



Fluctuation in the Income of Rubber Farmers in Tingkea'o Village: The Contribution of Production Costs and Selling Price

Emilia Margaretha Ngkolu^{1*}, Selmita Paranoan¹, Rahayu Indriasari¹, Ernawaty Usman¹

¹ Department of Accounting, Faculty of Economics and Business, Tadulako University, Central Sulawesi

*Corresponding author email: emiliamargaretha7@gmail.com

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ABSTRACT

This study aims to analyze the contribution of production costs, particularly fertilizer and pesticide costs, as well as the selling price of rubber sap to the income fluctuations of rubber farmers in Tingkea'o Village, North Morowali. Using a quantitative descriptive analysis approach with SEM PLS analysis processed through WarpPLS V.8.0 software. Data were collected from 34 rubber farmers randomly through structured interviews, direct observation, and documentation. The results show that fertilizer and pesticide costs contribute significantly and positively to rubber farmers' income, with path coefficients of 0.419 and 0.342, respectively (p -value < 0.001). Conversely, the selling price has no significant effect (p -value = 0.205). The independent variable model explains 41.5% of the variation in income, with the remainder influenced by other external factors. This study reinforces the farming theory of optimizing production costs to improve farmers' livelihoods, while also revealing the limited influence of selling prices due to market structure and the role of middlemen. The strategic recommendations provided can form the basis for policies to support the development of sustainable rubber farming and improve the welfare of farmers in the region.

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INTRODUCTION

Public sector management accounting plays an important role in providing relevant and reliable information to support the planning, control, and performance evaluation processes in the public sector, including in the management of resources in the agricultural sector (Lubis et al., 2024; Sinaga, 2017; Wahyuni et al., 2024). This accounting information forms the basis for strategic and operational decision-making, particularly in efforts to improve the efficient use of public funds and the transparency of financial management, which has a direct impact on community welfare (Kamasi et al., 2023; Siahay, 2023; Tandibua' et al., 2024) as is the case with rubber farmers. Conceptually, different methods of calculating production costs will have an impact on the level of income (Widyanti et al., 2022).

This study highlights the importance of management accounting, which serves to analyze the contribution of production costs and selling prices to fluctuations in rubber farmers' income, so that the results can be used by public sector administrators and managers in formulating more targeted policies.

The theory of farming emphasizes the optimization of the use of production factors, such as land, labor, capital, and production inputs (fertilizers and pesticides), to obtain maximum income from agricultural activities (Yuliana et al., 2024). In the context of rubber farmers, the income earned is the difference between the revenue from rubber sap sales and the total production costs incurred. This theory is highly relevant to the research conducted because it examines the contribution of production costs and selling prices to the income earned by rubber farmers, thereby identifying improvements in farmer welfare through the effectiveness and efficiency of managed rubber farming.

Hardyaningtyas & Hernawati (2023) state that, in the process of improving farmers' welfare, production costs contribute significantly to maximizing yields for rubber farmers. In this case, expenditures on the purchase of fertilizers and pesticides are the main expenses that farmers spend to maintain their rubber plantations and are considered a form of investment in the growth of rubber trees and soil fertility in plantations. In addition, determining the selling price is also one of the main factors for rubber farmers to generate income from their business (Alfia N & Muhammad T., 2023). Higher selling prices provide greater income for rubber farmers. Conversely, lower selling prices result in losses for rubber farmers. This is due to the many factors that cause a decline in the selling price of farmers' rubber harvests. The financing incurred for production costs and the determination of appropriate selling prices for the efforts made by rubber farmers have a very significant impact on the income from rubber farmers' harvests. Therefore, it is important for rubber farmers to be able to predict both of these things (Kullawong et al., 2020).

Changes in the selling price of rubber latex directly affect the income of rubber farmers (Mustazila et al., 2024). When prices fall, farmers tend to reduce the use of inputs such as fertilizers and pesticides to cut costs, which can ultimately reduce productivity and crop quality. In addition, geographical conditions and climate change also have a significant impact, such as decreased production due to erratic rainfall or increased pest attacks (Rosana et al., 2020). In line with this, (Khaswarina & Eliza, 2025) states that prolonged rainy seasons hamper rubber tapping activities, as wet tree conditions can damage latex quality, which ultimately lowers market prices. Therefore, adapting to these changes poses a unique challenge for farmers, making it crucial to analyze the contribution of costs and selling prices to understand the dynamics of farmers' income amid market and environmental uncertainty.

