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Economic Analysis of Income of Smallholder Oil Palm Farming In Asahan Regency of North Sumatra

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Abstract: Asahan Regency is a major oil palm production center in North Sumatra Province, showing a continuous increase in planted area and production that significantly shapes the regional agricultural economy. This study aims to analyze farm income of smallholder oil palm farming in Asahan Regency. The research was conducted purposively across three sub-districts, utilizing a multistage sampling method combined with proportional quota sampling to select 130 respondents. The economic results showed that smallholder oil palm farming is highly profitable, with an average net income of IDR 143,907,718 per year. To optimize regional economic growth and farmers' welfare, local governments should implement price controls on agricultural inputs and strengthen credit access to lower production costs.

Keyword: Income, Oil Palm Farming, Smallholder Economic.

INTRODUCTION

Indonesia is one of the world's largest producers of oil palm, making the plantation subsector a strategic contributor to the national agricultural economy and rural livelihoods (BPS, 2020). However, despite its significant production capacity, the productivity of independent smallholder plantations remains relatively low, averaging only 3.42 tons/ha, primarily due to inefficient input utilization, limited access to capital, and slow adoption of agricultural technology (Ministry of Agriculture, 2020; Arsyad & Maryam, 2017). These constraints reduce production efficiency and ultimately weaken the economic welfare of farming households that depend on oil palm cultivation (Nainggolan et al., 2021).

Previous studies have consistently shown that production costs, input allocation, and production levels are important determinants of farm income. For example, fertilizer use, labor costs, and production volume significantly influence the profitability of oil palm farming, while inefficient input management reduces farmers' financial performance (Purwanto, 2020). Other studies have emphasized the importance of technological adoption and access to production resources in improving plantation productivity (Arsyad & Maryam, 2017; Nainggolan et al., 2021). Nevertheless, these studies generally examine production

factors or farm profitability separately and rarely integrate production cost components with comprehensive financial feasibility indicators. Moreover, empirical evidence focusing on independent smallholder oil palm farmers in Asahan Regency remains limited, despite the region's importance as one of the major oil palm production centers in North Sumatra.

The situation in Asahan Regency highlights the importance of addressing this research gap. Although the regency contributes substantially to regional oil palm production, independent farmers continue to face considerable economic pressure resulting from fluctuations in Fresh Fruit Bunch (FFB) prices. In 2023, FFB prices declined from IDR 1,855/kg to IDR 1,800/kg (Asahan Regency Plantation Office, 2023), while production costs continued to increase due to expenditures on fertilizers, pesticides, labor, and other farming inputs. This imbalance between revenue and production costs raises concerns regarding the long-term financial sustainability of smallholder oil palm farming.

Business Costs and Income

Production costs consist of raw material costs (production inputs), direct labor, and overhead. These costs are categorized into fixed costs (FC) which remain constant regardless of production volume (e.g., rent, taxes, depreciation) and variable costs (VC) which fluctuate in proportion to output levels (e.g., raw materials and per-unit wages). Total cost is expressed by the formula: $TC = FC + VC$ (Soekartawi, 2002).

Farm business income is the difference between total revenue (TR) and total cost (TC), calculated using the formula: $Income = TR - TC$. TR is derived by multiplying the production quantity by the selling price. Since farmers act as investors, managers, and laborers simultaneously, farm business income is classified into net return, family farm income, family labor income, farm net cash flow, and household net cash flow.

METHOD

Hypotheses

The hypotheses for this study are as follows: (1) smallholder oil palm farming in Asahan Regency is profitable (Hutajulu, 2019).

Research Time and Location

This research was conducted from April to May 2025. The study location was selected using a purposive sampling method (Sugiyono, 2013), focusing on several sub-districts within Asahan Regency.

Research Method

This study employed a survey method. According to Sugiyono (2013), a survey involves gathering primary data through structured questionnaires administered to a sampled segment of a population to identify the relative occurrences, distributions, and relationships among specific variables.

Sampling and Data Collection Methods

The study area was selected purposively in Asahan Regency, the primary center of oil palm production in North Sumatra, which accounted for 1,654,040 tons (22.20%) of the provincial output in 2021. Based on the highest production levels, three sub-districts were chosen, each represented by two villages: Bandar Pulau (Desa Bandar Pulau Pekan and Padang Pulau), Bandar Pasir Mandoge (Desa Bandar Pasir Mandoge and Suka Makmur), and Aek Kuasan (Desa Aek Loba and Alang Bonbon).

