

## Article

# The Contribution of Oil Palm Smallholders Farms to the Implementation of the Sustainable Development Goals-Measurement Attempt

Ketut Sukiyono <sup>1,\*</sup> , Muhammad Mustopa Romdhon <sup>1</sup>, Gita Mulyasari <sup>1</sup>, M. Zulkarnain Yuliarso <sup>1</sup>, Musriyadi Nabiu <sup>1</sup>, Agung Trisusilo <sup>1</sup>, Reflis <sup>1</sup>, Dompok M. T. Napitupulu <sup>2</sup>, Yoga Nugroho <sup>3</sup> , May Shiska Puspitasari <sup>4</sup>, Sigit Sugiardi <sup>5</sup>, Arifudin <sup>6</sup>  and Masliani <sup>7</sup>

- <sup>1</sup> Department of Agricultural Socio-Economics, Faculty of Agriculture, University of Bengkulu, Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371, Indonesia; m.romdhon@unib.ac.id (M.M.R.); gita.mulyasari@unib.ac.id (G.M.); mzulkarnainy@unib.ac.id (M.Z.Y.); mnabiu@unib.ac.id (M.N.); atrisusilo@unib.ac.id (A.T.); reflis@unib.ac.id (R.)
  - <sup>2</sup> Agribusiness Department, Faculty of Agriculture, University of Jambi, Jl. Jambi—Muara Bulian, No. KM. 15, Mendalo Darat, Jambi 36361, Indonesia; dompak@unja.ac.id
  - <sup>3</sup> Agribusiness Department, Faculty of Agriculture, University of Teuku Umar, Jl. Alue Peunyareng, Ujong Tanoh Darat, Aceh 23681, Indonesia; yoganugroho@utu.ac.id
  - <sup>4</sup> Agribusiness Department, Faculty of Agriculture, University of Musi Rawas, Jl. Sultan Mahmud Badaruddin II, Lubuklinggau 31625, Indonesia; mayshiska@unmura.ac.id
  - <sup>5</sup> Agribusiness Department, Faculty of Agriculture, Panca Bhakti University, Jl. Komodor Yos Sudarso No. 1, Sungai Beliang, Kota Pontianak 78244, Indonesia; sigit.sugiardi@upb.ac.id
  - <sup>6</sup> Agribusiness Department, Faculty of Agriculture, University of Riau, Kampus Bina Widya, Jl. H.R. Soebrantas Km. 12.5, Simpang Baru, Pekanbaru 28293, Indonesia; arifudin@lecturer.unri.ac.id
  - <sup>7</sup> Agribusiness Department, Faculty of Agriculture, University of Palangka Raya, Jl. Yos Sudarso Komp., Tunjung Nyaho, Palangka Raya 73112, Indonesia; maslianijaliani@agb.upr.ac.id
- \* Correspondence: ksukiyono@unib.ac.id



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**Abstract:** Smallholder oil palm plantations play an essential role in the Indonesian economy, both on a national, regional, local, and household scale. However, no data or studies show how much smallholder oil palm plantations contribute to achieving in each sustainable development goals (SDGs). The development of smallholder oil palm plantations, like other economic developments, wherever conducted needs to provide benefits to the community such that it exceeds the costs incurred, including the costs of preserving and protecting the environment. To assess its contribution, it is essential to examine the Sustainable Development targets in which smallholder oil palm plantations contribute. Therefore, this study is aimed at examining sustainable development goals to which smallholder oil palm plantations can contribute. Based on focus group discussion and the literature review, there are 13 SDGs for smallholder oil palm plantations that contribute and play a role in achieving the targets set by the United Nations in sustainable development. These results are significant as a basis for further studies to prove the presumption concerning the role and positive contribution of smallholder oil palm plantations in each of the existing SDG targets.

**Keywords:** palm oil; SDGs; smallholders

## 1. Introduction

According to data from the Indonesian Central Statistics Agency [1], plantations are an important sub-sector in the Indonesian economy, contributing around 3.27 percent in 2019. In total, the export value of plantations reached US\$25.38 billion, and palm oil and its derivative products constituted the main contributor. Even ref. [1] reported that the increase in exports of processing industrial products by 20.67 percent was contributed by an increase in exports of palm oil. A wealth of data proves that oil palm expansion into poor and remote areas lifts these areas from poverty and becomes centers of local

economic growth. Now, the spread of oil palm covering 26 provinces from 34 provinces makes oil palm plantations an essential component in economic growth and sustainable village development, especially in reducing poverty in villages. BPS data also informs that poverty and inequality in Indonesia tend to decrease. In March 2021, the poverty rate in Indonesia was 10.14%. The percentage of the rural poor was 13.10%, down from 13.20% in September 2020. However, this poverty reduction performance has not been able to clearly show the contribution of oil palm plantations, especially in the achievement of other Sustainable Development Goals (SDGs). One of the main reasons is the variety of sources of household income in rural areas, not only from oil palm. This question needs to be answered because governments use the SDG to combat extreme poverty by ensuring sustainable environmental, economic, and social development [2].

