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Impact of Rubber to Oil Palm Farm Transition on Income and Welfare of Farmers in North Padang Lawas Regency

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Abstract

The decline in rubber prices from Rp18,000 to Rp6,000–Rp10,000 per kilogram has encouraged farmers in Sihopuk Baru Village, North Padang Lawas Regency, to shift to oil palm farming as an adaptive response to structural market pressures. This study aims to analyze the driving factors of this shift and its impact on farmers' income and welfare. A mixed methods approach with a sequential explanatory design was applied, involving 32 respondents selected through a census method and 8 key informants selected purposively. Quantitative analysis using the Paired Samples T-Test was complemented by qualitative analysis conducted through the stages of data reduction, data presentation, and conclusion verification. The results identified five driving factors: structural rubber price pressure, superior oil palm productivity (an 8.1-fold increase), labor allocation efficiency, institutional support, and long-term profit prospects. The transition increased average farmer income by 139%, from Rp2,783,512.50 to Rp6,653,593.75 per month ($t = -7.828$; $df = 31$; $p < 0.001$). Multidimensional impacts include reduced workload intensity, increased accumulation of productive assets, and improved access to education. The findings confirm that the transformation of smallholder plantation commodities is an effective mechanism for improving rural welfare, although its sustainability depends on the stability of crude palm oil (CPO) prices and the capacity for household economic diversification.

INTRODUCTION

The plantation sector is a crucial pillar of Indonesia's rural economic transformation, serving both as a source of foreign exchange and as a livelihood for millions of smallholder farmers. Over the past two decades, the dynamics of plantation commodity shifts reflect a complex interaction between global market pressures, farmers' adaptive capacity, and prevailing agricultural policies. The shift from rubber to oil palm across various regions of Sumatra and Kalimantan represents one of the most significant structural transformations in the history of contemporary Indonesian tropical agriculture.

Indonesia, as the world's leading producer of crude palm oil (CPO), has recorded consistent expansion of oil palm plantations as documented by Rustiadi et al. (2023) and the Direktorat Jenderal Perkebunan (2023). Rustiadi et al. (2023) assert that this expansion has structural implications for the rural economy, including job creation, the strengthening of upstream-downstream industrial linkages, and interregional income redistribution. Chrisendo et al. (2022), drawing on smallholder household data, further assert that oil palm expansion has

had multiple impacts on income, labor markets, and access to basic services, making it the most transformative commodity in contemporary tropical agriculture.

Natural rubber, on the other hand, is facing increasingly acute structural pressures. Global oversupply resulting from massive plantation expansion and the substitution of synthetic for natural rubber in the automotive sector has consistently depressed farm-gate prices (Wijaya et al., 2023). The inescapable costs of fertilizer, daily tapping labor, and the maintenance of aging plants further erode profitability, trapping farmers in low-income situations (Kühling et al., 2022). Within this framework, land conversion decisions are not merely impulsive reactions to price fluctuations but rather long-term investment calculations grounded in comparisons of the risk-return profiles of the two commodities.

The tension between the economic and ecological dimensions of oil palm expansion has generated significant academic and policy debate. Pahmi et al. (2023) document the negative social impacts of oil palm expansion on local communities, while Mulyasari et al. (2023) identify trade-offs between improved economic well-being and biodiversity degradation. However, Renner et al. (2024) also find that sustainability certifications such as the Roundtable on Sustainable Palm Oil (RSPO) can mitigate negative impacts while preserving economic benefits for smallholders.

Consistent with the findings of Fatmasari et al. (2018) that oil palm plantation expansion produces ecological landscape changes and livelihood dilemmas for rural communities, this study positions the phenomenon in Sihopuk Baru Village as a microcosm of these dynamics: a commodity transformation that delivers tangible economic benefits while also demanding attention to ecological impacts and the long-term resilience of local communities.

