Sustainable management of smallholder oil palm farming during the COVID-19 pandemic

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Abstract. The emergence of the CoronaVirus Disease in 2019, until now has had a negative impact on various sectors of people's lives including the agricultural sector. Smallholder oil palm farming has also experienced a negative impact due to the pandemic. This research aims to knowing the situation of smallholder oil palm farming before and during pandemic; and to knowing the readiness of farmers to manage smallholder oil palm farming; and to knowing the sustainability of the management of smallholder oil palm farming during the pandemic. This research was conducted in STM Hilir Subdistrict, Deli Serdang District, North Sumatra, Indonesia, which was carried out in September - December 2020. The data used were primary and secondary data which were analyzed descriptively with income analysis method and simple tabulation. Based on the results of data analysis, concluded: smallholder oil palm farming during the COVID-19 pandemic was not stable, due to an increase in production costs of 20.2%/month, and a decrease income of farmers by 6.69%/harvest season/ha. In period of COVID-19 pandemic-19.59% of farmers said they are ready to develop their farming in a sustainable manner. Sustainable management smallholder oil palm farming during the pandemic is going well, based on indicators of ecological conservation, where farmers tend to use organic fertilizers. In accordance with the results of the study suggested; so that the government provides continuous counseling to farmers, provides incentives, subsidies for production facilities for farmers, so that farmers continue to apply health protocols in carrying out their farming activities.

1. Introduction

The CoronaVirus Disease-19 pandemic was first identified in Wuhan, China in December 2019 and is currently spreading to more than 200 countries in the world. In year 2020 this pandemic caused world economic growth to fall by 3%. Economic growth in developed countries fell 6.1%, world trade fell 13%-32% with a global inflation rate of 3% [1]. The COVID-19 pandemic has also had impact on aspects socio-economic activities of communities [2, 3] even paralyzing the economic activities of rural and urban communities [4] due to the COVID-19 pandemic, the marketing of agricultural products has been also disrupted, resulting in a decrease in income [5].

The COVID-19 pandemic has disrupted transportation facilities in the agricultural sector, resulting in the transportation of production inputs such as; fertilizers, pesticides and medicines to limited centers. In fact, around 67.3% of farmers in the Northeast region of Thailand reported having difficulty getting production inputs due to transportation facilities [6]. The COVID-19 pandemic has also disrupted food security due to limited accessibility, which has resulted in the disruption of the food supply chain from the agricultural sector to consumers [7-9], and has an impact on a decrease in farmers’ income [10].
Due to the COVID-19 pandemic smallholder oil palm farmers participate also experienced an income shock. Farmers have difficulty accessing labor inputs, due to social border policies. Goods circulation and agricultural production supply chains are also disrupted [11]. The supply of labor is reduced because the community prioritizes maintaining health, and does not carry out activities outside the home [3]. In February 2020, Indonesia was only able to export 84,000 tons of crude palm oil (CPO) to various countries in the world, this export volume decreased by 77.36% compared to the previous period in 2019 of 371,000 tons [12]. Oil palm plantations are one of the agricultural sub-sectors that play an important role in economic development, particularly in North Sumatra Province. Data for Central of Statistic Agency of North Sumatra Province in 2020 states that the area of oil palm plantations in North Sumatra Province was recorded at 434,360 ha with a production of 1,682.29 thousand tons of fresh fruit bunches (FFB) in 2018, then this oil palm area increased by 1.09% to 439,080 ha in 2019 with a production of 7,006.99 thousand tons of FFB or an increase of 316.5% [13].

The majority of the communities in Deli Serdang District to develop smallholder oil palm farming. Data for Central of Statistic Agency of Deli Serdang District in 2020 shows that the area of oil palm plantations in this region was recorded at 13,374.99 ha in 2019 with a production of 38,731.83 tons [14]. STM Hilir Subdistrict, Hamparan Perak Subdistrict and STM Hulu Subdistrict with the largest land area and also production in Deli Serdang District.

The development of oil palm farming is a supporting factor for economic growth, increased income and employment [15]. For people in rural areas, smallholder plantations are an alternative to change the family economy for the better [16]. Communities in STM Hilir Subdistrict generally depend on smallholder oil palm farming for their economic activities as a source of income. Based on data for Central of Statistic Agency of STM Hilir Subdistrict in 2020, smallholder oil palm plantations in this region covered an area of 2,860 ha in 2017 with a production of 3,060.29 tons. The land area of this commodity decreased by 1.1% in 2018 to 2,827.69 ha with a production of 8,555.42 tons [17].

During the COVID-19 pandemic, farmers must make efforts to increase their agricultural productivity, such as; carry out adaptation and mitigation, adoption of agricultural technology, and improvement of extension services and training [18]. During the COVID-19 pandemic, farmers are required to maintain environmental sustainability, especially the ecology of oil palm farming [19]. The use of environmentally friendly technology, through extension systems and improving farmer education is very important to transfer technology in the development of their farming [18].