Following Hair et al. (2021), a total sample of 130 respondents was determined using a multistage sampling approach across the sub-district and village levels. Proportional quota

sampling was applied to distribute the sample across the villages as follows: Bandar Pasir Mandoge (23), Suka Makmur (15), Bandar Pulau Pekan (23), Padang Pulau (24), Aek Loba (24), and Alang Bonbon (21). The final selection of individual farmers was executed through simple random sampling based on local farmer group registries. Primary data were collected through field observations and structured interviews using questionnaires, while secondary data were obtained from literature reviews and official institutional reports.

Data Analysis Methods

Data processing began with editing and tabulation before entering quantitative analysis. First, farm income (π) was calculated using the formula $\pi = TR - TC$, where Total Revenue (TR) is the product of price (P) and production quantity (Q), and Total Cost (TC) is the sum of Total Fixed Cost (TFC) and Total Variable Cost (TVC).

Hypothesis testing (Income Feasibility) was evaluated using a One-Sample t-test by comparing the profitability value against zero ($\mu = 0$), where a significance level of $p \leq 0.05$ indicates a profitable farming operation.

RESULT AND DISCUSSION

General Overview of the Research Location

Asahan Regency is located on the East Coast of North Sumatra, geographically situated between 2°30'00"–3°10'00" N and 99°01'–100°00' E, with a total area of 3,732.97 km² spanning 25 sub-districts. The region features a tropical climate with an annual rainfall of 2,846 mm. In 2024, the population of Asahan Regency reached 813,720 people, dominated by a productive-age demographic (67%). Agriculturally, the regency serves as a primary hub for smallholder oil palm plantations in North Sumatra. In 2023, the smallholder oil palm area reached 75,518.92 ha with a Fresh Fruit Bunch (FFB) production volume of 1,501,360.81 tons. The presence of adequate palm oil mills in the region effectively integrates upstream plantation activities with downstream Crude Palm Oil (CPO) processing, establishing a robust agribusiness ecosystem for the local economy.

Table 1. Distribution of Respondents by Sub-District and Village in Asahan Regency

No	Sub-District	Village	Sample
1	Bandar Pasir Mandoge	Bandar Pasir Mandoge	23
		Suka Makmur	15
2	Bandar Pulau	Bandar Pulau Pekan	23
		Padang Pulau	24
3	Aek Kuasan	Alang Bonbon	21
		Aek Loba	24
Total			130

Source: Primary Data (Processed, 2026)

Table 2. Distribution of Respondents by Age Group in Asahan Regency

No	Age Group (Years)	Frequency	Percentage (%)
1	Young Age (<35 years)	5	3.8
2	Middle Age (35–55 years)	84	64.6
3	Older Age (>55 years)	41	31.6
Total		130	100

Source: Primary Data (Processed, 2026)

Table 3. Distribution of Respondents by Education Level in Asahan Regency

No	Education Level	Frequency	Percentage (%)
1	Primary School	15	11.5
2	Junior High School	19	14.6
3	Senior High School	70	53.9
4	Bachelor's Degree	26	20.0
Total		130	100

Source: Primary Data (Processed, 2026)

Table 4. Distribution of Respondents by Farming Experience in Asahan Regency

No	Farming Experience (Years)	Frequency	Percentage (%)
1	Low Experience (<5 years)	46	35.4
2	Moderate Experience (5–15 years)	50	38.5
3	High Experience (>15 years)	34	26.1
Total		130	100

Source: Primary Data (Processed, 2026)

Table 5. Distribution of Respondents by Family Size

No	Number of Dependents	Number of Respondents	Percentage (%)
1	Small Household (1–2 members)	64	49.23
2	Medium Household (3–4 members)	50	38.46
3	Large Household (>4 members)	16	12.31
Total		130	100

Source: Primary Data (Processed, 2026)

Table 6. Distribution of Respondents by Land Area in Asahan Regency

No	Land Area (Ha)	Frequency	Percentage (%)
1	Small Landholding (≤ 2 ha)	57	43.8
2	Medium Landholding (2.1–4 ha)	46	35.4
3	Large Landholding (>4 ha)	27	20.8
Total		130	100

Source: Primary Data (Processed, 2026)