The novelty of this research lies in several aspects. First, it focuses on North Padang Lawas Regency, a region with distinctive agroclimatic and institutional characteristics that have not previously been examined in the academic literature on plantation commodity transitions. Second, it employs a mixed methods sequential explanatory design in which quantitative analysis — specifically a Paired Samples T-Test comparing income before and after the transition on identical land parcels — is reinforced and elaborated through qualitative analysis of in-depth interviews with key informants. Third, the study uses a census method covering all 32 farmers in Sihopuk Baru Village who have converted from rubber to oil palm, eliminating sampling bias and ensuring representativeness. Fourth, it identifies five synergistic driving factors rather than relying on single-cause explanations, providing a more comprehensive understanding of transition decisions. Fifth, it analyzes multidimensional welfare impacts — encompassing income transformation, workload restructuring, asset accumulation, and human capital investment — beyond simple income comparisons. Sixth, the research design controls for identical land area across periods, as all farmers converted the same land without expansion, enabling stronger causal attribution than typical cross-sectional studies. Seventh, the study combines quantitative statistical testing ($t = -7.828$; $df = 31$; $p < 0.001$) with qualitative verification through farmer testimonies, providing robust evidence for the 139% income increase.

North Padang Lawas Regency represents a region undergoing a significant commodity transition, yet empirical research at the household level remains minimal. This constitutes a significant research gap (Anas et al., 2025), given that local dynamics can yield findings that differ markedly from studies conducted in regions with different agroclimatic and institutional

characteristics. This study therefore aims to: (1) analyze the determinants of the transition from rubber to oil palm farming; (2) statistically test the significance of differences in production and income between the two periods; and (3) evaluate the multidimensional implications of the transition for the welfare of farming households.

METHOD

This research was conducted in Sihopuk Baru Village, East Halongonan District, North Padang Lawas Regency, North Sumatra Province. The village was purposively selected to comprehensively represent the dynamics of land conversion from rubber to oil palm within a single community. Data collection took place in January 2026.

The study involved two layers of subjects. First, 32 farmer respondents were determined through a total census method: all farmers who had converted rubber land to oil palm and had farming experience in both periods were sampled (Sekaran dan Bougie, 2017). Second, 8 key informants were selected purposively based on variations in land area, experience, and income level, with data collection stopped after information saturation was reached. The main variables included production (kg/month), income (Rp/month), and determinants of transition.

The study employed a mixed methods approach with a sequential explanatory design (Creswell, 2014), where quantitative analysis was conducted first and then reinforced through qualitative analysis. Quantitative analysis employed descriptive statistics and the Paired Samples T-Test, chosen because the data were paired from identical subjects across two temporal periods. Normality requirements were met through the Shapiro-Wilk test ($n = 32$) which confirmed normal distribution in both variables ($p > 0.05$). Qualitative analysis followed a Miles et al. (2014)three-stage model: data reduction, data presentation, and conclusion drawing-verification. Data validity was maintained through source and method triangulation.

Research Limitations

This study has several limitations. First, the generalizability of the findings is limited to the context of Sihopuk Baru Village due to its specific agro-climatic and institutional characteristics. Second, data on rubber farming income was collected based on respondents' recall (*recall bias*) because farmers had already switched to oil palm at the time of data collection (January 2026). Third, the study did not control for longitudinal fluctuations in CPO prices, so the 139% increase in income may have been influenced by favorable commodity price cycles. Fourth, the ecological dimensions of land use change (e.g., impacts on biodiversity, soil quality, or water management) were not measured in this study.

RESULTS AND DISCUSSIN

Socio-Economic Characteristics of Respondent Farmers

The socio-economic characteristics of respondents serve as a contextual framework that determines the validity of causal attributions of research findings. The homogeneity of farmer profiles in terms of age, education, and land ownership allows differences in economic performance between the rubber and oil palm periods to be attributed to commodity shift factors, rather than to heterogeneity in individual characteristics.

Table 1. Age Distribution of Farmer Respondents, North Padang Lawas Regency, 2026

No	Age (Years)	Number of people)	Percentage (%)
1	35 - 45	12	37.5
2	46 - 56	12	37.5
3	57 - 67	8	25
	Amount	32	100

The dominance of the productive age group 35-56 years (75%) reflects that transition decisions are made by actors with optimal physical and cognitive capacity to manage transition risks. Conversely, 25% of respondents aged 57-67 years emphasized the labor efficiency argument: oil palm with a twice-monthly harvest frequency is more friendly to elderly farmers than rubber which requires daily tapping at 4:00-6:00 AM. Woittiez et al. (2024)This confirms that more flexible oil palm management allows elderly farmers to maintain productivity without experiencing the same physical intensity as rubber.

