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Analysis of Internal and External Factors of Farmers that Influence the Productivity of Self-Help Palm Oil Plantations in Merlung District, West Tanjung Jabung Regency

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ABSTRACT

This study aims to describe the conditions of self-help oil palm farming in Merlung District, West Tanjung Jabung Regency, and analyze the role of internal and external factors on productivity, including their influence through the moderating variable of production input use. Internal factors studied include age, education, farming experience, motivation, number of family members, and farmer ethnicity, while external factors include marketing access, FFB selling price, and access to the carrying market. The analysis was conducted using the Partial Least Square (PLS) method with a sample of 43 farmers. The results showed that oil palm farming is managed conventionally with an average land area of 2.6 ha per farmer. Maintenance activities include fertilization 1–4 times per year, spraying and pruning 1–2 times per year, and harvesting twice per month using family labor and outside labor. Internal factors were proven to have a positive and significant effect on productivity, while external factors did not have a direct effect. However, through moderation in the use of production inputs such as urea, NPK, and dolomite fertilizers, internal factors still have a positive, although not significant, influence, while external factors show a positive and significant influence on the productivity of self-help oil palm farming.

Keywords: Internal Factors, External Factors, Productivity, PLS

INTRODUCTION

West Tanjung Jabung Regency is one of the centers of oil palm plantations in Jambi Province, with a planted area of 88,625 hectares, producing 153,294 tons and a productivity of 1.73 tons per hectare. However, oil palm productivity in this region remains below the national average of 2.19 tons per hectare in 2024. Merlung District is one of the largest oil palm centers, ranking third in West Tanjung Jabung Regency. Merlung District has a planted area of 12,393 hectares, with a yield of 13.98%, and a production of 9.9%, or 15,186 tons, with a productivity of 1.23 tons/ha.

The majority of oil palm varieties in Merlung District are Tenera. A case study in Jambi conducted by Hasibuan (2023) found that properly ripened Tenera variety oil palms from independent smallholders produced a CPO yield of 20.2%. The quality of oil palm in West Tanjung Jabung Regency is 6.8 kg of fresh fruit bunches (FFB) to produce 1 kg of CPO. According to Sipayung (2023), independent oil palm production can reach 35 tons of FFB/ha/year. Based on this research, it can be calculated that by 2024, oil palm in Merlung District will only be able to produce 8.4 tons of FFB/ha/year, meaning productivity has only reached 24%.

Research by Siswanto et al. (2020) found that oil palm production is 86% influenced by factors such as land area, seed quality, fertilizer use, labor, plant age, education level, and other sources originating from outside the oil palm farming sector. In research by Ariyanto et al. (2017), plant age and urea fertilizer use influence oil palm production by smallholders using independent farming methods. Research by Mustari et al. (2020) states that palm oil production is influenced by factors such as labor use, seed type, TSP fertilizer application, herbicide use, and the number of trees. If production factors or production inputs affect palm oil production, they will also affect palm oil productivity. Research by Biky et al. (2023) found that farmer characteristics consist of internal and external factors.

Internal factors include farming experience, formal education level, land area, and farmer income, while external factors include production facilities, capital availability, price guarantees, and full attendance. Based on these studies, it can be concluded that internal factors, external factors, and production input factors significantly influence palm oil productivity. Research by Panjaitan & Paman (2020) found that urea fertilizer affects palm oil productivity. Farahdiba et al. (2025) stated that the application of dolomite fertilizer to oil palm plants affects the number of bunches per hectare, the number of bunches per tree, and the weight of bunches per hectare, while the application of NPK fertilizer affects the weight of bunches per tier.

The productivity of oil palm farming is influenced by the concept of farming as a planned resource management activity to achieve production efficiency (Hasan & Qomariyah, 2003; Mosher, 1968), as well as the utilization of production factors such as land, capital, labor, and expertise (Karmini, 2018; Mubyarto in Wulan et al., 2022). According to Mankiw (2014), capital is one of the production factors that can increase production capacity and productivity. The level of production depends on farmer decisions, such as the amount of input, land area, number of seeds, fertilizers, pesticides, labor and other inputs to be used by farmers (Nainggolan, S., et al., 2024). Independent farmers manage their farms independently with limited capital and technology, so decision-making is greatly influenced by the capabilities of each farmer (Tety et al., 2010). External factors such as support from extension workers, farmer groups, the government, marketing access, and the selling price of fresh fruit bunches (FFB) also influence production decisions, where closer market access and direct sales to the mill tend to increase prices received and productivity (Waldi et al., 2019). Furthermore, the use of chemical fertilizers is an important component, as urea, NPK, and dolomite have been shown to increase the number of bunches, bunch weight, and output per hectare (Panjaitan & Paman, 2020; Farahdiba et al., 2025). Various studies have shown that internal factors such as age, education, experience, motivation, and family size consistently have a significant effect on productivity, while external factors generally have a significant effect when moderated by the use of production inputs (Barus, 2025; Lestari, 2023; Yanita et al., 2023; Nainggolan et al., 2021).

