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ASSESSMENT OF INCOME, LABOR ALLOCATION, AND AGRICULTURAL PRACTICES ACROSS SUCO AND ALDEIA OF COCONUT FARMERS: A CASE STUDY IN THE SAME ADMINISTRATIVE POST, MANUFAHI MUNICIPALITY

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Abstract

Coconut farming plays a crucial role in the livelihoods of rural communities in tropical regions, where coconut products are a major source of income. Farmers often face challenges related to land size, labour costs, and access to markets, which can significantly impact their productivity and profitability. Understanding these dynamics is essential to improving farming efficiency and income generation. This study aims To assess the impact of production factors (number of coconut trees, production levels) on income among coconut farmers, to evaluate the influence of land area size on income distribution and identify the threshold sizes that provide significant income benefits, to examine the role of labor costs (for cultivation, harvest, and transportation) in relation to income, with a focus on identifying labor investment strategies that maximize income, to analyze the moderating effect of geographic location (Suco and Aldeia) on labor costs and income, to understand any localized influences on economic outcomes. This research was carried out in Manufahi municipality, taking place from January to March 2024. The variables observed in this study are analysing the relationship between land area, labour allocation, and income in coconut farming, to compare labour costs and income distribution across various Suco and Aldeia, to investigate the factors influencing income variability in coconut farming, to assess the impact of regional factors such as pests, diseases, and access to markets on labour and income, and to propose strategies for improving income and farming efficiency in rural communities. Land Area Owned remains strongly correlated with variables such as the Number of Coconut Trees Planted (0.9) and Average Production per year (0.95), reinforcing the idea that larger land areas allow for more trees and higher production, Holarua has a wider range of incomes, spanning from near zero to over $800. The median income is around $300, but there are several outliers, both high and low. This suggests that within Holarua, there is greater income variability, with some farmers earning significantly more than others. In Letefoho, incomes range from close to zero to about $600. The median income is slightly lower than in other Suco, falling below $300. There are a few outliers on the higher end, indicating that while most farmers earn a similar amount, there are some individuals who manage to generate significantly more income. Tutuluro has a more compressed income range, with most farmers earning between $200 and $400. The median income is close to $300, with no extreme outliers. This suggests that income distribution in Tutuluro is fairly uniform, with most farmers earning similar amounts. Wide Variation in Some Suco: Babulo, Dai-Sua, and Holarua exhibit wide ranges of income, with some farmers earning significantly more than others. This suggests that income disparities are greater in these Suco, possibly due to differences in farm size, crop types, or market access.

***Keywords**: coconut, income, labor costs, and Farmers*

INTRODUCTION

Agribusiness development policies are designed to elevate the agricultural sector as a primary economic driver by strengthening an interconnected system of subsystems essential for agricultural growth and productivity. According to Mhlanga and Bernabe (2018), agribusiness policies increasingly emphasize inclusive business models that integrate smallholders into the supply chain, enhancing infrastructure and creating robust linkages for production and marketing subsystems. Similarly, Kebede and Hendriks (2019) highlight that policy support for agro-industrial development focuses on establishing comprehensive value chains that connect production, processing, and distribution networks, providing small-scale farmers with access to essential resources and wider markets.

Research by Devaux et al. (2018) and Paloma et al. (2017) further underscores the importance of policies that support the development of subsystems like seed industries and agro-industrial processing. These subsystems contribute to an agribusiness environment that encourages productivity and economic diversification. Sartas et al. (2020) emphasize that policy measures supporting infrastructure and service subsystems play a crucial role in enhancing agribusiness scalability, facilitating the transition from subsistence farming to a more market-oriented approach. Collectively, these subsystems function synergistically within the agribusiness framework, positioning agriculture as a strategic sector for national economic development by linking rural economies to larger markets, increasing agricultural outputs, and creating sustainable value chains.

Coconut plays a multifaceted role in the agricultural economy and environmental sustainability. As a key plantation crop, coconut contributes substantially to the income of farmers and rural communities, providing both direct income from its products and employment opportunities in coconut cultivation and processing (Subramanian and Murugaiyan, 2017). The crop serves as a valuable source of raw materials for industries that process coconut products into oil, food, and other goods, enhancing domestic value addition and providing avenues for copra exports that contribute to foreign exchange earnings (Gunathilake et al., 2021). This industry structure not only supports economic stability in coconut-producing regions but also establishes the coconut sector as an essential contributor to both local and national economies.

