Analysis of the Role of Oil Palm Plantation Sub-Sector in Gross Regional Domestic Product of West Kalimantan Province

Caroline Laura Duta, Josephine Wuri*, Antonius Budisusila, Laurentius Bambang Harnoto
Universitas Sanata Dharma, Indonesia
Email: carolineeeld04@gmail.com, josephine@usd.ac.id*, abudisusila@gmail.com, bambang_har@usd.ac.id

ABSTRACT

Oil palm plantations are a very important commodity, especially in supporting the country's economy, creating jobs, and increasing people's income in plantation commodity-producing areas. This study aims to analyze the role of the oil palm plantation subsector in the Gross Regional Domestic Product of West Kalimantan Province. The data used in this study are annual secondary data on oil palm production volume, number of laborers, and Gross Regional Domestic Product of West Kalimantan Province during the 2018–2023 period. The research method used is the fixed effect panel data regression analysis method. The results show that the role of the oil palm plantation subsector in the Gross Regional Domestic Product of West Kalimantan Province is positive and significant. This is evident from the positive and significant influence of palm oil production volume and the number of workers on the GDP of West Kalimantan Province, both partially and simultaneously.

KEYWORDS	*contribution, palm oil, labor, GRDP, fixed effect*

INTRODUCTION

Agriculture is one of the important factors that plays a key role as a main source of food supply and supports economic growth. The development of the agricultural sector not only affects the Gross Domestic Product (GDP), but can also affect the Gross Regional Domestic Product (GDP) which helps regional economic growth, such as provinces or districts/cities (Ardianti, 2025). The role of the agricultural sector, in addition to being the largest contributor to the formation of GDP, also plays a role in the labor absorption and expansion labor and can increase regional cash receipts through increasing exports from agricultural sector commodities (Nadziroh, 2020). This sector is divided into several subsectors,

namely food crops, horticultural crops, plantation crops, livestock, agricultural services and hunting (Abdul, 2023).

The plantation subsector is one of the subsectors that has experienced the most consistent growth, both in terms of land and production (Williadi, As'ad, 2024). The plantation sub-sector is of concern to the government because its production can increase the country's foreign exchange and has great opportunities to increase exports (Pratama et al., 2023). It will directly affect the region's GDP in a significant way, as the plantation subsector becomes a major pillar in the local economy (Ramli & Hiola, 2019).

Oil palm (*Elaeis guineensis* Jacq.) is one of the commodities in the agricultural sector that is included in the plantation crop subsector. This commodity is used in various sectors of daily life (Asir et al., 2022). There are two main products of palm fruit, namely *Crude Palm Oil* (CPO) and *Palm Kernel Oil* (PKO) core oil (Fevriera & Safara Devi, 2023). Palm oil is widely used in a variety of products, from food, cosmetics, to biodiesel fuel. Palm oil production also contributes to regional economic growth, as well as state income through CPO and PKO exports (Basuki, 2021; Hardiyanto, 2021).

Kalimantan is one of the preferred areas for oil palm development after Sumatra, because the island of Kalimantan has a large land, suitable land conditions and agroclimate, making it very possible for oil palm development on a wide scale (Munawir, 2023). West Kalimantan Province is one of the areas that has a large potential for oil palm plants (Junrillah et al., 2021). In this province, an increase in the amount of land available for oil palm plantations follows the high production of oil palm, indicating a correlation between the two (Adzani & Arif, 2023). So that the oil palm plantation subsector becomes a large provider of jobs and a source of community income (Mehraban et al., 2021). This sector also contributes to the GDP of West Kalimantan Province.

The potential of oil palm in West Kalimantan Province has increased from year to year, making this commodity important in providing jobs for the community (Zahara & Anwar, 2021). However, in the midst of this significant economic potential, the existence of oil palm collectors poses quite serious problems regarding the price of Fresh Fruit Bunches (FFB) received by farmers. Collectors buy FFB far below the official price by taking advantage of low bargaining positions, urgent needs and limited access to information that farmers have (Syahputri et al., 2023). The existence of non-transparent weighing and unilateral price cuts on the grounds that the quality of the FFB paid is poor, further reducing farmers' incomes. Although CPO prices have increased in the global market, farmers have not had a positive impact on this, as their profits have been drained by this illegal practice (Chairul & M., 2023).