Analysis using PLS-SEM is considered appropriate because it can handle multiple variables, overcome multicollinearity, does not require the assumption of normality, and is effective for predictive research with relatively small samples (Evi, T & Rachbini, W. 2022; Ghozali & Kusumadewi, 2023). Partial Least Squares (PLS) is a powerful analysis method because it does not assume a specific data measurement scale and is suitable for small sample sizes. PLS can be used to confirm theories and explain the presence or absence of relationships between latent variables (Ghozali, 2014). PLS-SEM combines factor analysis and multivariate regression to model relationships between variables with a simpler structure and is more flexible with regard to the assumption of data normality (Hair & Alamer, 2022).

Based on the background and problems presented, this study aims to (1) Describe the picture of the independent pattern of oil palm farming in Merlung District, West Tanjung Jabung Regency, (2) Determine the condition of internal factors (farmer age, farmer education, farming experience, farmer motivation, number of family members) and external factors (access to marketing, FFB selling price and access to the carrying market) that influence the productivity of independent pattern oil palm in Merlung District, West Tanjung Jabung Regency, (3) Analyze the direct influence of internal and external factors of farmers on the productivity of independent pattern oil palm in Merlung District, West Tanjung Jabung Regency, (4) Analyze the influence of internal and external factors of farmers with the moderating variable of the use of production inputs (urea, NPK and dolomite fertilizers) on the productivity of independent pattern oil palm plantations in Merlung District, West Tanjung Jabung Regency.

RESEARCH METHOD

Research Design

This research is a quantitative study using a survey approach to analyze the influence of internal and external factors of farmers on the productivity of independent oil palm plantations, as well as the moderating role of production input use. The analytical method used is Partial Least Square (PLS) because it is able to analyze the relationship between latent variables and reflective indicators with a relatively small sample size. The study was

conducted in 2025 in Merlung District, West Tanjung Jabung Regency, Jambi Province. The research area was selected purposively because it is one of the centers of independent oil palm plantations with relatively low productivity compared to other districts.

Research Target/Subject

The study population was all independent oil palm farmers in Merlung District. According to Wahyudi et al. (2023), the Slovin and Taro Yamane formula can be applied if the population size is known. The sample size of 43 farmers was determined using a simple random sampling technique based on the availability of farmer population data in the research village.

Research Procedure

The research was conducted through several stages: (1) determining the location and research population, (2) compiling the questionnaire instrument, (3) collecting primary data through interviews using questionnaires, (4) collecting secondary data from government agencies, and (5) processing and analyzing data using PLS according to the modeling stages.

Instruments, and Data Collection Techniques

Primary data was obtained through a structured questionnaire containing indicators of internal factors (age, education, experience, motivation, number of family members), external factors (marketing access, fresh fruit bunches (FFB) prices, access to the shoulder market), productivity (production and land area), and production inputs (urea, NPK, dolomite). Secondary data were obtained from the Central Statistics Agency (BPS), the Plantation Service, and other official publications. The research instrument used a Likert scale and a numeric scale according to the characteristics of the variable indicators.

Data analysis technique

The analysis was conducted using Partial Least Square (PLS) with the following stages: (1) designing a measurement model (outer model) to assess the validity and reliability of indicators; (2) compiling a structural model (inner model) to test the relationship between latent variables; (3) constructing a path diagram; (4) converting the model to a mathematical equation; (5) estimating model parameters using the PLS algorithm; (6) evaluating Goodness of Fit through R-square, f-square, and Q-square values; and (7) testing hypotheses through t-statistic and p-value values. The model is used to analyze the direct influence of internal and external factors as well as the indirect influence through the moderating variables of production input.