Various literature reveals that the SDG aims to eliminate poverty in all its forms by 2030. For example, refs. [3,4] explain that the SDG goal is a step of change to improve the welfare of the poorest people in the world. This concept provides a reasonable justification for assessing the impact of oil palm plantations, especially for oil palm farmers who are the main actors in developing oil palm plantations. Several studies have been conducted to examine the contribution of oil palm in achieving the SDG, which has also been discussed qualitatively and macro, among others by [5–9]. However, this study has not revealed in detail and comprehensively the contribution of oil palm plantations to poverty alleviation, let alone for other relevant SDGs goals. For example, although they quantitatively reveal the role of oil palm plantations in reducing inequality and poverty, they do not show the role of oil palm plantations in other SDGs targets. As shown by TNP2K, oil palm plantations contribute to achieving other SDGs targets, such as eliminating hunger and fighting climate change.

The studies that specifically examine the contribution of oil palm plantations to achieving the SDGs goals is challenging to find. The studies conducted by [5,7,8] reveal more about the role that oil palm plantations play in achieving the SDGs, including in absorbing labor and initiating the regional economy. However, their research does not explain the role or contribution of smallholder oil palm farmers to any sustainable development goals. In other words, their research does not clearly explain the contribution of smallholder palm oil to any of the SDGs. In addition, a study conducted by Saragih et al., (2020) [10] on the sustainability of oil palm development has not revealed clearly and in detail the link between the dimensions used and the SDGs. However, several studies related to the achievement of the SDGs have also been conducted, including the analysis of [11] on cement companies in Mexico, [12] on gender equality in Tanzania, and [13] on the role of sustainable financial innovation in Europe. Once again, these studies examine the role of sectors in achieving one of the SDGs, except for [13] survey on more complex goals. This information shows the importance and openness of exploring the role of oil palm plantations, especially smallholder oil palm plantations, in achieving the SDGs comprehensively. Furthermore, this is important, according to [14], SDGs and the effectiveness of policies designed and implemented to achieve each goal are also interrelated. Ref. [15] added that interactions between the SDGs could be positive and negative, usually influenced by key factors such as geographic context, resource support, time horizon, and governance.

This study examines and discusses the role of smallholder oil palm in the achievement of sustainable development goals, more precisely, examines what sustainable development goals (SDGs) are to which smallholder oil palm can contribute. The following section briefly describes the methodology used to identify the relevant SDGs, and is followed by a discussion of the literature review on the development of smallholder oil palm and the role of the agricultural sector in achieving the SDGs. The next section of this study discusses the relevant SDGs in which smallholder oil palm plantations can play a role in achieving the SDGs. The last section presents conclusions and recommendations for future research.

## 2. Methods

The method used in this study is focus group discussion (FGD) among the authors. This FGD was directed to identify the relevant SDGs to which smallholder oil palm is possible to contribute to their achievement. This FGD also invited two competent resource persons to provide a broader picture of sustainable development in Indonesia, particularly an overview of the role of oil palm plantations in achieving sustainable development goals. The results of this FGD activity are complemented by various literatures that are most relevant to the identified SDGs. The literatures used were obtained from various publications, both published in Indonesia and/or from other sources.

## 3. Literature Review

### 3.1. *The Development of Indonesian Oil Palm Smallholders: A Brief Overview*

Oil palm originates from the tropical rain forests of West Africa, where this plant has been commercially cultivated in Indonesia since 1911 on the east coast of Sumatra under Dutch rule [16]. Ref. [17] reported that the area of the first plantation, established in 1910–1914, was 2620 ha. This oil palm plantation area increased to 6920 ha in 1919 and continued to increase until 1936, when the total planted area reached 75,000 ha, of which 63,234 ha were productive crops. After that, there was no significant development of oil palm plantations until the 1970s, when state plantations and large private plantations controlled oil palm plantations.

Indonesia's oil palm plantations increased significantly after the 1970s, following the implementation of the Perkebunan Inti Rakyat (PIR) development scheme (PIR or NES = Nucleus Estate Scheme). This scheme was developed for one reason, as [18] stated, namely that establishing an oil palm plantation requires a large amount of capital that is affordable by only large companies. In this scheme, refs. [19–21] explain that state-owned plantation companies (called nucleus plantations) assist smallholders such as plasma smallholders in developing oil palm plantations. The core company provides seeds, technical assistance, and financing to plasma farmers and purchases the plasma farmers' produce. This PIR pattern was developed with three designs, namely PIR-local, PIR-special, PIR-trans, and integrated with population redistribution policies through resettlement or transmigration schemes to provide labor for new plantations [22]. Furthermore, according to [23], the PIR pattern continues to develop with various partnership patterns, including the Primary Cooperative Credit to Members (KKPA) pattern and plantation revitalization.

