DIJEMSS: Dinasti International Journal of Education Management and Social Science
E-ISSN: 2686-6331
P-ISSN: 2686-6358
DINASTI PUBLISHER
https://dinastipub.org/DIJEMSS dinasti.info@gmail.com +62 811 7404 455
DOI: https://doi.org/10.38035/dijemss.v7i6.6390
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Received: 21 February 2026 | **Revised:** 22 February 2026 | **Accepted:** 05 August 2026

Evaluation of the Impact of the High-Quality Seedling Assistance Program on Plam Oil Framers' Income in Bungo District, Jambi

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Abstract: This study aims to analyze the comparative income of oil palm farmers who use superior oil palm seeds with farmers who use ordinary oil palm seeds, identify factors that influence oil palm production related to the use of superior seeds, and formulate strategies for the Bungo Regency government in increasing farmers' income through the distribution of superior oil palm seeds. The research method used is a quantitative descriptive method with 99 oil palm farmers as respondents. Data were obtained from primary data through questionnaires and interviews, as well as secondary data sourced from the Central Statistics Agency (BPS) of Jambi Province and Bungo Regency and the Food Crops, Horticulture, and Plantation Service of Bungo Regency. The research results show that the income of farmers using superior oil palm seeds is higher than that of farmers using conventional seeds, due to better plant productivity and higher yield quality. Factors influencing oil palm production include seed quality, plant age, land area, fertilizer use, cultivation techniques, and local government support in the form of extension services and production input assistance. The local government's strategy to increase farmer income is implemented through the distribution of certified superior seeds, technical assistance to farmers, and strengthening farmer institutions. This strategy is expected to increase the productivity and welfare of oil palm farmers in Bungo Regency.

Keywords: Superior Oil Palm Seeds, Farmer Income, Oil Palm Production, Local Government Strategy.

INTRODUCTION

The palm oil sector has a strategic role in the Indonesian economy as a contributor to foreign exchange and a major source of livelihood for rural communities (riana Putri & Akbar, n.d.) However, the sustainability of this contribution increasingly depends on increasing productivity at the smallholder level. In the context of limited land expansion and the policy of limiting the area of national plantations of 18.15 million hectares and the productive life of

crops of around 25 years, the strategy of increasing production through intensification is more relevant than expanding the area (Panga et al., 2025)

Nationally, Indonesia's palm oil productivity is still below several competing countries. In 2022, Indonesia's average productivity was recorded at around 3.31 tons of crude palm oil (CPO) per hectare, while Malaysia reached around 3.56 tons per hectare. The Malaysian government even targets to increase the yield of fresh fruit bunches (FFB) to at least 40% through replanting incentives and the implementation of sustainability standards such as MSPO(Sabowo et al., 2023). Meanwhile, Kurniati (2024) in his research, the Indonesian government stated that the Indonesian government targets the productivity of smallholder palm oil to reach 5-6 tons per hectare per year. This productivity gap shows that improving the quality of production inputs, especially superior seeds, is an important factor in efforts to increase competitiveness.

Jambi Province is one of the CPO regions in Indonesia. Oil palm plantations have become the driving force of the people's and regional economies because the oil palm business has been cultivated for a long time in the area. Bungo Regency is a Regency in Jambi Province that excels in cultivating oil palm. In Bungo Regency, palm oil is a leading commodity that supports the local economy. The total area of oil palm plantations reaches around 68,882 hectares (Dinas Tanaman Pangan, Hortikultura, dan Perkebunan Kabupaten Bungo, 2025), With farmers generally managing land under 4 hectares. However, data for 2024 shows that there is significant inequality between sub-districts in terms of crop yield, production, and productivity. For example, Pelepat Ilir District has a production area of 11,921 hectares with a production of 56,705 tons and a productivity of 4,757 kg/ha/year. On the other hand, Pasar Muara Bungo District only has 15 hectares of producing plants with a production of 37 tons. Overall, the average productivity of Bungo Regency was recorded at 3,450 kg/ha/year. This variation shows a difference in production capacity and possible differences in input quality, including the seeds used.