RESULTS AND DISCUSSION

Overview of Oil Palm Farming in Merlung District, West Tanjung Jabung Regency

Oil palm farming activities carried out by farmers in Merlung District are still relatively conventional. Farmers obtain information regarding cultivation techniques, maintenance, and marketing through informal communication with fellow farmers, direct interaction with agricultural extension workers, and the use of social media. Oil palm maintenance is a crucial aspect of cultivation, affecting productivity and the productive life of the plants. These activities include weed control, pruning (sprouting), and fertilization, which involve family or non-family labor depending on the intensity of the work. Farmers in Merlung District generally eradicate weeds by spraying herbicides such as gramaxone, paratop, and roundup, or mowing with lawn mowers. Pruning is carried out periodically twice a year to remove old fronds, to maintain light circulation, reduce the risk of disease, and facilitate harvesting. Farmers generally use urea, NPK, dolomite, KCL, TSP, and SP36 fertilizers one to three times per year, depending on financial capacity.

Harvesting is the final stage in oil palm cultivation. Plants begin producing at around four years of age and can survive for up to twenty-five years. Fruit is considered ready for harvest when it turns reddish and the fruit bunches begin to fall off. At the research site, harvesting occurs every two weeks, or approximately 24 times per year. The frequency and accuracy of this harvesting technique directly impact the quality and quantity of fresh fruit bunches (FFB), making it a crucial component of farm management.

Overview of Factors Influencing Oil Palm Farming Productivity in Merlung District, West Tanjung Jabung Regency

Internal Factors

- **Farmer Age**

Age is one factor that can influence a person's physical ability in farming. Increasing age tends to reduce their ability to accept new technology. Furthermore, age shapes patterns of thinking, acting, and decision-making in farm management. The ages of farmer respondents in the study area varied, with the youngest being 30 years old and the oldest being 79 years old. The average age of farmers in the study area was 46.8 years. Based on the Manpower Law Number 13 of 2003, the productive age range is set between 15 and 64 years, where farmers in this range are expected to be able to support farm management to achieve optimal production and productivity.

- **Farmer Education**

Education is one factor that can influence the level of oil palm productivity among farmers. Research indicates that 23.3% of farmers graduated from elementary school, 16.3% from junior high school, 46.5% from high school, 2.3% from diploma level, and 11.6% from undergraduate level. The findings indicate that the education level of farmers in the study area is generally in the middle category.

- **Farming Experience**

Farming experience plays a crucial role in farmer management, as field practice allows for learning to address challenges such as weather changes, pest attacks, and market price fluctuations. This experience also shapes strategic decisions regarding the selection of cultivation techniques, technology adoption, and natural resource management. However, length of experience does not automatically guarantee the quality of farming, as farmers with limited experience can excel through intrinsic skills and knowledge. Oil palm farming experience is measured from the time the business is first initiated.

The highest percentage of farmers based on oil palm farming experience in the study area was in the 9-12 years range, at 41.9%. This finding indicates that farmers in the study area have adequate experience in oil palm farming, with an average of 12.5 years of experience.

- **Farmer Motivation**

Farmer motivation is the inner drive of a farmer to achieve a desire and need that drives them to engage in farming. This motivation plays a crucial role in encouraging farmers to adopt innovative practices, such as the use of organic fertilizers or efficient irrigation techniques, which contribute to increased oil palm productivity. The study results showed that 81.4% of farmers with a motivation score of 5, 9.3% with a score of 3, and 9.3% with a score of 1. This indicates that farmers in the study area have high motivation.

- **Family Membership**

In this study, family membership refers to the number of people in a household. The greater the number of family members, the greater the number of dependents and needs within the family. This forces farmers to work harder to meet their family's needs. Productive-age family members can be employed as primary or additional laborers in farming operations to increase oil palm production and productivity.

The majority of families in the study area (62.8%) have 3-4 members, while 11.63% and 25.6% have 1-2 and 5-6 members, respectively.

External Factors

External factors are generally identified as economic factors. These economic factors focus on human behavior, where humans are assumed to act rationally to achieve maximum benefit or utility. Specifically, economic factors include access to marketing, prices, and access to traditional markets.

- **Access to Marketing**

Access to marketing for oil palm in the study area is through two channels: middlemen and direct mills. Farmers who sell their harvests directly to mills are typically those with significant harvests and those with numerous relatives who also cultivate oil palm. Access to marketing can be a factor influencing oil palm productivity because the prices offered by each middleman vary.

