Oil palm contribution to sdgs achievement: a case study in main oil palm producing provinces in Indonesia

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Abstract. The development of oil palm plantations and their production is not only expected to generate foreign exchange for the country, but it is also expected to have a positive impact on the social and economic development of the community, which must be in line with the sustainable development goals (SDGs). The development of oil palm plantations that involves the people through the Nucleus Estate and Smallholder (NES or PIR) Scheme with its various variations has several weaknesses that are detrimental to farmers, causing various conflicts and weaken farmers' bargaining position, unclear determination of plantation development costs and unclear criteria in determining the quality and price of fresh fruit bunches (FFB) produced by farmers. This study aims to study whether oil palm development is able to improve socio-economic conditions of the people in Indonesia, mainly in main oil palm producing provinces in accordance with the SDGs targets, including no poverty (Goal-1), reduced inequality (Goal-10), and good health and wellbeing (Goal-3). The research was carried out on a national level, especially in oil palm producing provinces in Indonesia. The data used are time series data for the period of 1990 to 2020. The analysis model used is a regression model where oil palm area as an independent variable and the SDGs indicators as dependent variables. The results showed that oil palm development could significantly reduce the number of poor people in both rural and urban areas, had not been able to reduce income inequality even in 4 provinces significantly increased income inequality, and had no effect on improving people's health and wellbeing based on the human development index.

1 Introduction

In the conditions of the Covid-19 pandemic, the vegetable oil market in 2022 is estimated at 215.4 millions metric tons and will increase to 258.4 million metric tons in 2026 with the growth rate of 4.4% per year. Palm oil is projected to grow by 5.2% to reach 101.8 million metric tons by 2026 (39.4% of the world's total vegetable oil). Meanwhile, soybean oil is

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predicted to grow at an average of 4.5 per year with a share in 2026 of 29.6% [1]. Meanwhile, in the 2021 world palm oil market, Indonesia controls the market with an export share of 54.7%, followed by Malaysia with 29,2% [2].

Indonesia is the largest palm oil producing country in the world. In 2022, the harvested area is 12.5 million hectares and contributes to the world's total harvested area of 51.7% [3]. For Indonesia, oil palm is one of the economic pillars that makes a major contribution to foreign exchange earnings and job creation for the community [4, 5] and reduces poverty among agricultural and non-agricultural households [6-9]. The Central Bureau of Statistics (BPS) noted that the export value of Indonesian palm oil in 2020 reached US $18,7 billion [10].

Apart from being a foreign exchange earner for the country, the development of oil palm and its production is also expected to improve the socio-economic conditions of the people in line with the goals of sustainable development. SDG). One of the important indicators as a form of achievement of sustainable development is the level of people's welfare. Several studies have revealed that oil palm development has significantly increased the income of oil palm smallholders and at the same time increased the economic activities of the community in the main oil palm production areas [11, 6, 7, 12] and improving the standard of living of farmers [6, 13]. Likewise, at the macro level, it was found that during the period 2000 to 2010, oil palm development had reduced the number of poor people and this decline was faster in main oil palm production areas [11].

Oil palm development has various impacts on the socio-economic conditions of smallholders. Research from the University of Kent concluded that unsustainable livelihoods, socio-economic inequality and environmental problems remain major challenges in the palm oil industry [14]. There are variations in the socio-economic impacts of oil palm between locations with different biophysical characteristics and socio-economic conditions in Indonesia [15]. Several studies that produce this negative impact include [16-18]. Previous researchers doubted that the economic growth was not sufficient to decrease poverty rates in developing countries.

This study examines at the macro level whether oil palm development can improve the communities' socio-economic conditions in Indonesia, especially in oil palm producing areas in accordance with the sustainable development goals (SDGs). The indicators used are the poverty level which is calculated from the percentage of the population who is below the poverty line, the communities' welfare is measured by the human development index (HDI), and the income distribution is measured in Gini ratio.

