Analysis of the Development of Production and Exports of Crude Palm Oil (CPO) in West Sumatra Province

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Abstract. This study aims to determine the effect of oil palm plantation area, international CPO prices, oil palm plantation labor, and CPO exports both directly and indirectly through palm oil production. This study uses secondary data obtained from the Central Bureau of Statistics and Ministry of Trade. The data used is time series data for 2002-2021 in West Sumatra Province. The analytical method used is path analysis using AMOS.23. The results of this study indicate that the variable area of oil palm plantations does not have a direct effect on CPO exports, but has an indirect effect on CPO exports through the variable oil palm production. While the international CPO price variable has no significant relationship to CPO exports either directly or indirectly through the variable palm oil production. Meanwhile, the labor variable in oil palm plantations has no direct effect on CPO exports. However, it indirectly affects CPO exports through the variable palm oil production.

Keywords: Area of Palm Oil Plantations, International CPO Prices, Oil Palm Plantation Labor, Palm Oil Production, and West Sumatra CPO Exports.

1. Introduction

Indonesia is a growing nation with a vast array of potential natural resources. The agriculture and plantation industries represent one of the vast potentials of natural resources. In addition, Indonesia boasts incredibly fertile plantation land that may be used to grow oil palm, cloves, coffee, rubber, tea, and other plantation crops.

Subsectors of the plantation industry are extremely important to Indonesia's economic growth. The oil palm plantation subsector is one of these subsectors that contributes to the nation's foreign exchange earnings. Given the declining oil and gas production industry, which has been the main source of foreign exchange revenues, this function will become even more critical in the future. The government anticipates

A. Patunru et al. (eds.), *Proceedings of the 8th International Conference on Accounting, Management, and Economics (ICAME 2023)*, Advances in Economics, Business and Management Research 279,
https://doi.org/10.2991/978-94-6463-400-6_45

that the plantation subsector can contribute more significantly to expanding non-oil and gas exports as the foreign exchange contributions from oil and gas exports decline [1]. The country's foreign exchange profits, farmers' income, job possibilities, and the availability of plantation products for other sectors—particularly the industrial sector—are all intended to be increased by the development of the plantation subsector.

The amount of palm oil produced in Indonesia is determined by the size of the country's palm oil plants, which makes Indonesia the world's largest producer of palm oil. In contrast to other plantation crops, this is corroborated by Indonesia's geographic position, which fits the needs of palm oil plants. As a feedstock and biodiesel raw material, palm oil offers benefits. Palm oil's capabilities are required by diverse businesses across several nations [2], [3], and [4].

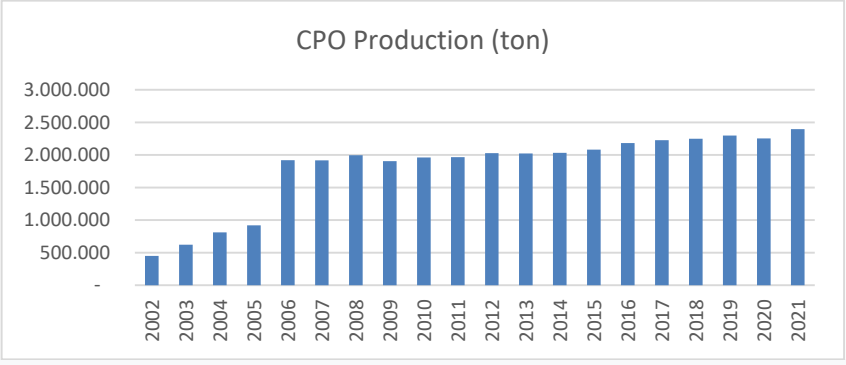
Since 2008 [5], Indonesia has been the world's leading producer and exporter of palm oil. Due to its high perceived profitability, plantation expansion in Indonesia was significantly impacted by the increase in global demand for edible oil in the 1990s [6].The majority of the land for palm oil plantations was allotted to the islands of Sumatra and Kalimantan [7]. According to estimates, Indonesia's palm oil business is one of the biggest sources of foreign exchange revenues, with exports worth IDR 240 trillion [8]. Among its well-known qualities, palm oil is the least expensive edible oil in the world [10], having low production costs [9]; [6] the demand for palm oil is consistently strong throughout the majority of the world (Sayer et al., 2012: 114), with Indonesia being the leading producer of palm oil worldwide.

How vital are Indonesia's Crude Palm Oil (CPO) exports worldwide? Indonesia is a country that contributes around 55 percent of the world's palm oil and 42 percent of the world's vegetable oil, making Indonesia the largest palm oil-producing country in the world. Many industries depend on palm oil, especially foodstuffs, the cosmetics industry, the chemical industry, the animal feed industry, and others. These analyses make Indonesian Crude Palm Oil (CPO) necessary for the world [11]. The rapid development of the Indonesian palm oil industry has attracted international attention, especially the world's main vegetable oil producing countries. Since 2006, Indonesia has been a palm oil producer that is largest in the world. In 2016, Indonesia surpassed Malaysia. Indonesia's CPO production share has reached 53.4% of the world's total CPO, while Malaysia's share is 32% [12]. The increasing number of processed products from palm oil has resulted in an increase in the need for palm oil. The market share for palm oil is also very promising because demand increases every year quite a lot [13].