Research shows that 81.3% of farmers sell their crops to middlemen. This is due to a lack of access to direct sales to mills. Farmers who sell their crops to middlemen collaborate with them, such as obtaining loans to purchase production inputs (fertilizers, pesticides) and even for family needs.

- **Fresh Fruit Bunch (FFB) Selling Price**

The FFB selling price is the price farmers receive for selling FFB to middlemen or mills (Rp/kg). The price received by respondent farmers varies depending on where they sell their crops. Farmers who sell their crops to middlemen receive lower prices than those who sell directly to mills or to the Palm Oil Mill (RAM). FFB prices are a factor that can influence oil palm productivity, with farmers receiving high FFB prices tending to optimize their farming practices to increase production. The price of Fresh Fruit Bunches (FFB) received by farmers in the study area varies. 19 farmers, or 44.1%, received FFB prices below Rp 2,900/kg.

- **Access to the Pikul Market**

Pikul market access refers to the agricultural roads used by farmers to carry out their farming activities, or the roads used by farmers to transport fruit to the Harvesting Point (TPH) and carry out other farming activities. The better the access to the pikul market, the easier it is for farmers to carry out their farming activities.

In the study area, 53.5% of farmers had difficult access to the pikul market. Only 37.2% had very easy access, and 9.3% had easy access. Farmers with very easy access to the pikul market are those whose oil palm plantations are located near the edge of the road leading to the village or main road, with smooth, level, and unpaved roads. Farmers with easy access to the pikul market are those whose oil palm plantations must pass through other farmers' plantations, but the roads are smooth, level, and unpaved. Meanwhile, farmers with difficult access to the pikul market are those whose oil palm plantations must pass through other farmers' plantations, with roads that are damaged, and full of potholes.

Oil Palm Farming Production and Productivity

Production is the activity of utilizing inputs to produce outputs. The primary input in oil palm farming is land area, with the use of production inputs such as fertilizer. On average, each farmer owns 2.6 hectares of land. Farmers can produce an average of 51.5 tons of palm oil per farmer, or 19.8 tons per hectare per year. Farm productivity is calculated by comparing production yield (output) and land area (input), which is 19.8 tons per hectare. The harvest, in the form of fresh fruit bunches (FFB), is sold directly.

Use of Production Inputs

Factors of production are an economic concept that encompasses all resources used in the process of producing goods and services, such as land, labor, capital, and skills. Karmini (2018) in Wulan et al. (2022) explains that everything provided by nature or society that can be utilized in production activities is included in the factors of production, which consist of four main elements: land, capital, labor, and skills.

The average land area cultivated by farmers in the study area was 2.6 hectares per farmer. The types of fertilizers used included urea, NPK, and dolomite. Urea fertilizer usage was 1,642.1 kg/farmer and 631.6 kg/ha. NPK fertilizer usage was 1,630.1 kg/farmer and 626.9 kg/hectare. Dolomite usage was 781.0 kg/farmer and 300.4 kg/hectare.

Path Diagram Conversion to Equation

Converting path diagrams and PLS measurements into structural equations aims to express causal relationships between various constructs, the values of which can be determined in the PLS software from the PLS algorithm menu.