Previous research on this is still limited to specific regions and has not provided conclusive conclusions. This research will focus on the five districts with the largest oil palm production in West Kalimantan. The five districts are Ketapang with the highest production of 8,618,396 tons, followed by Sanggau, Sintang Landak, and Kapuas Hulu. This is because these districts have the most significant contribution to the regional economy. Data analysis was carried out using fixed effect panel data to overcome the problem of unobserved individual heterogeneity that often occurs. This is a novelty of research in analyzing the role of the oil palm plantation subsector in the GDP of West Kalimantan Province.

RESEARCH METHOD

The research method used is a descriptive quantitative research method, panel data regression model processed using EViews 12. This study uses annual secondary data for West Kalimantan Province 2018-2023. The approach used in this study is panel data, which is a combination of times-series data during the 2018-2023 period and cross-section data covering five districts in West Kalimantan Province.

The data used in this study consists of 2 data, namely dependent variable data in the form of GDP data for West Kalimantan Province and independent variable data in the form of palm oil production volume and number of workers. The data was obtained by researchers through sources from the Central Statistics Agency (BPS) of West Kalimantan Province. The analysis method in this study is panel data regression and data processing using EViews 12 software. The form of the panel data regression model in this study:

$$LPDRB_{it=} \alpha + \beta_1 LPROD_{it} + \beta_2 TK_{it} + \varepsilon_{it}$$

Information:
LPDRB= Gross Regional Domestic Product (ln)
LPROD = Palm Oil Production Volume (ln)
TK   = Total Workforce (Soul)
α   = Constant
β1, β2 = Coefficients Regresi
ε   = Error term

The estimation method using panel data can be carried out through three approaches which include Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM). To choose the most appropriate model to use in managing panel data, several tests were carried out, including the Chow test, the Hausman test and the Lagrange Multiplier test. To ensure that the estimation results meet the BLUE (Best Linear Unbiased Estimator) criteria, it is necessary to test the classical assumptions in regression analysis. In this study, the

classical assumption test used was the normality, multicollinearity test and heteroscedasticity test. In addition, a Hypothesis Test was also carried out to influence the influence of independent variables on dependent variables, both partially and simultaneously.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

In table 1, the Gross Regional Domestic Product (GDP) has a *mean value* of 14.94915 percent, which shows that the average value is close to the median of 14.83536 percent. The range of GDP values is relatively small, with a minimum value of 14.22922 percent and a maximum value of 15.53341 percent, indicating variation, but tends to be stable between regions. The standard deviation of 0.452258 percent indicates that there is a low variation, reflecting that the contribution of oil palm plantations to GDP tends to be stable and consistent.

Table 1 Descriptive Statistics

	LPDRB	LPROD	TK
Mean	14.94915	12.72793	208098.1
Median	14.83536	12.56260	219661.5
Maximum	15.53341	14.80244	279775.0
Minimum	14.22922	11.49381	138815.0
Std. Dev.	0.452258	0.884065	39220.40
Skewness	-0.088248	0.665742	-0.573658
Kurtosis	1.632546	2.647055	2.402785
Jarque-Bera	2.376351	2.371774	2.091251
Probability	0.304777	0.305475	0.351472
Sum	448.4745	381.8378	6242944
Sum Sq. Dev.	5.931586	22.66558	44.600000
Observations	30	30	30

Source: Data processed

The volume of palm oil production has an average of 12.72793 percent, while the median value is slightly lower at 12.56260 percent. The range of production volume values between 11.49381 percent and 14.80244 percent shows a significant variation in the level of palm oil production volume, namely the existence of relatively low to relatively high production due to other factors. The standard deviation of 0.884065 percent indicates that the level of variation is quite substantial in the level of palm oil production volume.

The number of workers has an average of 208098.1 people, with a higher median of 219661.5 people. This shows that the labor force data is leaning towards higher values. The value range of the number of workers is from 138815.0 people to 279775.0 people, indicating a large difference in the number of workers involved/working in oil palm plantations. The standard deviation is 39220.40

people, indicating that the variation is so large that the number of workers employed varies greatly.

