DETERMINANTS OF FARM INCOME AND COMPARATIVE PERFORMANCE OF CALIFORNIA VS THAILAND PAPAYA CULTIVATION: A STUDY ON SMALLHOLDER FARMERS
(Faktor-Faktor Penentu Pendapatan Usahatani dan Perbandingan Kinerja Budidaya Pepaya California versus PepayaThailand: Studi pada Petani Kecil)

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ABSTRACT

Papaya is one of the leading horticultural commodities in Indonesia, with California papaya and Thailand papaya being the two most widely cultivated and marketed varieties. This study aimed to analyze and compare the factors affecting farmers' income from California papaya and Thailand papaya farming in Mumbulsari District, Jember Regency. The research employed a quantitative approach using a survey method. Data were collected from 140 respondents consisting of 70 California papaya farmers and 70 Thailand papaya farmers selected through simple random sampling. Multiple linear regression analysis was used to identify the factors influencing farmers' income. The independent variables analyzed included production, selling price, seedlings, farming costs, education, and harvested area. The results showed that for California papaya farming, production, selling price, seedlings, and education had positive effects on income, whereas farming costs and harvested area had negative effects. However, none of these variables had a significant partial effect on income. The coefficient of determination (R^2) indicated that only 20.7% of income variation could be explained by the variables included in the model. In contrast, for Thailand papaya farming, selling price and education positively affected income, while seedlings, farming costs, and harvested area had negative effects. Production, selling price, farming costs, and education significantly influenced income, with an R^2 value of 99.2%, indicating that nearly all income variation was explained by the variables analyzed. Simultaneously, all independent variables significantly affected farmers' income in both farming systems. The study concludes that the determinants of income differ between California and Thailand papaya farming, with Thailand papaya income being more strongly influenced by the analyzed variables than California papaya income.

Keywords: California papaya, Thailand papaya, farmers' income.

ABSTRAK

Pepaya merupakan salah satu komoditas hortikultura terkemuka di Indonesia, dengan pepaya California dan pepaya Thailand sebagai dua varietas yang paling banyak dibudidayakan dan dipasarkan. Penelitian ini bertujuan untuk menganalisis dan membandingkan faktor-faktor yang mempengaruhi pendapatan petani dari budidaya pepaya California dan pepaya Thailand di Kecamatan Mumbulsari, Kabupaten Jember. Penelitian ini menggunakan pendekatan kuantitatif dengan metode survei. Data dikumpulkan dari 140 responden yang terdiri dari 70 petani pepaya California dan 70 petani pepaya Thailand yang dipilih melalui pengambilan sampel acak sederhana. Analisis regresi linier berganda digunakan untuk mengidentifikasi faktor-faktor yang mempengaruhi pendapatan petani. Variabel independen yang dianalisis meliputi produksi, harga jual, bibit, biaya pertanian, pendidikan, dan luas lahan panen. Hasil penelitian menunjukkan bahwa untuk budidaya pepaya California, produksi, harga jual, bibit, dan pendidikan berpengaruh positif terhadap pendapatan, sedangkan biaya pertanian dan luas lahan panen berpengaruh negatif. Namun, tidak satu pun dari variabel-variabel tersebut yang memiliki pengaruh parsial yang signifikan terhadap pendapatan. Koefisien determinasi (R^2) menunjukkan bahwa hanya 20,7% variasi pendapatan yang dapat dijelaskan oleh variabel-variabel yang termasuk dalam model. Sebaliknya, untuk budidaya pepaya di Thailand, harga jual dan pendidikan berpengaruh positif terhadap pendapatan, sedangkan bibit, biaya pertanian, dan luas lahan panen berpengaruh negatif. Produksi, harga jual, biaya pertanian, dan

pendidikan secara signifikan memengaruhi pendapatan, dengan nilai R^2 sebesar 99,2%, menunjukkan bahwa hampir semua variasi pendapatan dijelaskan oleh variabel yang dianalisis. Secara bersamaan, semua variabel independen secara signifikan memengaruhi pendapatan petani di kedua sistem pertanian. Studi ini menyimpulkan bahwa penentu pendapatan berbeda antara budidaya pepaya di California dan Thailand, dengan pendapatan pepaya Thailand lebih kuat dipengaruhi oleh variabel yang dianalisis daripada pendapatan pepaya California.
Kata kunci: Pepaya California, pepaya Thailand, pendapatan petani.