2 Research methods

The research scope covers all major oil palm producing provinces in Indonesia, namely Aceh, North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, West Kalimantan, Central Kalimantan, South Kalimantan and East Kalimantan. The substance of the research is focused on the impact or influence of oil palm development on several indicators of sustainable development targets (SDGs). In this article, the observed indicators are limited to (1) poverty reduction (Goal 1 - no poverty) which is measured from the percentage of poor people, (2) health and good life (Goal 3 - Good Health and Well-being) which is measured from the development index human (HDI), and (3) reduce inequality (Target 10) that is measured from the Gini coefficient.

HDI describes the three dimensions of human life. The three dimensions are life opportunity (longevity), knowledge, and a decent living standard. In order to calculate HDI, each component of HDI is standardized with the minimum and maximum values.

Indonesian Central Bureau of Statistics [19] calculates HDI by the following formula:

$$HDI = \sqrt[3]{(X_1 + X_2 + X_3)} * 1000 \quad (1)$$

where X_1 indicates the health index, X_2 indicates education index and X_3 indicates decent standard of living index.

Following BPS [19], the Gini coefficient refers to the Lorenz curve, which is a cumulative expenditure curve that compares the income distribution with an equal distribution representing the cumulative percentage of the population. The formula used is as follow:

$$GR = 1 - \sum_{i=1}^{n} f_{pi}\, x\, (Fc_i + Fc_{i-1}) \quad (2)$$

Where GC indicates gini coefficient, f_{pi} indicates population frequency in the i-th expenditure class, F_{ci} indicates the cumulative frequency of the total expenditure in the i-th expenditure class, and F_{ci-1} indicates cumulative frequency of total expenditure in the (i-1)th expenditure class.

Time series data for 1990-2018 are used in this study. The time span is chosen with the consideration that this period is considered sufficient in representing the movement fluctuations or changes in the research variables. Data were collected from the main source, namely the BPS, both in form of national publications and publications of each province which became the object of research.

Data were analyzed using a simple regression model with the variable area of oil palm as a proxy for oil palm development as the independent variable, while each of SDGs indicator observed as the dependent variable. In general, the regression model used is:

$$Yi = \beta 0 + \beta iXi + \beta jZj + \varepsilon i \quad (3)$$

Where i = 1 for goal indicator 1 (number of poor people in %), i = 2 for goal indicator 3 (human development index), and i = 3 for goal indicator 10 (Gini coefficient), and t is the year of observation (2000-2020). X is oil palm planted area, and Zj are exogenous variabels related to each of SDGs' goal.

3 Result and discussions

3.1 Impact of Oil palm plantation development on poverty alleviation

Oil palm is an important commodity in the plantation sub-sector in Indonesia. Palm oil makes a significant contribution to supporting the agricultural sector and the economy of oil palm producing provinces. As a leading commodity, oil palm development has a multiplier effect on other sectors. Thus, the oil palm expansion will create jobs for the community, reduce unemployment, and reduce the poverty rate. The estimation results on the effect of the area of oil palm plantations on poverty alleviation in main oil palm production provinces are presented in the following table 1.

Table 1. The effect of oil palm development on the number of poor people.

Province	Poor in Urban + Rural Areas			Poor in Rural Areas		
	Coefficients	**t-stat.**	**Prob.**	**Coefficients**	**t-stat.**	**Prob.**
Aceh	-3.406E-5*	-3.209	.005	-4.699E-5*	-5.249	.000
North Sumatera	-7.551E-6*	-6.578	.000	-8.700E-6*	-5.222	.000
West Sumatera	-2.027E-5*	-3.841	.001	-6.716E-6	-1.112	.288
Riau	-5.659E-5*	-4.042	.001	-5.817E-6*	-4.871	.000
Jambi	-9.636E-6*	-5.150	.000	-6.693E-6*	-4.222	.001
South Sumatera	-1.507E-5*	-9.637	.000	-1.209E-5*	-7.002	.000
Bengkulu	-2.647E-5*	-14.900	.000	-2.087E-5*	-9.876	.000
West Kalimantan	-4.859E-6*	-4.348	.001	-3.820E-6*	-4.046	.002
Central Kalimantan	-6.307E-6*	-9.918	.000	-5.976E-6*	-15.349	.000
South Kalimantan	-7.601E-6*	-10.716	.000	-7.536E-6*	-7.519	.000
East Kalimantan	-6.498E-6*	-7.386	.000	-1.018E-5*	-8.802	.000
NATIONAL	-9.528E-7*	-12.245	.000	-1.042E-6*	-9.508	.000

*) Significant at $\alpha = 1\%$.

