantations has no effect and is not significant to the productivity of oil palm plantations, and also for the relationship of the number of workers to the productivity of oil palm plantations is negative. This can be interpreted that the more the number of workers in the oil palm plantation, the lower the productivity level of the oil palm plantation itself. These results are not in accordance or contrary to the hypothesis in this study which states that the amount of labor has a significant influence on the productivity of oil palm. This hypothesis is based on previous research, such as Nuryartono et.al. (2016), Monita & Zebua (2023), Raharjo (2020) which state that the amount of labor has a significant effect on increasing the productivity of oil palm plantations because the demand for labor itself will continue to grow over time, and if the labor is employed efficiently and effectively right on target it will increase the amount of output and productivity of the oil palm plantation itself.

Then the results of this study are also not in line or contrary to the theory used in this study, namely productivity itself can be influenced by two factors, namely internal factors and external factors. Internal factors include products, processes, land area, labor, and quality. While external factors are influenced by competitors of other companies, consumer demand, and government regulations (Sumanth, 1984). Where this research focuses on internal factors and especially on factors that are in accordance with the variables in this study. In addition, N. Mankiw (2011) states that the quality of labor determines the productivity of a company or region. Improving labor skills and education can significantly increase production efficiency and output. Labor is the main factor in the production process that plays a direct role in creating added value in a product. However, labor here, which is human resources in the management of oil palm plantations, must also have sufficient capacity in terms of management and others.

The results of this study which state that the number of workers in oil palm plantations has no effect and is not significant on the

productivity of oil palm plantations and also has a negative relationship is supported by several previous studies such as Aryanti & Ikhwan (2020), Aswarman (2018), and Munawaroh (2022). Previous studies stated that the relationship between labor and oil palm productivity is not always unidirectional and positive, this is influenced by various factors such as the presence of an excess number of workers and having low work quality. The low quality of the workforce will only increase operational costs but the level of productivity of oil palm does not increase. This is because the level of ability or competence of the workforce is still lacking and the low level of training to develop all of that. In essence, a large number of workers does not always have a linear and positive relationship if the workforce is not managed optimally.

CONCLUSIONS

Based on the results of the study, it can be concluded that the land area of oil palm plantations has a negative and significant influence on productivity, indicating that land expansion without efficient management actually reduces yield per hectare. In contrast, total production has a positive and significant effect, confirming the importance of yield optimization as the key to increasing productivity. Meanwhile, the number of workers shows an insignificant negative effect, indicating that an increase in the number of workers without quality and efficiency improvements does not have a positive impact on productivity.

Based on these findings, it is suggested that land management should focus on efficiency and technology utilization, not merely on expansion. The use of appropriate technology and superior seeds is important to increase production yields per hectare. In addition, improving the quality of labor through training also needs to be a major concern so that workers can work more effectively. Interventions and programs to increase productivity should be prioritized in areas with high production potential such as Riau, North Sumatra and Central Kalimantan, while maintaining the principle of environmental sustainability.

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