In accordance with Douglas C. Nort's 1956 export-based model economic growth theory, a region's competitive advantage determines its rate of economic growth. The growth of the affected region can be accelerated if it can support the development of industries with competitive advantages as a foundation for exports. Due to the multiplier effect that increasing exports will have on the local economy, there will be economic growth [14].

West Sumatra Province has advantages, one of which is in the Crude Palm Oil (CPO) sector. According to the previously mentioned notion of sector superiority, a region's potential superiority will be more beneficial if it engages in international trade—in this case, exports. When a nation can meet its local commodity demands and generate items or services in big quantities, export operations take place. As a result, there is a chance for overproduction of commodities, which could then be exported. The exporter will get paid for their export-related activity; this money is typically referred to as foreign exchange.The amount of foreign exchange received will increase with the frequency of shipments. The foreign exchange earned can be utilized to pay for the importation of capital goods and raw materials that are required for production, adding value to the product. The GDP value is the total added value generated by all of the economy's output units. Economic growth is defined as the yearly rise in GRDP calculated using constant prices. This indicates that the primary factor driving regional economic growth is exports, specifically the foreign demand for local products [15].

West Sumatra Province is one of the areas that produce a lot of palm oil and exports Crude Palm Oil (CPO). For West Sumatra Province, CPO (Crude Palm Oil) exports contribute a lot to the GRDP of West Sumatra Province. Several things have caused oil palm in Indonesia to develop in West Sumatra, including the carrying capacity of the land, the technical climate, and meeting the requirements for planting and developing the cultivation of oil palm plants. The following is the CPO (Crude Palm Oil) production of West Sumatra Province for the period 2002-2021



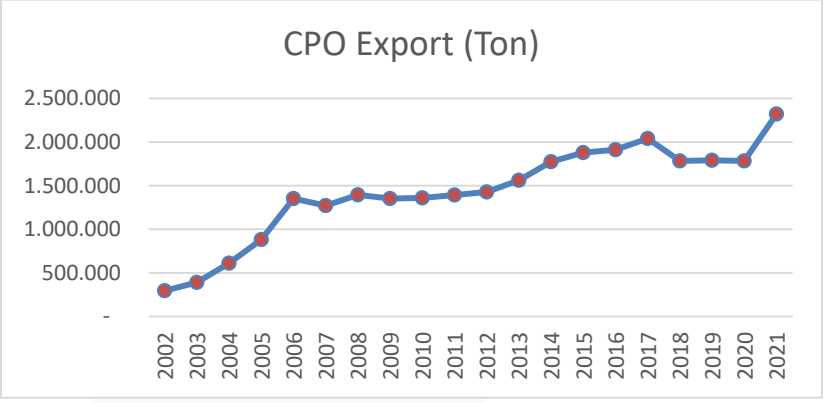
(Sources : West Sumatra Central Statistics Agency *2021)*

Fig. 1.1 CPO Production of West Sumatera Province 2002-2021

Figure 1.1 above illustrates the general upward trend in the output of crude palm oil (CPO) in the West Sumatra Province. The production of crude palm oil, or CPO, is divided as follows: smallholder plantations produce 44.75% of the oil, large national private firms (PBSN) provide 52.39%, and PT Perkebunan Nusantara (PTPN) only 2.86%. Large national private enterprises (PBSN) and PT Perkebunan Nusantara (PTPN) owned 42.68% of the oil palm plantations, with people's plantations making up 57.32% of the total area [16].

Production that exceeds domestic demand provides a significant opportunity for the export market to become the main driver of the local economy. Employment opportunities servicing the local market fluctuate in tandem with those servicing this market. The local economy is impacted when (export) factories close because the laid-off workers have less money to spend. It is believed that export job possibilities are crucial due to the major driver's role. Opportunities for employment that cater to the local market are viewed as non-basic and as modifying or adaptable [17].

The West Sumatra Province's CPO export volume is plotted in the graph below.



(Sources : West Sumatra Central Statistics Agency *2021)*

Fig. 1.2 Graph of CPO export volume for West Sumatra Province 2002-2021.

In Figure 1.2 above, West Sumatra Province CPO (Crude Palm Oi) exports in 2002-2021, the value fluctuates, but there is a tendency to increase based on volume (tons). They are starting from 2002 with a CPO export volume of 294 thousand tonnes to 2.3 million tonnes in 2021 with a growth percentage of 87%.

The production of crude palm oil (CPO) in West Sumatra Province is still regarded as less productive than that of its bordering provinces, despite the fact that both the volume and value of CPO exports from the province are growing annually. The production of numerous Sumatra provinces is compared to that of West Sumatra Province in the following.