Table 2. Education Level of Farmer Respondents

No	Level of education	Number of people)	Percentage (%)
1	Elementary School	1	3.13
2	JUNIOR HIGH SCHOOL	6	18.75
3	SENIOR HIGH SCHOOL	24	75.00
4	Higher Education (D3-S1)	1	3.13
	Amount	32	100

The dominance of high school graduates (75.0%) reflects an adequate economic literacy base. Monzon et al. (2023)found a positive correlation between farmers' agronomic capacity and their ability to adopt better management practices. Ruml et al. (2022)explained the phenomenon of low-educated farmers being able to achieve above-average productivity as a substitute for formal education by social capital: farmers integrated in strong institutional networks are able to access technical knowledge equivalent to that of more highly educated farmers. The implication is that investments in agricultural extension and strengthening farmer groups can provide greater returns per budget rupiah.

"The difference is, it's easier for me to find information. I've taken training on fertilizers and pesticides. So my production is more efficient. From 5 hectares, I can get 4,000 kg per month. (ES)"

Table 3. Type of Respondents' Work: Farmers

No	Type of work	Number of people)	Percentage (%)
1	Farmer	27	84.38
2	Trader (Side Job)	5	15.63
	Amount	32	100

The composition of 84.4% of farmers as full-time farmers implies that shocks to farm income directly impact the overall economic condition of the household. The fact that 15.6% of farmers have side jobs as traders, most of which began after the transition to oil palm, is clear evidence of the labor-time reallocation mechanism (Kühling et al., 2022). In an oil palm

system with two harvest cycles per month, the created time margin is converted into non-farm income, creating a multiplier effect on total household income.

"Palm oil is harvested twice a month. So I have a lot of free time to sell groceries at the market. Back when I was growing rubber, I didn't have time. You have to tap rubber every day, and it's tiring. (H)"

Table 4. Respondents' Rubber Business Experience

No	Farming Experience (Years)	Number of people)	Percentage (%)
1	1 - 10	14	43.75
2	11 - 20	16	50.00
3	21 - 30	2	6.25
	Amount	32	100

Table 5. Respondents' Palm Oil Business Experience

No	Farming Experience (Years)	Number of people)	Percentage (%)
1	1 - 10	20	62.50
2	11 - 20	10	31.25
3	21 - 30	2	6.25
	Amount	32	100

The contrast between the distribution of rubber experience (50% with 11-20 years) and palm oil (62.5% with 1-10 years) offers crucial analytical insights. The majority of respondents have a long track record in rubber, indicating that the decision to switch was not driven by technical incompetence, but rather by an economic calculation that rubber's risk-return profile was no longer competitive. Woittiez et al. (2024)confirms that the yield gap among smallholder palm oil farmers stems primarily from suboptimal input use, not agroclimatic factors, indicating that productivity, which has already increased 8.1-fold, still has the potential for further improvement. verify Rustiadi et al. (2023)that this wave of conversion is consistent with the national trend of palm oil expansion.

Table 6. Distribution of Agricultural Land Area (Rubber and Oil Palm)

No	Land Area (Ha)	Number of people)	Percentage (%)
1	1 - 5	30	93.75
2	6 - 10	2	6.25
	Amount	32	100
	Total Area	92.00 Ha	
	Average	2.88 Ha	

The identity of the land area distribution between the two periods of 93.75% in the range of 1-5 Ha with an average of 2.88 Ha is the main methodological strength of this study. This condition allows for stronger causal attribution than in ordinary cross-sectional studies, because the identical land area in both periods makes the income difference attributable to commodity changes, not to changes in business scale: because all respondents converted the same land without area expansion, the observed income difference can be attributed more confidently to commodity variables, not changes in business scale (Ruml et al., 2022).