2). Determination of Estimation Method
a). Method Determination using Chow Test

Table 2 Chow Test Results

Effects Test	Statistic	d.f.	Prob.
Cross-section F	125.325539	(4.23)	0.0000
Cross-section Chi-square	93.797218	4	0.0000

Source: Data processed

Based on the results of the table 2 test, the cross-section probability value of F is 0.0000 smaller than the significance level of 0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted. This shows that the Fixed Effect Model (FEM) is better used than the Common Effect Model (CEM) for the analysis of panel data in this study.

b). Determination of Method using the Hausman Test

Table 3 Hausman Test Results

Test Summary	Chi-Sq Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	11.267646	2	0.0036

Source: Data processed

Based on the results of the above test, the probability value of random cross-section is 0.0036 smaller than the significance level of 0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted. This shows that the Fixed Effect Model (FEM) is better used than the Random Effect Model (REM) for the analysis of panel data in this study. The existence of a correlation between individual effects and independent variables indicates that FEM is a better choice, as FEM is able to accommodate individual effects as a fixed parameter rather than REM which considers individual effects as random components of error terms.

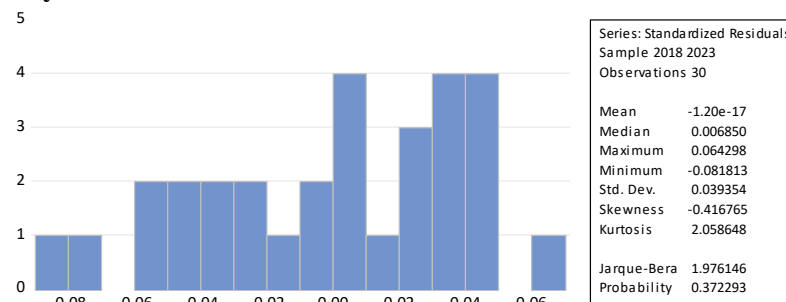## 3). Classical Assumption Test
a). Normality Test

Figure 1 Normality Test Results
Source: data processed

Analysis Of The Role Of Oil Palm Plantation Sub-Sector In Gross Regional Domestic Product Of West Kalimantan Province

From the results of the test in Figure 1, it can be seen that the Jarque-Bera probability value is 1.976146, which is greater than the significance level of 0.05. Thus, the decision taken is to accept H0. This means that the residual regression model is normally distributed, so that the assumption of normality in the regression model has been met. When the assumption of normality is met, it indicates that the regression model used is valid for hypothesis testing, as the estimated sampling distribution of parameters will follow the normal distribution, which is an important condition for valid statistical inference.

b). Multicollinearity Test

Table 4 Multicollinearity Test Results

	LPROD	TK
LPROD	1.000000	0.635576
TK	0.635576	1.000000

Source: Data processed

Based on table 4 of the multicollinearity test results, it can be seen that the value of the correlation coefficient between production volume and the number of workers is 0.635576, which is less than 0.8. Thus, it can be concluded that there is no multicollinearity between independent variables in the regression model. The absence of multicollinearity is a positive thing because it indicates that there is no strong linear relationship between the independent variables of production volume and the amount of labor. This condition shows that the influence of each independent variable on the dependent variable of GDP can be estimated more accurately and reliably. The non-multicollinearity assumptions that are fulfilled ensure that the results of the regression coefficient estimation will not be biased and can be better interpreted separately.

c). Heteroscedasticity Test

Table 5 Heteroscedasticity Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.092434	0.103434	0.893654	0.3808
LPROD	-0.010288	0.009728	-1.057598	0.3012
TK	3.45E-07	3.82E-07	0.904210	0.3753