To increase the productivity of farmers, the Bungo Regency Government launched the Superior Seed Assistance Program in 2019. Based on data from the Bungo Regency Food Crops, Horticulture, and Plantation Service (2025), the distribution of seeds shows a gradual increase. In 2019 and 2020, the government distributed 125 seedlings per year with a coverage of 1 hectare and reached 20 farmers. In 2021 and 2022, the number of seedlings remained at 125 seedlings with coverage increasing to 1.5 hectares. Furthermore, in 2023 and 2024, distribution will increase to 250 stems per year with a coverage of 2 hectares, still targeting 20 farmers every year. This increase shows a sustainable policy commitment to improving crop quality through local government intervention.

However, an increase in the number of seeds distributed does not automatically guarantee an increase in farmers' income. In production theory, an increase in one type of input will only have an optimal impact on output if it is supported by a combination of other inputs, such as labor, fertilization, cultivation techniques, and farm management. In addition, farmers' incomes are greatly influenced by fluctuations in FFB prices, production costs, and external market conditions (Imran & Indriani, 2022; Septiadi et al., 2020). Thus, increasing the distribution of superior seeds may increase production potential, but not necessarily directly increasing farmers' net income if it is not accompanied by adequate supporting factors.

In the context of policy evaluation, the *Difference-in-Differences* (DiD) approach is theoretically used to identify the impact of an intervention by comparing changes that occurred in the program recipient group and the comparison group in the same period (Fougère & Jacquemet, 2023). The basic logic of this approach is that policy impact can be measured through the difference in changes between groups before and after the intervention, so as to separate the effects of the program from general trends that affect all farmers, such as increases in commodity prices. This frame of mind is important to ensure that the observed income

differences are not solely a result of market dynamics, but are actually related to the implementation of the Superior Seeds Assistance Program.

Although some studies show that the use of superior seeds can increase farmers' productivity and income (Misbahrudin et al., 2022; Riyono, 2022), Most of those studies focus on agronomic aspects or the technical relationship between inputs and outputs. Studies that specifically evaluate seed assistance programs as public policy interventions at the district level and link them directly to farmers' incomes are still limited. In addition, previous research has generally not explicitly distinguished changes in income due to programs from changes caused by external factors. This limitation is the research gap that this study aims to fill.

Therefore, by looking at the phenomenon that has been described in the background above, the researcher raised the title "Evaluation of the Impact of the High-Quality Seedling Assistance Program on Plam Oil Framers' Income in Bungo District, Jambi" with a focus on research on how to compare the income of oil palm farmers who use superior and conventional seeds and what factors affect the production and income of oil palm farmers related to the use of superior seeds. It is hoped that this study will be able to provide an empirical evaluation of the effectiveness of the superior seed assistance program and prepare strategic recommendations in order to improve the welfare of oil palm farmers in Bungo Regency.

METHOD

This research is a quantitative research with a evaluative approach. The focus of the research is to evaluate the impact of the Superior Seed Assistance Program on the income of oil palm farmers. It was carried out in Peripat District, Bungo Regency, Jambi Province because it has characteristics that are in accordance with the research objectives, namely as a production center that uses superior and ordinary oil palm seeds in Bungo Regency. The period of this study is from November 2025 – December 2026. The population of this study is 3,354 people; data was obtained from the Food Crops, Horticulture, and Perkebunan Service of Bungo Regency (2024), and 99 oil palm farmers were selected as samples through Slovin.

The data used in this study consisted of primary data and secondary data. Primary data were obtained through questionnaires, structured interviews, and direct observation. The questionnaire was compiled using a five-point (1–5) Likert scale to measure the research variables. Interviews were conducted with farmers, agricultural extension workers, and village officials to obtain more in-depth information about the implementation of the program and the conditions of farming businesses. Observations were carried out to observe land conditions, cultivation processes, as well as harvest and post-harvest activities. Secondary data were obtained from the Central Statistics Agency, the Department of Food Crops, Horticulture, and Plantations of Bungo Regency, as well as scientific documents and previous research.