Comparison of Farm Production

Production volume is the causal link between commodity choice and income. The extreme difference in production between the two periods cannot be explained by changes in land area, providing the strongest agronomic argument for why this shift resulted in significant income changes.

Table 7. Rubber Production Before Land Conversion (Kg/Month)

No	Production (Kg/Month)	Number of people)	Percentage (%)
1	100 - 300	23	71.88
2	301 - 501	4	12.50
3	502 - 702	3	9.38
4	703 - 903	2	6.25
	Amount	32	100
	Total Production (Kg)	8,924	

The average rubber production of 278.88 kg/month with 71.88% of farmers concentrated in the 100-300 kg/month group reflects a stagnant condition that is a manifestation of three structural pressures: (1) aging plants that reduce the biological capacity of latex production; (2) suboptimal maintenance due to weakened investment incentives; and (3) complete dependence on weather for tapping operations. Novita et al. (2024)categorizes this condition *as a low-equilibrium trap* : low prices reduce investment capacity, which reduces productivity, which further depresses income. Kühling et al. (2022)confirms that farmers who do not rejuvenate or diversify face an irreversible decline in income in the medium term.

"I used to wake up at 4 in the morning to tap. Every day, I didn't know any holidays. If it rained, I couldn't do it, I lost my income. (S)"

Table 8. Palm Oil Production After Land Conversion (Kg/Month)

No	Production (Kg/Month)	Number of people)	Percentage (%)
1	1,000 - 3,000	24	75.00
2	3,001 - 5,001	6	18.75
3	5,002 - 7,002	1	3.13
4	7,003 - 9,003	1	3.13
	Amount	32	100
	Total Production (Kg)	71,350	
	Average (Kg/Month)	2,229.69	

The surge in production from 278.88 kg to 2,229.69 kg per month on identical land, an 8.1-fold increase consistent with the documented agronomic superiority of oil palm. Lim et al. (2023)quantified that the actual productivity of smallholder oil palm consistently exceeds that of other tropical plantation commodities on equivalent land. Monzon et al. (2023)showed that the majority of the palm oil yield gap in Indonesia is caused by suboptimal fertilizer application, making a fertilizer subsidy program based on the actual needs of marginal farmers the policy intervention with the highest benefit-cost ratio (Woittiez et al., 2024).

"Yes, it's a bit narrow, son. Besides, the land is near a swamp, so it's not very fertile. I also don't have the capital to make regular fertilizer. Production is just that much, around 700 kg per month. (W)"

Income Comparison

Table 9. Rubber Farming Income Before Land Conversion (Rp/Month)

No	Income (Rp/Month)	Number of people)	Percentage (%)
1	Rp100,000 - Rp1,000,000	4	12.50
2	Rp1,001,000 - Rp2,000,000	11	34.38
3	Rp2,001,000 - Rp3,000,000	7	21.88
4	Rp3,001,000 - Rp4,000,000	2	6.25
5	Rp4,001,000 - Rp5,000,000	3	9.38
6	Rp5,001,000 - Rp6,000,000	3	9.38
7	> Rp. 6,000,000	2	6.25
	Amount	32	100
	Total Income (Rp)	Rp89,072,400.00	
	Average (Rp/Month)	Rp2,783,512.50	

The distribution of rubber income concentrated below Rp2,000,000 per month (46.88% of farmers) and an average of Rp2,783,512.50 represents a condition below a decent standard of living. Novita et al. (2024)calls this condition a *structural welfare deficit* : an income gap that cannot be overcome from within the rubber farming system without commodity changes. From a perspective Harahap et al. (2024), this configuration reflects the systemic failure of small-scale rubber farming in its basic function as a provider of decent livelihoods, especially when global prices are in a long-term downward trend.