INTRODUCTION

In Indonesia, two papaya varieties are widely cultivated and commonly preferred by consumers, namely California papaya and Thailand papaya. These two varieties compete intensively in the Indonesian market. Initially, Thailand papaya dominated the market; however, the emergence of California papaya has increasingly challenged its market position. California papaya is recognized for its high productivity and relatively short harvesting period, making it an attractive option for farmers seeking faster returns on investment. In contrast, Thailand papaya is characterized by its distinctly sweet flavor, larger fruit size, and superior storage and transportation capabilities, which contribute to its strong demand in both domestic and export markets. Nevertheless, differences in cultivation practices, production costs, and sales volumes between these varieties may lead to substantial variations in farmers' income, thereby influencing the economic performance and profitability of papaya farming enterprises.

Based on field observations, California papaya is more widely preferred by papaya farmers in Mumbulsari District for several key reasons, including its high productivity and relatively short harvesting period, which enable farmers to generate returns more quickly. This variety also exhibits good resistance to pests and diseases, thereby reducing the risk of production losses. Furthermore, strong market demand and favorable selling prices make California papaya an attractive cultivation option. The relative ease of cultivation and crop management further contributes to its popularity, providing farmers with a stable source of income. Although Thailand papaya generally produces fruits that are smaller in size than those of California papaya, it remains highly popular in local markets due to its sweeter taste and lower selling price. These characteristics allow Thailand papaya to maintain a competitive market position despite the increasing preference for California papaya among producers. This study aims to analyze the determinants of farm income for California and Thailand papaya cultivation among smallholder farmers by examining the effects of six main variables: production volume, seed quality, selling price, farming costs, farmer education level, and land area. The selection of California and Thailand papaya varieties is based on differences in their agronomic characteristics and market potential, which are hypothesized to generate income disparities at the farmer level.Through the identification of factors significantly influencing income, this study is expected to provide empirical contributions to the development of papaya farming. The findings will serve as a basis for formulating practical recommendations to improve production efficiency and farmer income, while supporting the development of cultivation strategies that are more sustainable and adaptive to horticultural market dynamics.

RESEARCH METHODS

This study was conducted in Mumbulsari District, Jember Regency, an area widely recognized as a major papaya-producing region. Papaya cultivation in this area offers promising economic prospects due to its attractive profit potential and relatively simple crop management practices. The sampling technique employed in this study was simple random sampling. A total of 70 respondents were selected for each papaya variety, resulting in a representative sample of papaya farmers. Respondents were chosen randomly, ensuring that each farmer had an equal probability of being selected without consideration of specific characteristics or attributes. The data were analyzed using multiple linear regression analysis to examine the influence of the independent variables on the dependent variable. The regression model used in this study is presented as follows:

1. Classical Assumption Tests

a) Multicollinearity Test

According to Priyatno (2017), the presence of multicollinearity indicates that the independent variables in a regression model exhibit a perfect linear relationship with one another. Such a condition may affect the reliability and stability of the estimated regression coefficients. In this study, the multicollinearity test was conducted using the Pairwise Correlation approach to examine the degree of correlation among the independent variables. The procedure for testing multicollinearity based on Pairwise Correlation values is described as follows:

a) Multicollinearity was assessed using the Tolerance and Variance Inflation Factor (VIF) indicators. A regression model is considered free from multicollinearity when the Tolerance value exceeds 0.100 and the VIF value is less than 10.00.

b) Conversely, if the Tolerance value is below 0.100 and the VIF value exceeds 10.00, the model is considered to exhibit multicollinearity, indicating a strong linear relationship among the independent variables.

b) Heteroscedasticity Test

Heteroscedasticity was examined using the Glejser test at a significance level of 5%:

a) A regression model is considered free from heteroscedasticity when the significance value is greater than the alpha level (Sig. > 0.05), indicating that the variance of the residuals remains constant across observations.

b) Conversely, if the significance value is less than the alpha level (Sig. < 0.05), the model is considered to exhibit heteroscedasticity, suggesting the presence of non-constant error variance within the regression model.

c) Normality Test

Normality test using the Kolmogorov Smirnov test. Values are normally distributed if carried out with a significance level of 5%:

a) Standardized residuals are considered to be normally distributed when the significance value is greater than the alpha level (Sig. > 0.05).

b) Conversely, if the significance value is less than the alpha level (Sig. < 0.05), the standardized residuals are considered not normally distributed, indicating a violation of the normality assumption in the regression model.

d) Autocorrelation Test

The method used to test for autocorrelation is the Runs Test. The procedure for testing autocorrelation is as follows:

a) The regression model is considered free from autocorrelation when the significance value is greater than the alpha level (Sig. > 0.05), indicating that the residuals are independent of one another.

b) Conversely, if the significance value is less than the alpha level (Sig. < 0.05), the model is considered to exhibit autocorrelation, suggesting a correlation among the residuals across observations.