Along with the ease of plating and the promising prospects of oil palm, people around large plantations have begun to learn to grow oil palm independently. Furthermore, this has led to the rapid development of smallholder oil palm plantations in Indonesia. Ref. [24] publishes that of Indonesian oil palm plantations covering an area of 16,381,959 ha, 40.79% are people's plantations, while 54.94% are large private plantations and the rest are state plantations. The people's plantation area has increased sharply compared to 1982, which only reached 2% of Indonesia's total oil palm plantations. Of the total oil palm plantations, 80% are mature plantations, while the remaining 14.76% are immature plantations, and 3.22% are non-yielding plantations. These community plantations involve 4,427,273 farmers or 2,566,066 farmer households [24].

Furthermore, these oil palm plantations create no less than 12 million indirect jobs. In terms of production, in 2021, the contribution of large private plantations is estimated to be still the main contributor with a share of 62% or 30,728,504.00 tons, followed by smallholder plantations at 16,755,437.00 tons or 34% of the total production in 2018 [24]. However, smallholder oil palm plantations also face problems, especially low productivity besides the age of the oil palm plantations.

According to [25,26], smallholders' average oil palm production is significantly lower than large oil palm plantations. [27] also reports that Indonesia's CPO productivity is around 3–4 tons/ha, much lower than Malaysia's 4–10 tons/ha. Ref. [27] also added that from 5.61 million ha of smallholder oil palm area, 2.4 million ha consisting of 1.5 million

ha of independent oil palm and 0.9 million ha of plasma oil needed to be immediately rejuvenated.

### 3.2. Agriculture and Sustainable Development Goals (SDGs)

Ref. [28] expressed that Sustainable Development has become a ubiquitous development paradigm that is often used as a slogan for international aid agencies, jargon for development planners, conference themes, academic papers, and slogans for development and environmental activists. The implementation of sustainable development based on a new approach to how to regulate and organize the economy should become an essential and natural part of everyday practice [29–31] added that the concept of sustainable development had attracted widespread attention compared to other development concepts, refs. [32–35] argue that sustainable development ensures that the current use of resources does not deprive future generations of social, economic, and environmental benefits. In contrast, ref. [36] views sustainable development as development that meets the needs of the present generation without compromising the needs of future generations.

Furthermore, sustainable development was measured using a three-dimensional approach, namely social, economic, and environmental. Specifically related is the conservation of ecosystems and biodiversity, production systems, population control, human resource management, preservation of progressive culture, and community participation [37]. Sustainable development results are an increase in economic growth, social justice, good environmental management, and better governance. Measuring sustainability is very important because it helps assess whether a country or company progresses or vice versa in a certain period [38].

In 2015, the United Nations General Assembly adopted the Sustainable Development Goals (SDGs), which form the core of the 2030 Agenda for Sustainable Development. The SDGs agenda has 17 goals and 166 targets used as the basis for the world to carry out sustainable development and direct global development strategies until 2030 [39]. The seventeen goals include SDG1: No poverty, SDG2: No hunger, SDG3: Healthy and prosperous lives, SDG4: Quality education, SDG5: Gender equality, SDG6: Clean water and proper sanitation, SDG7: Clean and affordable energy, SDG8: Jobs sustainable development and economic growth, SDG9: Industry, innovation, and infrastructure, SDG10: Reducing inequality, SDG11: Sustainable cities and communities, SDG12: Responsible consumption and production, SDG13: Addressing climate change, SDG14: Marine ecosystems, SDG15: Land ecosystems, SDG16: Peace, justice and strong institutions, and SDG17: Partnerships to achieve the SDGs.

In more detail, it is known that the achievement of the SDGs cannot be separated from the agricultural sector. Several SDGs out of 17 SDGs are directly or indirectly related to agriculture, as stated by [40–42], who also concluded that food and agriculture are the core issues of the 17 SDGs. It also shows the multidimensional role of the agricultural sector in achieving the SDGs. Furthermore, ref. [43] explains that food and agriculture are essential for achieving the 2030 Agenda for Sustainable Development. The important role of food and agriculture in achieving the SDGs starts from SDG1 and SDG2, namely ending poverty and hunger. Food and agriculture also have a role in SDG11 and SDG14, namely tackling climate change and preserving natural resources. Ref. [44], by adapting [40], explains that there is at least a link between the eight goals in the SDGs and agriculture. These eight goals are SDG1: No poverty; SDG2: No hunger; SDG6: Clean water and sanitation; SDG7: Affordable and Clean Energy; SDG12: Responsible consumption and production; SDG13: Action against climate change; SDG14: Life underwater; and SDG15: Living on land. In contrast to [40,44,45] of the SDGs, this study also proves that each commodity in the agricultural sector contributes to the achievement of different SDGs.