"Back when the rubber was booming, just thinking about paying school fees was a struggle. My income was only Rp. 2.9 million a month. I barely even had enough to eat every day. (S)"

Table 10. Palm Oil Farming Income After Land Conversion (Rp/Month)

No	Income (Rp/Month)	Number of people)	Percentage (%)
1	Rp1,000,000 - Rp4,000,000	7	21.88
2	Rp4,001,000 - Rp7,000,000	12	37.50
3	Rp7,001,000 - Rp10,000,000	6	18.75
4	Rp10,001,000 - Rp13,000,000	5	15.63
5	Rp16,001,000 - Rp19,000,000	1	3.13
6	Rp19,001,000 - Rp22,000,000	1	3.13
	Amount	32	100
	Total Income (Rp)	Rp212,915,000.00	
	Average (Rp/Month)	Rp6,653,593.75	

The shift in income distribution after the transition shows two complementary changes. On the one hand, there was a substantial *upward shift*: the average jumped to IDR 6,653,593.75, a 139% increase, verifying the argument Chrisendo et al. (2022)that oil palm adoption significantly contributed to improving the livelihoods of smallholder farmers. On the other hand, the widening distribution gap indicates *increased income heterogeneity*. Anas et al. (2025)warns that the benefits of oil palm are not distributed evenly: farmers with better access to capital, quality land, and strong institutional networks receive significantly larger premiums.

A critical difference between high- and low-income farmers lies in the length of the marketing chain: farmers who sell directly to palm oil mills (PKS) receive a price of Rp200-

300/kg higher than those who sell through middlemen. Ruml et al. (2022)emphasized that access to more efficient marketing channels is the most critical determinant of profitability differences between farmers. Strengthening farmer cooperative institutions and facilitating direct access to processing industries has a more equitable distributional impact than universal input subsidy programs (Veriasa et al., 2024).

"Previously, I only produced 750 kg of rubber per month, earning around Rp7.5 million. Now, I produce 7,300 kg of palm oil per month, earning Rp21.9 million. That's more than double. (HSS)"

Inferential Analysis

The Shapiro-Wilk normality test (n = 32) confirmed that both variables were normally distributed ($p > 0.05$), validating the use of parametric statistics. The results of the Paired Samples T-Test are presented in Table 11 and Table 12.

Table 11. Paired Samples Statistics

ariables	Mean (Rp)	Standard Deviation	Std. Error Mean
Before the Change of Function	2,783,512.50	1,894,726.00	334,976.00
After the Change of Function	6,653,593.75	4,518,325.00	798,746.00

Table 12. Paired Samples T-Test Results

Mean Diff. (Rp)	Std. Dev.	Std. Err.	95% CI Lower	95% CI Upper	t / df / Sig.
-3,870,081.25	2,796,433.00	494,398.00	-4,876,123.00	-2,864,039.00	-7,828 / 31 / 0,000

The t-value of -7.828 (df = 31; $p < 0.001$) exceeds the critical t-table value of ≈2.042 ($\alpha = 0.05$) by a very large margin, indicating a substantially strong income difference. The 95% confidence interval [-Rp4,876,123; -Rp2,864,039] that does not contain zero verifies that the difference is not a sampling artifact. The average difference of Rp3,870,081.25, equivalent to 139% of the baseline average, places this study at the high end of the impact spectrum in the Indonesian palm oil adoption literature.

The magnitude of the 139% increase exceeds findings Chrisendo et al. (2022)documenting improvements in the welfare of oil palm farmers across Indonesia and is consistent with documentation Novita et al. (2024)of increases in incomes of oil palm farmers in Sumatra. Kühling et al. (2022)shows that the magnitude of the impact is positively correlated with the low initial commodity profitability: advanced rubber plant aging and long-term depreciation in rubber prices create a much lower baseline, so the 139% figure reflects how deeply the rubber has degraded at the study site.

Transition Determinants

The decision to switch commodities cannot be explained by a single factor. Triangulation analysis of 32 questionnaires and 8 in-depth interviews identified five determinants operating in a synergistic system.

1. **Rubber Price Pressure**

   The decline in rubber prices from Rp18,000 to Rp6,000-Rp10,000/kg within a decade reflects a structural shift in the global commodity market: the substitution of

natural rubber by synthetic rubber in the automotive supply chain and excess production capacity. Wijaya et al. (2023)confirms that this is the mechanism driving the massive wave of conversion of rubber land to oil palm in Indonesia: not the inability of farmers to cultivate rubber, but rather the rational calculation that improvements in the rubber system cannot change its economic fundamentals.