This study was conducted purposively in Asahan Regency, specifically within Bandar Pasir Mandoge, Bandar Pulau, and Aek Kuasan sub-districts. Following the removal of 14 outliers, the final sample comprised 130 respondents. Demographic analysis indicated that the majority of respondents fell within the productive age range of 35–55 years (64.6%), which supports the physical capacity required for labor-intensive cultivation and technological adaptation. The formal education level was relatively high, dominated by high school graduates (53.9%) and bachelor's degree holders (20.0%), reflecting proficiency in economic management and production input optimization. Farming experience was predominantly in the moderate category of 5–15 years (38.5%) and the high category of >15 years (26.1%), indicating established managerial competence in cultivation. Family size was relatively small, with 1–2 dependents (49.23%) and an overall average of 2.7 persons, thereby easing domestic consumption burdens. Meanwhile, landholding distribution was characterized by small-scale ownership of ≤ 2 ha (43.8%), serving as a critical determinant in core input cost allocation and farm profit margins.

Oil Palm Farm Analysis

Table 7. Average Farm Cost Structure per Year (N=130)

Farm Component	Average Value (IDR/ha/kg/Year)	Percentage (%)
A. Variable Cost		
Fertilizer	12,161,415	33.43
Pesticides	1,643,000	4.52
Labor	22,572,046	62.05
Sub-total Variable Cost	36,376,461	100
B. Fixed Cost		
Equipment Depreciation	1,767,856	82.51
Seedling Amortization	266,592	12.44
Land Tax	108,485	5.06
Sub-total fixed cost	2,142,682	100
Total Cost (TC)	38,519,143	100

Table 8. Average Annual Oil Palm Production and Revenue

No	Description	Average
1	Oil palm production (kg/year)	72,350
2	Total revenue (IDR/year)	182,426,861

Source: Primary Data (Processed, 2026)

Table 9. Average Annual Oil Palm Farm Income

No	Description	Average
1	Farm revenue (IDR/year)	182,426,861
2	Total production cost (IDR/year)	38,519,143
	Total	143,907,718

Source: Primary Data (Processed, 2026)

Based on Tables 7, 8, and 9, smallholder oil palm farming in Asahan Regency is proven to be highly profitable. With an average production volume of 72,350 kg/year, farmers generate a total annual revenue of IDR 182,426,861 and a net farm income of IDR 143,907,718. The average total production cost is IDR 38,519,143 per year, of which 94.44% consists of variable costs, primarily labor wages (62.05%) and fertilizer inputs (33.43%). In contrast, fixed costs account for only 5.56% of total production costs, including equipment depreciation, seedling amortization, and land taxes.

This cost structure indicates that the profitability of smallholder oil palm farming is largely determined by the efficient management of variable inputs rather than fixed investments. Because variable costs represent the largest proportion of production expenses, improvements in labor productivity and more efficient fertilizer application can substantially increase farmers' net income (Xin, 2022). This finding is consistent with agricultural production theory, which emphasizes that optimizing variable inputs is essential for improving production efficiency and maximizing farm profitability (Bhamare, 2023; Thakur et al., 2024; Tom et al., 2024). Furthermore, research has shown that optimal input allocation can lead to significant increases in agricultural productivity and efficiency (Wake, 2019). In soybean production, the efficient allocation of essential production inputs enables farmers to maximize yields while reducing unnecessary production costs. Appropriate combinations of these inputs improve technical efficiency, enhance resource use efficiency, and support the long term sustainability of soybean farming. A study by Gaviglio et al. (2021) also found that farms that optimized their input allocation were more likely to achieve higher technical efficiency and greater output.

The high level of farm income also reflects that, under the prevailing production and price conditions, oil palm cultivation remains an economically attractive enterprise for

independent smallholders in Asahan Regency. Nevertheless, the heavy reliance on labor and fertilizer expenditures suggests that farmers are vulnerable to increases in wage rates and input prices. Any significant rise in these costs, without a corresponding increase in productivity or selling prices, would directly reduce profit margins. Therefore, maintaining profitability requires not only increasing production but also implementing cost-efficient farm management practices.

These findings are broadly consistent with previous studies reporting that production efficiency and effective cost management are the primary determinants of profitability in oil palm farming. The results further suggest that policies promoting balanced fertilizer use, improved cultivation techniques, access to affordable agricultural inputs, and labor-saving technologies could enhance farmers' economic performance. Consequently, strengthening extension services and supporting efficient input management are important strategies for sustaining the profitability and long-term financial viability of smallholder oil palm plantations.

CONCLUSIONS AND RECOMMENDATIONS

Farm Income: The average net income of smallholder oil palm farmers in Asahan Regency is IDR 143,907,718 per year, demonstrating strong economic performance.

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