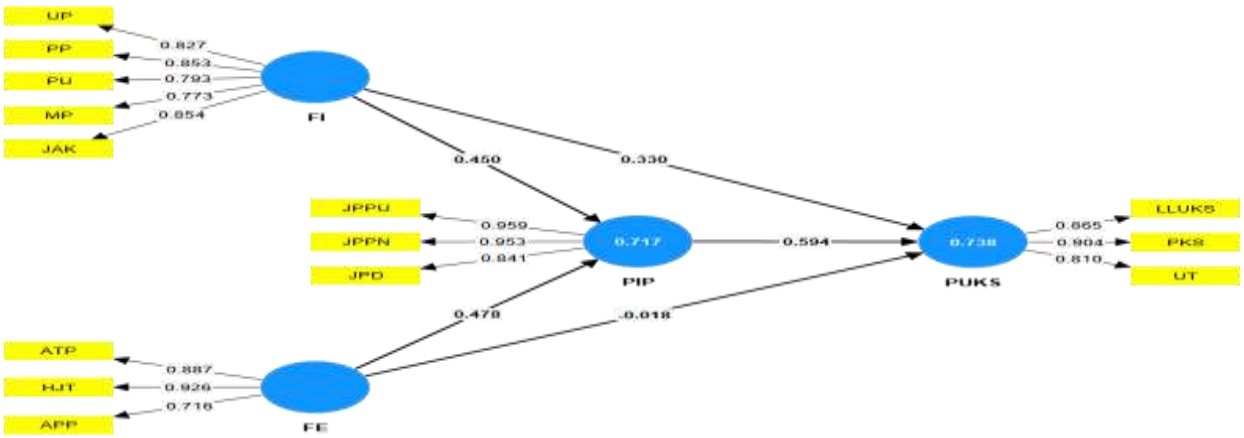

Figure 1. Path Diagram of Indicator Variables of the Influence of Internal and External Factors of Farmers on the Productivity of Self-Help Palm Oil Plantations in Merlung District, West Tanjung Jabung Regency in 2025.

Direct Effect

The direct effect is determined by the results of the path coefficient test. The direct effect represents the relationship between internal variables (farmer age, farmer education, farming experience, farmer motivation, and family size) and external variables (market access, fresh fruit bunch (FFB) selling price, and access to the "pillar" market) on production input usage variables (amount of urea, NPK, and dolomite fertilizer used). The influence of internal factor variables (farmer age, farmer education, farming experience, farmer motivation and number of family members) and external factor variables (marketing action, FFB selling price and access to the carrying market) on oil palm farming productivity variables can be seen in Table 1.

Table 1. Direct Effects Between Latent Variables.

Relationship between Variables	*Path coefficients*	*Sample mean*	*Standard deviation*	*T -statistik*	*P- value*	Information
FI -> PIP	0.450	0.441	0.135	3.336	0.001	Positive and significant
FI -> PUKS	0.330	0.339	0.162	2.034	0.042	Positive and significant
FE -> PIP	0.478	0.490	0.124	3.843	0.000	Positive and significant
FE -> PUKS	-0.018	-0.030	0.206	0.086	0.932	Negative is not significant
PIP -> PUKS	0.594	0.596	0.218	2.723	0.006	Positive and significant

Source: Processed data results of Smart PLS Version 4.0, 2025.

Table 1 shows that internal factors have a direct, positive and significant effect on production input use and a significant, positive effect on oil palm farming productivity. A positive path coefficient with a t-statistic > 1.96 or p-value < 0.05 indicates a significant effect. This means that every 10% increase in internal factors directly increases production input use by 4.50% and productivity by 3.30%. This is consistent with research by (Dewantoro, R 2021) and (Laoli, J 2025).

External factors directly have a positive and significant effect on production input use. This means that every 10% increase in external factors leads to a 4.78% increase in production input use. External factors also have a direct, negative, but insignificant, effect on oil palm farming productivity. This means that every 10% increase in external factors leads to a 0.18% decrease in productivity. The FFB price variable aligns with research (Barus, E BR 2025), which found that commodity prices had no direct effect on potato farming productivity. The use of production inputs directly had a positive and significant effect on oil palm farming productivity. This means that every 10% increase in production input use resulted in a 5.94% increase in farm productivity. This is consistent with research (Laoli, J 2025) and (Lestari, I 2023), which found that fertilizer, as a production input, affected oil palm production.

Indirect Effects

In this study, internal and external factors not only directly influenced farm productivity but also indirectly through the moderating variable of production input use (amount of urea, NPK, and dolomite fertilizer used). Positive or negative path coefficients, with a p-value <0.05, indicate a significant effect. The indirect effects of internal and external variables on farm productivity can be seen in Table 2.

Table 2. Indirect Effects of Internal and External Factor Variables on Farm Productivity.

Relationship between Variables	*Original Sample*	*Sample mean*	*Standard deviation*	*T-statistik*	*P-value*	Information
FI -> PIP -> PUKS	0.267	0.272	0.148	1.800	0.072	Positive and significant
FE -> PIP -> PUKS	0.284	0.281	0.110	2.591	0.010	Positive and significant

Source: Processed data results of Smart PLS Version 4.0, 2025.

Table 2 shows that the coefficient of the internal factor variable indirectly affecting farm productivity through the use of production inputs is 0.267, meaning that every 10% increase in internal factors will increase the productivity of oil palm farming by 2.67%. The coefficient of the external factor variable indirectly affecting farm

productivity through the moderating variable, input use, is 0.284, meaning that every 10% increase in the external factor variable indirectly affects farm productivity by 2.84%. This finding is consistent with research by Iska Malinda (2021), which states that the analysis of related factors indicates that the total coefficient of the indirect influence of economic factors on farm productivity is positive and significant.