Previous studies have shown variations in farmer income across various commodities, influenced by fluctuations in selling prices, production costs, and other external factors. Several previous studies that analyzed farmer income in commodities different from those in this study showed fluctuating income due to the influence of financing and prices set by farmers (Alfia N & Muhammad T., 2023; Hardyaningtyas & Hernawati, 2023; Rizki Muhamad, 2022; Sudyarti et al., 2022). By comparing previous studies, this study confirms the contribution of private rubber farmers' production costs in using fertilizers and pesticides as well as farmers' selling prices on income generation that drives the activities of rubber farmers in Tingkea'o Village, North Morowali Regency. This study will provide recommendations on the performance of farmers in

Tingkea'o Village in order to develop businesses to obtain appropriate income from the financing spent.

Given the gaps and phenomena revealed in the research, this study aims to analyze the contribution of production costs, namely fertilizer and pesticide costs and rubber latex selling prices, to the income fluctuations of rubber farmers in Tingkea'o Village. The results of this study are expected to provide strategic recommendations for the management and administrators of rubber farming businesses, both at the individual and institutional levels, in making decisions related to the efficient use of resources and adjustments to harvest marketing strategies. The contribution of this study is also expected to be an important consideration in the development of public policies that support the sustainability and improvement of the welfare of rubber farmers amid the challenges of market and environmental changes.

Contribution of Fertilizer Costs to the Income of Rubber Farmers in Tingkea'o Village

Fertilizer costs in the process of maintaining rubber trees among rubber farmers in Tingkea'o Village are considered to have a significant positive impact on supporting maximum income. This is based on research (Abdul Hakim, 2018; Mustamin, 2018; Sari et al., 2023) which reveals that fertilizer is one of the main components that has a significant influence on increasing rubber production and farmer income. Based on the findings of previous research, the following hypothesis is formulated:

H₁: Fertilizer costs contribute significantly to the income of rubber farmers in Tingkea'o Village

Contribution of Pesticide Costs to the Income of Rubber Farmers in Tingkea'o Village

Pesticide costs in the process of cleaning rubber tree areas in Tingkea'o Village from pests to obtain income are considered positive and significant in supporting maximum income. Research (Mustamin, 2018; Sudiyarti et al., 2022; Wardani & Yani, 2022) states that pesticide costs are an important part of the production budget that significantly affects income. Based on the findings of previous studies, it is formulated that:

H₂: Pesticide costs contribute significantly to the income of rubber farmers in Tingkea'o Village.

Contribution of Selling Price to the Income of Rubber Farmers in Tingkea'o Village

The selling price is considered one of the main factors that is very important to farmers' income. In order to obtain higher sales, the selling price plays a more crucial role than costs. Therefore, the selling price is considered an important part that significantly contributes to the income of rubber farmers in Tingkea'o Village. (Alfia N & Muhammad T., 2023; Andriani et al., 2023; Mustamin, 2018; D. Y. Sari et al., 2023; K. Sari et al., 2023; Tomina et al., 2023) found that price is a key factor, where higher prices will have a significant effect on farmers' income. Based on the previous findings, it is formulated that:

H₃: Selling prices contribute significantly to the income of rubber farmers in Tingkea'o Village.