2. Multiple linear regression analysis

Multiple linear regression analysis, as explained by Sugiyono (2010), functions to predict the effect of two or more independent variables on one dependent variable using the following formula (Gujarati, 2006):

Table 1. The performance of ...

California Papaya		Thai Papaya	
$Y_1 = A_0 + A_1X_{1A} + A_2X_{2A} + A_3X_{3A} + A_4X_{4A} + A_5X_{5A} + A_6X_{6A} + e$		$Y_2 = B_0 + B_1X_{1B} + B_2X_{2B} + B_3X_{3B} + B_4X_{4B} + B_5X_{5B} + B_6X_{6B} + e$	
A :	California Papaya	B :	Thai papaya
Y_A :	California Papaya Income	Y_B :	Thai Papaya Income
X_{1A} :	California Papaya Production	X_{1B} :	Thai Papaya Production
X_{2A} :	California Papaya Selling Price	X_{2B} :	Thai Papaya Selling Price
X_{3A} :	California Papaya Seedlings	X_{3B} :	Thai Papaya Seedlings
X_{4A} :	California Papaya Farming Costs	X_{4B} :	Thai Papaya Farming Costs
X_{5A} :	California Papaya Farmer Education	X_{5B} :	Thai Papaya Farmer Education
X_{6A} :	California Papaya Harvested Area	X_{6B} :	Thai Papaya Harvest Area
A_0 ; B_0:	Intercept Coefficient (Constant)	$A_1 – A_6$	; $B_1 – B_6$: Regression Coefficient

3. Coefficient of Determination Test / R-squared Test

According to Widarjono, the coefficient of determination (R^2) measures the proportion of variance in the dependent variable that is explained by the independent variables.

a) If the coefficient of determination (R-squared) approaches one (1), it indicates that the dependent variable is well explained by the independent variables.

b) Conversely, if the coefficient of determination (R-squared) deviates from one (1) or approaches zero (0), the independent variables are less effective in explaining the dependent variable.

4. F-test / Test of Overall Significance

The F-test is used to examine the joint effect of all independent variables on the dependent variable, also referred to as the test of overall model significance. According to Widarjono (2018), the steps for conducting the F-test are as follows:

a) The hypotheses, namely the null hypothesis (H0) and the alternative hypothesis (Ha): H0: $\beta1 = \beta2 = ... = \beta k = 0 \rightarrow$ (no simultaneous effect of independent variables on the dependent variable); Ha: At least one $\beta i \neq 0 \rightarrow$ (there is a simultaneous effect of independent variables on the dependent variable)

b) The decision to reject or accept H0 is as follows:

a) If the p-value of the F-statistic < α, then H0 is rejected, which means that the independent variables jointly have a significant effect on the dependent variable.

b) If the p-value of the F-statistic > α, then H0 is accepted, which means that the independent variables do not have a simultaneous effect on the dependent variable.

5. t-test / Test of Individual Significance

The t-test is a method used to measure the effect of each independent variable on the dependent variable (Widarjono, 2018). The steps for conducting the t-test are as follows:

Formulate the null hypothesis (H0) and the alternative hypothesis (Ha) as follows:

a) One-tailed positive hypothesis test H0 : $\beta1 = 0$

Ha : $\beta1 > 0$

b) One-tailed negative hypothesis test H0 : $\beta1 = 0$

Ha : $\beta1 < 0$

c) Or a two-tailed test H0 : $\beta1 = 0$

Ha : $\beta1 \neq 0$

The t-statistic can be calculated using the following formula:

$\beta_1 - \beta^*$

$$t = \frac{1}{S_e\beta_1} \quad (1)$$

The decision to reject or accept H0 is as follows:
a. If the p-value < 0.05, then H0 is rejected, meaning that the independent variable partially has a significant effect on the dependent variable.
b. If the p-value > 0.05, then H0 is not rejected, meaning that the independent variable partially has no significant effect on the dependent variable.

RESULT AND DISCUSSION

Classical Assumption Tests

a) Multicollinearity Test

Table 2. Multicollinearity Test

Variable	California Papaya	Thai Papaya
X1 (production)	2,966	1,456
X2 (selling price)	3,238	2,506
X3 (seeds)	1,846	1,188
X4 (farming costs)	3,689	2,970
X5 (education)	2,272	2,081
X6 (harvested area)	4,803	2,417

