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THE IMPACT OF IMPLEMENTING ISPO (INDONESIAN SUSTAINABLE PALM OIL) POLICY ON INCREASING THE INCOME OF INDEPENDENT OIL PALM FARMERS

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Abstract

The implication of the Indonesian Sustainable Palm Oil (ISPO) policy is that palm oil produced by farmers can meet international market standards. However, the number of farmers implementing ISPO in Jambi Province remains relatively small. Several issues faced by independent smallholder palm oil farmers in Jambi in implementing ISPO certification include: (1) Financial constraints – the cost of obtaining ISPO certification is often high, including audit costs, capacity building, and farm improvements (2) Technology and knowledge – many independent smallholders lack access to modern farming technology or the knowledge needed to meet ISPO standards. The purpose of this article is to analyze the factors influencing palm oil production and the impact of ISPO policy implementation on increasing the income of independent smallholder palm oil farmers in Jambi Province. The sample consisted of 30 independent farmers in Rasau Village, Merangin Regency, selected using stratified sampling. Criteria included farmers certified with ISPO, having 2–10 hectares of land, and more than five years of planting experience. The econometric model built was a simultaneous equations model, and data were processed using SAS for Windows 9.0. The results showed that palm oil production was significantly influenced by land area, number of seedlings, and amount of fertilizer. Farmers' income was significantly influenced by fresh fruit bunch (FFB) production, FFB price, fertilizer price, and labor wages. The ISPO policy's impact on increasing independent farmers' income in Jambi Province is seen through increases in oil palm land area, FFB production, and FFB prices, which are linked to higher farmer incomes. The application of ISPO fosters greater agricultural output and professionalization. Certified farmers have better job possibilities and more consistent economic returns. This connects with SDG 8's sustainable development goals. Aside from that, it touches on SDGs 12 and 13.

Keywords: Farmers, Income, ISPO, Oil Palm, SDG's

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INTRODUCTION

Indonesia is an agrarian country, with agriculture comprising sub-sectors such as livestock, plantations, food crops, fisheries, and forestry. Among these, the plantation sub-sector is the most prominent, contributing 55.65% of agricultural export earnings in 2020 (BPS, 2021). The plantation sub-sector is rapidly developing, especially the palm oil industry. The widespread cultivation by communities, private companies, and the state is expected to increase farmers' incomes and welfare. Oil palm is a flagship plantation commodity whose production increased significantly between 2017 and 2019, though it declined in 2020 and 2021. Nevertheless, production still reached 46.888 million tons in 2021, making it the top plantation commodity in Indonesia (BPS, 2021).

Palm oil plays a crucial role in the Indonesian economy, contributing around 3.5% to GDP, employing around 16 million people, and generating over US$20 billion annually from exports, mainly to India, the EU, and China. Programs like the B30 biodiesel initiative have stabilized palm oil prices and improved farmer income. The government promotes productivity through replanting programs and training, while initiatives like ISPO aim to ensure sustainable and responsible farming aligned with the Sustainable Development Goals (SDGs).

Jambi Province is one of the main palm oil–producing provinces on the island of Sumatra, based on data on plantation area and palm oil production. This is based on the cultivation status in the four largest palm oil–producing provinces in Sumatra in 2020. The area of smallholder palm oil plantations in Jambi Province reaches 506,462 hectares. Smallholder plantations are plantation businesses owned or managed by individuals and not incorporated as legal entities. The large size of smallholder plantations in Jambi Province has drawn the government's attention for continued development efforts. Over the past five years, the area and production of smallholder palm oil plantations have increased each year (Table 1).

Table 1. Area, Production, Productivity, and Number of Palm Oil Farmers in Jambi Province, 2016–2020

Year	Area (Ha)				Production (Tons)	Productivity (Tons/Ha)	Number of Farmers (Households)
	Immature Plants (TBM)	Mature Plants (TM)	Old/Damage Plants (TTM)	Total			
2016	97.404	324.347	14.283	436.034	977.799	3,015	200.991
2017	110.345	334.815	14.800	459.960	1.013.811	3,028	206.787
2018	110.340	338.302	18.931	467.573	1.010.393	2,987	210.684
2019	108.733	368.305	20.956	497.994	1.123.329	3,050	212.833
2020	108.046	376.374	22.042	506.462	1.142.078	3,034	221.711

Source: Jambi Provincial Plantation Office, 2020

Table 1 shows that from 2016 to 2020, the total area and production of smallholder palm oil plantations in Jambi Province increased. However, in terms of productivity,

there were fluctuations with a generally declining trend. This downward trend was caused by a decrease in the area of immature plants (TBM) compared to the previous year's TBM area. Therefore, it can be assumed that the size of the palm oil plantation area affects palm oil productivity. The development of smallholder palm oil plantation areas in Jambi Province is closely related to the expansion of palm oil plantations in each regency. Jambi Province has nine regencies, each of which has land dedicated to palm oil cultivation.