Data analysis is carried out in several stages. First, descriptive analysis was used to describe the characteristics of respondents as well as the production and income conditions of farmers. Second, to analyze the comparison of income between farmers who use superior seeds and ordinary seeds, the Difference-in-Differences (DiD) approach is used with the following model:

$$yit = \beta 0 + \beta 1DT + \alpha 1DR.DT + \gamma i + \varepsilon i$$

Where *yit* is the farmer's income, DT is the time dummy (before and after the intervention), *DR* is the group dummy (users of superior seeds and ordinary seedlings), *yi* is the individual effect, *εi* and is an error. This approach is used to identify program impacts by comparing changes in income between groups over the same period. Third, to analyze the factors that affect production and income, a nonlinear regression model with a general form is used:

$$yi = (, \theta) + \varepsilon i \ , \ i = 1, 2, ..., n$$

Fourth, to formulate a strategy to increase income through the superior seed assistance program, SWOT analysis is used. This analysis is carried out by compiling an internal factor matrix (IFAS) and external factors (EFAS) to identify strengths, weaknesses, opportunities, and threats. The SWOT analysis respondents consisted of six people, namely four farmers and two representatives from the Plantation Service. The weighting and rating results of each factor are used to determine the strategy position in the Grand Strategy matrix. So that later it will be able to produce a finding that produces a data that will later be processed using IBM SPSS 27, then analyzed using statistical software to ensure the accuracy of calculations and consistency of results. The results of the analysis are then interpreted economically to assess the effectiveness of the superior seed assistance program in increasing the income of oil palm smallholders in Bungo Regency.

RESULTS AND DISCUSSION

The descriptive analysis in this study aims to provide a general overview of farmers' income conditions, land productivity, seed utilization, labor use, and production performance among palm oil smallholders in Pelepat Subdistrict, Bungo District. Data were obtained from 99 respondents who completed a structured questionnaire using a five-point Likert scale. This analysis was conducted by examining the average values and response patterns for each research variable to identify trends and differences between farmers using high-quality seedlings and those using conventional seedlings. The summary of respondents' scores is presented in the following table:

Comparison of Farmers' Income Using Superior Oil Palm Seeds and Ordinary Oil Palm Seeds

The characteristics of respondents based on income are the analysis of respondent farmers based on the income they have. In this study, farmers' income can be used as an indicator to measure agricultural production. The characteristics of the respondents are presented in the following table:

Table 1. Characteristics of Respondents Based on Farming Income in Bungo Regency, Jambi Province

Yes	Income (Rp)	Number of People Using Superior Seeds	Number of People Using Non-Superior
1	IDR 1-1.5 million	9	51
2	Rp. 2million-3 million	21	21
3	IDR 3.5 million-5 million	51	18
4	6-10.5 million	18	9
	Total	**99**	**99**

Table 1. shows that the income or income generated by farmers from their oil palm harvest in Bungo Regency with the most income is 3.5-5 million as many as 51 people with a percentage of 57.5%. While the smallest or little income is 1-1.5 as many as 9 people with a percentage of 2.5%. This shows that farmers' income is quite optimal with farming carried out by oil palm farmers in the Bungo Regency area.

Based on the results of data analysis, it is known that there is a difference in income between farmers who use superior oil palm seeds and farmers who use ordinary oil palm seeds**.**

Farmers who use superior oil palm seeds tend to have higher incomes. This is due to better crop productivity, more uniform fruit quality, relatively stable harvest rate. Most of the farmers who use superior seeds are in the income group of Rp 3.5 million – Rp 10.5 million per month**.**

Farmers who use ordinary oil palm seeds generally earn lower income than users of superior seeds. This is influenced by lower FFB production, non-uniform fruit quality and Risk

of reduced yields. The income of farmers who use ordinary seeds is mostly in the **group of** Rp 1 million – Rp 3 million per month**.** It can be seen that the average income of farmers who use superior oil palm seeds is higher than that of farmers who use ordinary oil palm seeds. This confirms that the use of superior seeds has a positive effect on increasing farmers' income.