Several studies have tried to examine the contribution of the agricultural sector to the achievement of the SDGs; however, none of these studies have quantitatively and in detail analyzed the contribution of the agricultural sector. The contribution of agriculture to the eight SDGs, as expressed by [44], has also never been performed. Some of the studies

conducted are still partial, namely only on a few SDGs. For example, study [46] reviews the role of smallholders concerning the Sustainable Development Goals (SDGs). The dual function of smallholders in adopting the SDGs and their socio-economic limitations make it difficult for them to meet expectations as drivers of sustainable development. Ref. [46] shows that 13 SDGs and their respective targets address these socio-economic limitations. Nevertheless, this study does not quantitatively explain the contribution of smallholders in achieving the SDGs.

Furthermore, a study in South Africa conducted by SADC (2013, 2016) [47,48] suggests that economic growth, poverty reduction, and food security are significantly affected by the performance of the agricultural sector, which is an essential source of livelihood both directly and indirectly for more than 60% population in South Africa. This finding also confirms the importance of the agricultural sector to the achievement of the SDGs. The results of this literature review also indicate the importance of assessing the role of agriculture, especially smallholders, including oil palm smallholders, in achieving the SDGs.

#### 4. The Contribution of Indonesian Palm Oil Smallholders in SDGs: An Overview

As previously stated, the number of oil palm smallholders is quite large, with the second-largest land area after large private companies. In terms of employment, small farmers also involve more than 4.4 million people or 2.5 million households. This data shows the important role of smallholder oil palm farmers in alleviating poverty and increasing food security, as mandated in the SDGs. Ref. [49] discussed the importance of smallholders where these planters are the backbone of food security in developing countries. According to [49], they contribute up to 70% of national food production and 30–34% of total world food production.

Regarding plantations, including smallholder oil palm plantations, Law No. 39 of 2014 concerning plantations mentions the multifunctionality of plantations. Based on this law, ref. [9] stated that there are three functions of plantations, namely economic, ecological and socio-cultural functions. Thus, the role of smallholder oil palm plantations in sustainable development is clear. This role was also seen from the objectives of organizing plantations, including improving the welfare and prosperity of the people, providing employment, developing responsible and sustainable plantation resources, providing sources of raw materials for downstream industries, and maintaining local wisdom and environmental sustainability.

The above discussion indicates the importance of smallholder oil palm plantations in achieving the SDGs. However, a study that focuses on the contribution of independent and plasma oil palm smallholders to the achievement of the SDGs is challenging to find. The main reason is allegedly that it is unclear on which SDGs oil palm plantations, especially small oil palm plantations, contribute. Many studies have discussed the significance of oil palm plantations in achieving the SDGs, but focus on only one or two SDGs, including the [6]. Whereas the studies of [46,50–52] suggests that there are multiple goals of SDGs that small farmers play. However, according to [53,54], sustainable development is relative and location- or country-specific for each sector and industry.

Starting from the 17 SDGs and 169 target indicators, this study discusses and examines the 13 SDGs that have the potential to be contributed and played by small oil palm plantations, both independent and plasma plantations in Indonesia. The 13 SDGs consist of (1) No Poverty (SDGs 1); (2) Zero Hunger (SDGs 2); (3) Good Health and Well-being (SDGs 3); (4) Quality Education (SDGs 4); (5) Gender Equality (SDGs 5); (6) Clean Water and Sanitation (SDGs 6); (7) Affordable and Clean Energy (SDGs 7); (8) Decent Work and Economic Growth (SDGs 8); (9) Industry, Innovation, and Infrastructure (SDGs 9); (10) Reduced Inequalities (SDGs 10); (11) Climate Action (SDGs 13); (12) Life on Land (SDGs 15); and (13) Partnerships for the Goals (SDGs 17). Furthermore, the thirteen SDGs are classified into three pillars of the four pillars of sustainable development, namely (1) social development pillar, (2) economic development pillar, and (3) environmental



development pillar. The fourth pillar, namely legal development and governance, is less relevant for oil palm plantations to contribute to the achievement of the SDG16 target. The three pillars of development and related SDGs will be briefly discussed as follows.