A major issue in developing palm oil in Jambi Province is the constraints faced by farmers in implementing the Indonesian Sustainable Palm Oil (ISPO) policy. One factor contributing to the relatively low level of ISPO adoption among farmers in Jambi Province is the lack of awareness about the importance of ISPO in increasing palm oil prices. Of the nine regencies cultivating palm oil, only four have implemented the ISPO policy. This indicates that ISPO adoption at the farmer level remains relatively low. The four regencies that have implemented the ISPO policy are Bungo, Batanghari, Merangin, and West Tanjung Jabung. This shows the need to further promote ISPO certification in Jambi Province. Farmers who are ISPO-certified naturally have advantages, such as better-organized and more environmentally friendly palm oil farming practices.

The implication of ISPO implementation is that the palm oil produced by farmers meets international market standards. However, the number of farmers applying ISPO in Jambi Province is still relatively small. Several challenges faced by independent smallholders in obtaining ISPO certification, as reported in the Palm Oil Research Grant (2020), include debt and land legality issues, high replanting costs, and concerns about meeting household needs during the immature planting period (Yanita et al., 2021). Partner farmers generally have a higher potential to obtain ISPO certification than independent smallholders because they tend to have clearer land ownership status (Hasnah et al., 2021). These issues have led to various perceptions among independent farmers. Therefore, it is important to study smallholders' perceptions regarding ISPO implementation and the factors influencing those perceptions.

The challenges in developing ISPO in Jambi Province are also related to the slow pace of innovation adoption among farmers. Understanding new agricultural technologies requires mental readiness before farmers decide to adopt and apply them, a process shaped by perception. According to Rogers (1983), the rate of adoption of an innovation depends on the adopter's perception of the characteristics of that innovation. The low adoption rate of ISPO certification may be due to the difficulty of implementation, as farmers' readiness to adopt ISPO certification remains very low (Dharmawan et al., 2019). In addition, farmers' understanding of ISPO is still limited, and many factors influence their willingness to adopt it. Given this, it is important to study the impact of ISPO on increasing smallholder farmers' incomes, as the main motivation for farmers to implement a policy is often the direct economic benefit it provides, particularly for independent smallholders (Watts et al., 2021).

The ISPO standard was first launched in 2011. However, by March 2021, only 20% of smallholders had obtained ISPO certification (Putra, 2021). Based on this data, further strategies and policies are needed to encourage smallholders to adopt ISPO certification in Indonesia, particularly in Jambi Province. Various studies have been conducted on ISPO implementation in Indonesia, such as those by Hasnah et al. (2018), Erdi et al. (2021), and Heriyanto et al. (2021), which largely focus on institutional, feasibility, and incentive aspects of ISPO implementation. Some problems faced by independent smallholders are due to the non-functioning of farmers' economic

institutions (cooperatives and farmer groups), which reduces competitiveness and business efficiency.

Through ISPO certification, independent smallholders are required to join farmer groups and cooperatives. In this program, farmer groups function as a platform for learning and collaboration, whether in marketing, providing production inputs, maintaining farm access roads, or engaging in environmental conservation. Some direct benefits felt by farmers include higher selling prices for fresh fruit bunches (FFB), which result from several factors: improved FFB quality, a shorter marketing chain (Amalia et al., 2022), and better quality of production roads that reduce transportation costs.

Based on these issues, the objective of this paper is to analyze the factors influencing palm oil production and the impact of the ISPO policy on increasing the income of independent smallholder palm oil farmers in Jambi Province. Accordingly, the research aims to examine the factors affecting palm oil production and the effects of the ISPO policy on improving the income of independent smallholder palm oil farmers in Jambi Province.

RESEARCH METHODS

This research is descriptive in nature, conducted through the collection of current facts based on available data, followed by data analysis, interpretation, and drawing conclusions. The research location was chosen to be Rasau Village, Renah Pamenang District, Merangin Regency, Jambi Province, with the consideration that this location has a cooperative (KUD) whose members include ISPO-certified farmers and is also one of the palm oil–producing areas in Jambi Province.