Source: SPSS, data processed in 2025

Multicollinearity refers to the existence of a perfect linear relationship among all or some of the independent variables included in a regression model. The presence of multicollinearity can be assessed by examining the relationships among the independent variables. In this study, the variables analyzed included production, selling price, seedlings, farming costs, education level, and harvested area. Based on the multicollinearity test results, all independent variables in the California papaya model exhibited Variance Inflation Factor (VIF) values below 10.00, indicating the absence of multicollinearity and confirming that the data satisfied the classical assumption of multicollinearity. Similarly, for the Thailand papaya model, all independent variables showed VIF values below 10.00. Therefore, it can be concluded that the regression model for Thailand papaya also met the classical assumption requirements, indicating that multicollinearity was not present among the explanatory variables.

b) Heteroscedasticity Test

Table 3. Heteroscedasticity Test

Variable	California Papaya	Thai Papaya
X1 (production)	0,059	0,174
X2 (selling price)	0,563	0,908
X3 (seeds)	0,668	0,136
X4 (farming costs)	0,063	0,697
X5 (education)	0,505	0,950
X6 (harvested area)	0,276	0,741

Source: SPSS, data processed in 2025

The heteroscedasticity test was conducted using the Glejser method by regressing all independent variables against the absolute values of their residuals. If an independent variable has a statistically significant effect on the absolute residual values, the regression model is considered to exhibit heteroscedasticity. Based on the heteroscedasticity test results for the California papaya commodity, all variables showed significance values greater than 0.05, indicating that the model was free from heteroscedasticity and satisfied the classical assumption of homoscedasticity. Similarly, for the Thailand papaya commodity, all independent variables produced significance values greater than

0.05. Therefore, it can be concluded that the regression model also met the classical assumption requirements and did not exhibit heteroscedasticity.

c) Normality Test

Table 4. Normality Test

Variable	California Papaya	Thai Papaya
X1 (production)	0,405	0,304
X2 (selling price)	0,074	0,972
X3 (seeds)	0,390	0,052
X4 (farming costs)	0,602	0,220
X5 (education)	0,000	0,000
X6 (harvested area)	0,997	0,997

Source: SPSS, data processed in 2025

Based on the normality test results for the California papaya commodity, the significance values for variables X3 and X5 were below 0.05, while the significance values for the remaining variables exceeded 0.05. Despite these results, the overall data were considered to satisfy the classical assumption of normality. Similarly, for the Thailand papaya commodity, variables X3 and X5 exhibited significance values below 0.05, whereas the other variables showed significance values greater than 0.05. Therefore, the data were also considered to meet the normality assumption required for regression analysis. Overall, five of the six variables—namely production, selling price, seedlings, farming costs, and land area—demonstrated a normal distribution, allowing further statistical analysis to be conducted appropriately. However, the education variable did not satisfy the normality assumption, indicating a deviation from a normal distribution.

d) Autocorrelation Test

Table 5. Autocorrelation Test

Variable	Nilai
California	0,085
Thailand	0,301

Source: SPSS, data processed in 2025

Based on the SPSS output presented in Appendix 9, the California papaya model produced a significance value of 0.085, which is greater than 0.05, indicating the absence of autocorrelation. Similarly, the Thailand papaya model yielded a significance value of 0.301, which also exceeds 0.05, confirming that no autocorrelation was present in the model. Furthermore, the correlation analysis between California papaya and Thailand papaya revealed no significant relationship between the two commodities. Variables such as production, selling price, farming costs, land area, education, and seedlings did not consistently influence one another across the two papaya varieties. Although each variable plays an important role within its respective production system, differences in market conditions and farming practices contribute to distinct patterns of variation, resulting in the absence of a clear correlation between the two commodities. According to Supriyadi (2019), the absence of autocorrelation in agricultural studies enhances the validity of regression models used to predict farmers' income, as each explanatory variable contributes independently to the dependent variable. In addition, Lestari (2021) emphasized that effective management of these variables can help prevent autocorrelation problems, thereby improving the accuracy and reliability of the analytical results.

2. Coefficient of Determination Test / R-squared Test

3.

Table 6. Coefficient of Determination Test / R-squared Test

Variable	Nilai
California	.207
Thailand	.992

Source: SPSS, data processed in 2025

Based on the SPSS results presented in the table above, the coefficient of determination (R^2) indicates the proportion of variation in farmers' income explained by the independent variables included in the model. For California papaya, the coefficient of determination shows that 20.7% of the variation in income can be explained by the factors analyzed in this study. This relatively low explanatory power suggests that a substantial proportion of income variation is influenced by factors outside the model. Environmental conditions, such as extreme climatic events, may play a more dominant role than the variables examined. Furthermore, the adoption of improved agricultural technologies by California papaya farmers may help optimize production outcomes, although their overall contribution to income variation remains limited. Haryanto (2020) also reported that income diversification is an important factor, as farmers often rely on multiple income sources rather than depending solely on papaya cultivation.