Table 1. 1 CPO Production Productivity in several Provinces in Sumatra in 2021

Provinces	**Land area (hectares)**	**CPO productivity (kg/ha)**

West Sumatera	448.840	3.895
North Sumatera	1.248.086	4.747
South Sumatera	1.117.358	3.957
Bangka Belitung	234.818	4.463

(Source: Palm oil statistics in numbers, 2021)

Based on the comparison of West Sumatra Province with North Sumatra, South Sumatra, and Bangka Belitung, as shown in Table 1.1, it can be inferred that West Sumatra Province has the lowest productivity of CPO (Crude Palm Oil). Productivity is calculated by dividing output by the total acreage of land. West Sumatra Province can produce more, and it can do so by making the land it possesses more productive. Similar to production, exports can be expanded if there is still room to grow, mainly because the global crude palm oil (CPO) market is growing yearly.

Expanding CPO (crude palm oil) production would boost exports and planter welfare, benefiting the province of West Sumatra's economic development. Consequently, it is critical to understand the elements that determine CPO (crude palm oil) exports from West Sumatra Province and how commodity production affects those exports.

Several factors affect the actual production volume, including workforce and land area as inputs. Four main categories of production components are mentioned by Gilarso (2004): capital or equipment, natural resources, human resources, and entrepreneurial activities. Combining these main groupings will result in a business activity. It is determined that these four categories of production factors work together to produce output [18]. Several factors affect production volume, including workforce and land area as inputs.

One resource (input) used in palm oil production is land area. According to production theory, the relevant rule is that more significant input—in this case, the amount of land used—will result in higher production output and spur economic growth [19].

Similarly, labor affects production in a significant, unilateral way. In other words, the more work is employed, the more production is generated, and the opposite is also true. The production produced rises with the number of workers, increasing the output value. Thus, the value of production is positively impacted by the quantity of workers. (Mankiw, 2016).

One external element influencing output is price. The quantifiable amount of commodities given in the market at different price points is referred to as supply,

according to Alfred Marshall's theory in his book The Principles of Economics (1890). Stated differently, supply can be understood as a functional relationship between the level of price and the quantity delivered. The supply curve's relationship between quantity and price is positive (positive slope). Producers will attempt to increase the quantity of an item they sell if the price of the good increases, according to the supply function.

Thus, both directly and indirectly through CPO (Crude Palm Oil) production, researchers are interested in studying the effects of oil palm plantations, global CPO pricing, and labor from palm oil plantations on CPO (Crude Palm Oil) exports. The results of this study will be included into the planning and policy-making processes of provincial governments, particularly those of West Sumatra Province, as well as export and production entities, in order to enhance the performance of CPO (crude palm oil) exports. As a result, the author selected the study "Analysis of Production and Export Development of Crude Palm Oil (CPO) in West Sumatra Province."

1.1 Problem Formulation

1. Does the area of oil palm plantation land affect CPO exports in West Sumatra Province directly or indirectly by producing CPO in West Sumatra Province for the 2002-2021 period?
2. Does the international CPO price affect CPO exports from West Sumatra Province directly or indirectly through CPO production in West Sumatra Province in the 2002-2021 period?
3. Does the palm oil plantation workforce influence CPO exports in West Sumatra Province directly or indirectly through CPO production in West Sumatra Province in the 2002-2021 period?

1.2 Research Purposes

1. To measure and analyze how much influence the area of oil palm plantations has on CPO exports in West Sumatra Province directly or indirectly through CPO production in West Sumatra Province for the 2002-2021 period.
2. To measure and analyze how much influence international CPO prices have on CPO exports. To measure and analyze how big an influence the area of oil palm plantations has on CPO exports in West Sumatra Province directly or indirectly through CPO production in West Sumatra Province for the 2002-2021 period.
3. To measure and analyze how much influence the palm oil plantation workforce has on CPO exports in West Sumatra Province directly and indirectly through CPO production in West Sumatra Province for the 2002-2021 period.

2. Literature Review

Several previous researchers used as literature review, namely research from:

The Determining Factors of Production on Palm Oil Plantations in North Mamuju Regency study by Dimas Deworo Puruhito, Jamhari, Slamet Hartono, and

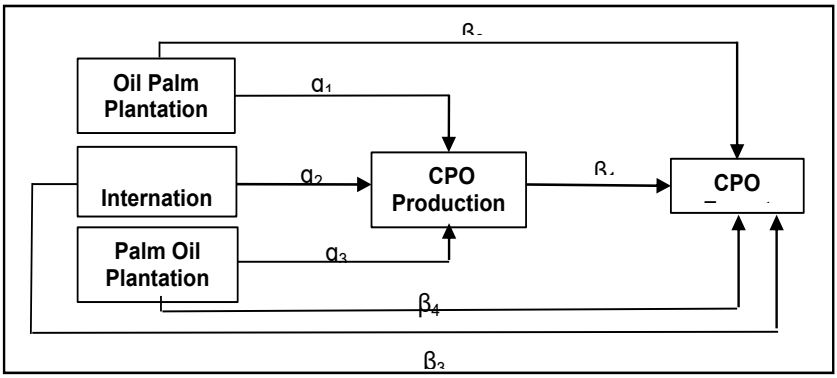
Irhamo (2019) revealed that labor from outside the family and land area input has a significant positive impact on CPO production.