Source: data processed

Based on the results of the heteroscedasticity test, it can be seen that the probability value of each independent variable, namely the production volume is 0.3012 and the amount of power is 0.3753 which is greater than the significance of 0.05. This shows that there is no heteroscedasticity in this regression. The absence of heteroscedasticity is a positive thing because it is assumed that the variant of the *error term* (residual) is constant at each level of independent variable.
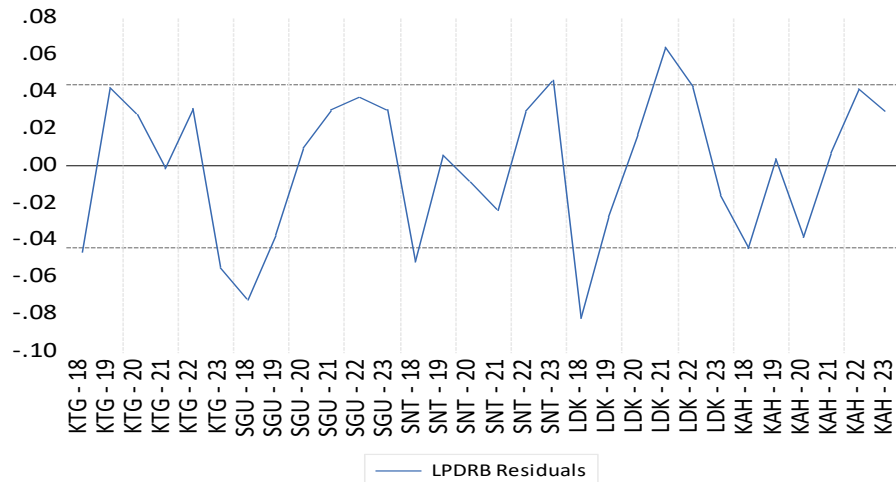
Figure 2. Heteroscedasticity Test Results
Source: data processed

From the residual graph (blue color) it can be seen that the residual value does not cross the limit (500 and -500), meaning that the residual variance is the same for all observations. The residual distribution pattern was relatively even and did not form a systematic pattern throughout the observation period for the five cross-section units. This shows that the variant of the residual is constant. Therefore, it can be concluded that there are no symptoms of heteroscedasticity in the regression model or in other words the model has passed the heteroscedasticity test. This homocedasticity condition is important to ensure that the estimator produced is BLUE (Best Linear Unbiased Estimator) so that the results of the analysis can be trusted and can be used for valid decision-making in this study.

4). Panel Data Regression Analysis

Table 6 Fixed Effect Regression Results

Dependent variable: LPDRB

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.91386	0.217804	63.88250	0.0000
LPROD	0.052536	0.020485	2.564644	0.0173
TK	1.76E-06	8.04E-07	2.190212	0.0389
R-squared	0.992428	Mean dependent var		14.94915
Adjusted R-squared	0.990453	S.D. dependent var		0.452258
S.E. of regression	0.044191	Akaike info criterion		-3.199648
Sum squared resid	0.044915	Schwarz criterion		-2.872702
Log likelihood	54.99472	Hannan-Quinn criter.		-3.095055
F-statistic	502.4117	Durbin-Watson stat		1.200026
Prob(F-statistic)	0.000000			

Source: Data processed

Analysis Of The Role Of Oil Palm Plantation Sub-Sector In Gross Regional Domestic Product Of West Kalimantan Province

If written in a fixed effect panel data regression equation, it is as follows:

$$\text{LPDRB}_{it=} \ 13.9139 + 0.052536 \ \text{LPROD}_{it} + 0.00000176 \ \text{TK}_{it} + \ \varepsilon_{it}$$

Based on the estimated results, the regression equation of panel data is:

Coefficient Interpretation:

1. The constant (α) is 13.91386, this value indicates that if all independent variables are zero, then GDP will be worth 13.91386 percent. This very positive constant value will have a direct economic interpretation in the context of regional economic growth.

2. The coefficient of LPROD (β1) is 0.052536. This coefficient is positive, which means that the volume of palm oil production has a positive effect on GDP. Specifically, any 1 percent increase in palm oil production volume will increase GDP by 0.052536 percent, assuming other variables remain constant.

3. The TK coefficient (β2) is 0.00000176. This coefficient has a positive value, which means that labor has a positive effect on GDP. Any increase in the number of workers by 1 million people/person will increase GDP by 1.76 percent assuming other variables remain constant.