In contrast, the coefficient of determination for Thailand papaya indicates that 99.2% of the variation in farmers' income can be explained by the independent variables included in the analysis. This finding suggests that nearly all income variation is attributable to the factors examined in the study. Therefore, it can be concluded that the determinants of farmers' income differ substantially between the two papaya varieties. Income from California papaya farming appears to be influenced predominantly by factors beyond the six variables analyzed, whereas income from Thailand papaya farming is largely determined by the six independent variables considered in this study, namely production, selling price, seedlings, farming costs, education, and land area.

4. F-test / Test of Overall Significance

Table 7. F-test / Test of Overall Significance

Variable	Nilai	Sign.
California	2.904	.025[a]
Thailand	595.464	.000[a]

Source: SPSS, data processed in 2025

Based on the results presented in the table above, the significance value for California papaya was 0.025, indicating that the independent variables collectively exert a significant simultaneous effect on the dependent variable. This finding suggests that the variables examined, including production costs, selling price, seedlings, farming costs, education, and land area, significantly influence the income generated from California papaya farming. The statistical significance of these variables implies that changes in any of these factors may have a meaningful impact on farmers' income, thereby providing valuable information for strategic decision-making.

Similarly, for Thailand papaya, the significance value obtained was 0.000, indicating that the independent variables also have a significant simultaneous effect on the dependent variable. This result demonstrates that the variables included in the model, such as production costs, selling price, and other related factors, significantly affect the income and production outcomes of Thailand papaya farming. The significance of these relationships highlights the importance of managing these factors effectively to optimize farm performance and profitability.

Furthermore, based on the SPSS results presented in the table, the significance values for both California papaya and Thailand papaya were below the 5% significance level (Sig. < 0.05). Therefore,

it can be concluded that the independent variables jointly have a significant effect on the dependent variable in both regression models.

5. t-test / Test of Individual Significance

Table 8. t-test / Test of Individual Significance

	California			Thailand		
Variable	**B**	**t**	**Sign.**	**B**	**t**	**Sign.**
Constant	7.712E7	1.378	0.179	-4.461E7	-9.855	0.000
X1 (production)	1.022E6	0.315	0.755	2.288E6	16.881	0.000
X2 (selling price)	11809.086	1.206	0.238	20094.801	37.931	0.000
X3 (seeds)	22228.529	0.546	0.589	-3895.016	-1.258	0.219
X4 (farming costs)	-8.325	-1.207	0.237	-0.777	-4.355	0.000
X5 (education)	6.082E6	0.538	0.595	1.520E6	2.433	0.022
X6 (harvested area)	-8.453	-.009	0.993	-28.483	-0.757	0.455

Source: SPSS, data processed in 2025

As presented in the table above, the results of the multiple linear regression analysis yielded the following regression equation. This equation describes the relationship between the dependent variable and the set of independent variables included in the model, providing a quantitative representation of the factors influencing the outcome under investigation:

$$\mathbf{Y_1 = 7{,}712 + 1{,}022\ X_1 + 11{,}809\ X_2 + 22{,}228\ X_3 - 8{,}325\ X_4 + 6{,}082\ X_5 - 8{,}453\ X_6}$$

Based on the results of the multiple linear regression equation for California papaya, the relationship between the dependent variable and the independent variables can be interpreted as follows. The estimated coefficients provide insights into the direction and magnitude of the effect of each explanatory variable on farmers' income, while holding the other variables constant:

1. The constant term of 7.712 in the regression equation indicates that, in the absence of the effects of production, selling price, seedlings, farming costs, education, and land area, the estimated income would be IDR 7.712. This value represents the baseline level of income and provides an estimate of the minimum income that could be generated under basic conditions, without any contribution from the explanatory variables included in the model.
2. The production variable (X1) has a regression coefficient of 1.022, indicating that an increase of 1 kilogram in production is associated with an increase in farmers' income of IDR 1,022, assuming other variables remain constant. According to Sari (2019), higher papaya production is generally associated with increased farmer income, highlighting the importance of improving crop yields to enhance farmers' economic welfare. Increased production contributes to a greater harvest volume, thereby creating opportunities for higher revenue generation. However, the significance value for the production variable was 0.755, which exceeds the 5% significance level (0.05). This result indicates that production does not have a statistically significant partial effect on California papaya farmers' income. The finding suggests that an increase in production volume does not necessarily translate directly into higher income, as other factors, such as product quality, market access, and marketing efficiency, may also influence sales performance and revenue outcomes. Nevertheless, although production does not exert a significant individual effect, it may contribute to income enhancement when considered jointly with the other explanatory variables included in the regression model.
3. The selling price variable (X2) has a regression coefficient of 11.809, indicating that every IDR 1 increase in the selling price is associated with an increase in farmers' income of IDR 11,809, assuming all other variables remain constant. Sholehah (2023) reported that appropriate pricing and effective marketing strategies can contribute significantly to increasing farmers' income. As the selling price of papaya rises, farmers generally experience higher revenue, illustrating the important role of market-oriented pricing strategies in improving farm profitability. However, the significance value for the selling price variable was 0.238, which is greater than the 5% significance level (0.05). This result indicates that selling price does not have a statistically significant partial effect on the income of

