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ANALYSIS OF FARMERS' INCOME IN THE INTEGRATED CATTLE AND OIL PALM FARMING SYSTEM IN LABUHAN BATU REGENCY

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Abstract
The aim of this study is to analyze the economic contribution of oil palm and cattle farming and to evaluate the potential benefits of integrating these two systems for smallholder farmers in Labuhan Batu Regency. This research employs a field observation method using questionnaires and interviews, involving 34 respondents who are both oil palm farmers and cattle breeders. The study applies descriptive quantitative analysis to assess farmers' production costs, revenues, and incomes. The results show that oil palm farming serves as the primary source of income, generating an annual net income of Rp 1,227,107,960, while cattle farming provides Rp 460,843,461. Integration of cattle and oil palm farming reduces production costs through the use of oil palm by-products as cattle feed and organic fertilizer, and improves land-use efficiency. The integrated system also adds value by producing biogas and reducing weeding costs. This study contributes to the existing literature by providing empirical data on the economic performance of integrated oil palm-cattle farming at the smallholder level in Labuhan Batu Regency, a topic that has been scarcely explored. The findings highlight that integrated farming can significantly enhance farmer income and support sustainable agricultural practices. It is recommended that smallholders adopt integrated systems more widely to realize these benefits, and that agricultural policies and extension services provide training and develop scalable models to support implementation.

Keywords: *Integrated Farming System, Smallholder Farmers, Oil Palm Farming, Cattle Farming.*

1. INTRODUCTION

The escalating demand for animal-based food, especially beef, is significantly correlated with population growth at both national and regional levels. To address this demand, the Directorate General of Livestock has initiated the Program for the Acceleration of Beef Self-Sufficiency (P2SDS), concentrating efforts in 18 provinces recognized as beef cattle centers, including North Sumatra (Martindah et al., 2022). Self-sufficiency in beef production is defined as fulfilling 90% of the national demand through domestic resources, revealing a persistent deficit of approximately 100,000 tons that is currently met through imports of feeder cattle and beef The essence of this acceleration program lies in optimizing local livestock resources through enhanced governmental roles and the encouragement of private sector involvement in feedlot and breeding industries, ultimately aiming to reduce dependence on imported feeder cattle and beef, leading to foreign exchange savings

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(Hutwan et al., 2019). The national target within the PSDS 2014 framework aimed for a yearly increase of 30,000 tons in beef availability and a population increase of 111,400 cattle between 2010 and 2014. North Sumatra's specific goals included a 5,657-ton annual increase in beef availability and a population augmentation of 12,016 cattle during the same period.

In Indonesia, the demand for beef has surged to 720,225 tons, contrasted with a production capacity of only 437,300 tons, necessitating imports to cover approximately 39.3% of the national requirement (Saragi et al., 2022). This surge is attributed to both an expanding population of 261.9 million and heightened public awareness regarding the nutritional importance of animal protein, which has elevated meat consumption, particularly beef (Pinardi et al., 2020). Beef cattle farming in North Sumatra often serves as a supplementary income source for farmers, employing traditional methods in beef processing. The success of beef cattle ventures hinges on adequate nutrient provision, which directly impacts livestock health, underscoring the critical role of sustainable, high-quality feed in livestock cultivation (Wahyuningsih et al., 2023). Indonesia's agricultural strategies include initiatives to import frozen beef and augment the domestic cattle population through the introduction of beef cattle breeds, complemented by programs designed to secure productive cows (Martindah et al., 2022). Feed quality plays a pivotal role in enhancing the performance and quality of beef cattle, yet many farmers struggle to provide good feed at affordable prices (Maranatha et al., 2021).

The integration of cattle farming with palm oil plantations presents a strategic approach to bolster beef production and achieve self-sufficiency, capitalizing on the extensive availability of biomass from the palm oil industry, this integration can transform potential waste into valuable cattle feed, addressing both nutritional needs and waste management concerns (Pinardi et al., 2020) (Silalahi et al., 2019). This integrated approach not only supports sustainable agricultural development but also has been shown to increase farmer's income from oil palm plantations and beef cattle through increased productivity of Bali cattle with an average daily gain of 0.22 kg to 0.56 kg, and increased production of fresh fruit bunches of oil palm (Suyatno et al., 2021). Cattle farming in Indonesia is predominated by small-scale farmers, who face challenges such as low livestock productivity, often attributed to inadequate ration quality. Supplementation strategies, utilizing resources like gambier leaf residue, could improve the rumen's ability to process dietary protein, thereby enhancing cattle growth.