The sample in this study consisted of independent smallholder farmers managing their own oil palm plantations, with a minimum landholding of 2 hectares per household. A total of 30 farmers were purposively selected from the chosen village. Purposive selection was based on the criterion that the farmers already possessed ISPO certification. Thus, the total number of respondent farmers was 30, with data collected using a questionnaire. The research was conducted in December 2022.

The model specification formulated in this study is closely related to the research objective, namely to examine the impact of the ISPO policy on increasing the income of independent smallholder palm oil farmers in Jambi Province. The formulated equations are structural equations for production and income. The model developed is a simultaneous equation econometric model. Data processing was carried out using the computer software SAS for Windows 9.0.

Palm Oil Production Analysis

The factors suspected to influence palm oil production in the research location are land area, number of seedlings, amount of fertilizer, amount of pesticides, and the number of laborers used. The palm oil production equation is :

PKS = a0 + a1LHN + a2BBT + a3PPK + a4PST + a5JTK + U1

PKS = FFB Production (Kg)
LHN = Land Area (Ha)
BBT = Amount of Seedlings (stems)
PPK = Amount of Fertilizer (Kg)
PST = Amount of Pesticides (Liter)

JTK = Amount of Laborers (HOK)

Analysis of Palm Oil Farmers' Income

The income of palm oil farmers is presumed to be influenced by fresh fruit bunch (FFB) production, FFB price, fertilizer price, pesticide price, and labor wages

$$I = b0 + b1PKS + b2HKS + b3HPP + b4HPEST + b5UTK + U2$$

I = Farmer's Income (IDR/Ha)
PKS = FFB Production (Kg)
HKS = FFB Price (IDR/Kg)
HPP = Fertilizer Price (IDR/Kg)
HPS = Pesticide Price (IDR/Liter)
UTK = Labor Wages (Rp/Ha)

The analysis of this model uses the 2SLS (Two-Stage Least Squares) method, as the application of 2SLS produces consistent estimates, is simpler, and easier to apply (Gujarati, 2003). In this study, the statistical criteria used to validate the estimated values of the econometric model are the Root Mean Square Error (RMSE), Root Mean Percent Square Error (RMSPE), and Theil's Inequality Coefficient (U) (Pindyck and Rubinfield, 1991). These criteria are formulated as follows:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t^s - Y_t^a)^2}$$

$$RMSPE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(\frac{Y_t^s - Y_t^a}{Y_t^a}\right)^2}$$

$$U = \frac{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t^s - Y_t^a)^2}}{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t^s)^2} + \sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t^a)^{0.5}}}$$

Y_t^s = baseline simulated value of the observed variable
Y_t^a = actual value of the observed variable
n = number of observation periods

Analysis of the Impact of the ISPO (Indonesian Sustainable Palm Oil) Policy on Increasing Farmers' Income

The RMSPE statistic analyzes the degree to which the estimated values of endogenous variables deviate from the pattern of their actual values in relative terms (percent). To assess the closeness between the simulated variables and the actual ones, the coefficient of determination (R^2) is used. The smaller the RMSPE and Theil's U values and the larger the R^2 value, the better the model estimation. Simulation analysis is used to explain the impact of ISPO on increasing the income of independent smallholder farmers. The simulation was applied to the period January 2020 – January 2022, since ISPO implementation in the research location began in 2020. This analysis covers a past period; therefore, the simulation is referred to as a historical simulation.

Accordingly, several alternative simulation scenarios were developed to assess the impact of ISPO on increasing the income of independent smallholder farmers:

1. Increase in oil palm plantation area by 5 percent. This simulation is based on oil palm area growth data, in which the highest increase in plantation area reached 5 percent over the past two years.
2. Increase in FFB production by 76 percent. This simulation is based on palm oil production data in Renah Pamenang District, Merangin Regency, where the average increase in production reached 76 percent.
3. Increase in FFB price by 10 percent. This simulation is based on farmer-level FFB price trends at the research location, where the average price increase reached 10 percent over the past two years.