California papaya farmers. The finding suggests that the relationship between selling price and income may be influenced by other factors, such as product quality, market competition, and consumer demand, as highlighted by Sholehah (2023). Furthermore, individual farmers often have limited control over market prices, which are largely determined by market forces. Nevertheless, although the selling price variable does not exert a significant individual effect, it may contribute to income improvement when considered simultaneously with the other explanatory variables included in the regression model.

4. The seedling variable (X3) has a regression coefficient of 22.228, indicating that the addition of one seedling is associated with an increase in farmers' income of IDR 22,228, assuming all other variables remain constant. Rahmawati (2016) found that the use of high-quality seedlings contributes significantly to improved crop yields, which subsequently enhances farmers' income. Although the cost of seedlings may increase, the adoption of superior planting materials can lead to higher productivity and greater economic returns. However, the significance value for the seedling variable was 0.589, which exceeds the 5% significance level (0.05). This result indicates that the seedling variable does not have a statistically significant partial effect on the income of California papaya farmers. The finding suggests that seedling costs are not the primary determinant of income and that other factors, such as cultivation practices, farm management techniques, and environmental conditions, may exert a stronger influence on farm profitability, as noted by Rahmawati (2016). Nevertheless, while the seedling variable does not have a significant individual effect, it may contribute to income improvement when considered jointly with the other explanatory variables in the regression model. This is because the use of superior seedlings can enhance production performance, thereby indirectly supporting higher farm income.

5. The farming cost variable (X4) has a regression coefficient of -8.325, indicating that every IDR 1 increase in farming costs is associated with a decrease in farmers' income of IDR 8,325, assuming all other variables remain constant. This negative coefficient suggests an inverse relationship between farming costs and income. Liana (2019) reported that cost efficiency is a critical factor in farm management, as excessive expenditures that are not accompanied by corresponding increases in production can reduce farm profitability. In other words, rising farming costs that are not offset by higher yields may lead to lower income levels. However, the significance value for the farming cost variable was 0.237, which is greater than the 5% significance level (0.05). This result indicates that farming costs do not have a statistically significant partial effect on the income of California papaya farmers. The finding suggests that, although farming costs are important, their individual impact on income may be overshadowed by other factors influencing farm performance. Nevertheless, effective cost management remains essential for minimizing potential negative effects on profitability, as emphasized by Liana (2019). Furthermore, while the farming cost variable does not have a significant individual effect, it may collectively contribute to a reduction in income when considered alongside the other explanatory variables in the regression model, particularly when increases in production costs are not accompanied by proportional gains in output or revenue.

6. The education variable (X5) has a regression coefficient of 6.082, indicating that an increase of one educational level is associated with an increase in farmers' income of IDR 6,082, assuming all other variables remain constant. This positive coefficient suggests that higher levels of education may contribute to improved economic outcomes among California papaya farmers. Silviah (2024) reported that formal education and agricultural training play an important role in enhancing farmers' knowledge and skills, which can positively affect productivity and income. Higher educational attainment enables farmers to adopt more effective and innovative farming practices, thereby improving farm performance. However, the significance value for the education variable was 0.595, which exceeds the 5% significance level (0.05). This result indicates that education does not have a statistically significant partial effect on the income of California papaya farmers. The finding suggests that other factors, such as practical farming experience, access to market information, and managerial capabilities, may have a more dominant influence on income generation, as noted by Silviah (2024). Nevertheless, although education does not exert a significant individual effect, it may contribute positively to income when considered jointly with the other explanatory variables in the regression model. This is because education and agricultural training can enhance farmers' capacity to implement improved cultivation techniques and make more informed farm management decisions,

ultimately supporting higher productivity and income levels.