5). Hypothesis Test

a). Test F

Table 7 F Test Results

Model	Prob.
F-statistic	502.4117
Prob(F-statistic)	0.000000

Source: Data processed

From the results of the F test, it can be seen that the F-statistical probability value is 0.000000, which is smaller than the significance level of α = 0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted. This shows that the volume of palm oil production and the number of workers together have a significant influence on the GDP of West Kalimantan Province in the 2018-2023 period.

b). T Test

Table 8 T Test Results

Variabel	Coefficient	Std. Error	t-Statistic	Prob.
C	13.91386	0.217804	63.88250	0.0000
LPROD	0.052536	0.020485	2.564644	0.0173
TK	1.76E-06	8.04E-07	2.190212	0.0389

Source: Data processed

Based on table 8 the results of the T Test are displayed in the regression coefficient table, which can be explained as follows:

1. Variable Volume of Oil Palm Production

The t-statistical probability value for the variable volume of palm oil production is 0.0173, which is less than the significance level of 0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted. This shows that the volume of palm oil production partially has a positive and significant effect on the GDP of West Kalimantan Province. The regression coefficient of 0.052536 indicates that any increase in the amount of production by 1 percent will increase GDP by 0.052536 percent, assuming other variables are constant.

2. Labor Volume Variables

The t-statistical probability value for the labor force variable is 0.0389, which is less than the significance level of 0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted. This shows that the number of workers partially has a positive and significant effect on the GDP of West Kalimantan Province. The regression coefficient of 0.00000176 shows that any increase in the number of workers by 1 million people/person will increase GDP by 1.76 percent, assuming other variables are constant.

Based on the results of the test, it was concluded that the independent variables of oil palm production volume and the number of workers partially had a significant positive influence on the GDP of West Kalimantan Province.

c). Determination Coefficient Test (R2)

Table 9 Determination Coefficient Test

Model	Prob
Adjusted R-squared	0.990453

Source: Data processed

Based on the results of table 9, the regression output in the *adjusted R-squared* value column is 0.990453 or 99.04%. The value of the determination coefficient shows that independent variables consisting of palm oil production and the number of workers are able to explain the GDP variable of West Kalimantan Province of 99.04%, while the remaining 0.96% is explained by other variables that are not included in this research model.

Discussion
The Effect of Oil Palm Production Volume and Number of Labor on the GDP of West Kalimantan Province

The results of the panel data regression showed that simultaneously the volume of palm oil production and the number of workers had a positive and significant influence on the Gross Regional Domestic Product (GDP). The results

of the F Test on the fixed effect panel data regression model showed that the significance value was less than 0.05, which was 0.00, so it can be concluded that H0 was rejected and H1 was accepted. This means that the volume of palm oil production and the number of workers simultaneously have a positive and significant effect on GDP. The value of the coefficient indicates the magnitude of the influence of the independent variable on the dependent variable.

Palm oil commodity data from 2018 to 2023 shows significant growth and its contribution to the economy in agriculture. There has been a consistent increase in palm oil production over the past six years. This is supported by the West Kalimantan government's efforts in developing the oil palm plantation sub-sector in a sustainable and comprehensive manner. In line with this production growth, GDP also shows an overall upward trend. This indicates that the role of the oil palm plantation sub-sector is increasingly playing an important role in the economy of West Kalimantan Province.

The increase in demand for oil palm production volume has resulted in an increase in added value generated by the plantation subsector. This is because the palm oil production units that are successfully harvested and processed will contribute to the GDP. In addition, harvesting activities require more transportation, processing at FFB (Fresh Fruit Bunches) mills, and require greater logistical and financial support.

Labor plays a role through the availability of adequate labor so as to create optimal conditions for oil palm plantations. A workforce that has expertise in the cultivation and processing process of oil palm will have an impact on the optimal volume of palm oil production. The increase in the number of workers in oil palm plantations contributes to the growth of the GDP of West Kalimantan Province.

The results of another study conducted by Yamani et al. (2024) show that independent variables, namely the volume of palm oil production and the number of labor, explain the influence on GDP. This is in accordance with the hypothesis proposed, namely that the volume of palm oil production can increase if production factors in agriculture are utilized to the maximum. Not only will the volume of oil palm production increase, but also the quality produced by each plant that is planted will also be better.