In addition to its economic benefits, coconut cultivation supports environmental conservation through its role as a perennial tree crop capable of sequestering carbon dioxide (CO_2) and releasing oxygen, thus aiding in greenhouse gas mitigation efforts (Fernando et al., 2018). Coconut plantations also support biodiversity conservation and have potential applications in eco-tourism, especially in tropical regions where they form part of the natural landscape (Ranasinghe et al., 2020). Furthermore, coconut is a significant food source, contributing to dietary needs and nutritional security in many tropical regions. Shortages in coconut supply can impact both local economies and food security, highlighting its importance to community welfare and economic resilience (Perera et al., 2019).

Coconut stands as a primary plantation commodity in Timor-Leste, contributing significantly to the nation’s economy. The main products derived from coconut, particularly coconut oil and copra, have substantial economic value, positioning them as leading contributors to foreign exchange earnings in comparison to other plantation commodities (Silva et al., 2021).

METHODS

This research was conducted in the Same Administrative Post, located in Manufahi Municipality. This location was specifically (purposively) chosen due to its significant the focus of this research is on the Low Income of Farmers from Coconuts and the Low Selling Price of Coconuts. The scope of this study is limited to farmers' income from coconuts, considering factors such as land area, labour, capital, farmer education, and management. Research Questionnaire: Analysis of Coconut Farmer Income.

Information collected directly from the main source or study subjects. In this context, the data includes:

Interviews: Conducting in-depth interviews with coconut farmers to understand the production process, challenges, and strategies for increasing income, Field Observations: Performing direct observations in coconut plantations to understand production practices, soil conditions, and other factors affecting crop yield and farmer income, Surveys: Distributing questionnaires to farmers to collect statistical data on income, production costs, and production volumes.

Methodological Triangulation: A technique used in qualitative research to strengthen findings by combining data from various sources, including in-depth interviews, literature studies, and field observations.

Google Forms: A free service from Google that allows users to easily create various types of online forms, such as surveys, questionnaires, or quizzes.
Secondary Data: Information that already exists and has been collected by others previously. This includes: Agricultural Statistical Reports: Official reports from the government or related institutions providing insights into coconut production, market prices, and income trends in the area. Scientific Literature: Articles, papers, and scientific publications discussing similar topics, including other case studies on coconut production. Historical Data: Information about past coconut production and income that can be used for trend analysis and comparison.
The number of farmer respondents to be observed in this study is 26 respondents from Babulo village, 35 respondents from Daisua village, 9 respondents from Grotu village, 14 respondents from Holarua village, 39 respondents from Letefoho village, and 18 respondents from Tutuluro village. From these 6 villages, there is a total of 141 respondents who will be analyzed in this study. The sampling technique used in this study is total sampling of the population.
In this study, the applied data analysis method is quantitative descriptive analysis. This analysis involves calculating income, including receipts and production costs, as well as income from coconut farming.

Statistical Analysis

Four types of statistical analyses were applied to examine the research variables:

Correlation Analysis (Heatmaps).

Used to identify the strength and direction of relationships among economic, demographic, and geographic variables of coconut farmers. Variables include:Economic: land ownership, income, labor costs, number of trees, production, sales.Supporting: pests, market access, capital access, training, men/women.Geographic: Suco and Aldeia (coded numerically).Pearson correlation coefficients were calculated and visualized in heatmaps.

Kruskal-Wallis H-Test (Non-Parametric).

Assessed differences in income distributions across groups: By Suco (within Manufahi municipality), By Aldeia, By land area groups.

Tukey Honest Significant Difference (HSD) Test.

Performed after the Kruskal-Wallis test to identify specific groups, especially land area groups, showing significant income differences.

Descriptive & Inferential Statistics for Labor Costs.

Explored the relationship between labor costs (cultivation, harvest, transport) and total income. Pair plots and histograms illustrated correlations and cost distributions. Kruskal-Wallis tests were also applied to compare labor costs across Suco and Aldeia.