#### 4.1. Social Development Pillars

The social development pillars in the SDGs are directed at realizing the fulfillment of quality fundamental human rights in a fair and equal manner to improve welfare for the entire community. These pillars include SDG1: No poverty, SDG2: No hunger, SDG3: Healthy and prosperous lives, SDG4: Quality education, and SDG5: Gender equality. As many studies have revealed, the existence of oil palm is enjoyed directly or indirectly by the people of Indonesia, including the world community. For oil palm farmers, the oil palm plantation business that has been conducted has helped them a lot to escape poverty, which is also free from the problem of hunger. Ref. [55] study concludes that the expansion of oil palm plantations has reduced poverty and income inequality in the districts with the largest oil palm plantations. Oil palm plantations have also contributed to poverty reduction by 2.6 million people in rural areas [56,57]. One of the reasons why oil palm grows rapidly is because of its profitability hence, it continues to grow and is difficult to stop [58]. These studies demonstrate the important role of oil palm in achieving SDG1 and SDG2.

Some results, such as [59]’s study using BPS data, discovered that oil palm plantations have improved the welfare of oil palm farmers in Sambas Regency by 172% compared to before the existence of oil palm plantations. Ref. [60] also discovered the same result, where 77% of oil palm farmers in the Central Mamaju Regency were included in the prosperous category using indicators developed by BPS. The State Electricity Company (PLN), and the Regional Drinking Water Company (PDAM) provides easy access to health, fulfill food and non-food needs, as well as provide access to education. Two studies inform the contribution of smallholder oil palm plantations in SDG3 and SDG4.

From a gender perspective (SDG5), smallholder oil palm plantations also provide a place for females to contribute to every on-farm and off-farm activity. The study conducted by [61] discovered the contribution of females in every oil palm farming activity, both in decision making and the implementation of farming activities. In the case of North Sumatra and West Kalimantan, a study by [62] discovered that females are actively involved in working in the garden for approximately 2–3 h per day until the oil palm plants bear fruit at the age of 3–4 years. However, there is gender discrimination in some aspects, especially in access to resources and capital.

Based on the discussion above, possible targets and indicators that were developed and used to assess the contribution of smallholder oil palm plantations to the achievement of the SDGs targets in the pillars of social development are presented in Table 1.

**Table 1.** Tentative targets and indicators for the contribution of palm oil in achieving the social development pillars of the SDGs.

Targets *	Indicators
SDG1: No Poverty	The poverty rate of oil palm farmers (as percentage of oil palm households living below the poverty line in the survey area).
By 2030, eradicate extreme poverty for all people and gender, and have equal rights to economic resources and access to basic services.	Poverty Rate by gender and age group (as percentage of oil palm smallholders living below the poverty line in the survey area, by sex and age group).
	Oil palm smallholder households with access to basic services (Proportion of oil palm households that can access basic services (such as health and education) by gender and age group category).
	The status of the oil palm land obtained is based on legal documents (Proportion of oil palm smallholders who have land rights based on legal documents and who have land rights based on gender and type of ownership).

Table 1. Cont.

Targets *	Indicators
SDG2: Zero hunger	<p>The ratio of per capita normative consumption to food availability (the amount of food availability is above the average cutting day of the population and or the proportion of oil palm farmers who have a frequency of eating 3 times a day).</p> <p>The proportion of household expenditure on food to total household expenditure (Percentage of household food consumption expenditure for palm oil to total household expenditure).</p> <p>The Pola Pangan Harapan (PPH)/Desirable Dietary Pattern (DDP) score indicates the quality of food consumption (composition of food diversity based on the energy contribution of the main food groups and measured by scores).</p> <p>The proportion of ownership of agricultural area for productive and sustainable food (Percentage of land ownership planted with food crops, non-oil palm).</p>
SDG3: Healthy and Prosperous Life	<p>Accessibility of oil palm farmers to public health facilities and conditions and the non-existence of epidemic diseases from within the household (Number of palm oil household members infected with HIV, tuberculosis (TB), malaria, hepatitis, and/or leprosy per uninfected household member and the proportion who use health facilities for their disease).</p> <p>Proportion of underage married women and ever-married women aged 15–49 years whose last delivery was (a) assisted by trained health personnel; (b) in health facilities (Percentage of underage married women to the number of female family members and the utilization of reproductive health access).</p> <p>Oil palm farmer household expenditure on health as part of total household expenditure or income (Percentage of allocation or expenditure on health costs to total palm oil household expenditure).</p> <p>Insurance Ownership Health insurance (Percentage of palm oil household members who have health insurance).</p>
SDG4: Quality Education	<p>The level of education for members of the oil palm farmer household at the elementary school/equivalent, junior high school/equivalent, and senior high school/equivalent levels (proportion of palm oil household members who have completed education at the elementary/equivalent, junior high/equivalent, and high school/equivalent levels).</p> <p>The number of adolescent/adult oil palm farmer household members in a certain age group, proficient/capable of (i) reading and (ii) counting, by gender (Proportion of oil palm household members who achieve at least the minimum proficiency level in: (i) reading, (ii) counting).</p> <p>Accessibility of oil palm smallholder household members to formal and non-formal education facilities (proportion of household members who attend available formal and non-formal education).</p> <p>The number of adolescent household members (age 15–24 years) and adults (aged 15–59 years) with information and communication technology (ICT) skills (Measured as a percentage of all palm oil households).</p>
SDG5: Gender equality	<p>Females participation in oil palm plantation activities (the proportion of female oil palm household members who work on their own oil palm plantations or not).</p> <p>Recognition and appreciation of Females who participate in oil palm (The ratio of the wages received by women working in oil palm plantations compared to the wages of men in the same type of work).</p> <p>Life quality of Females in the household (the proportion of female household members who experience domestic violence).</p>