Nyoman Tri and Bagus Putu's research (2020) examined how CPO output and international prices affected the amount of CPO exported. Data from 2004 to 2018—fifteen years—were examined in this study. The study's findings indicate that global CPO pricing significantly and favorably impacts CPO exports. The volume of CPO produced in Indonesia significantly and favorably affects CPO exports. The 2019 study "Analysis of the Effect of Capital and Labor on CPO Production in Aceh Tamiang Regency" by Nanda Lisa revealed that labor and capital variables significantly increased Tamiang Regency's CPO production.

A study named "Analysis of Factors Affecting Crude Palm Oil (CPO) Exports in South Kalimantan Province" was carried out in 2022 by Freddy Siahaan and Ali Wardana. According to the findings, output volume significantly boosts CPO exports. CPO exports are not significantly impacted by CPO prices, however.

3. Research Framework

This study will examine the direct and indirect effects on CPO exports (Y2) in Sumatra Province West of oil palm plantation land area (X1), labor (X3), and international CPO prices (X2) on CPO production (Y1). These variables are meant to further guide researchers in their search for knowledge and data inside this study to address the previously mentioned issues. A study framework, similar to the one in the following image, can be made based on this explanation. Figure 2.1 below shows the relationship between variables based on the theoretical explanation given above:



Oil palm farms have a major positive impact on the export of CPO. because land area is an input, or resource, in the production of palm oil. The applicable law states that an increase in input—in this case, the amount of land used—would result in a rise in production output, which will raise the supply of CPO for export (Sulaiman Nur, 2019).

CPO exports are significantly positively impacted by the link between international CPO prices. because the supply curve's positive slope indicates a positive link between pricing and production quantity. When a good's price rises in the supply function, producers will attempt to manufacture more goods in order to benefit more from the price increase. On the other hand, producers will typically cut back on production if prices drop. Producers will naturally tend to expand production and export their goods if global CPO prices rise. Under ceteris paribus circumstances, the law is applicable (other things stay constant).

Meanwhile, there is a significant favorable relationship between the workers on palm oil plantations and CPO exports. According to Adam Smith's Classical Theory, labor is the primary productive factor affecting a nation's wealth. This is based on the notion that land would be useless if humans had not developed nature. This theory also maintains that human resources are the foundation for economic growth. As a result, output can be increased proportionately to worker input. This increase in CPO output may lead to a rise in the volume of CPO exports [20].

4. Research Method

This research was carried out in West Sumatra Province. The data used is time series data for 2002-2021. This research uses secondary data with the main data sources from the West Sumatra Province Central Statistics Agency (BPS) and Bappebti. Which includes data on CPO (Crude Palm Oil) exports, CPO production, oil palm plantation area, international CPO prices, and plantation sector employment. The method used is a quantitative method with simultaneous equation data analysis techniques.

4.1. Data Analysis Method

Data analysis and interpretation are done through analytical procedures. Simultaneous Equations, run through the AMOS 23 program, is the data analysis method employed by the model created in this study. The total direct and indirect impacts of changes in exogenous variables on endogenous variables are measured using this analysis technique. [21].

The following equation is used to determine how much the variables of oil palm plantation labor, land area, and international CPO prices affect CPO exports through the CPO production variable:

$$Y_{1} = (X_{1,}X_{2,}X_{3}) \quad (3.1)$$

$$Y_{2} = f(Y, X_{1,}X_{2,}X_{3}) \quad (3.2)$$

Then, the above function is transformed into an econometric model with the equation as below:

$$Y_{1} = (\alpha_{0} + \alpha_{1}X_{1,} + \alpha_{2}X_{2,} + \alpha_{3}X_{3} + \mu_{1}) \quad (3.3)$$

$$Y_{1} = (\beta_{0} + \beta_{1}Y_{1,} + \beta_{2}X_{1,} + \beta_{3}X_{2} + \beta_{4}X_{3} + \mu_{2}) \quad (3.4)$$

Where:
X_1 = Oil Palm Plantation Land Area (Hectares)
X_2 = International CPO Price (US$/ton)
X_3 = Palm Oil Plantation Labor (Persons)
Y_1 = CPO Production (Tons)
Y_2 = CPO Exports (Tons)