From Table 1, in 11 main oil palm producing provinces, oil palm development reduced significantly the poverty rate both in rural and urban areas with a significance level of 1 percent, except in rural West Sumatra which shows insignificance. Nationally, oil palm development of 1 million hectares can reduce the number of poor people by 0.95% and 1.04% for urban + rural areas and for rural areas, respectively. Meanwhile, in the main oil palm producing provinces, there are variations in the magnitude of the impact of oil palm development in reducing the poverty rate. For urban + rural areas, it ranges from 4.86% (West Kalimantan) to 56.59% (Riau), while for rural areas it ranges from 3.82% (West Kalimantan) to 46.99% (Aceh).

The decline in poverty rate as a result of oil palm development is in line wit the study of Susilowati et al. [20] that in general, the factors that influence poverty reduction include increased control over productive assets and opening access to and utilization of job opportunities. In addition, poverty reduction can be achieved by using supporting factors for poverty reduction, especially focusing on potential factors such as agricultural development. Oil palm development also contributes significantly to Gross Domestic Product. Based on available data, Kasryno [11] states that the contribution of palm oil products to the total net agricultural value has increased, which indicates that its contribution to GDP also tends to increase. Meanwhile, an increase in GDP is believed to reduce the poverty rate [21-25].

The regression coefficient in Table 1 can also be used to calculate the area of oil palm that needs to be developed in order to reduce 1% of the number of poor people. Table 2 shows the area of oil palm that must be developed to reduce the number of poor people by 1 percent.

Table 2. Oil palm plantation area to reduce 1% of the number of poor people.

Province	Additional of land Area (ha)	
	Urban + Rural	Rural
Aceh	29.360,0	21.281,1
North Sumatera	132.432,8	114.942,5
West Sumatera	49.334,0	-
Riau	17.671,0	171.909,9
Jambi	103.777,5	149.409,8
South Sumatera	66.357,0	82.713,0
Bengkulu	37.778,6	47.915,7
West Kalimantan	205.803,7	261.780,1
Central Kalimantan	158.554,0	167.336,0
South Kalimantan	131.561,6	132.696,4
East Kalimantan	153.893,5	98.231,8
NATIONAL	1.049.538,2	959.692,9

Table 2 shows that nationally, a 1% reduction of the poverty rate in rural and urban areas can be gained by expanding 1,049,532.2 hectares of oil palm plantations, while for a 1% reduction in the number of poor people in rural areas only 959,692,9 hectares expansion of oil palm is needed. In the main oil palm producing provinces, oil palm expansion to reduce 1% of poverty rate varies widely. For urban and rural areas, the smallest additional area of oil palm was in Riau with an area of 17,671 hectares, while the largest was in West Kalimantan, namely 205,803.7 hectares. As for rural areas, the smallest is in Aceh with an expansion of 21,281.1 hectares and the largest is in West Kalimantan with 261,780.1 hectares.

3.2 Impact of oil palm plantation development on income distribution

One form of inequality in the distribution of income from an economic point of view is the unequal distribution of income among population groups. Income distribution is used to study whether development results can be allocated equally to the community. Oil palm development as a leading commodity plays a very important role in Indonesia's economy. It is also expected to increase the distribution of income, not only for the plantation enterprises, but also for farmers and economic actors in related sectors such as labors, transportation services and trade. The indicator used in this study is the Gini Ratio. The impact of oil palm development on income distribution are presented in Table 3.

Table 3. The effect of oil palm development on the gini ratio.