Note: \* target and indicators are modified according to FGD results and the scope of the study, namely household scale.

#### 4.2. Economic Development Pillars

Oil palm plantations have provided economic benefits, not only for plantation owners and the economy of the area where oil palm farmers live. Furthermore, this indicates that one of the SDG targets played by smallholders of oil palm plantations is their contribution to the achievement of SDG 8, namely decent work and economic growth. The study conducted by [63] concluded that the development of private and/or state oil palm plantations involving smallholders had improved the regional or regional economy in infrastructure development in rural areas. Although it does not specifically mention smallholder oil palm plantations. However, the expansion of oil palm plantations in West Kalimantan, as reported by [64], has changed the regional economy and social welfare structure as indicated by the increase in the Human Development Index (HDI) and Gross Regional Domestic Product (GRDP) per capita. Even [65] empirically discovered that the development of oil palm plantations in rural areas created a multiplier effect, especially employment and business opportunities, of 3.03. Furthermore, refs. [66–68] concluded that smallholder oil palm plantations have the potential to spur development in rural areas.

Besides increasing rural economic growth and job creation, smallholder oil palm plantations also have considerable potential in achieving SDG 10, namely reducing inequality. Refs. [55,60] state that smallholder oil palm plantations have reduced inequality in the Central Mamaju and districts dominated by oil palm plantations. The same finding shows that the palm oil industry contributes to economic growth, employment, and income distribution [69]. Ref. [70] also discovered that income distribution in oil palm plantation centers is quite good, with a Gini index of around 0.36. Furthermore, to improve the rural economy, the development of smallholder oil palm plantations has created and increased the purchasing power of oil palm farmers in rural areas. This, in turn, will increase the demand for public goods, including energy, and the importance of developing rural infrastructure to improve the accessibility of the area and farming communities. Subsequently, this means that improving the economy and welfare of oil palm farmers allows them to access the resources needed to support their lives. Improving the economy and welfare of oil palm farmers certainly cannot be separated from the role of farmer institutions, such as farmer groups, cooperatives, or extension institutions [68,71–73]. Cooperation between farmers and farmer organizations is also an essential factor for the creation of sustainable oil palm plantation development (SDG17).

Many studies also prove that oil palm plantations developed by the community independently or on a plasma have provided benefits for them. Not only high returns from land planted with oil palm, but smallholder oil palm plantations also provide high benefits from the aspect of labor [74,75]’s study, refs. [68,76] also show that oil palm is more profitable to cultivate than rubber and rice. These studies indicate the role of smallholder oil palm plantations in achieving the SDGs targets, particularly in the pillars of economic development. Table 2 below presents potential targets and indicators in assessing the contribution of smallholder oil palm plantations in achieving the SDGs targets.

#### 4.3. Environmental Development Pillar

Many environmental issues in sustainable development are related to the expansion of oil palm plantations, including deforestation accompanied by loss of biodiversity [77,78]. However, oil palm plantations also contribute to environmental aspects, which includes reducing emissions and absorbing carbon dioxide, and producing oxygen [79–81] having natural biopori to absorb and hold water, rainwater infiltration and reduce surface water runoff [82,83]. Oil palm is also a water-efficient plant compared to several other types of plants [84,85] and oil palm is the most efficient crop (after sugarcane) in water use for every giga joule (GJ) of the resulting bioenergy [86]. These studies conclude that there are many positive aspects that oil palm contributes to environmental development. In other words, oil palm plantations positively contribute to the pillars of environmental development, particularly in both SDG13 and SDG15.



**Table 2.** Targets and tentative indicators of palm oil contribution in achieving the economic development pillars of the SDGs.