Furthermore, integrating cattle with oil palm cultivation can significantly improve the sustainability and economic viability of agricultural operations by fully utilizing land resources and agricultural byproducts. Despite the recognized potential of cattle-oil palm integration, its widespread adoption among smallholder farmers faces obstacles, including the need for quantified benefits and scalable systems (Bremer et al., 2022). Integrated systems involving cattle have demonstrated economic benefits, such as increased animal productivity and fresh fruit bunch yields, higher income, reduced weeding costs, and internal rates of return around 19%. The diversity in management practices within existing cattle-oil palm integrations, ranging from grazing to intensive pen feeding, highlights the need for sustainable models tailored to the environmental, social, and economic contexts of both smallholders and commercial plantations. The application of technology for organic fertilizer production and complete feed based on the oil palm plantation industry is integral to achieving sustainable cattle farming (Utomo & Widjaja, 2020).

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However, despite its potential, cattle-oil palm integration is not widely adopted by smallholder farmers, partly due to the lack of local data on its economic benefits and the absence of scalable models suited to smallholder conditions (Bremer et al., 2022). Specifically in Labuhan Batu Regency, where smallholders dominate, there is limited research quantifying the economic contribution of integrated oil palm and cattle farming. Therefore, this study aims to analyze the income contribution of oil palm and cattle farming, and to evaluate the potential of integrated systems as a strategy to improve farmer welfare and support sustainable agriculture in the region.

2. METHOD

This study employs a field observation method using research instruments such as questionnaires and interviews. It is a descriptive quantitative study. The population comprises 34 oil palm farmers/cattle breeders. The entire population is used as the sample, making it a saturated sample. The data analysis method applied is both descriptive and quantitative analysis.

To address the first research question regarding the income of farmers who implement the integration system in the study area, the researcher will analyze their income using the following methods:

Production Costs

According to Listiani et al. (2019), cost analysis refers to the total expenditures incurred, consisting of total fixed costs—expenses that remain constant regardless of production level—and total variable costs, which fluctuate with changes in production output. The total cost is obtained by summing the fixed and variable costs and can be calculated using the formula:

$TC = TFC + TVC$

TC = Total Cost

TFC = Total Fixed Cost

TVC = Total Variable Cost

Revenue

Revenue is the result of multiplying the production output by the selling price, typically showing a negative correlation with price—meaning prices tend to fall when there is overproduction. The greater the quantity of products produced and the higher the price per unit, the larger the revenue received by producers (Listiani et al., 2019). Conversely, if the production volume is low and the prices are low, total revenue will also be reduced. Mathematically, revenue is calculated as:

$TR = Q \times P$

TR = Total Revenue

Q = Quantity of Production

P = Selling Price

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Income

Income refers to the amount of money earned by farmers, calculated as the difference between total revenue and production costs. Farm income is derived by subtracting total costs from total revenue. The formula to determine income is:

I = TR – TC

I = Income

TR = Total Revenue

TC = Total Cost

3. RESULT AND DISCUSSION

Production Costs

The total production cost refers to all expenses incurred by farmers during the production process. For oil palm and cattle farming in Desa Makmur Jaya, these costs include fixed costs, variable costs, revenues, and income.

Fixed Costs

In farmer-managed farming systems, fixed costs are primarily depreciation expenses calculated based on the economic value of tools used. These tools include sickles, machetes, hoes, sprayers, harvesting tools (dodos and egreks), and wheelbarrows.

Table 1. Fixed Costs for Oil Palm Farming and Cattle Farming

	Oil Pal Farming		Cattle Farming	
No	**Item**	**Average Depreciation (Rp)**	**Item**	**Average Depreciation (Rp)**
1	Sickles	52,000	Barn	689,706
2	Machetes	48,000	Rope	6,686
3	Hoes	27,600	Boots	16,588
4	Sprayers	54,240	Buckets	6,344
5	Dodos	29,100	Shovel	27,068
6	Egreks	170,000	Sickles	10,147
7	Wheelbarrows	156,100		
Total (Annual)		**537,040**		**756,539**

Source: Processed Primary Data, 2024

The highest fixed cost on oil palm farming is for the egrek tool at an average of Rp 170,000, while the lowest is for the hoe, with an average of Rp 27,600. The barn has the highest fixed cost on cattle farming at Rp 689,706, while the lowest costs are for rope and buckets, each averaging Rp 6,344.