METHODS

This study uses a numerical-based method with a quantitative descriptive approach and SEM PLS analysis through WarpPLS V.8.0 Software data processing to measure and analyze the income of rubber farmers in Tingkea'o Village. This approach was applied to provide clear calculations and descriptions of rubber farmers' income during the 2024 period in Tingkea'o Village. The analysis was conducted by highlighting two main variables, namely production costs consisting of fertilizer and pesticide costs and the selling price of rubber, which directly affect farmers' income. The calculation of rubber farmers' net income in this study refers to the formula proposed by (Suwandike et al., 2023; Yuliana et al., 2024), namely:

$$\pi = \text{TR} - \text{TC}$$

Explanation:

π = Income

TR = Total Revenue

TC = Total Cost

$$\text{TR value} = \text{P} \times \text{Q}$$

Explanation:

P = Price (Selling Price)

Q = Quantity (Production Volume)

$$\text{TC value} = \text{TFC} + \text{TVC}$$

Explanation:

TFC = Total Fixed Cost = 0

TVC = Total Variable Cost

The Total Fixed Cost (TFC) value for rubber farmers in Tingkea'o Village was not found in this study. This is because there are no fixed costs borne by farmers, given that all land and production facilities are privately owned, which means that farmers do not need to incur fixed costs as there is no equipment or supplies that require regular expenses such as depreciation calculations, which should be calculated at a fixed amount for each period. This is in contrast to fertilizer and pesticide costs, which are included in the variable cost component. These costs are fluctuating, changing according to need, and are not the same for every purchase for every rubber farmer in Tingkea'o Village (Alfia N & Muhammad T., 2023; Arrasyid, 2022).

Tingkea'o Village is the research location considered strategic and relevant based on the characteristics of land ownership and management, which are entirely carried out by the farmers themselves without a profit-sharing system with other parties. This study involved 34 rubber farmers as respondents and research informants, who were selected using random sampling to represent the population of rubber farmers in Tingkea'o Village. Data were collected through structured interviews based on a set of questions provided by the researchers, direct observation in the farmers' plantation areas, and documentation obtained from the farmers. Table 1 presents information on farmers in Tingkea'o Village.

Table 1. Infographic List of Ownership, Land Area and Annual Production, Sales Period of Rubber Farmers in Tingkea'o Village

Owner Name	Land Area	2024 Production	Sales Period
Mr. FN	1 Ha	1,137	3 times
Mr. KN	1 Ha	763	3 times
Mrs. TrT	1 Ha	950	3 times
Mr. HMN	1.5 Ha	1,243	3 times
Mrs. YM	1 ha	1,173	3 times
Mr. AL	1 Ha	2,789	4 times
Mr. CBM	1 Ha	1,899	4 times
Mrs. IS	1 Ha	1,438	4 times
Mr. ST	1 Ha	1,919	4 times
Mr. K	1 Ha	1,352	4 times
Mr. PT	1 Ha	2,598	5 times
Mr. AM	1 Ha	2,465	5 times
Mr. YM	2 Ha	1,792	5 times
Mr. MM	1 Ha	1,204	5 times
Mr. MNg	1 Ha	3,940	5 times
Mr. SpT	1 Ha	1,644	5 times
Mr. AdL	1 Ha	2,697	5 times
Mrs. SP	1 Ha	1,724	5 times
Mrs. MG	1 Ha	1,760	5 times
Mr. AT	2 Ha	3,125	5 times
Mr. MT	1 Ha	2,272	5 times
Mr. MK	2 Ha	2,199	5 times
Mr. BT	1 Ha	2,281	5 times
Mrs. RP	1 Ha	1,792	5 times
Mr. DT	1 Ha	2,316	6 times
Mr. YPM	2 Ha	2,390	6 times
Mr. HK	1 Ha	2,852	6 times
Mr. YBK	2 Ha	2,035	6 times
Mr. TP	2 Ha	2,029	6 times
Mr. RU	1 Ha	1,966	6 times
Mr. BYP	1 Ha	1,949	6 times
Mr. MNd	2 Ha	4,350	6 times
Mr. ERYN	1 Ha	2,382	6 times
Mr. DmT	1 Ha	2,063	6 times

RESULTS AND DISCUSSION

R-Square & Q Square Table

The coefficient of determination or R-Square is a statistical indicator used to measure the effectiveness of a model in explaining the variation that occurs in the dependent variable. The R-Square value represents the proportion of change in the dependent variable that can be explained by the independent variables used in the model. In other words, R-Square describes how well the model describes the fluctuations in the dependent variable. Based on the data in Table 2, an R-Square value of 0.415 was obtained, indicating that fertilizer costs (X1), pesticide costs (X2), and selling prices (X3) were able to explain 41.5% of the variation in the income variable (Y). The remaining 58.5% was influenced by other external factors.