Total Influence

The total influence on more than two latent variables is obtained by summing the direct and indirect influences, while the total influence between two latent variables is equivalent to the magnitude of the direct influence (as depicted in the path diagram) between variables in the structural equation model. In this study, there are four latent variables, so the influence analysis can be explained using the concept of total influence. The total influence values of internal and external factors on oil palm farming productivity can be seen in Table 3.

Table 3. Total Influence of Internal and External Factor Variables on Oil Palm Farming Productivity.

Hubungan antar Variabel	*Path coefficients*	*Sample mean*	*Standard deviation*	*T-statistik*	*P- values*	Keterangan
FI -> PIP	0.450	0.441	0.135	3.336	0.001	Positive and significant
FI -> PUKS	0.597	0.611	0.130	4.589	0.000	Positive and significant
FE -> PIP	0.478	0.490	0.124	3.843	0.000	Positive and significant
FE -> PUKS	0.266	0.251	0.166	1.606	0.108	Positive not significant
PIP -> PUKS	0.594	0.596	0.218	2.723	0.006	Positive and significant

Source: Processed data results of Smart PLS Version 4.0, 2025

Table 3 shows that the coefficient relationship resulting from the total influence is nearly identical to the direct influence. The difference lies in the coefficient value of the relationship between internal factor variables and productivity and the coefficient value of external factors on productivity. Internal factors have a positive and significant effect on production input use and farm productivity. This means that for every 10% increase in internal factor variables, production input use increases by 4.50% and productivity increases by 5.97%. The results of the internal factor analysis align with research by Barus, E.B.R. (2025) on farmer age, farmer education, farming experience, and farmer motivation. In this study, increasing farmer age, farmer education, farming experience, and farmer motivation, combined with social factors, will increase productivity. Furthermore, the internal factor variable, family size, is also consistent with research (Lestari, I, 2023).

External factors have a positive and significant effect on production input use and a positive but insignificant effect on productivity. This means that, overall, every 10% increase in economic factors will result in a 4.78% increase in production input usage and a 2.66% increase in farm productivity. The total effect of production input usage on productivity is positive and significant. This means that every 10% increase in production input usage will result in a 5.94% increase in productivity. The results of the analysis of production input usage align with research (Laoli, J 2025), which found that urea and NPK fertilizer variables have a positive and significant effect. The effect of the combined use of urea and NPK fertilizers on production input usage in this study was that increasing urea and NPK fertilizer use increased productivity.

Analysis of the Influence of Indicators on Latent Variables

The latent variables in this study consisted of four variables: internal factors, external factors, production input usage, and oil palm farm productivity. Each of these variables was measured through a number of manifest indicators that empirically represent the relevant latent construct. The results of the analysis of the influence of indicators on latent variables can be seen in Table 4.

Table 4. Influence of Indicators on Latent Variables

	Original Sampel (O)	*Sample Mean (M)*	*Standard Deviation (STDEV)*	*T- statistik (O/STDEV)*	*P-value*
UP <- FI	0.827	0.820	0.089	9.328	0.000
PP <- FI	0.853	0.846	0.066	12.858	0.000
PU <- FI	0.793	0.796	0.074	10.654	0.000
MP <- FI	0.773	0.748	0.126	6.123	0.000
JAK <- FI	0.854	0.860	0.051	16.628	0.000
ATP <- FE	0.887	0.894	0.023	39.115	0.000
HJT <- FE	0.926	0.916	0.044	21.135	0.000
APP <- FE	0.716	0.701	0.145	4.937	0.000
JPPU <- PIP	0.959	0.956	0.021	45.324	0.000
JPPN <- PIP	0.953	0.951	0.021	44.361	0.000
JPD <- PIP	0.841	0.827	0.085	9.890	0.000
LLUKS <-PUKS	0.865	0.858	0.075	11.575	0.000
PKS <- PUKS	0.904	0.897	0.046	19.735	0.000
UT <- PUKS	0.810	0.801	0.096	8.436	0.000