The outbreak of the COVID-19 pandemic has made it difficult to manage human resources in farming [20], this must be anticipated by means of workers having to wear face shields, wear gloves, and consider reducing working hours while still implementing social distancing so that production can increase more stable [21]. This research was conducted to knowing the situation of smallholder oil palm farming before and during the COVID-19 pandemic, and to knowing the readiness of farmers in managing smallholder oil palm farming during the pandemic, as well as to knowing the sustainable management of smallholder oil palm farming in the COVID-19 pandemic period at STM Hilir Subdistrict, Deli Serdang District, North Sumatra Province.

2. Materials and Methods
This research activity was carried out in STM Hilir Subdistrict, Deli Serdang District, in September-December 2020. The research location was chosen deliberately with the consideration that the subdistrict is one of the potential areas for smallholder oil palm development in Deli Serdang District, and the people in this region generally have source of livelihood as smallholders from oil palm farming.

Deli Serdang District is one of the areas in North Sumatra Province which has also been affected by the COVID-19 pandemic after the Medan City. The population in this study were smallholder oil palm farmers who were socially and economically affected by the COVID-19 pandemic, who were located in 4 (four) villages in STM Hilir Subdistrict, namely Kuta Jurung Village with 367 households, Negara Village with 780 households, Talun Kenas Village with 725 households and Sumbul Village 662 households with a total population of 2,534 households [17]. The number of samples in this study was determined using the Slovin method with the formula [22]:

\[ n = \frac{N \times \left(1 + \frac{1}{N} \right)}{E^2} \]

where:
- \( n \) is the number of samples
- \( N \) is the total population
- \( E \) is the level of error associated with the survey

This study has been approved by the Institutional Review Board of the University of North Sumatra, North Sumatra Province, Indonesia.
description: \( n_e = \frac{N}{1 + Ne^2} \) ..........................\( 1 \)

This study uses primary data and secondary data. Primary data were obtained from the field through in-depth interviews with respondents using a questionnaire. The secondary data in the form of data on land area and smallholder oil palm production were obtained from the Central of Statistics Agency of Deli Serdang District, and other official publications related to this research. The data analysis method used a descriptive method in the form of income analysis and simple tabulation [23].

3. Results and discussion

3.1. Conditions of oil palm farming smallholders before and the COVID-19 pandemic period

Based on the results of data analysis, it is known the condition of smallholder oil palm farming in STM Hilir Subdistrict, with indicators of average production costs, average farmer income before and during the COVID-19 pandemic, as shown in Table 1.

Table 1. Conditions of smallholder oil palm farming management based on indicators of average production cost expenditure, average income of farmers before and during the COVID-19 pandemic per month.

| No | Description                          | before the pandemic | during the pandemic | percentage change (%) |
|----|--------------------------------------|---------------------|---------------------|-----------------------|
| 1  | Average equipment cost (IDR)         | 34,565.20           | 34,875.20           | 0.90                  |
| 2  | Average fertilizer cost (IDR)        | 53,430.90           | 67,050.20           | 25.50                 |
| 3  | Average agricultural medicine costs (IDR) | 4,550.00           | 5,650.00           | 24.20                 |
| 4  | Average labour cost (IDR)            | 975,050.25          | 1,175,250.00        | 20.50                 |
| 5  | Average of total production cost (IDR) | 1,067,596.35       | 1,282,825.40        | 20.16                 |
| 6  | Average production (Kg)              | 5,535.00            | 4,250.00            | -23.22                |
| 7  | Average selling price (IDR)          | 1,220.00            | 1,550.00            | 27.05                 |
| 8  | Average farmer income (IDR)          | 5,685,103.65        | 5,304,674.60        | -6.69                 |

Table 1 shows that the COVID-19 pandemic has had an impact on the management of smallholder oil palm farming, which is indicated by an increase in production costs per month by 20.20% to an average of IDR 1,282,825.40/month during the pandemic, from an average of IDR 1,067,596.35 before the pandemic. The elements of production costs that experienced a drastic increase were the cost of fertilizers with an average increase of 25.5% and the cost of medicines by 24.2% during the COVID-19 pandemic. The increase in the cost of fertilizers and medicines is due to price increases and limited availability due to social restriction policies and activities in the industrial and transportation sectors.

The results of this study are in accordance with the findings Blanke [24] due to the COVID-19 pandemic, transportation restrictions occurred in agricultural areas such as in Zimbabwe, South Sudan, causing farmers to find it difficult for suppliers to obtain food crop farming inputs, such as; seeds, fertilizers, facilities and infrastructure. Likewise with small farmers in Uganda, due to the pandemic, farming and gardening activities were disrupted, due to limited access to production inputs, due to market closures to prevent the spread of the COVID-19 [5].