RESULTS AND DISCUSSION

Relationship between all identified variables.

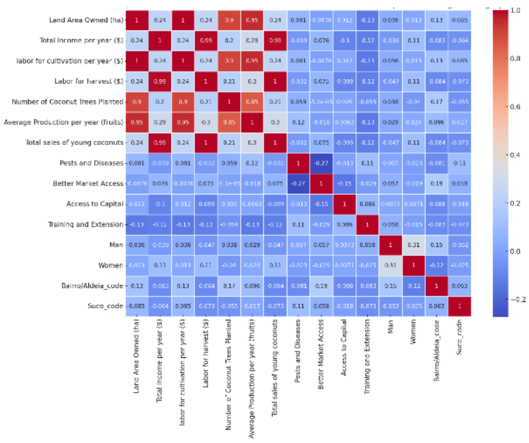


Figure 1: *Heatmap between fifteen variables related to the income of coconut farmers in Manufahi municipality.*

Total income continues to show a very strong correlation with Labor for Harvest (0.99) and Total Sales of Young Coconuts (0.99), underscoring that income is closely tied to labor efficiency in harvesting and the ability to sell young coconuts effectively. New variables such as Better Market Access and Access to Capital have very weak correlations with Total Income, suggesting that these factors may not be the primary drivers of income in this dataset. For example, Better Market Access has a weak negative correlation with Total Income (-0.076), indicating limited influence.

Relationship between all significant variables.

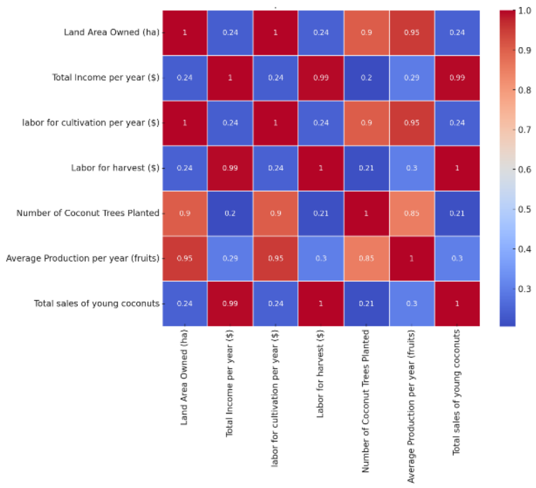


Figure 2. Heatmap between seven variables related to the income of coconut farmers in Manufahi municipality.

Total income shows a very strong correlation (0.99) with labor for harvest, indicating that income is closely linked to the amount of labor invested in harvesting. This suggests that harvesting plays a critical role in determining income levels for coconut farmers. There is also a strong correlation (0.99) between total income and total sales of young coconuts, which indicates that the income earned is directly related to the sales of young coconuts, the primary product for these farmers. The correlation between total income and the number of coconut trees planted is relatively weak (0.2), suggesting that merely planting more trees does not necessarily lead to higher income without efficient harvesting and sales practices.

Labor for cultivation is strongly correlated with land area owned (1.0) and average production per year (0.95), suggesting that larger farms require more labor for cultivation, and this increased labor leads to higher yields. However, the relationship between labor for cultivation and total income is weak (0.24), indicating that increasing cultivation labor does not directly translate into higher income without efficient harvesting and sales strategies.

Pairwise relationships between total income.

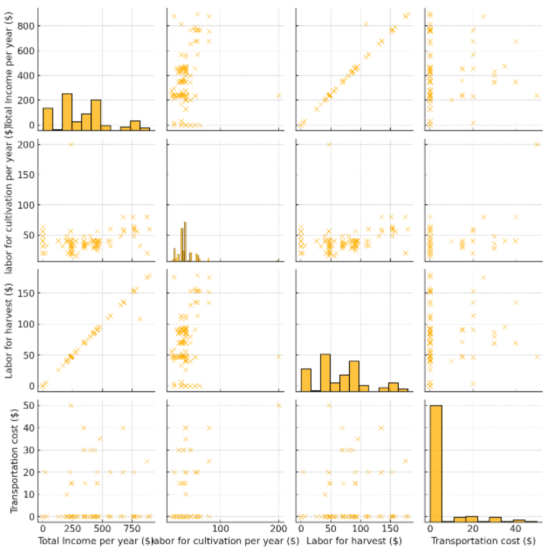


Figure 3. Pairwise relationships between total income, labor for cultivation, labor for harvest, and transportation costs.