Targets *	Indicators
<b>SDG7: Clean and affordable energy</b>	
Ensure universal access to affordable, reliable, eco-friendly, and modern energy services by 2030.	Access of oil palm farmer households to electrification (Oil palm household electrification ratio).
	Household electricity spending, including electricity consumption per capita (Electricity consumption per capita).
	Accessibility to the use of gas (LPG) for households (Proportion of palm oil households using LPG for energy needs).
	Oil palm farmer households using non-environmentally friendly fuels for their household (Proportion of palm oil households whose main energy source is technology and non-environmentally friendly fuel).
<b>SDG8: Decent work and economic growth</b>	
Promoting supportive development policies productive activities, creative decent employment, entrepreneurship, creativity, and innovation, and encouraging and growing micro, small and medium enterprises (MSMEs), through access to financial services.	Increase employment opportunities in the village through labor absorption in oil palm plantations owned (Proportion of oil palm household members working in the oil palm sector by age and gender).
	Accessibility of oil palm farmers to new growth centers of the economy, including job opportunities outside of oil palm (Proportion of oil palm household members working outside the oil palm sector by age and gender).
	Non-food household consumption of household expenditure (Percentage of household non-food consumption expenditure for palm oil to total household expenditure).
	Accessibility of oil palm farmer households to financial/economic institutions/village-owned enterprises/cooperatives (Proportion of palm oil households that use nearby financial services).
<b>SDG9: Industry, innovation, and infrastructure</b>	
Develop infrastructure that quality, reliable, sustainable, and resilient, including regional and cross-border infrastructure, to support economic development and human well-being, with focus on affordable and fair access for all.	The distance of the oil palm farmer's house to the roadworthy-(The distance of the house from the road suitable for motorized vehicles is categorized as far, medium and close).
	Practices to increase oil palm production through the use of production inputs and waste utilization (GAP = Good Agricultural Practices) (Number of types of good agricultural practices available by oil palm farmers).
	Development of a biomass processing unit through the utilization of available palm oil waste (Number of households utilizing available palm oil biomass).
	Accessibility of oil palm farmer households to ICT facilities, specifically broadband facilities (Number of households using ICT facilities, especially the internet).
<b>SDG10: Decrease discrepancy</b>	
By 2030, progressively achieve and sustain population income growth and reduce inequality and promote social, economic, and political inclusion for all.	Oil palm farmers live below the poverty line by gender and age group (Number or proportion of oil palm households below the poverty line).
	Distribution of income among oil palm farmer households-(measuring using a Gini Index).
	Involvement of female oil palm farmers in social, economic, and cultural activities or institutions (the proportion of women who are active members of social, economic or cultural groups in their area).
<b>SDG17: Partnerships to achieve sustainable development goals.</b>	
Increase local and regional cooperation and partnerships between smallholders and oil palm farmer institutions for the achievement of sustainable development goals.	Membership of oil palm farmers in economic, extension, and other institutions related to oil palm, either directly or indirectly (the proportion of oil palm households that are active members of extension, economic and social activities related to oil palm development).
	The level of farmer participation and benefits in the institutions they follow (The activity level of palm oil farmers in the group is measured by the level of their presence and the level of benefits derived from their participation).
	Availability and accessibility of oil palm smallholder institutions (Number of groups or institutions that can participate and receive benefits).

Note: \* target and indicators are modified according to FGD results and the scope of the study, namely household scale.

Ref. [87] defines the environmental development pillars of the SDGs as the achievement of sustainable management of natural resources and the environment as a support for all life. In the case of oil palm, it is clear that environmental sustainability aspects cannot be separated between oil palm cultivation and oil palm farmers themselves. Through oil palm cultivation by farmers, the village economy grows and develops. Hence, the number of poor farmers and the number of hungry people in rural areas was reduced or eliminated, as previously discussed. Furthermore, the development of the rural economy certainly impacts the ease of access to clean water and proper sanitation (SDG6). Thus, potential targets and indicators that was developed to assess the contribution of oil palm smallholders to the achievement of the SDGs is summarized and presented in Table 3

**Table 3.** Tentative targets and indicators for the contribution of palm oil in achieving the environmental development pillars.