Based on the previous equation, several substructure equations can be formed as follows:
CPO Production Substructure Equation (Y1):

$$Y_1 = \alpha_0 + \alpha_1 X_{1,} + \alpha_2 X_{2,} + \alpha_3 X_3 + \mu_1$$
$$Ln\, Y = \alpha_0 + \alpha_1 LnX_{1,} + \alpha_2 LnX_{2,} + \alpha_3 LnX_3 + \mu_1 \qquad (3.3a)$$

CPO Export Sub Structure Equation (Y2)

$$Y_2 = \beta_0 + \beta_1 Y_{1,} + \beta_2 X_{1,} + \beta_3 X_{2,} + \beta_4 X_3 + \mu_2$$
$$Ln\, Y = \beta_0 + \beta_1 LnX_{1,} + \beta_3 LnX_{2,} + \beta_4 LnX_3 + \mu_2 \qquad (3.4a)$$

Substitute equation (3.3a) into equation (3.4a) to obtain the following equation:

$$ln\, Y_2 = \beta_0 + \beta_1(\alpha_0 + \alpha_1 lnX_1 + \alpha_2 lnX_2 + \alpha_3 lnX_3 + \mu_1) + \beta_2 lnX_1 + \beta_3 lnX_2 + \beta_4 lnX_3 + \mu_2$$
$$ln\, Y_2 = \beta_0 + \beta_1\alpha_0 + \beta_1\alpha_1 lnX_1 + \beta_1\alpha_2 lnX_2 + \beta_1\alpha_3 lnX_3 + \beta_1\mu_1 + \beta_2 lnX_1 + \beta_3 lnX_2 + \beta_4 lnX_3 + \mu_2$$

$$ln\, Y_2 = \beta_0 + \beta_1\alpha_0 + (\beta_1\alpha_1 + \beta_2) lnX_1 + (\beta_1\alpha_2 + \beta_3) lnX_2 + (\beta_1\alpha_3 + \beta_4) lnX_3 + \mu_2$$

So it can be written:

$$lnY_2 = (\beta_0 + \beta_1\alpha_0) + (\beta_1\alpha_1 + \beta_2) lnX_1 + (\beta_1\alpha_2 + \beta_3) lnX_2 + (\beta_1\alpha_3 + \beta_4) lnX_3 + \beta_1\mu_1 + \mu_2 \qquad (4)$$

$$lnY_2 = \pi_0 + \pi_1 lnX_1 + \pi_2 lnX_2 + \pi_3 lnX_3 + \mu_{1,2} \qquad (5)$$

Where:
Direct Influence:
α_1 = Direct effect of oil palm plantation land area on CPO production
α_2 = Direct influence of international CPO prices on CPO production
α_3 = Direct influence of Palm Oil Plantation Labor on CPO Production
β_1 = Direct effect of CPO production on CPO exports
β_2 = Direct effect of palm oil plantation land area on CPO exports
β_3 = Direct effect of international CPO prices on CPO exports
β_4 = Direct influence of palm oil plantation workers on CPO exports
Indirect Influence:

$\alpha_1\beta_1$ = Indirect Effect of Palm Oil Plantation Land Area on CPO Exports through CPO Production

$\alpha_2\beta_1$ = Indirect effect of international CPO prices on CPO exports through CPO production

$\alpha_3\beta_1$ = Indirect influence of Palm Oil Plantation Labor on CPO Exports through CPO Production

Total Influence:

$\pi_0 = \beta_0 + \alpha_0\beta_1$ (Direct influence of Y_1 CPO Production, with constant Y_2 CPO Exports)

$\pi_1 = \beta_2 + \alpha 1\beta_1$ (Total influence of X_1 Oil Palm Plantation Land Area)

$\pi_2 = \beta_3 + \alpha 2\beta_1$ (Total influence of X_2 International CPO Prices)

$\pi_3 = \beta_4 + \alpha 3\beta_1$ (Total influence of X_3 Palm Oil Plantation Labor)

$\pi_{1,2} = \mu_2 + \mu_1\beta_1$ (Total error terms Y_1 and Y_2)

4.1 Operational Definition

Palm Oil Plantation Land Area (X_1) is the most important production factor in all oil palm plantations, whether owned by large companies or people, which is the place where production can be carried out and where the results are produced. The land area referred to in this research is the area where oil palm commodities are planted in units (hectares) in West Sumatra Province during the 2002-2021 period.

International CPO price (X_2) is the price of palm oil used in the international market. The data used is palm oil price data in USD/ton units during the 2002-2021 period.

Palm Oil Plantation Workers (X_3) are every person who is able to carry out work to produce goods and services to meet their own needs and those of the community. As an indicator of labor force in this research data was used on the number of labor force people aged 15 years and over who work in the oil palm plantation sector in West Sumatra Province for the period 2002-2021. The data used for analysis is the total value of the working workforce in units (persons).

CPO Production (Y1) is the total amount of CPO produced in the West Sumatra Province between 2002 and 2021 from both large and smallholder plants. The quantity of CPO produced in tons was the data used for analysis.