Variable Costs

Variable costs are fluctuating expenses incurred by farmers during farming activities. These include costs for seeds, fertilizers, medicines, and labor.

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Table 2. Variable Costs for Oil Palm and Cattle Farming

Description	Total (Rp)	Average (Rp)	Description	Total (Rp)	Average (Rp)
Seed Cost	295,520,000	8,691,765	Cattle Seed Cost	425,500,000	12,514,706
Fertilizer Cost	390,035,000	11,471,618	Medication	3,900,000	114,706
Labor Cost	45,200,000	1,329,412	Labor Cost	165,000,000	4,852,941
Total	**730,755,000**	**21,492,794**	**Total**	**594,400,000**	**17,482,353**

Source: Processed Data, 2024

Based on the results of the study involving 34 farmers engaged in cattle farming and oil palm cultivation, it was found that the highest variable cost components in each type of farming come from different sources. In cattle farming, the highest cost is from the purchase of cattle, with a total expenditure reaching Rp 425,500,000. On average, each farmer spent Rp 12,514,706 on purchasing cattle. This indicates that the initial investment in livestock procurement is the most significant cost component in cattle farming.

Meanwhile, in oil palm cultivation, the highest variable cost comes from fertilizer expenses, with a total expenditure among all respondents amounting to Rp 390,035,000, or an average of Rp 8,691,765 per farmer. This shows that fertilization is a crucial activity in oil palm cultivation and represents the largest share of variable costs.
Thus, in both cattle farming and oil palm cultivation, there are dominant cost components that play a key role in determining the total expenditure—namely, cattle purchase for livestock farming and fertilizer purchase for oil palm farming.

Farm Revenue from Cattle and Oil Palm

Revenue is generated from the sale of products (oil palm and cattle) over a year. It is calculated by multiplying the quantity produced by the market price. Revenue varies based on production volume and market price.

Table 2. Revenue from Oil Palm and Cattle Farming

Oil Pal Farming			Cattle Farming		
Description	**Unit**	**Total Production**	**Description**	**Unit**	**Total/Year**
Oil Pal Production	Kg/year	612,000	Cattle Production	Head	96
Price per Kg	Rp/Kg	3,200	Price	Rp	11,000,000
Total Revenue	Rp/year	**1,958,400,000**	**Total Revenue**	Rp	**1,056,000,000**

Source: Processed Primary Data, 2024

Oil palm farming produces 612,000 kg per year with a price of Rp 3,200 per kg, resulting in a total annual revenue of Rp 1,958,400,000. Cattle farming produces 96 heads per year with a price of Rp 11,000,000 per head, resulting in a total annual revenue of Rp 1,056,000,000.

Generally, oil palm farming provides high income and is labor-efficient, making it easier to manage compared to other commodities such as rubber. This allows farmers to expand their land and increase household income (Euler et al., 2017). The integration of oil palm and cattle can significantly increase economic value by utilizing oil palm waste as feed and organic fertilizer, and by generating additional products such as biogas, which add further

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value (Silalahi et al., 2020), (Nazlah et al., 2020). Integrated farming systems have been shown to generate higher farmer incomes compared to systems without integration. For instance, a study in Pasangkayu found that farmers with palm-cattle integration earned significantly higher incomes (Rp 11 million per year) compared to those without integration (Rp 900 thousand per year) (Nazlah et al., 2020). Integration systems also support environmental sustainability by reducing the need for chemical fertilizers and improving land-use efficiency (Kristiana et al., 2018).

Income from Oil Palm and Cattle Farming

Income is defined as the difference between total revenue and total production costs over one year.