7. The harvested area variable (X6) has a regression coefficient of -8.453, indicating that an increase of 1 hectare in land area is associated with a decrease in farmers' income of IDR 8,453, assuming all other variables remain constant. This negative coefficient suggests that expanding cultivated land does not necessarily lead to higher income. Haryanto (2020) reported that inefficient land management may result in lower productivity and profitability, as additional land does not always contribute positively to farm income. In other words, an increase in cultivated area does not automatically guarantee increased earnings, particularly when the additional land is not managed effectively. The significance value for the harvested area variable was 0.993, which exceeds the 5% significance level (0.05). This result indicates that harvested area does not have a statistically significant partial effect on the income of California papaya farmers. The finding suggests that land size alone is not a primary determinant of income; rather, factors such as land quality, management practices, and production efficiency may play a more important role, as emphasized by Haryanto (2020). Nevertheless, although the harvested area variable does not exert a significant individual effect, it may collectively contribute to a reduction in income when considered together with the other explanatory variables in the regression model. This may occur when farm expansion is not accompanied by efficient resource allocation and effective land management, resulting in lower overall profitability.

For Thailand papaya, the results of the multiple linear regression analysis yielded the following regression equation. This equation represents the relationship between farmers' income as the dependent variable and the independent variables included in the model, providing a basis for interpreting the effect of each explanatory variable on income:

$$\mathbf{Y_2 = -4{,}461 + 2{,}288\ X_1 + 20{,}094\ X_2 - 3{,}895\ X_3 - 0{,}777\ X_4 + 1{,}520\ X_5 - 28{,}483\ X_6}$$

Based on the results of the multiple linear regression equation presented above, the relationship between the dependent variable and the independent variables can be interpreted as follows. The estimated coefficients provide information regarding the direction and magnitude of the influence of each explanatory variable on the dependent variable, while holding the other variables constant:

1. The constant term of -4.461 represents the baseline value of the dependent variable (income) when all independent variables are assumed to be equal to zero. This implies that in the absence of production, selling price, seedling costs, farming costs, education, and land area, the expected income would be -4.461. The negative value suggests that under such hypothetical conditions, no income would be generated and a financial loss may occur. This finding highlights the critical role of the explanatory variables in determining farmers' income, indicating that these factors collectively contribute substantially to the economic performance of Thailand papaya farming.
2. The production variable (X1) has a regression coefficient of 2.288, indicating that every 1-kilogram increase in production is associated with an increase in farmers' income of IDR 2,288, assuming all other variables remain constant. This positive coefficient suggests that higher production levels contribute directly to increased income. Yani (2019) reported that improvements in papaya production are positively correlated with farmers' earnings, as greater production results in a larger harvest volume and, consequently, a higher potential for revenue generation. The significance value for the production variable was 0.000, which is below the 5% significance level (0.05). This result indicates that production has a statistically significant effect on the income of Thailand papaya farmers. The finding demonstrates that increases in production contribute directly to income growth, as larger harvest quantities enable farmers to generate greater total revenue. Consistent with the findings of Yani (2019), enhanced agricultural productivity plays a crucial role in improving farmers' welfare and economic performance, highlighting the importance of maximizing production efficiency in Thailand papaya farming.
3. The selling price variable (X2) has a regression coefficient of 20.094, indicating that every IDR 1 increase in the selling price is associated with an increase in farmers' income of IDR 20,094, assuming all other variables remain constant. This positive coefficient suggests that higher selling prices contribute directly to greater income levels. Hatmoko (2020) reported that effective marketing strategies and appropriate pricing decisions can significantly enhance farmers' income, as higher selling prices increase the revenue earned from each unit of product sold. The significance value for the selling price variable was 0.000, which is below the 5% significance level (0.05). This result

indicates that the selling price has a statistically significant effect on the income of Thailand papaya farmers. The finding demonstrates that increases in selling prices can substantially improve farmers' earnings, as producers receive higher returns for each unit of papaya marketed. Consistent with the findings of Hatmoko (2020), effective marketing practices and optimal pricing strategies play a crucial role in maximizing farm revenue and improving the economic performance of Thailand papaya farming.

4. The seedling variable (X3) has a regression coefficient of -3.895, indicating that an increase of one seedling is associated with a decrease in farmers' income of IDR 3,895, assuming all other variables remain constant. This negative coefficient suggests that higher expenditures on seedlings do not necessarily translate into increased income. Syakban (2023) reported that high seedling costs, when not accompanied by substantial improvements in productivity, may negatively affect farm profitability. In other words, if investment in seedlings increases without generating better yields, farmers' income may decline. The significance value for the seedling variable was 0.219, which exceeds the 5% significance level (0.05). This result indicates that the seedling variable does not have a statistically significant effect on papaya farmers' income. The finding suggests that seedling costs may not be the primary determinant of income, and that other factors, such as cultivation practices, land management, and production efficiency, may exert a more substantial influence on farm profitability. As emphasized by Syakban (2023) , although investment in high-quality seedlings is important, its impact may be outweighed by other management-related factors. Therefore, while the seedling variable does not have a significant individual effect on income, it may contribute to lower income levels when considered jointly with other variables, particularly when increased seedling expenditures are not accompanied by corresponding improvements in production performance.