The total amount of CPO exports coming from West Sumatra is represented by CPO exports (Y2). The number of CPO exports (yearly) reported in tons for the years 2002–2021 is the data used.

5. Study Results And Discussion

5.1 General Development of Research Variables

Output and pricing considerations are inextricably linked to CPO output and export growth. The production and exports of CPO from West Sumatra Province have generally increased over the past 20 years (2002–2021). However, there has been some volatility. The same applies to oil palm farms' land area, labor force, and CPO's global pricing. The area covered by oil palm plants grew by 87%. The workforce on oil palm plantations expanded by 27%. Additionally, the price of CPO internationally has risen by 67% from 2002 to 2021.

5.2 Estimation Result

The variables of oil palm plantation land area (X1), international CPO prices (X2), and palm oil plantation labor (X3) can explain the CPO production variable (Y1) of 86.1%, according to the Squared Multiple (R2) results. Variables not included in the model account for the remaining 13.9% of the explanation. Next, 87.7% of the CPO export variable (Y2) can be described by the variables land area for smallholder oil palm plantations (X1), labor from palm oil plantations (X3), and international CPO pricing (X2). External variables may explain the remaining 12.3%. model.

Table 1 below displays the estimated findings of the effects of labor from palm oil plantations, international CPO pricing, and land area on CPO output and exports.

Table 4. 1. Estimated Results of the Direct Influence of Palm Oil Plantation Land Area, International CPO Prices, and Palm Oil Plantation Labor on CPO Production and CPO Exports

	Estimate	S,E.	C.R.	P
Y1 ⊗X1	1,569	0,391	4,009	***
Y1 ⊗X2	0,114	0,110	1,042	0,297
Y1 ⊗X3	0,470	0,223	2,102	0,036
Y2 ⊗X1	-1,407	1,490	-0,944	0,345
Y2 ⊗X2	0,500	0,320	1,564	0,118
Y2 ⊗X3	-0,416	0,700	-0,595	0,552
Y2 ⊗Y1	3,061	0,634	4,830	***

Source: Data processed with AMOS 23

The table of research results displays the overall indirect impact of labor, international CPO pricing, and land area of oil palm plantations on CPO (crude palm oil) exports through CPO production. It also displays the total impact of the factors examined in Table 2 that follows.

Table 4. 2 Direct Effects, Indirect Effects, dan Total Effects

		X_1	X_2	X_3	Y_1
Direct Effects	$\mathbf{Y_1}$	1,569	0,114	0,470	0,000

	Y_2	-1,407	0,500	-0,416	3,061
Inderect Effects	Y_1	0,000	0,000	0,000	0,000
	Y_2	4,803	0,350	1,438	0,000
Total Effects	Y_1	1,569	0,114	0,470	0,000
	Y_2	3,396	0,850	1,021	3,061

Source: Data processed with AMOS 23

With a probability of 0.345 and a coefficient value of -1.407, Table 4.2 demonstrates that the direct impact of oil palm plantation area (X1) on CPO exports (Y2) demonstrates a negligible effect (prob. > 0.05). This implies that there won't be a noticeable impact on changes in the size of smallholder oil palm plantations on the amount of CPO exported. The first hypothesis, according to the estimation's results, is that the area of oil palm plantations directly and significantly increases the amount of crude palm oil (CPO) exported.

Although from the estimation results the direct influence of the variable area of oil palm plantation land (X1) on CPO exports (Y2) is not significant. However, the indirect effect of the oil palm plantation land area variable (X1) on CPO exports (Y2) through plantation CPO production (Y1) shows a significant positive effect with a coefficient value of 4.803. This influence is obtained from the relationship between the area of oil palm plantation land and CPO production with a coefficient value of (1.569 x 3.061) which is then continued with a significant positive relationship between CPO production and CPO (Crude Palm Oil) exports. These findings mean that every increase in the area of oil palm plantations will affect the amount of CPO (Crude Palm Oil) exports through CPO production. By comparing the direct and indirect effects of oil palm plantation area on CPO exports, it was found that the dominance of positive and significant indirect effects. Therefore, it can be said that the total influence of oil palm plantation land area on CPO exports shows a positive relationship tendency. This is in accordance with the initial hypothesis which states that the area of oil palm plantations has a positive and significant indirect effect on CPO (Crude Palm Oil) exports through CPO production.

The probability value of 0.118, which is higher than the significant level value (prob. > 0.05), indicates that the international CPO price variable (X2) has a negligible direct effect on CPO exports (Y2). This implies that variations in the price of crude palm oil (CPO) on a global scale will not impact variations in the volume of CPO exports. The first hypothesis, which holds that global CPO prices have a considerable positive direct effect on CPO (Crude et al.) exports, needs to be

supported by these estimation results.