visually explores the relationships between Total Income per year, Labor for cultivation, Labor for harvest, and Transportation costs. The diagonal of the plot shows histograms for each variable, revealing the distribution patterns. For example, Total Income has a wider range, while Transportation costs are concentrated near lower values, indicating that most farmers spend less on transportation.

The off-diagonal scatter plots reveal interactions between the variables. Notably, there is a positive relationship between Total Income and Labor for harvest. This suggests that farmers who invest more in harvesting labor tend to generate higher income. However, the relationship between Total Income and Labor for cultivation is less pronounced, indicating that increased cultivation labor does not directly lead to higher income in the same way.

Transportation costs, on the other hand, show weak or no clear correlation with other factors like income or labor, meaning that transportation expenses do not significantly impact income or labor investments in this dataset.

In summary, the pair plot suggests that labor for harvesting plays a critical role in income generation, while transportation costs remain relatively minimal and uncorrelated with other key factors.

Distribution of labour costs.

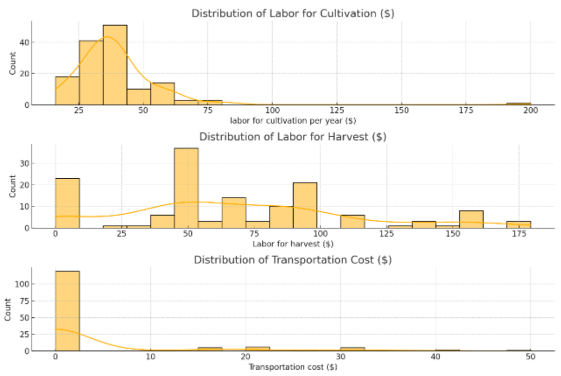


Figure 4. Distribution of labor costs for cultivation, harvesting, and transportation across the dataset.

In contrast, the second histogram, depicting labor costs for harvesting, demonstrates a wider range of spending. While the majority of farmers spend around \$50, there are notable clusters of higher expenditures, with some farmers spending up to \$175. This variation suggests that different farmers have diverse needs or practices related to harvesting labor, which might depend on factors like farm size or crop yield.

The final histogram [Figure 5.4], focused on transportation costs, shows that most farmers spend very little on transportation. The vast majority of transportation expenses are clustered near zero, with only a few farmers incurring costs higher than \$20. This suggests that transportation is not a significant cost for most farmers in this dataset.

In summary, labor for harvesting shows the greatest variability, with some farmers investing significantly more in this area compared to cultivation and transportation. In contrast, transportation costs are consistently low, indicating that it plays a minimal role in overall labor expenditures for most farmers.

This figure shows the varying costs for key farming activities. The right-skewed distribution for Labor for Cultivation suggests that while most farmers keep cultivation costs low, a few invest significantly more. This may be due to larger farm sizes or differing cultivation practices (Huang et al., 2019).

In contrast, the broader distribution of Labor for Harvest reflects diverse harvesting needs, potentially driven by varying crop yields or labor availability. The consistently low Transportation Costs across most farmers imply that transportation does not significantly impact overall costs, aligning with studies that indicate transportation is often a minor component in rural farm budgets (World Bank, 2020)

Boxplots comparing labor costs for cultivation.

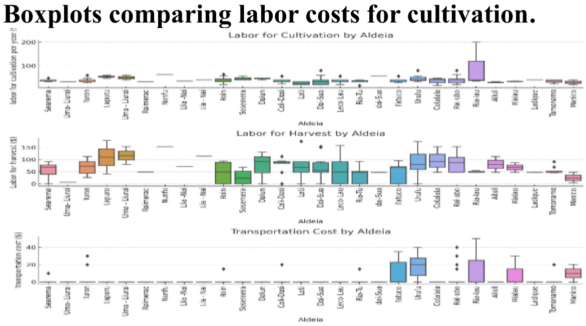


Figure 5. Boxplots comparing labor costs for cultivation, harvesting, and transportation across different Aldeia.