Based on Table 1 it can be seen that the COVID-19 pandemic has an impact on the management pattern of smallholder oil palm farming, which is indicated by a decrease in production of up to 23.22%, with an average production before the pandemic of 5,535.00 kg/harvest season/ha and decreased to 4,250.00 kg/harvest season/ha during the pandemic.
Due to the COVID-19 pandemic, farmers’ income decreased by 6.69% from an average of IDR 5,685,103.65/harvest season/ha to IDR 5,304,674.60/harvest season/ha. The results of this study are in accordance with the findings of [25] which stated that the pandemic had an impact on all lines in the agricultural sector, including horticulture and food crop farming. As a result of social restrictions, farmers cannot do their farming, this also affects the maintenance aspect which causes a decrease in farmers’ production and income [7].

3.2. Farmers’ readiness in managing oil palm farming smallholders in the COVID-19 pandemic period
In the period of the COVID-19 pandemic, smallholder oil palm farmers in STM Hilir Subdistrict were ready to develop their farming even though they were in limited conditions. Based on the results of data analysis it was identified the readiness of smallholder oil palm farmers in developing their farming during the COVID-19 pandemic as shown in Table 2.

Table 2. Description of the readiness of oil palm farmers smallholder in managing their farms during the COVID-19 pandemic.

| No | Description                                                                 | Respondent’s opinion |
|----|----------------------------------------------------------------------------|----------------------|
|    |                                                                            | strongly agree   | agree | disagree | strongly disagree |
| 1  | The pandemic affects the prices of agricultural fertilizers and medicines  | 32 73 9 20 2 5 1 2 |
| 2  | The COVID-19 pandemic affects the distribution Channels for smallholder oil palm production facilities and infrastructure | 29 66 11 25 4 9 0 0 |
| 3  | The COVID-19 pandemic affects the price of fresh fruit bunches (FFB)       | 25 57 15 34 4 9 0 0 |
| 4  | The COVID-19 pandemic affects the distribution Channel of fresh fruit bunches (FFB) from farmers to palm oil mills | 22 50 19 43 2 5 1 2 |
| 5  | Impact of COVID-19 pandemic on the income of smallholder oil palm farmers | 39 89 3 7 2 5 0 0 |
| 6  | Farmers are ready to manage their farms during the COVID-19 pandemic       | 26 59 15 34 3 7 0 0 |

Table 2 shows that 73% of respondents said the COVID-19 pandemic affected the availability of fertilizers and medicines at the farmer level. Then 66% of respondents said that the COVID-19 pandemic had also affected the distribution channel of farming production facilities and infrastructure. And 89% of respondents said that the COVID-19 pandemic had a bad impact on the income level of smallholder oil palm farmers. However, 59% respondent of farmers are very ready to develop their farms even during the pandemic.

The findings in this study are in accordance with the findings of [6] who stated that the COVID-19 pandemic situation, around 67.3% of farmers in the Northeastern region of Thailand had difficulty getting inputs for farming production, such as; seeds, fertilizers, and other means of production. Even due to the COVID-19 pandemic, farmers in Malawi are constrained in buying inputs for farming entering the planting season and the marketing process for agricultural products is also disrupted due to limited means of transportation [5].

3.3. Sustainable management of oil palm farming smallholders in the COVID-19 pandemic period
Based on the results of the study, it is also known that the management of smallholder oil palm farming in a sustainable manner during the pandemic in STM Hilir Subdistrict, based on indicators of ecological-biophysical conservation as shown in Table 3.
Table 3. Identification of sustainable smallholder oil palm farming management with ecological indicators-biophysical conservation during the COVID-19 pandemic.

| Indicators of conservation ecological-biophysical | before the pandemic | during pandemic | percentage change (%) |
|---------------------------------------------------|---------------------|----------------|----------------------|
|                                                   | yes  | %   | not | %   | yes  | %   | not | %   |
| Conservation action                               | 25   | 56.8 | 19  | 43.2 | 28   | 63.6 | 16  | 36.4 | 12.0 | -15.8 |
| Land cover planting                               | 11   | 25.0 | 33  | 75.0 | 13   | 29.5 | 31  | 70.5 | 18.2 | -6.1  |
| Crop diversification or intercropping             | 12   | 27.3 | 32  | 72.7 | 25   | 56.8 | 19  | 43.2 | 108.3 | -40.6 |
| Use of inorganic fertilizers                      | 38   | 86.4 | 6   | 13.6 | 21   | 47.7 | 23  | 52.3 | -44.7 | 283.3 |
| Use of organic fertilizers                        | 21   | 47.7 | 23  | 52.3 | 35   | 79.5 | 9   | 20.5 | 66.7 | -60.9 |

Based on Table 3, it can be identified the management pattern of smallholder oil palm based on ecological-biophysical indicators of conservation during the pandemic. The results showed that 25 respondent farmers or 56.6% before the pandemic managed their farms by paying attention to land conservation, and during the COVID-19 pandemic the number of respondents who took conservation actions increased 12% to 28 respondents.