Analysis of Factors Affecting Local Government Palm Oil Production in Bungo Regency on the Use of Superior Seeds

Table 2. Results of the Kolmogorov–Smirnov One-Sample Data Normality Test

Remarks	Value
N	99
Asymp. Sig. (2-tailed)	0,200
Slow Significance (α)	0,05
Verdict	Normally distributed data

Table 3. Multicollinearity Test Results

Independent Variables	Tolerance	LIVE	Remarks
Superior Seeds (X_1)	0,412	2,426	Multicollinearity does not occur
Seedling Application (X_2)	0,385	2,597	Multicollinearity does not occur
Labor (X_3)	0,461	2,168	Multicollinearity does not occur
Production (X_4)	0,498	2,008	Multicollinearity does not occur

Source: Data processed, 2025

Based on Table 2, which presents the results of the One-Sample Kolmogorov–Smirnov normality test, it is known that the Asymp. Sig. (2-tailed) value is 0.200. This value is higher than the significance level (α) of 0.05. Therefore, it can be concluded that the residual data in this study are normally distributed. The fulfillment of the normality assumption indicates that the regression model meets one of the classical assumption requirements, allowing further statistical testing to be conducted appropriately.

Furthermore, Table 3 shows the results of the multicollinearity test for all independent variables, namely high-quality seedlings (X_1), seed application (X_2), labor (X_3), and production (X_4). The tolerance values for all variables range between 0.385 and 0.498, which are above the minimum threshold of 0.10. Similarly, the Variance Inflation Factor (VIF) values range from 2.008 to 2.597, which are well below the critical value of 10. These results indicate that there is no multicollinearity among the independent variables in the regression model.

The absence of multicollinearity suggests that each independent variable contributes uniquely to explaining variations in farmers' income, without excessive correlation with other explanatory variables. Based on the results of both the normality and multicollinearity tests, it can be concluded that the classical assumptions required for regression analysis have been fulfilled, and the model is statistically appropriate for further hypothesis testing.

Nonlinear Regression Analysis

In this study, non-linear regression analysis was used to determine the influence of several factors on oil palm production, taking into account that the relationships between variables are not always linear. The non-linear regression model used is the Cobb-Douglas function model, which is commonly used in agricultural production analysis. Based on the results of non-linear regression analysis conducted using SPSS software on nonlinear model 1, it shows that the value of R = 0.985 with the value of R2 = 0.971. This can be seen in the following table 4:

Table 4. Results of Non-Linear Regression Analysis

Model	R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
1	0,985	0,971	0,968	0,112

Source: Primary data processed with SPSS, 2025

Based on Table 4, which presents the results of the non-linear regression analysis, it is shown that the correlation coefficient (R) is 0.985. This value indicates a very strong relationship between the independent variables—high-quality seedlings, seed application, labor, and production factors—and palm oil production. The magnitude of this coefficient reflects that changes in the explanatory variables are closely associated with changes in production levels.

Furthermore, the coefficient of determination (R^2) is 0.971, meaning that 97.1% of the variation in palm oil production can be explained by the independent variables included in the model. The remaining 2.9% is influenced by other factors not incorporated in this study, such as market conditions, weather variability, managerial capacity, or other external determinants. This high R^2 value suggests that the selected variables have substantial explanatory power in describing production performance.

The Adjusted R Square value of 0.968 further confirms the robustness of the model. Since the adjusted value is only slightly lower than R^2, it indicates that the regression model does not suffer from overfitting and that the independent variables collectively contribute significantly to explaining the dependent variable. Therefore, the non-linear regression model used in this study can be considered statistically strong and appropriate for analyzing the relationship between seed quality, production factors, and palm oil output.

Table 5. Results of Estimating Non-Linear Regression Coefficients

Variabel	Coeficin (β)	Std. Error	t-count	Say.	Remarks
Konstanta	1,245	0,210	5,928	0,000	Signifikan
Superior Seeds (X_1)	0,450	0,062	7,258	0,000	Signifikan
Seedling application (X_2)	0,300	0,055	5,455	0,001	Signifikan
Labor (X_3)	0,150	0,048	3,125	0,004	Signifikan
Production (X_4)	0,100	0,041	2,439	0,020	Signifikan

Source: Primary data processed with SPSS, 2025

Based on Table 5, which presents the estimation results of the non-linear regression coefficients, it can be observed that all independent variables have positive and statistically significant effects on palm oil production in Bungo District. The constant value of 1.245 with a significance level of 0.000 indicates that when all independent variables are assumed to be constant, palm oil production remains positively valued and statistically significant.