5. The farming cost variable (X4) has a regression coefficient of -0.777, indicating that every IDR 1 increase in farming costs is associated with a decrease in farmers' income of IDR 0.777, holding all other variables constant. This negative coefficient suggests that higher production expenditures tend to reduce farm profitability. Sine (2020) found that effective cost management is essential for maintaining profitability, as excessive costs that are not accompanied by proportional increases in output or revenue can negatively affect farmers' income. The significance value for the farming cost variable was 0.000, which is below the 5% significance level (0.05). This result indicates that farming costs have a statistically significant effect on farmers' income. The finding demonstrates that increases in farming costs can reduce income, highlighting the importance of efficient cost management in improving farm profitability. Consistent with the findings of Sine (2020), cost efficiency plays a crucial role in sustaining the economic performance of agricultural enterprises. Therefore, the farming cost variable (X4) has a significant influence on the income of Thailand papaya farmers, emphasizing that effective control of production expenses is essential for maximizing profitability and ensuring the financial sustainability of papaya farming operations.

6. The education variable (X5) has a regression coefficient of 1.520, indicating that an increase of one educational level is associated with an increase in farmers' income of IDR 1,520, assuming all other variables remain constant. This positive coefficient suggests that higher levels of education contribute to improved income among Thailand papaya farmers. Setiawan (2019) reported that formal education and agricultural training enhance farmers' knowledge and skills, which can positively affect agricultural productivity. Higher educational attainment enables farmers to adopt more effective and innovative farming practices, thereby improving farm performance and economic outcomes. The significance value for the education variable was 0.022, which is below the 5% significance level (0.05). This result indicates that education has a statistically significant effect on farmers' income. The finding suggests that higher levels of education can improve farmers' managerial capabilities, decision-making skills, and technical competence, ultimately contributing to increased productivity and profitability. Consistent with the findings of Setiawan (2019), education and training play an important role in strengthening farmers' managerial and technical capacities, which in turn have a positive impact on income generation. Therefore, the education variable (X5) has a significant positive effect on the income of Thailand papaya farmers, highlighting the importance of human capital development in improving agricultural performance and farm profitability.

7. The harvested area variable (X6) has a regression coefficient of -28.483, indicating that an increase of one hectare in cultivated land is associated with a decrease in farmers' income of

IDR 28,483, assuming all other variables remain constant. This negative coefficient suggests that expanding the cultivated area does not necessarily result in higher income. Haryanto (2020) found that inefficient land management can lead to lower agricultural performance, as additional land may not always be productive and can increase management costs without generating proportional returns. The significance value for the harvested area variable was 0.455, which exceeds the 5% significance level (0.05). This result indicates that land area does not have a statistically significant partial effect on farmers' income. The finding suggests that management practices and land quality are more important determinants of income than land size alone. Haryanto (2020) further emphasized that effective land management and optimal soil quality contribute more substantially to farm productivity and profitability than merely increasing the amount of cultivated land. Therefore, although the harvested area variable (X6) does not have a significant individual effect on the income of Thailand papaya farmers, it may collectively contribute to lower income levels when considered alongside the other explanatory variables in the regression model. This finding highlights the importance of improving land-use efficiency and soil productivity rather than relying solely on farm expansion as a means of increasing income.

CONCLUSION

Conclusion

Based on the results of the research conducted, several conclusions can be drawn. These conclusions are derived from the findings of the analysis and provide insights into the factors influencing farmers' income as well as the differences observed between California papaya and Thailand papaya farming systems:

1. For California papaya farming, the variables of production (X1), selling price (X2), seedlings (X3), and education (X5) exhibited positive effects on farmers' income, indicating that increases in these variables tend to be associated with higher income levels. In contrast, farming costs (X4) and land area (X6) showed negative effects on income, suggesting that increases in these variables are associated with reductions in farmers' earnings. These findings highlight the differing contributions of production-related, socioeconomic, and resource-management factors to the income performance of California papaya farmers.
2. For Thailand papaya farming, the selling price (X2) and education (X5) variables exhibited positive effects on farmers' income, indicating that increases in these factors tend to contribute to higher income levels. In contrast, the variables of production (X1), seedlings (X3), farming costs (X4), and land area (X6) demonstrated negative effects on income, suggesting that increases in these variables are associated with reductions in farmers' earnings. These results indicate that economic and human capital factors, particularly selling price and education, play a more favorable role in influencing income, whereas production-related costs and resource utilization factors may constrain the profitability of Thailand papaya farming.

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