Table 3. Oil Palm and Cattle Farming Income

	Oil Pal Farming		Cattle Farming	
Description	**Total/Year (Rp)**	**Average (Rp)**	**Total/Year (Rp)**	**Average (Rp)**
Revenue	1,958,400,000	57,600,000	1,056,000,000	31,058,824
Total Costs	731,292,040	21,508,589	595,156,539	17,504,604
Income	**1,227,107,960**	**36,091,411**	**460,843,461**	**13,554,219**

Source: Processed Data, 2024

Oil palm farming generates an annual revenue of Rp 1,958,400,000 with an average of Rp 57,600,000, annual costs of Rp 731,292,040 with an average of Rp 21,508,589, and a net income of Rp 1,227,107,960 with an average of Rp 36,091,411.

Cattle farming generates an annual revenue of Rp 1,056,000,000 with an average of Rp 31,058,824, annual costs of Rp 595,156,539 with an average of Rp 17,504,604, and a net income of Rp 460,843,461 with an average of Rp 13,554,219.

This data shows that oil palm farming provides greater revenue and net income compared to cattle farming. This finding is consistent with research indicating that oil palm is a leading commodity that is labor-efficient and generates high income for smallholder farmers in Indonesia (Euler et al., 2017). The integration of oil palm and cattle farming is widely recommended in the literature as it can enhance business efficiency and increase farmers' income. Oil palm by-products can be utilized as animal feed and organic fertilizer, thereby reducing input costs and adding economic value (Silalahi et al., 2020), (Kristiana et al., 2018). A study in Pasangkayu also demonstrated that integrated systems generate significantly higher incomes compared to non-integrated systems and are considered sustainable from economic, social, and environmental perspectives (Nazlah et al., 2020).

Table 4. Average Annual Income per Farmer

Type	**Total Income (Rp)**
Oil Palm	1,227,107,960
Cattle	460,843,461
Total/year	**1,687,951,421**
Total/month	**140,662,618**
Per farmer	**4,137,136**

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Source: Processed Data, 2024

Based on the research, the average income per farmer is approximately Rp 2,938,563. Oil palm farming generates an annual income of Rp 1,227,107,960. Cattle farming contributes Rp 460,843,461 per year. The combined total annual income is Rp 1,687,951,421, or about Rp 140,662,618 per month. This results in an income per farmer of approximately Rp 4,137,136 per month.

This data illustrates that oil palm farming is the primary income contributor, while cattle farming serves as a supplementary source. This pattern aligns with studies showing that integrating oil palm and cattle farming can enhance farmer incomes, optimize land use, and contribute to sustainability. Integration not only provides additional income from cattle, but also reduces costs in oil palm farming through the use of cattle manure as organic fertilizer, which can reduce dependency on chemical fertilizers (Kristiana et al., 2018).

Further, integrated systems can produce additional valuable products like biogas, which adds economic value beyond direct farm output (Silalahi et al., 2020). Studies in Pasangkayu show that integrated systems significantly increase annual incomes compared to non-integrated systems, demonstrating the potential of integration to improve livelihoods (Nazlah et al., 2020).

In conclusion, this research reinforces the evidence that oil palm is a strong economic base, and that cattle integration can provide meaningful income supplements and environmental benefits when properly managed.

4. CONCLUSION

The findings of this study confirm that oil palm farming serves as the primary source of income for farmers, contributing significantly higher annual and monthly revenues compared to cattle farming. This supports the background assertion that oil palm is a leading, labor-efficient commodity capable of generating substantial income for smallholders. Furthermore, while cattle farming offers additional revenue, its main strength lies in its role as a complementary enterprise that can enhance land use efficiency and contribute to sustainable agricultural practices through the integration of cattle manure as organic fertilizer, in line with the potential benefits highlighted in previous studies.

The integration of cattle and oil palm farming, as reflected in the results, demonstrates the opportunity for farmers to boost their livelihoods by optimizing the use of agricultural by-products and producing added-value outputs such as biogas. This aligns with evidence from Pasangkayu and other regions, where integrated systems not only raise incomes but also strengthen environmental sustainability and reduce production costs, confirming that the adoption of such systems can provide both economic and ecological advantages.

Recommendations

1. It is recommended that smallholder farmers and plantation managers adopt integrated oil palm-cattle systems more broadly, as this approach has been proven to increase

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income, enhance sustainability, and reduce dependency on chemical fertilizers through the effective use of organic inputs.

2. Policymakers and agricultural extension services should prioritize the development of scalable models and provide targeted training and support to overcome adoption barriers, ensuring smallholders can effectively implement and benefit from integrated farming systems.

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