Contains three boxplots comparing labor costs for cultivation, harvesting, and transportation across different Aldeia. Boxplots provide a clear visual of the data distribution, highlighting the median, quartiles, and potential outliers for each category.

Figure 5. 5 shows how labor costs for cultivation vary across different Aldeia. Most Aldeia have relatively low and consistent cultivation labor costs, with the majority falling below $50. However, there are some Aldeia with higher variability, such as Rai-lau, which shows a significantly larger range in labor costs, including some outliers above $100. The general pattern indicates that labor for cultivation does not show extreme differences across most Aldeia, but certain villages like Rai-lau demonstrate that some farmers invest more in cultivation labor.

Labor for harvest shows more variability across Aldeia compared to cultivation. While some Aldeia such as Searema and Uma-Liurai exhibit lower costs for harvesting, others like Loti and Rai-lau show higher ranges, with some values reaching up to $150 or more. The wide range in several Aldeia suggests that harvesting labor is more dependent on individual practices, crop yields, or perhaps the availability of labor. There are also outliers in multiple Aldeia, indicating that in some cases, farmers spend significantly more on harvest labor than the majority.

Boxplots comparing labor costs for cultivation.

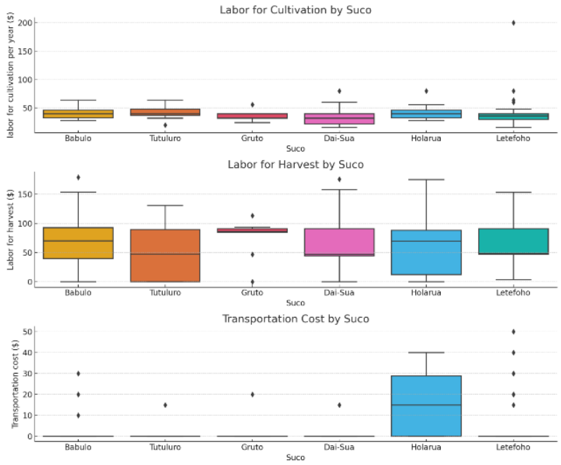


Figure 6. Boxplots comparing labor costs for cultivation, harvesting, and transportation across different Suco.

Describes labor costs based on Suco. Most Suco exhibits relatively similar labor costs for cultivation, with costs clustering below $50. The exception is Letefoho, which shows a higher degree of variability, with an outlier approaching $200, indicating that some farmers in this region invest significantly more in cultivation labor. Other Suco, such as Tutuluro and Holarua, also have small outliers, but these are less extreme. This suggests that labor for cultivation remains relatively stable across regions, with only a few exceptions where farmers are spending considerably more.

Labor for harvest shows more variation between Suco compared to cultivation. Babulo and Tutuluro have median labor costs between $50 and $100, while Suco like Gruto and Holarua exhibit broader ranges, with outliers both above and below the typical cost ranges. Dai-Sua and Letefoho have more moderate ranges, indicating that harvest labor costs are fairly consistent within these Suco. Holarua shows a higher range of harvest labor costs, with some outliers, which suggests variability in how labor is used for harvesting in this region.

Comparison of income distribution between Land Area Group in Manufahi Municipality.

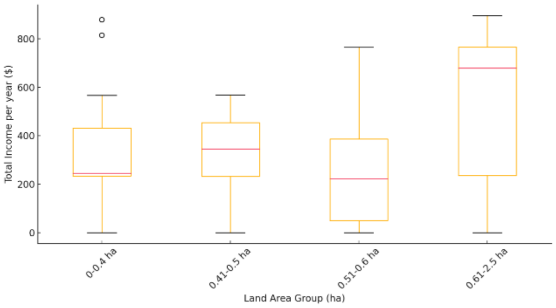


Figure 7. Boxplot of comparison of income distribution between Land Area Group in Manufahi Municipality.