The indirect effect of the international CPO price variable (X2) on CPO exports (Y2) through CPO production (Y1) shows an overall insignificant effect with a coefficient value of 0.350 (0.114 x 3.061). This influence is obtained from an insignificant relationship between international CPO prices and CPO production with a probability value of 0.297 which is then continued with a positive and significant relationship between CPO production and CPO (Crude Palm Oil) exports with a probability value of 0.036. Because the relationship between international CPO prices and CPO production is not significant, the indirect influence between international CPO prices (X2) on CPO exports (Y2) through CPO production (Y1) is also not significant because the relationship has been broken. These findings mean that any increase in international CPO prices will not affect the amount of CPO (Crude Palm Oil) exports through CPO production. This is not in accordance with the initial hypothesis which states that international CPO prices have a significant positive effect both directly and indirectly on CPO (Crude Palm Oil) exports through CPO production.

Palm oil plantation workers (X3) have no direct relationship to CPO exports (Y2) with a probability value of 0.552, which is greater than the significant level (prob. > 0.05). This means that changes in the workforce for palm oil plantations will not affect significant changes in the amount of CPO exports. The results of this estimation are not in accordance with the initial hypothesis which states that palm oil plantation workers have a direct positive and significant effect on CPO (Crude Palm Oil) exports.

Although from the estimation results the direct influence of the oil palm plantation labor variable (X3) on CPO exports (Y2) is not significant. However, the indirect influence of the palm oil plantation labor variable (X3) on CPO exports (Y2) through CPO production (Y1) shows a significant positive influence with a coefficient value of 1.438. This influence is obtained from the relationship between palm oil plantation labor and CPO production with a coefficient value of (0.4709 x 3.061) which is then continued with a significant positive relationship between CPO production and CPO (Crude Palm Oil) exports. These findings mean that every increase in palm oil plantation labor will affect the amount of CPO (Crude Palm Oil) exports through CPO production. By comparing the direct and indirect effects of palm oil plantation labor on CPO exports, it was found that the dominance of positive and significant indirect effects. Therefore, it can be said that the total influence of palm oil plantation labor on CPO exports shows a positive relationship tendency. This is in accordance with the initial hypothesis which states that palm oil plantation labor has a positive and significant indirect effect on CPO (Crude Palm Oil) exports through production.

This will be examined further based on the estimated coefficient values shown in Tables 1 and 2. The analysis was performed in line with the previously mentioned order of hypotheses. The outcomes of hypothesis testing can then be explained based on the estimation findings obtained with the Simultaneous Equation

Model (Tables 1 and 2).

Analysis of the Influence of Palm Oil Plantation Land Area Both Directly and Indirectly on CPO Exports Through CPO Production

The area of plantations serves as a natural resource or input for the production of plantation commodities, such as palm oil commodities, and is crucial to this process. Based on production theory, the role of land area directly influences how much production will be produced. Production is a factor that influences supply. Production levels will be directly proportional to supply levels. This is what underlies the relationship between the area of oil palm plantations and the volume of CPO exports. Iswandhie (2000) stated that the larger the plantation area cultivated, the quantity of production produced is expected to tend to increase. If CPO production increases, the volume of Indonesian CPO (Crude Palm Oil) that can be exported will also increase. So it can be concluded that the area of oil palm plantations has a positive effect on CPO exports.

Based on the estimation results, it can be concluded that there is no significant direct impact of oil palm crops on CPO exports. The first hypothesis, which claimed that the area of smallholder oil palm plantations had a positive and significant effect on CPO exports, is not supported by this study.

The findings of this study are consistent with those of Andi Yulianto's (2019) investigation on the variables affecting the volume of Indonesian palm oil (CPO) exports from 1998 to 2018. The findings indicate that the amount of Indonesian palm oil (CPO) exports is not significantly impacted by the variable plantation land area. It is clear from this study that the amount of land used for oil palm has no bearing on CPO exports.

The land area of oil palm plantations is a substantial positive indirect influence on CPO exports through CPO output, even if it has no significant direct impact. This result supports the original theory, which holds that the area of oil palm plantations influences CPO exports in an indirect and favorable way through CPO production.

This is possible because plantation land cannot directly influence exports; rather, expanding plantation land first boosts production capacity, enabling the manufacture of a significant amount of items that can be exported. This explains why the region of oil palm plantations in the province of West Sumatra has an indirect impact on CPO exports through CPO production rather than a direct one.

The results of this research show that the area of oil palm plantations does not directly influence the amount of CPO exports in West Sumatra Province. However, it is able to increase CPO exports through CPO production. So far, Indonesia is still considered the largest producer of palm oil which originates from the expansion of oil palm plantation areas. This is different from neighboring Malaysia, which is also known as a palm oil producer, which comes from increasing land

productivity [22].

These findings are in line with the results of research conducted by Dimas Deworo Puruhito, Jamhari, Slamet Hartono, and Irhamo in 2019, regarding Determining Factors of Production on Palm Oil Plantations in North Mamuju Regency, with the research results showing that land area input is a determining input that has a positive effect significant impact on CPO production.