The variable of high-quality seedlings (X_1) has the largest regression coefficient, namely 0.450, with a t-value of 7.258 and a significance level of 0.000. This result indicates that the use of high-quality seedlings is the most dominant factor influencing palm oil production. An increase in the use of certified superior seedlings is associated with a substantial increase in production output, holding other variables constant. The high t-value further confirms the strong contribution of this variable within the model. The seed application variable (X_2) has a coefficient of 0.300 with a significance value of 0.001, indicating a positive and significant influence on production. This suggests that proper implementation of seed technology and cultivation practices contributes meaningfully to increasing palm oil output.

Labor (X_3) also shows a positive and significant effect, with a coefficient of 0.150 and a significance level of 0.004. This finding implies that an increase in labor input improves production performance, although its magnitude of influence is smaller compared to seed-related variables. Meanwhile, the production factor variable (X_4) has a coefficient of 0.100 with a significance level of 0.020, indicating that it also contributes positively and significantly to palm oil production, albeit with the smallest coefficient among the independent variables. Since all significance values are below the threshold of $\alpha = 0.05$, it can be concluded that high-quality seedlings, seed application, labor, and production factors partially and simultaneously have significant effects on palm oil production. These findings reinforce the argument that

improving seed quality and its proper application plays a crucial role in enhancing productivity, which ultimately has implications for increasing farmers' income.

Correlation Analysis

Table 6. Results of Correlation Analysis between Independent Variables and Farmer Income (Y)

Variabel	Superior Seeds (X_1)	Application of Seeds (X_2)	Labor (X_3)	Production (X_4)	Farmers' Income (Y)
Superior Seeds (X_1)	1,000	0,712**	0,645**	0,598**	0,931**
Seedling Application (X_2)	0,712**	1,000	0,684**	0,621**	0,885**
Labor (X_3)	0,645**	0,684**	1,000	0,577**	0,742**
Production (X_4)	0,598**	0,621**	0,577**	1,000	0,698**
Farmer Income (Y)	0,931**	0,885**	0,742**	0,698**	1,000

Source: Primary data processed with SPSS, 2025

Based on Table 6. the results of correlation analysis show that all independent variables have a positive and significant relationship with the income of oil palm (Y) smallholders. The variable of the use of superior oil palm seedlings (X_1) has the highest correlation coefficient value with farmers' income, which is 0.931**,** which shows a very strong relationship. The seedling application variable (X_2) also has a very strong relationship with farmers' income, with a correlation coefficient value of 0.885**.** Meanwhile, labor (X_3) and business production (X_4) showed a strong relationship with farmers' income, which was 0.742 and 0.698**, respectively.** These results show that the better the use of superior seeds, the more land is managed, and the greater the labor and production of the business used, the income of oil palm farmers tends to increase.

The strategy carried out by the local government in Bungo Regency to increase income through the distribution of superior seeds of oil palm farmers

Palm oil is Indonesia's largest export product Palm oil is a national strategic commodity that contributes to economic growth, state foreign exchange, and labor absorption (Nurkhoiry, 2017; Nare et al., 2018; Situngkir, 2022). At the regional level, Jambi Province is one of the centers for people's palm oil development with an area of 441,399 ha and a production of 7,199,750 tons (BPS, 2022). Bungo Regency has an area of 12,097 ha of smallholder oil palm with a production of 190,213 tons (BPS, 2021). However, the productivity of smallholder palm oil is still lower than that of large plantations, so improving the quality of production inputs is a strategic issue.