RESULTS AND DISCUSSION

Benefits of ISPO Certification for Independent Smallholder Palm Oil Farmers

The independent smallholder palm oil farmers in the research location are those who have not yet joined any farmer economic institutions such as companies or cooperatives (KUD). One hundred percent of respondents sell their palm oil to middlemen, as they do not yet have partnerships with palm oil mills. According to the study, several problems are faced by independent smallholders: 82 percent of respondents stated that the issues were due to the non-functioning of farmer economic institutions (such as cooperatives and farmer groups), which negatively impacts competitiveness and business efficiency. The remaining 18 percent cited problems related to access and technology. Through ISPO certification, independent smallholders are required to join farmer groups and cooperatives. In this program, farmer groups function as platforms for learning and cooperation—both in marketing, supplying production inputs, maintaining farm access roads, and engaging in environmental conservation efforts. The study's findings indicate that with ISPO certification, several direct benefits can be felt by farmers, including an increase in the selling price of fresh fruit bunches (FFB) as a result of several factors: improved FFB quality, a reduction in the FFB marketing chain, and improvements in the quality of farm access roads, which in turn reduce transportation costs.

Model Estimation Results

The model assessing income improvement among farmers was constructed as a dynamic simultaneous equation model consisting of two equations. The model reflects the interrelationship between ISPO policy implementation and increases in farmers' income. Both equations exhibited strong explanatory power, with coefficients of determination (R^2) exceeding 0.80—specifically, 0.82 for the first equation and 0.85 for the second. This indicates that, overall, the independent variables in the behavioral equations effectively explain variations in the dependent variables.

Palm Oil Production

As shown in Table 2, the variables in the palm oil production equation demonstrate strong explanatory capacity, accounting for 82.35% of the variation in production.

Table 2. Estimation Results of the Palm Oil Production Equation

Variable	Parameter Estimate	Prob > |t|	Label
Intercept	0.0032	0.0001	Intercept
LHN	3.4642	0.0028	Land Area (Ha)

BBT	2.4278	0.0045	Amount of Seedlings (Stems)
PPK	0.4573	0.0318	Amount of Fertilizer (Kg)
PST	0.0176	0.1363	Amount of Pesticides (Liter)
JTK	1.432	0.1124	Amount of Laborers (HOK)
R-Square 0.8235			Dw 1.7865
F-hit 4318.5			

Source: Data is processed, 2023

Table 2 show is Variation in Palm Oil Production Development. Palm oil production is positively related to land area, number of seedlings, amount of fertilizer, amount of pesticides, and number of laborers used. Based on the analysis results, palm oil production is significantly influenced at the 5% level by land area, number of seedlings, and amount of fertilizer. A change in land area of one hectare will result in a change in fresh fruit bunch (FFB) production of 4.245 kg. This finding is consistent with the study by Murdy et al. (2021), which states that with an increase in land area, farmers will plant more oil palm, thereby increasing palm oil production—in this case, FFB. Based on the analysis results, the change in FFB production as a result of a change in the number of seedlings used by one plant is 2.427 kg. This is because an increase in the number of seedlings used will increase the amount of FFB production.

Farmer's Income

The analysis results show that the dependent and independent variables in the oil palm farmer income equation are able to explain well, namely by 85.321%. Farmer income is positively related to FFB production and FFB prices, and negatively related to fertilizer prices, pesticide prices, and labor wages. The farmer income equation is significantly influenced at the 5% significance level by FFB production, FFB price, fertilizer price, and labor wage. A change in palm oil production of 1 kg will result in a change in farmer income of IDR 4.5671/Ha. This is because an increase in palm oil production will increase the amount of FFB sales, thereby increasing farmer income. A change in FFB price of IDR 1 per kilogram will result in a change in farmer income of IDR 1.7652/kg. This is because the higher the FFB price, the greater the farmer's income.

Table 3. Estimation Results of the Farmer Income Equation

Variable	Estimated Parameter	Prob > |t|	Label
Intercept	-0.0521	0.4421	Intercept
PKS	4.5671	0.0001	FFB Production (Kg)
HKS	1.7652	0.0001	FFB Price (IDR/Kg)
HPP	-2.3671	0.0000	Fertilizer Price (IDR/Kg)
HPS	-0.0004	0.1123	Pesticide Price (IDR/Liter)
UTK	-3.455	0.1102	Labor Wage (Rp/Ha)
R-Square 0.8532			Dw 1.8831
F-hit 2234.1			

Source: Data is processed, 2023

Impact of ISPO on Increasing Farmers' Income

The evaluation of the impact of ISPO implementation on increasing farmers' income is limited to changes in variables related to ISPO, namely the increase in oil

palm plantation area, the increase in oil palm production, and the increase in FFB prices. The evaluation was conducted for three historical simulation scenarios. The following are the simulation results for each scenario.