To evaluate the significance level of a model's predictive ability, the Q-Square value must be greater than zero, while a value less than zero indicates that the model does not have relevant predictive ability. Based on the data in Table 2, a Q-Square value of 0.428 was obtained, indicating that the model in this study is relevant.

Table 2. R-Squared and Q-Squared Results

Farmer Income	Value
R-Squared	0,415
Q-Squared	0,428

Source: WarpPLS 8.0 (2024)

Model Fit Table

The model fit test results show that the average path coefficient index (APC) has a value of 0.271 with a p-value of 0.001 (<0.05). The average R-Square index (ARS) has a value of 0.415 with a p-value of 0.001 (<0.05). The adjusted average R-Square index (AARS) value is 0.404 with a p-value of 0.001, which is also less than the significance limit (<0.05). Meanwhile, the average full collinearity VIF (AFVIF) obtained a value of 1.316, which is within the tolerance limit of <= 3.3. And the average Block VIF (AVIF) value is 1.415, which is also within the tolerance limit of <= 3.3. These results indicate that all model fit criteria have been met, so the inner model in this study is declared feasible and acceptable.

Table 3. Model Fit Test Results

Indicator	Result	Criteria	Description
Average Path Coefficient (APC)	0,271 P <0,001	P <0,05	Fulfilled
Average R-Squared (ARS)	0,415 P <0,001	P <0,05	Fulfilled
Average adjusted R-Squared (AARS)	0,404 P <0,001	P <0,05	Fulfilled
Average full collinearity VIF (AFVIF)	1.316	Accept on <=5, Ideal <=3,3	Ideal
Average Block VIF (AVIF)	1.415	Accept on <=5, Ideal <=3,3	Ideal

Source: WarpPLS 8.0 (2024)

Test Framework

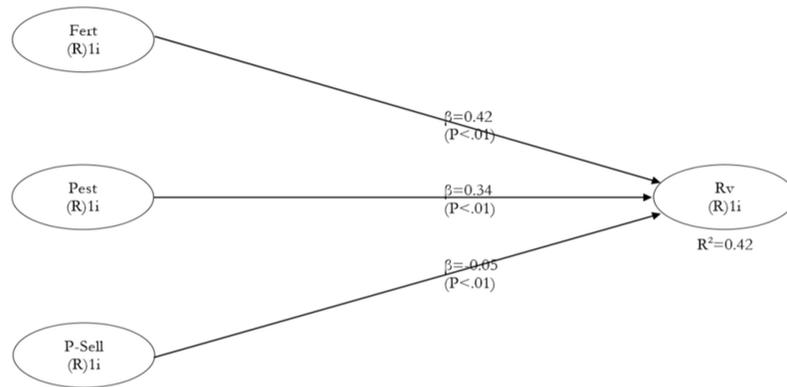


Figure1. Hypothesis Path Framework

Explanation:

Fert = Fertilizer Costs

Pest = Pesticide Costs

P-Sell = Selling Price

Rv = Revenue

Hypothesis Testing Table

Hypothesis testing in the SEM-PLS analysis approach is conducted using the t-test as the primary instrument for assessing the significance of relationships between variables. The decision to accept or reject a hypothesis is based on the p-value, where a p-value < 0.05 indicates that the tested relationship is statistically significant. The complete results of the p-value test are presented in Table 4.

Table 4. Hypothesis Testing Results

Hypothesis	Path Coefficient	P-Value	Description
Fertilizer (X1) => Income (Y)	0.419	<0.001	Accepted
Pesticides (X2) => Income (Y)	0.342	<0.001	Accepted
Selling Price (X3) => Income (Y)	-0.052	0.205	Rejected

Source: WarpPLS 8.0 (2024)

The test results show that the fertilizer cost variable (X1) has a positive and significant effect on rubber farmers' income, with a path coefficient value of 0.419 and a p-value of <0.05, namely <0.001. This means that the hypothesis stating that fertilizer costs contribute to income is statistically significant and acceptable. This also shows that fertilizer plays a major role in increasing production and the success of farming, thereby having a direct positive impact on income.