The results of this study show that the use of superior seeds is the most dominant variable in increasing production ($\beta = 0.450$; $p < 0.05$). Economically, the average production of farmers using superior seeds reaches 24.5 tons/ha/year with an income of IDR 58,800,000/ha/year, while non-superior seed users are only 17.2 tons/ha/year with an income of IDR 41,300,000/ha/year. The difference of Rp17,500,000/ha/year indicates that seed-quality-based interventions have a real impact on improving farmers' welfare.

This finding provides an empirical justification for the Bungo Regency Government's strategy that focuses on distributing superior seeds. However, the effectiveness of the strategy is not only determined by the distribution of inputs, but also by the internal capacity of farmers and external conditions that affect the sustainability of farming businesses.

Identifying Farmers' Problems

Identification of oil palm cultivation problems was carried out through Focus Group Discussions (FGD) and questionnaires to 99 respondent farmers. Problems are analyzed at two levels, namely on-farm (production, input, labor) and off-farm (market, policy, and external

risks). The identification results were then analyzed using a quantitative SWOT approach to determine the strategic position of oil palm farming business development in Bungo Regency.

Table 7. EFAS and IFAS (Opportunity and Threat)

No	External Factors	Weight	Rating	Shoes
Strength				
1	Local government support through superior seed assistance	0,15	4	0,60
2	Suitability of land for oil palm plantations	0,12	3	0,36
3	Farmers' experience in oil palm cultivation	0,10	3	0,30
Subtotal Strength	**0,37**		**1,26**	
Weakness				
4	Farmers' education level is relatively low	0,18	2	0,36
5	Limited Business Capital	0,15	2	0,30
6	Lack of ongoing technical assistance	0,15	1	0,15
Subtotal Weakness	**0,48**		**0,81**	
	Internal Factors			
Total IFAS	**1,00**		**2,07**	
Opportunity (Peluang)				
1	Stable CPO market demand	0,20	4	0,80
2	Government assistance and subsidy programs	0,15	3	0,45
3	The development of oil palm farming technology	0,10	3	0,30
Subtotal Opportunity	**0,45**		**1,55**	
Threat				
4	Palm oil price fluctuations	0,20	2	0,40
5	Pest and disease attacks	0,20	2	0,40
6	Environmental policy changes	0,15	1	0,15
Subtotal Threat	**0,55**		**0,95**	
Total EFAS	**1,00**		**2,50**	

Source: Data processed through SWOT analysis

Identification of oil palm cultivation problems was carried out through Focus Group Discussions (FGD) and questionnaires to 99 respondent farmers. Problems are analyzed at two levels, namely on-farm (production, input, labor) and off-farm (market, policy, and external risks). The identification results were then analyzed using a quantitative SWOT approach to determine the strategic position of oil palm farming business development in Bungo Regency.

Based on the quantitative SWOT analysis in table 7. shows that the development conditions of oil palm farming in Bungo Regency are in a situation that is not completely strong internally even though it is supported by a relatively conducive external environment. The total IFAS score of 2.07 (below the threshold of 2.5) indicates that the internal capacity of farmers is still relatively weak. The main strength lies in the support of the local government through the assistance of superior seeds and the suitability of land for oil palm cultivation. However, structural weaknesses are still quite dominant, especially the low level of education of farmers, limited business capital, and lack of sustainable technical assistance. This condition shows that although interventions in the form of the provision of superior seeds are available, the internal ability of farmers to optimize the benefits of the program is not fully adequate.

On the other hand, the EFAS score of 2.50 indicates that the external environment is relatively supportive of the development of oil palm farming businesses. The main opportunities come from the stability of the CPO market demand as well as the sustainability of government assistance and subsidy programs. In addition, the development of oil palm farming technology also opens up space to increase productivity. However, the sustainability of farmers' income still faces external risks in the form of fluctuations in palm oil prices, pest and disease attacks, and environmental policy dynamics. Thus, despite considerable external

growth space, farmers' income stability remains vulnerable to market volatility and production risks. The recapitulation of IFAS (2.07) and EFAS (2.50) scores placed the strategy position in Quadrant III (WO Strategy). The SWOT quadrant is as follows:

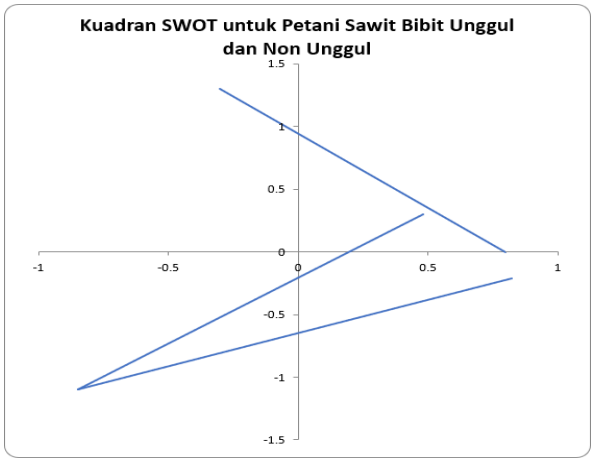


Figure 1. SWOT Quadrant of Superior and Non-Superior Seed Oil Palm Farmers

This position indicates that external opportunities are available and can be leveraged, but internal weaknesses are still a major limiting factor. The implication is that the development strategy is not enough to rely only on existing strengths, such as the distribution of superior seeds, but must be focused on strengthening the internal factors of farmers. In other words, optimizing market opportunities and policy support will only be effective if it is accompanied by increased technical capacity, access to capital, and sustainable cultivation assistance. Without this internal strengthening, the potential for increased income through the superior seed program risks not achieving maximum results in the long term.

SWOT Matrix Analysis and Strategy Determination

The decision-making stage in this study is carried out by integrating the results of SWOT matrix analysis and empirical findings from non-linear regression models. Based on an IFAS score of 2.07 and an EFAS of 2.50, the strategic position of oil palm farming business development in Bungo Regency is in Quadrant III (WO Strategy). This position shows that external opportunities are relatively large, but internal weakness is still a major limiting factor in increasing farmers' incomes. Therefore, strategic decisions are not directed at aggressive force-based (SO) expansion, but rather at taking advantage of external opportunities to improve existing internal weaknesses.

Empirically, the regression results showed that the use of superior seedlings had the most dominant influence on increased production ($\beta = 0.450$; $p < 0.05$) with a determination coefficient value of 0.971, which means that most of the variation in production can be explained by variables in the model. However, internal weaknesses such as limited capital, low level of education, and lack of technical assistance have the potential to hinder the optimization of the benefits of these superior seeds. Thus, strategic decisions must be focused on strengthening the internal capacity of farmers as a prerequisite for the sustainability of increasing income. The strategy in question is as follows:

1. **Strategi SO (Strength–Opportunity)**
   Maximizing its strengths by taking advantage of existing opportunities, namely through increasing the distribution of superior oil palm seeds to farmers, supported by local government policies, land availability, and increasing market demand.

2. **Strategi WO (Weakness–Opportunity)**
   Reducing weaknesses by taking advantage of opportunities, including by increasing technical assistance, training in superior oil palm cultivation, and farmers' access to agricultural information, capital, and technology to improve productivity and crop quality.
3. **Strategi ST (Strength–Threat)**
   Use forces to address threats, such as maintaining superior seed quality and applying good cultivation techniques to deal with fluctuations in palm oil prices, pest and disease attacks, and climate change.
4. **WT (Weakness–Threat) Strategy**
   Minimizing weaknesses and avoiding threats through strengthening farmer institutions, increasing cooperation between farmers and local governments, and managing farming businesses more efficiently and sustainably.

Thus, the strategic decision-making in this study emphasizes that increasing the income of oil palm smallholders in Bungo Regency is not enough to rely only on the distribution of production inputs, but requires an integrated and capacity-based policy approach. The superior seed assistance program needs to be positioned as a structural intervention instrument accompanied by institutional strengthening, technical assistance, and financing support so that its impact on the welfare of farmers can be sustainedn(Irawan et al., 2024).