Increase in Oil Palm Plantation Area

Oil palm plantation area is one aspect that contributes to increased oil palm farming income. According to theory, increasing land area will enhance farming income. This is consistent with the results of data analysis in Table 4 below:

Table 4. Impact of a 5 Percent Increase in Oil Palm Plantation Area on Farmers' Income Growth

No.	Endogenous Variable	Baseline Value	Simulation Value	Change (%)
1	Oil Palm Production	4311.3	4867.2	12.89
2	Farmer's Income	4.113	5.311	29.12

Source: Data Processed, 2023

Table 4 show is the analysis results show that an increase in oil palm plantation area by 5 percent leads to an increase in oil palm production by 12.89 percent. This is consistent with the estimation results, where the increase in plantation area has a significant effect on increasing FFB production. In addition, the increase in oil palm production is followed by an increase in farmers' income by 29.12 percent. This aligns with the estimation results, which show that oil palm production has a significant effect on farmers' income.

Increase in Oil Palm Production

Palm oil output is one aspect that determines the income of oil palm growers. Oil palm growers' incomes will rise as production increases. This is consistent with the results of the analysis shown in Table 5 below.

Table 5. Impact of a 76 Percent Increase in Oil Palm Production on Farmers' Income Growth

No.	Endogenous Variable	Baseline Value	Simulation Value	Change (%)
1	Oil Palm Production	4311.3	7587.88	76,00
2	Farmer's Income	4.113	7.32114	78,00

Source: Data Processed, 2023

The analysis results (table 5) show that a 10 percent increase in oil palm prices will raise farmers' income by 78.00 percent. This is consistent with the estimation results, where an increase in oil palm prices has a significant positive effect on farmers' income

Increase in Oil Palm Prices

The Jambi Province Oil Palm Plantation Service decided the selling price for Fresh Fruit Bunches. This is the base farm-level sales price. Field data reveal that the selling price of FFB varies according to the supply chain. The results of data processing reveal that the price of FFB influences the level of income from palm oil farming. This is seen in Table 5 below.

Table 6. Impact of a 10 Percent Increase in Oil Palm Prices on Farmers' Income

No.	Endogenous Variable	Baseline Value	Simulation Value	Change (%)
1	Oil Palm Production	4311.3	7587.88	29.75
2	Farmer's Income	4.113	7.32114	26.91

Source: Data Processed, 2023

The analysis results show that a 10 percent increase in oil palm prices will raise farmers' income by 26.91 percent. This is consistent with the estimation results, where an increase in oil palm prices has a significant positive effect on farmers' income.

CONCLUSION

Based on the results of the research presented above, several conclusions can be drawn. Oil palm production is significantly influenced by several factors: land area, the number of seedlings, and the amount of fertilizer. The income of oil palm farmers is significantly affected by fresh fruit bunch (FFB) production, FFB prices, fertilizer prices, and labor wages. The impact of the Indonesian Sustainable Palm Oil (ISPO) policy on increasing the income of independent oil palm farmers in Jambi Province can be seen through increases in oil palm land area, FFB production, and FFB prices, all of which are related to higher farmer incomes.

There is a need to strengthen the role of institutions and governance in the implementation of Sustainable Oil Palm Production, as well as to increase farmer and company motivation through incentives that match the costs incurred from ISPO implementation. ISPO certification has not yet been well-socialized at the farmer level, resulting in a lack of farmer awareness and perception regarding ISPO certification. Farmers' knowledge about ISPO certification does not significantly influence ISPO implementation among independent farmers. This condition may be due to the still limited perception of ISPO certification among farmers.

The findings of this study suggest that ISPO has the potential to enhance farmer earnings but must be applied regularly. The implementation of the ISPO legislation has an influence on raising farmer incomes, demonstrating that sustainable certification may be economically beneficial. However, in order to have an egalitarian impact, expanding ISPO implementation to independent farmers must be accompanied by technical help, market incentives, and access to information so that they may achieve certification standards. Furthermore, this study suggests that improving production factors, stabilizing pricing, and expanding the implementation of ISPO rules are critical to raising the productivity and income of independent oil palm producers. A comprehensive and coordinated approach is required between the government, the corporate sector, and supporting institutions such thatThe implementation of the ISPO legislation has an influence on raising farmer incomes, demonstrating that sustainable certification may be economically beneficial. However, in order to have an egalitarian impact, expanding ISPO implementation to independent farmers must be accompanied by technical help, market incentives, and access to information so that they may achieve certification standards. Furthermore, this study suggests that improving production factors, stabilizing pricing, and expanding the implementation of ISPO rules are critical to raising the productivity and income of independent oil palm producers.

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