The Effect of Palm Oil Production Volume on the GDP of West Kalimantan Province

The results of the panel data regression showed that the volume of palm oil production partially had a positive and significant influence on the GDP of West Kalimantan Province. The variable of oil palm production volume proved to be significant because the results of the statistical test showed that the probability value was 0.0173 with a significance value of less than 0.05, so it can be concluded

that H0 was rejected and H1 was accepted. This shows that the variable volume of palm oil production has a positive and significant influence on GDP. This means that the more palm oil produced, the greater its contribution to regional economic growth. Increasing oil palm production volumes are driving a range of economic activities, such as farmers earning more decent incomes, wide open jobs in the oil palm plantation sub-sector and mills, and attracting new investments aimed at expanding operations.

The government is committed to increasing the productivity of oil palm plantations by formulating important policies in sustainable oil palm development. The People's Oil Palm Replanting Program (PSR) is a government priority program designed for national palm oil by increasing the productivity of smallholder plantations. Through this program, farmers are facilitated to replace old/unproductive oil palm plants with certified superior seeds. In addition, it is also supported by technical assistance from the local Plantation Office and the People's Oil Palm Replanting Fund (DPSR). The government also supports the application of modern agricultural technology, such as the use of balanced fertilizers, integrated pest control practices and efficient irrigation systems. This aims to increase land productivity by maintaining environmental sustainability.

The results of this study are in line with the results of research conducted by Yamani et al. (2024) showing that the amount of palm oil production has a positive and significant effect on GDP. Increasing the amount of palm oil production will increase GDP. This means that the amount of oil palm production has a significant effect on the GDP of the Plantation Sub-Sector. This is in accordance with the theory that states that an increase in the amount of production due to an increase in land will cause an increase in production. In the end, it will lead to an increase in GDP (Juanda et al., 2021).

The results of another study conducted by Feni & Marwan (2023) show that palm oil production continues to increase from year to year. Increasing oil palm production involves community participation for oil palm cultivation driven by ease of planting and maintenance, as well as the prospect of earning high incomes. Farmers don't need to worry because oil palm is indispensable in various industries so that the crop can be sold at any time.

The Effect of the Number of Labor on the GDP of West Kalimantan Province

The results of the data regression panel show that partially the number of workers has a positive and significant influence on the GDP of West Kalimantan Province. The variable number of labor is proven to be significant because the results of statistical tests show that the probability value is 0.0389 with a significance value less than 0.05, so it can be concluded that H0 is rejected and H1 is accepted. This shows that the number of workers has a positive and significant influence on GDP. A

larger workforce allows the plantation subsector to increase its production volume. The existence of sufficient labor also supports the creation of efficiency in the production and distribution process, and can attract new investments that see the potential of a large and active labor market. Companies also tend to invest in areas that have sufficient labor supply to meet operational needs, ultimately increasing GDP and strengthening regional economic growth.

The government, in an effort to manage the sustainable oil palm plantation sub-sector, has prepared and implemented the Oil Palm Regional Action Plan (RADKSB) which aims to realize oil palm that is environmentally friendly and has a positive impact on the community. This regulation is intended for oil palm industry players, especially independent smallholders to contribute more actively in implementing sustainable principles in oil palm plantations. In addition, the government through the Agriculture Office provides technical assistance and counseling on a regular basis with the aim of ensuring that farmers/workers have the same knowledge and skills as workers in large plantations, so that they can increase oil palm productivity.

The results of this study are in accordance with research conducted by Feninda (2023) which shows that the results of the workforce have a positive and significant effect on GDP. This means that the more labor force, the more productive the workforce, because the larger the labor force will increase labor participation which is able to increase GDP (Juanda et al., 2021). The results of another study conducted by Rozaini (2023) show that the labor variable has a positive influence on GDP. This is because the more labor is absorbed, the more it affects farmers' income and increases the economy.

CONCLUSION

This study finds that both the volume of palm oil production and the number of workers in the oil palm plantation subsector have positive and significant effects on the Gross Regional Domestic Product (GDP) of West Kalimantan Province. Increased production volume drives economic activities such as higher farmer incomes, job creation, and new investments, while a sufficient labor force supports production efficiency and attracts further investment. Together, these factors significantly contribute to the province's GDP, highlighting the growing importance of the oil palm plantation subsector in the regional economy. Future research could explore the environmental and social impacts of expanding oil palm plantations to balance economic growth with sustainability concerns.

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