Province	Coefficients	t-stat.	Prob.
Aceh	1.304E-7*	3.893	.002
North Sumatera	9.384E-10	.044	.966
West Sumatera	6.340E-10	.007	.994
Riau	2.037E-8	1.163	.266
Jambi	3.894E-8	1.058	.310
South Sumatera	1.173E-7*	3.726	.003
Bengkulu	1.757E-7**	2.156	.050
West Kalimantan	-8.331E-10	-.043	.966
Central Kalimantan	4.309E-8*	4.786	.000
South Kalimantan	1.452E-8	.626	.542
East Kalimantan	3.206E-8	1.745	.104
NATIONAL	4.648E-9*	3.430	.004

*) Significant at $\alpha = 1\%$. **) Significant at $\alpha = 5\%$.

Table 3 shows that nationally, oil palm development has a significant impact on income distribution with a very small regression coefficient. There are 4 out of 11 main oil palm producing provinces in Indonesia where the oil palm development has significant impacts on income distribution, namely Aceh Province, South Sumatra Province, Central Kalimantan Province, and Bengkulu Province, while in 7 other provinces, oil palm development does not show a significant effect on income distribution.

There are 2 things that are suspected as the causes of the insignificant impact of oil palm development on income distribution as measured by the Gini ratio. First, oil palm development in the last 10 years has been dominated by the expansion of ex-plasma independent smallholders with a relatively small plantation scale. Second, the oil palm business in production centers is still limited to the production of raw materials (fresh fruit bunches) whose marketing is controlled by collector traders who directly pick up products to farmers' gardens, thus limiting the entry of related businesses.

This condition can also be understood as a phenomenon that is in line with Kuznets' hypothesis which explains that when development begins, the distribution of income will be increasingly uneven. Kuznets argues that between economic development over time and equality there is an inverse U-shaped relationship with the argument that economic development cannot be distributed fairly at every stage of economic development [26]. Therefore, when the traditional agricultural economy grows, landowners will get benefit mainly and generate inequality.

Although the Kuznets study was carried out in the 20th century, this phenomenon is still being found today. Several studies that prove this include [27-30]. These studies also prove that there is no significant relationships between economic growth and inequality. Recent research conducted by Martinez [31] strongly verifies that the relationship described by Kuznets appears to have persisted.

3.3 Impact of oil palm plantation development on health and well-being

Grubel states that national income statistics that measure human well-being are imperfect, this has provoked the UNDP (United Nations Development Program) to publish annually social welfare indicators for 175 countries [32]. This indicator is known as the HDI that is as a tool used to calculate the level of welfare between countries or between regions [33].

HDI as an indicator of development has advantages because it does not only use economic dimensions but also social dimensions such as education and health dimensions. It is hoped that the oil palm development as a leading commodity will also impact positively on community's health and welfare. The results of the estimation on the impact of oil palm expansions on HDI in the main oil palm producing provinces are presented in the Table 4.

Table 4. The effect of oil palm development on human development index.

Province	Coefficients	t-stat.	Prob.
Aceh	7.294E-6	1.520	.151
North Sumatera	-1.429E-6	-.668	.515
West Sumatera	6.975E-6	.939	.364
Riau	-4.388E-7	-.314	.758
Jambi	6.810E-7	.195	.848
South Sumatera	1.099E-6	.340	.739
Bengkulu	8.347E-6	1.273	.224
West Kalimantan	3.050E-7	.213	.835
Central Kalimantan	-1.408E-6	-.779	.449
South Kalimantan	8.617E-6*	4.021	.001

East Kalimantan	3.695E-6*	3.224	.006
NATIONAL	2.604E-7	1.533	.148

*) Significant at $\alpha = 1\%$.

The economic growth and the income distribution will affect the level of poverty [34]. Economic growth is a necessary condition, but not the sufficient condition for poverty alleviation in developing countries. Moges found strong growth elasticities and unequal poverty elasticities in developing countries [35]. Likewise, the basic findings of Fforde state that the economic growth is the main tool for poverty reduction [36]. However, the concentration of economic activity in a certain area has a direct impact on income inequality [37].

4 Conclusion

The development of oil palm as a plantation commodity that makes a significant contribution to the Indonesian economy is also expected to improve people's welfare in terms of reducing poverty, improving income distribution, and increasing the human development index. However, this study reveals that oil palm development significantly reduces poverty rates in both rural and urban areas, but increases income inequality, and has no impact on increasing people's welfare in the human development index.

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