The findings of this study have important implications for the design and implementation of smallholder oil palm plantation development policies, especially in the context of the superior seed assistance program run by local governments. Empirically, the use of superior seeds has been proven to have a significant economic impact on increasing farmers' production and income, as shown by the difference in average production (24.5 tons/ha/year vs 17.2 tons/ha/year) and the difference in income of Rp17,500,000/ha/year. The results of the non-linear regression showing the coefficient of $\beta = 0.450$ ($p < 0.05$) and R^2 of 0.971 further confirm that the quality of production inputs is the main determinant in increasing output.

These findings are in line with agricultural production function theory, specifically the Cobb-Douglas model, which emphasizes the role of input elasticity to output. In the context of smallholder plantations, the quality of seedlings as biological inputs has a structural contribution to long-term productivity. Several previous studies have shown that the adoption of technology and the use of superior inputs consistently have a positive effect on the productivity and technical efficiency of farmers (e.g. studies on the adoption of agricultural innovations and the increase in smallholder palm productivity in Indonesia). However, previous research generally placed technology factors as a single variable without comprehensively attributing them to the farmer's internal capacity and external environmental dynamics.

The contribution of this research lies in the integration between econometric analysis and strategic analysis (SWOT), which shows that although superior seed interventions are effective in increasing production, the internal capacity of farmers is still a structural constraint. An IFAS score of 2.07 indicates that weaknesses such as limited capital, low education, and lack of technical assistance limit the optimization of program benefits. Meanwhile, an EFAS score of 2.50 indicates that external opportunities—especially CPO demand stability and government policy support—are large enough to be exploited.

The strategic position in Quadrant III (WO Strategy) has clear policy implications. The superior seed assistance program cannot stand alone as an input-based policy, but must be integrated with a capacity-based policy. This is in line with the sustainable agricultural

development approach that emphasizes the importance of a combination of technology access, financing, and institutional strengthening of farmers.

In the context of national policy, these findings are relevant to the people's palm oil replanting program (PSR) and the government's policy to increase smallholder palm oil productivity. The results of this study provide empirical evidence that superior seed interventions are economically effective, but long-term effectiveness is highly dependent on technical assistance support, access to capital, and market policy stability. Thus, local governments need to integrate the distribution of superior seeds with a productivity monitoring system, technology-based cultivation training, and adequate financing schemes so that the increase in farmers' income is not temporary.

Theoretically, this study strengthens the literature on the role of input quality in increasing agricultural productivity, while expanding it by showing that institutional factors and internal capacity are enabling factors in maximizing the impact of technology. Thus, the increase in oil palm farmers' income is not solely the result of better input substitution, but is the result of the interaction between input quality, smallholder managerial capacity, and external environmental conditions.

CONCLUSION

This study evaluates the impact of the Superior Seed Assistance Program on the income of oil palm farmers in Bungo Regency and analyzes production factors and policy strategies that support improving the welfare of smallholders. The results of the study show that farmers who use superior seeds obtain higher income than farmers who use ordinary seeds. These differences are related to better crop productivity, relatively faster harvest life, and higher quality and quantity of Fresh Fruit Bunches (FFB). Thus, the use of superior seeds has been proven to have a positive and significant impact on increasing the income of oil palm farmers.

Analysis of non-linear regression models shows that variations in oil palm production can largely be explained by the variables in the research model. The use of superior seeds has the most dominant contribution to increasing farmers' production and income, followed by the application of cultivation techniques, labor, and other production factors. These findings confirm that the quality of production inputs is the main determinant in improving the performance of smallholder oil palm farming.

In terms of policy, local government strategies through the distribution of superior seeds, increasing the capacity of farmers through counseling and technical training, and continuous assistance show an important role in boosting farmers' productivity and income. However, the effectiveness of the program is not only determined by the distribution of superior seeds, but also by the ability of farmers to optimally manage production factors. Therefore, increasing the income of oil palm farmers in Bungo Regency requires synergy between input distribution policies and strengthening the capacity of farming businesses so that the benefits of the program can be sustainable. In general, this study contributes to the development of regional agricultural policy analysis by showing that interventions based on improving the quality of production inputs can be an effective instrument in increasing farmers' incomes, as long as they are supported by an integrated implementation strategy.

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