"I used to plant rubber on all 10 hectares. But the price kept dropping. I calculated my losses. Finally, I switched to oil palm. Now, thank God, it's all oil palm. (HSS)"

2. **Superiority of Palm Oil Productivity**

An 8.1-fold increase in production on identical land represents a difficult-to-ignore agronomic advantage. Monzon et al. (2023)He Lim et al. (2023)emphasized that this superior productivity per unit of land is the strongest agronomic argument for oil palm adoption. Unlike the fluctuating price advantage, this advantage is technical-agronomic and relatively stable. Woittiez et al. (2024)He added that even with a significant yield gap, the actual productivity of oil palm for smallholders still far exceeds that of other plantation commodity alternatives.

3. **Working Time Efficiency**

The transformation from a rubber work regime, daily tapping from 4:00 to 6:00 a.m., seven days a week, to an oil palm regime with two to three harvest cycles per month represents a fundamental restructuring of human capital allocation. The savings in working time generate three categories of benefits: (1) diversified income from non-farm activities; (2) increased investment in human capital; and (3) reduced physical burdens that extend the productive life of older farmers. Chrisendo et al. (2022)confirm that the savings in working time from the shift to oil palm creates resource allocation space that can be converted to non-farm activities, resulting in a multiplier effect on total household income.

"Rubber has to be tapped every day. It's tiring. Now it's better, I have time for other businesses. I'm currently trying to raise cattle and chickens. (MA)"

4. **Institutional Support**

Institutional support, particularly farmer group membership, which opens access to direct sales to palm oil mills (PKS), acts as an accelerator that amplifies the financial benefits of uneven transitions among farmers. The price difference of IDR 200-300 per kg between farmers selling directly to PKS and those selling through middlemen has a cumulative annual value of IDR 5.4-8.1 million. Ruml et al. (2022)confirms that this price differential due to intermediation is one of the largest sources of inefficiency in the agricultural commodity value chain. Veriasa et al. (2024)adds that collective institutional membership also opens access to the RSPO certification program, which provides additional price premiums and long-term market stability.

"I'm in the Makmur group. I sell directly to the PKS, not to middlemen. The price difference can be Rp200-300 per kg. (FH)"

In addition to price and productivity factors, access to information and innovation networks is also crucial for successful transitions. Heliawaty et al. (2020)Research shows that farmers with broader access to information networks exhibit higher levels of innovative behavior, ultimately driving the adoption of new technologies. Therefore,

strengthening social capital and information networks is crucial for ensuring equitable distribution of the benefits of commodity transitions, not just for farmers with strong institutional access.

5. **Long-Term Profit Expectations**

The fifth factor operates through a social learning mechanism: farmers calibrate investment decisions based on the outcomes realized by earlier converts. Hendrawan et al. (2024)confirmed that farmers who adopt oil palm consistently experience welfare improvements that persist beyond the initial investment phase, and that the economic resilience of smallholder oil palm farmers is higher than that of farmers in other commodities. Kühling et al. (2022)modeled these dynamics as rational farmer responses to changes in commodity incentive structures, rather than emotional or bandwagon decisions.

"Thank God, I bought two cars, my house became two stories, and last year I went on the Hajj. Back when it was still rubber, I never thought about going there. (HSS)"

A synthesis of the five factors reveals that transition occurs when *push conditions* (structural rubber price pressures) meet sufficiently strong *pull conditions* (productivity, time efficiency, institutions, and long-term prospects) to justify the costs and risks of transition. Encouraging a profitable transition requires simultaneously managing price signals and strengthening pull conditions, particularly access to institutions and capital, which are key differentiators between farmers who benefit significantly from those who do not.

Impact on Welfare

Rising income is a necessary but not sufficient condition for sustained improvements in well-being. This section analyzes the four identified dimensions of well-being impact.