Based on the results of this research, efforts need to be made to increase plantation productivity, so various efforts can be made to improve plantation performance, not only by expanding land but by paying attention to other input factors that can increase output volume and output quality such as the use of fertilizers, herbicides, labor, age of plants, frequency of garden sanitation, distance between gardens and rivers, and selection of the type of soil used.

Analysis of the Influence of International CPO Prices Both Directly and Indirectly on CPO Exports Through CPO Production

The research estimation results indicate that there is no substantial impact of the worldwide CPO price variable (X2) on CPO exports (Y2) in West Sumatra, either directly or indirectly CPO production (Y1). These findings contradict the study's original hypothesis, which holds that West Sumatra's CPO exports are positively and significantly impacted by global CPO prices.

This study agrees with that of Muhammad Fakhruddin (2021), who found no discernible relationship between the volume of Indonesian CPO exports and global CPO prices.

Dominick Salvatore (2008) states that in Adam Smith's theory, namely the absolute advantage trade theory, where a country focuses on producing a commodity that is not owned by other countries, which is then exported to countries that do not have these production results. Countries that do not have the production of a commodity will continue to import that commodity even if prices rise or fall, this is in order to meet needs in that country. On the other hand, countries that have superior production output of a commodity will continue to export even if prices rise or fall, this is due to demand from countries that need that commodity to meet the needs of their country.

The CPO commodity is an inelastic product because the market response to offering the product is due to price changes over a long period of time. From the start of planting to harvest, the CPO commodity takes 4-5 years. So if there is an increase or decrease in international CPO prices, consumers will still consume CPO. This is also based on the needs of importing countries which are quite high so they will not give up their intention to import palm oil from West Sumatra whatever the price of palm oil. Apart from that, with the existence of a previous contractual agreement between the importer and exporter regarding the export volume and agreed price, prices that rise or fall do not have an influence on CPO exports. This is the reason why international CPO prices do not have a significant influence on CPO exports either directly or through CPO production

Analysis of the Influence of Palm Oil Plantation Labor Directly and Indirectly on CPO Exports Through CPO Production.

Labor acts as a production factor that is able to increase the usability of other production factors (cultivating land, utilizing capital, etc.) [23]. Labor is one of the most important factors in the production process to produce goods and services in addition to raw material and investment factors. Labor is also needed to transform raw materials into desired goods.

In Lewis's labor theory (1959), it is explained that excess labor is not a problem but is an opportunity for the workforce. Excess labor in one sector will make a good contribution to output growth and can provide labor supply in other sectors.

Based on the results of previous research, it shows that palm oil plantation workers do not have a significant influence on the amount of CPO (Crude Palm Oil) exports in West Sumatra, but have an indirect influence through CPO production. This is in accordance with the initial hypothesis which states that labor has a significant positive influence on exports through production, namely that increasing the number of workers increases the production output produced, which then increases export supply and conversely the less labor used, the less production output. resulting from. Therefore, the number of workers has a positive effect on export volume through increasing production output [24] .

This research is in line with research conducted by Ahmad Ridha (2018), with the research results showing that labor has a significant positive effect on the amount of CPO production in the District, East Aceh.
Based on the results found, this can happen because the input of palm oil plantation labor cannot directly affect CPO (Crude Palm Oil) exports, but rather an increase in palm oil plantation labor can increase production capacity first so that it can produce a lot of CPO offers that can be purchased. export. This influences why palm oil plantation workers in West Sumatra Province do not have a direct influence on CPO exports but instead have an indirect influence on CPO (Crude Palm Oil) exports through CPO production.

6. Conclusion

Several conclusions may be made based on the estimation results found and the discussion of the impact of labor from palm oil plantations, international CPO pricing, and land area used for oil palm plantations on CPO production and exports in this study. These conclusions include the following:

The results of the research indicate that exports of crude palm oil (CPO) are not significantly impacted by the varying land area used for oil palm farms. This variable has a notable positive indirect impact on CPO (Crude et al.) exports through CPO production. This is possible as the location of oil palm crops does not directly impact CPO exports. However, it has an impact on crude palm oil (CPO) exports after it has an impact on CPO production capacity. A 1% increase in the total area of plantation land can result in a 4.803% rise in CPO exports, demonstrating how the variable size of oil palm plantation land can indirectly affect CPO exports through CPO production.

Research findings show that the international CPO price variable does not have a significant effect either directly or indirectly on CPO (Crude Palm Oil) exports through CPO production.

Research findings show that the palm oil plantation labor variable directly has no effect on CPO (Crude Palm Oil) exports, whereas indirectly, it has a significant effect on CPO (Crude Palm Oil) exports through the CPO production variable. This can happen because palm oil plantation workers do not directly influence CPO exports. However, it affects CPO production first, then affects CPO (Crude Palm Oil) exports. Meanwhile, indirectly, the variable of palm oil plantation labor is able to influence CPO exports through CPO production, as proven by an increase in the number of palm oil plantation workers by 1% which can increase CPO exports by 1.438%.

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