The proper use of fertilizer in appropriate doses can increase plant growth and crop quality, thereby increasing farmers' income. Investing in fertilizer yields significant results in terms of production quality and quantity, so that the cost is not a wasteful expense, but rather a productive investment that contributes significantly to improving the welfare of rubber farmers. This is in line with research conducted by (Mustamin, 2018), (Nadhar et al., 2024), and (Putra & Habibie, 2022) which states that fertilizer costs have a positive and significant effect on farmers' income.

The pesticide cost variable (X2) also shows a positive and significant effect on farmers' income, with a path coefficient value of 0.342 and a p-value <0.001. This positive coefficient indicates that an increase in pesticide costs correlates with an increase in farmers' income. With a p-value that does not exceed the significance limit of <0.05, it statistically supports the hypothesis that spending on pesticide costs has a significant impact on rubber farmers' income and is acceptable.

This study is also in line with the theory of farming by optimizing production factors effectively and efficiently to obtain maximum income (Yuliana et al., 2024). Pesticides play an important role in maintaining the health of rubber plants from pests and diseases that can reduce crop yields. This is in line with the findings stated by (Sudiyarti et al., 2022), (Wardani & Yani, 2022), and (Putra & Habibie, 2022) that fertilizer costs have a positive and significant effect on income.

The path coefficient of the selling price variable (X3) shows a negative value of -0.052 with a p-value of 0.205, which means that the contribution of the selling price to income is not significant and this hypothesis is rejected, unlike the two previous variables. A negative coefficient indicates an opposite relationship and is statistically insignificant because the p-value exceeds the threshold of <0.05. This indicates that in the context of this study, changes in selling price do not contribute significantly to variations in farmers' income.

This finding can be explained by the structural conditions of the rubber market, which is not fully controlled by farmers but is determined by market mechanisms and intermediaries (middlemen). In addition, dependence on local markets and lack of access to broader price information also contribute to the weak influence of selling price on income. This is in line with research conducted by (Adetya & Suprapti, 2021), (Tanjung et al., 2023), and (Fatmawati & Nasrul, 2023) which states that selling prices do not have a significant effect on farmers' income.

From the perspective of public sector management accounting, this shows that efficient production cost management and targeted use of fertilizers and pesticides can be key strategies in increasing farmers' income. This requires the role of local governments and related institutions in encouraging farmers to use fertilizers effectively and efficiently, for example by applying appropriate agricultural technology, providing access to subsidies and technical assistance for quality agricultural inputs, training in the proper use of agricultural inputs, supporting sustainable productivity-based cultivation practices, and stabilizing prices through market intervention to maintain farmers' welfare.

Improving farmers' capacity through training in financial management and rubber harvest marketing can help them understand the dynamics of costs and selling prices, enabling them to make strategic decisions aimed at increasing income. The insignificance of selling prices on farmers' income indicates the weak bargaining position of farmers in the harvest distribution system. Farmers should be given support to diversify products that provide more stable prices. There is a need to establish cooperative-based marketing institutions or farmer-owned enterprises

to shorten the distribution chain, improve market access, and strengthen price negotiation positions.

CONCLUSION

The findings reveal that the income of rubber farmers in Tingkea'o Village comes from investment costs for purchasing fertilizers and pesticides to maintain rubber plantations, while the selling price is not an important factor in the income of rubber farmers throughout the production process. This shows the importance of a significant separation between financing that is an investment in the fertility of rubber trees through the purchase of fertilizers and pesticides and considering the timing of sales in order to maximize sales revenue based on market prices and middlemen pricing.

This study has implications for the operational activities of rubber farmers and other commodities to develop a market strategy that provides maximum revenue based on control over the timing of sales and maintenance of plantation areas. The study is limited to rubber commodities in Tingkea'o Village in the 2024 period. The limitation of this study is that it does not analyze the investment cost aspect, while some rubber farmers consider investment costs to have an impact on their income. Research is further recommended to explore and analyze investment financing models for rubber farmers in order to increase their business income.

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