Table 3 also shows a tendency to use organic fertilizers in managing their farms during the COVID-19 pandemic. Before the COVID-19 pandemic, there were 21 respondents or 47.7% who used organic fertilizers, and during the COVID-19 pandemic it increased by 66.7% to 35 respondents, and vice versa there was a 44.7% decrease in the use of inorganic fertilizers during the COVID-19 pandemic. The use of organic fertilizers has an impact on both the level of soil fertility, and the environment according to the findings of [26] who stated that the use of organic fertilizers will increase the number of soil microbes and respiration in the soil and this will increase the production of agricultural products.

In addition to conservation ecological-biophysical indicators, the process of managing smallholder oil palm farming in a sustainable manner in STM Hilir Subdistrict during the COVID-19 pandemic was also identified based on socio-economic indicators, as shown in Table 4.

Table 4. Identification of sustainable smallholder oil palm farming management with socio-economic indicators during the COVID-19 pandemic.

| Indicators of socio-economic                           | before the pandemic | during pandemic | percentage change (%) |
|-------------------------------------------------------|---------------------|----------------|----------------------|
|                                                       | yes  | %   | not | %   | yes  | %   | not | %   |
| Performance of social institutions and farmer groups  | 24   | 54.5 | 20  | 45.5 | 21   | 47.7 | 23  | 52.3 | 12.5 | 15.0  |
| Education and training of smallholder oil palm farmers is going well | 18   | 40.9 | 26  | 59.1 | 15   | 34.1 | 29  | 65.9 | 16.7 | 11.5  |
| Cultivated land area either owned or rented           | 43   | 97.7 | 1   | 2.3  | 42   | 95.5 | 2   | 4.5  | -2.3 | 100.0 |
| Farm productivity level                               | 41   | 93.2 | 3   | 6.8  | 35   | 79.5 | 9   | 20.5 | -14.6 | 200.0 |
| Farming income Level                                  | 42   | 95.5 | 2   | 4.5  | 31   | 70.5 | 13  | 29.5 | -26.2 | 550.0 |

Based on Table 4, the management pattern of smallholder oil palm farming is identified based on social indicators. A total of 54.5% of respondent farmers said that the performance of farmer groups was very good before the pandemic. Through farmer groups, farmers can participate in various trainings, exchange ideas and discuss environmentally friendly farming methods.

However, this condition changed during the pandemic and caused a decrease in the performance of farmer groups as stated by 47.7% of respondents, this was due to government policies in limiting social
movements and crowds in order to reduce the spread of COVID-19 in the community. The results of this study are in accordance with the findings [20], which stated that the pandemic caused difficulties in managing human resources in farming, including difficulties in conducting training and counseling due to restrictions [21].

Table 4 also shows the pattern of community oil palm farming management based on economic indicators during the pandemic. Research shows that 97.7% of farmers are able to optimally cultivate land for a certain area before the pandemic. During the COVID-19 pandemic, there was a 2.3% decrease in the area under cultivation, as stated by 95.5% of respondent farmers. The results of the study also showed a decline in farmers’ income, where before the COVID-19 pandemic, 42 respondents or 95.5%, said that smallholder oil palm farming provided high profits for farmers. And during the COVID-19 pandemic, only 31 respondent farmers or 70.5% said that smallholder oil palm farming was able to support the income of farmer households.

4. Conclusions

In accordance with the results of the study concluded: (a) the management of smallholder oil palm farming during the COVID-19 pandemic was not stable, due to an increase in production costs of 20.2%/month, which consisted of an increase in fertilizer costs by 25.5%/month, medicine costs 24.2%/month and costs workforce of 20.5%/month, as well as a decrease in farmers’ income levels by 6.69%/harvest season/ha, (b) as many as 59% of respondent of farmers said they were ready to develop their farms even the COVID-19 pandemic period, and (c) the sustainable management of oil palm farming during the pandemic based on ecological conservation indicators is going well, where 66.7% of respondents tend to use organic fertilizers in their farming. However, in terms of social indicators, 54.5% of respondent farmers said that the performance of farmer groups was still better before the pandemic. Based on the results of the research, it is suggested, (a) that the government provide counseling to farmers in optimizing the use of their production factors, (b) provide assistance to farmers in the form of incentives and subsidies for production facilities such as; fertilizers and medicines, and (c) so that farmers continue to apply health protocols in carrying out their farming activities.

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