For the Land Area Group (0.41-0.5 ha), the group has a similar distribution to the previous one, with a median income of around $400. The range of income is slightly narrower, with most farmers earning between $200 and $500. There are no outliers in this group, suggesting a more consistent relationship between land size and income.

For the Land Area Group (0.51-0.6 ha), the median income for this group is somewhat lower, around $200. The interquartile range (IQR) is also smaller compared to the other groups, showing that income is more concentrated. The range extends from just under $100 to around $500, but the relatively tight range suggests less variation in income among farmers with this land size.

Finally Land Area Group (0.61-2.5 ha), this group shows the largest variability in income. The median income is higher, around $500, and the range of income is much broader, extending from below $100 to over $800. This suggests that larger land areas tend to generate higher incomes, but there is also more variability in how farmers with larger landholdings perform. Some farmers in this group earn significantly more than others, reflecting the potential for greater income with larger land areas.

Comparison of income distribution between Aldeia in Manufahi Municipality.

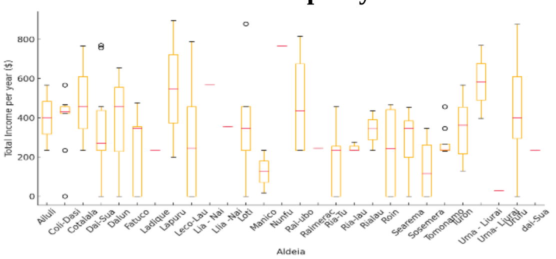
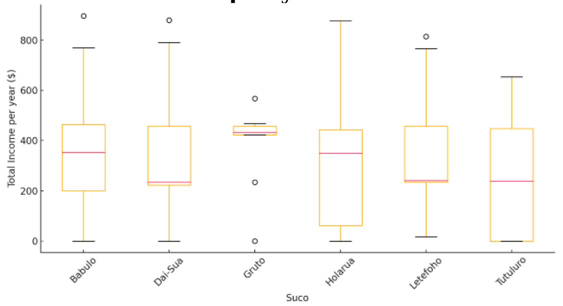


Figure 8. Boxplot of comparison of income distribution between Aldeia in Manufahi Municipality.

In contrast, some Aldeia, such as Lilia-Nai, Loti, and Sosemera, show very tight ranges in income. These villages have almost no variability, indicating that most farmers in these areas earn around the same amount, with little difference between them. This could point to more uniform farming practices, land distribution, or market access. For instance, Lilia-Nai has a nearly flat boxplot, suggesting that almost all farmers have similar incomes, close to the median.

Several Aldeia, such as Cotalala, Rai-lau, Searema, and Coli-Dasi, display significant outliers. In Cotolala and Rai-lau, some farmers earn far above the typical income range, while the majority remain below $400. These outliers suggest that a few farmers have much higher success, likely due to factors like better market access, larger landholdings, or more efficient farming techniques. The outliers in Searema and Coli-Dasi indicate similar disparities, where a few individuals are earning significantly more than their peers in the same village.

Comparison of income distribution between Suco in Manufahi Municipality.



about $600. The median income is slightly lower than in other Suco, falling below $300. There are a few outliers on the higher end, indicating that while most farmers earn a similar amount, there are some individuals who manage to generate significantly more income.

Tutuluro has a more compressed income range, with most farmers earning between $200 and $400. The median income is close to $300, with no extreme outliers. This suggests that income distribution in Tutuluro is fairly uniform, with most farmers earning similar amounts.

CONCLUSION

This study highlights the complex interplay between land size, labor allocation, and income in rural coconut farming communities. While larger land areas generally contribute to higher production and income, this relationship is not always proportional. Efficient labor allocation, particularly for harvesting, emerges as a critical factor in determining income, underscoring the importance of harvesting labor over cultivation or transportation efforts. However, regional disparities in income across different Suco and Aldeia reveal the influence of external factors such as pest management, access to markets, and capital.

Farmers in certain regions with smaller landholdings still manage to achieve higher income, suggesting that farming practices, access to better resources, or more effective market strategies can compensate for limited land. Furthermore, the weak correlations between access to markets, capital, and income suggest that improving these external factors may not significantly impact income without concurrent improvements in labor efficiency and harvesting practices.

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