Source: Processed data results of Smart PLS Version 4.0, 2025

Table 4 shows the manifest influence on its latent variables. The influence of a variable is declared significant if the calculated t-value exceeds the t-table value or the P-value is less than the significance level of $\alpha = 5\%$. A p-value of $0.000 < \alpha = 0.05$ means a real/significant influence. First, farmer age, farmer education, farming experience, farmer motivation and the number of family members together as manifest variables are able to explain internal factors. Where the magnitude of each of the manifest internal factors coefficients of farmer age is 0.827, the coefficient of farmer education is 0.853, the coefficient of farming experience is 0.793, the coefficient of farmer motivation is 0.773 and the coefficient of the number of family members is 0.854. This means that every 10% increase in the internal factors (farmer age, education, farming experience, motivation, and family size) will also increase the internal factors by 8.27%, 8.53%, 7.93%, 7.73%, and 8.54%, respectively. The variables of farmer age, education, farming experience, and motivation align with research findings (Barus, E BR 2025), which found that farmer age, education, farming experience, and motivation significantly impacted potato farming productivity. The farmer motivation variable also aligns with research (Aziz, S et al., 2020), which suggests that highly motivated farmers will encourage greater work effort, which is expected to impact rice farming productivity. The number of family members is also consistent with research (Lestari, I 2023).

Second, access to marketing, the selling price of fresh fruit bunches (FFB), and access to the market for carrying goods collectively serve as manifest variables that can explain economic factors. The coefficients for each external factor manifest, namely access to marketing, are 0.887, 0.926 for fresh fruit bunches (FFB) selling price, and 0.716 for access to the pikul market. This means that for every 10% increase in the manifest variables of access to marketing, FFB selling price, and access to the pikul market, the economic factor variables will increase by 8.87%, 9.26%, and 7.16%. The access to marketing and price variables align with research findings (Theresia, M. 2024) and (Lestari, I 2023), which show a significant impact on self-help oil palm farming, thus influencing its productivity.

Third, the combined use of urea, NPK, and dolomite fertilizers acts as a manifest variable that explains the use of production inputs. The coefficients for each of the production input manifest variables are 0.959, 0.953 for NPK fertilizers, and 0.841 for dolomite. This means that for every 10% increase in the manifest variables of urea, NPK, and dolomite fertilizer use, the production input usage variable will increase by 9.59%, 9.53%, and 8.41%. This aligns with research (Sukmayanto M, et al., 2022), which identified fertilizer as a production input that influences lowland rice production.

Fourth, land area, production, and plant age collectively act as manifest variables that can explain oil palm productivity. The coefficients for land area are 0.865, production 0.904, and plant age 0.810. This means that for every 10% increase in the manifest variables of land area, production, and plant age, the oil palm productivity variable

will increase by 8.65%, 9.04%, and 8.10%. This is in line with the view of Daryanto (2012) as cited in Laoli, J (2025), which states that productivity is a concept that describes the relationship between output (oil palm production) and resources or inputs (such as land area) used to achieve that output. In addition, the variable of plant age is consistent with the research findings of Willy Monika Y. et al. (2014) as referred to in Laoli, J (2025), where plant age was shown to have a significant influence on oil palm productivity, with a negative regression coefficient of -0.0048. This indicates that every one-month increase in plant age will result in a decrease in oil palm productivity of 0.0048 tons per hectare, assuming other variables remain constant (ceteris paribus).

CONCLUSION

Oil palm farming in Merlung District is still conventional with an average land area of 2.6 ha. The oil palm varieties planted by farmers are Marihat, PPKS, and TN 1. Fertilization is carried out 1–4 times per year, spraying 1–2 times per year, harvesting 2 times a month, pruning 1–2 times per year, using labor from within and outside the family. Internal factors include the average age of farmers with an average of 46.8 years, the average education of farmers with a secondary education, an average farming experience of 12.5 years, fairly high farmer motivation, and the number of family members with an average of 4 people. External factors include access to marketing (through middlemen, factories, and RAM), the selling price of FFB which varies between Rp 2,700 – Rp 3,000/kg and access to farmer's market in the research area as many as 53.5% of farmers have difficulty accessing the market. Internal factors have a direct positive and significant effect on the productivity of oil palm farming. Internal factors have a positive but insignificant effect on oil palm farming productivity through the moderating variable of production input use. External factors have no direct effect on oil palm farming productivity. External factors have a positive and significant effect on oil palm farming productivity through the moderating variable of production input use.

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