1. **Revenue Transformation**

The average increase of 139% (from Rp2,783,512.50 to Rp6,653,593.75) exceeded the estimates of comparative studies. Kühling et al. (2022)and Chrisendo et al. (2022)consistently documented that the greatest impact of palm oil adoption occurred among farmers who previously farmed commodities with low productivity and high risk profiles, which precisely describes the conditions of older rubber farmers in North Padang Lawas. However, 21.9% of palm oil farmers still earn less than Rp4,000,000 per month. Anas et al. (2025)identified that these farmers generally have low-quality land, limited access to capital, and are not integrated into collective institutions.

"Back when we were still growing rubber, our income was just enough. Now that we've grown oil palm, our income is higher, we can eat enough, and our household needs are better met. (W)"

2. **Workload Restructuring**

Reducing daily work intensity yields multiple benefits: reduced physical fatigue, increased capacity for economic diversification, and enhanced socio-community participation. Chrisendo et al. (2022)confirmed that this restructuring of work hours measurably improves farmers' well-being, including human capital accumulation and access to basic services. However, the concentrated twice-monthly oil palm harvest

creates peak labor-intensive needs, potentially increasing wage labor costs for farmers with land holdings exceeding 3 hectares.

"Now I'm growing oil palm, and I harvest twice a month. It's nice, not too tiring. I can still rest and join the social gathering. (S)"

3. **Asset Accumulation**

Evidence of asset accumulation, such as land purchases, vehicles, and home renovations, is a more robust indicator of well-being than short-term income because it reflects a cumulative surplus. Hendrawan et al. (2024)confirms that the accumulation of productive assets is the most valid indicator of increased economic resilience among oil palm farmer households. Productive assets also serve as an economic buffer against CPO price shocks. Based on interviews with eight informants, seven of them allocated surpluses for vehicle purchases or home renovations, and two of the seven informants also purchased additional land, demonstrating the need for education on financial management and long-term productive investment.

"Thank God, last year I bought another 1 hectare of land. (MA)"

4. **Human Capital Accumulation**

The most strategic dimension is increasing investment in children's education—a top priority for surplus income allocation among respondents. Chrisendo et al. (2022)The study confirmed that increasing access to education is the most important transmission channel between palm oil farming income growth and intergenerational poverty reduction. Three critical limitations need to be identified: first, concentration on a single commodity creates vulnerability to CPO price fluctuations (Mulyasari et al., 2023; Pahmi et al., 2023); second, current welfare improvements are still in the *ascending phase of* the CPO price cycle (Hendrawan et al., 2024); and third, Renner et al. (2024)identifying that RSPO certification can be a *dual-purpose mechanism* that stabilizes income and mitigates ecological risks, but its adoption among smallholders remains very limited.

"My two children are now in college, all of their money comes from palm oil. Thank God. (YH)"

The overall analysis synthesis yields a testable causal proposition: the shift from rubber to oil palm in North Padang Lawas Regency is a rational economic response that results in substantial and significant income transformation (139%; $t = -7.828$; $p < 0.001$) and is transmitted to four dimensions of well-being. The sustainability of this transformation is conditional, depending on the stability of CPO prices, the success of economic diversification, and the capacity of policies to address disparities in access to capital and institutions.

CONCLUSION

The transition from rubber to oil palm farming in Sihopuk Baru Village, North Padang Lawas Regency, was driven by five synergistic factors: structural rubber price pressure, superior oil palm productivity (8.1 times higher on identical land), efficient work time allocation, institutional support, and long-term profit expectations. These five factors collectively lower farmers' risk tolerance, making the decision to switch commodities a rational economic calculation.

Quantitatively, the transition was shown to increase average farmer income by 139%, from Rp2,783,512.50 to Rp6,653,593.75 per month ($t = -7.828$; $df = 31$; $p < 0.001$), on completely identical land areas. This verifies that the entire increase stems from commodity switching, not from land expansion. The income impact is then transmitted to four dimensions of well-being: improved fulfillment of basic needs, restructuring of workloads that encourage economic diversification, asset accumulation as a resilience buffer, and increased investment in children's education. To maintain the sustainability of these benefits, strengthening farmer cooperative institutions, fertilizer subsidy programs based on actual needs, diversification of income sources, and facilitating access to sustainability certification for smallholder farmers are needed.

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