Targets *	Indicators
SDG6: Clean water and proper sanitation	
By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	Oil palm households using safe drinking water services (Proportion of palm oil households using clean water from formal institutions).
	Farm households use safely managed sanitation services, including bathing, washing, and latrine facilities (Proportion of palm oil households owning and using safe sanitation).
	Oil palm farmer household activities in water conservation (Proportion of oil palm households participating in activities related to water conservation).
	Household clean water consumption per capita (Total water expenditure spent per capita).
SDG13: Action against climate change	
Actions to anticipate climate change, as well as improve education, raise awareness, as well as human and institutional capacities related to climate change mitigation, adaptation, impact reduction, and early warning.	The actions of oil palm farmers to increase the absorption of CO <sub>2</sub> emissions through planting ground cover on their land-(the proportion of the area of oil palm owned which is planted with cover crops).
	Actions by smallholder households to increase production without clearing new land (Number of good agricultural practices carried out by smallholders for their oil palm plantations).
	Oil palm farmers' perceptions and experiences of climate change caused by oil palm (measured or analyzed based on the experience of oil palm farmers related to the phenomenon of climate change over the past year).
SDG15: Land ecosystem	
Ensuring the conservation, restoration, and sustainable use of terrestrial and inland aquatic ecosystems and their environmental services, by taking action and significantly to reduce the degradation of natural habitats, loss of biodiversity.	The legality of oil palm plantations owned by farmers indicated by a certificate of ownership of plantation land.
	Smallholders organization and management of independent smallholders and the compliance of oil palm smallholders with organizational commitments (Measured by the level of eligibility of oil palm smallholders against their membership commitments).
	Environmental management and monitoring including compliance with biodiversity conservation (the proportion of oil palm area owned within the conservation area).
	Continuous improvement of smallholder plantation business (Number of good agricultural practices in oil palm plantations owned).

Note: \* target and indicators are modified according to FGD results and the scope of the study, namely household scale.

By carefully following the classification of the broader dimensions of the SDGs, namely people, prosperity, planet, partnership, and peace, as classified and discussed by [88–90], the contribution of smallholder oil palm plantations is also clear and significant to the achievement of the SDGs targets. These five dimensions, known as the 5 Ps, are in principle not much different from the pillars of the SDGs developed in Indonesia. To be sure, for

sustainable development, these five Ps are also interrelated such that the achievement of one P need to contribute to the achievement of the others. Briefly, the relevance of the 13 SDGs to smallholder plantations are explained as follows:

a. People

The SDGs clearly state to end poverty and hunger in all their forms and dimensions and ensure that all human beings fulfill their potential in dignity, equity, and a healthy environment. Related to this dimension, smallholder oil palm plantations contribute to the achievement of SDG1 targets: No Poverty; SDG2: Zero Hunger; SDG3: Good Health and Well-being; SDG4: Quality Education; SDG5: Gender Equality; and SDG6: Clean Water and Sanitation. Obviously, SDG1 to SDG5 are also pillars of social development that aim to meet basic human needs, even SDG1 and SDG2 fulfill needs, including the basic needs of oil palm farmers. The fulfillment of these basic needs, in turn, will make it easier for oil palm farmers to access SDG3, SDG4, and SDG6, namely health and education needs. Meanwhile, for SDG5, gender equality in smallholder oil palm plantations cannot be ignored. Therefore, the role of females in smallholder oil palm plantations is quite essential or not [61,62]. Furthermore, [91] explained that oil palm plantations also provide opportunities for females to work in the oil palm industry.

b. Planet

Regarding the planetary dimension, the target of the SDGs is to protect the earth from degradation. Furthermore, this shows the importance of smallholder oil palm plantations being managed with Good Agricultural Practices (GAP) principles. The implementation of GAP correctly and adequately will lead to the achievement of environmental protection and sustainable development, which is part of climate action, SDG13. The application of GAP to oil palm plantations, including smallholder oil palm plantations, is also to answer the criticism that the expansion of oil palm plantations, including smallholder oil palm plantations, is correlated with the risk of environmental damage, thereby reducing the capacity of the environment to provide environmental services [92,93].

c. Prosperity

Sustainable development is directed at achieving the level of welfare of each individual without compromising environmental sustainability. In line with that, the development of smallholder oil palm plantations is also directed at achieving sustainable development goals that promote the welfare of farmers, promote economic and social development in rural areas without compromising environmental sustainability. One of the efforts to preserve the environment is the use of clean and affordable energy sources (SDG7). This indicates that access to clean energy sources is essential to achieve sustainable development goals, especially SDG7 targets. This is important because ref. [94] reports that 3–4 billion people in developing countries depend on solid fuels, mainly traditional wood fuels, which are generally obtained from natural forests for cooking and heating. Therefore, improving the welfare of oil palm farmers is expected to increase oil palm farmer households' access to clean energy sources.

Equally important, rural economic growth dominated by smallholder oil palm plantations also eliminates inequality, especially economic inequality, compared to other villages [55,60]. The target of SDG10 is to reduce inequality in income and inequalities based on age, gender, ethnicity, origin, disability, religion or economic status, or otherwise. This inequality reduction will occur quickly when oil palm plantation development also grows job opportunities to reduce unemployment (SDG8). A review conducted by [95] discovered that smallholder oil palm positively impacted income and employment, although not as large as large private or state plantations. Equally important, smallholder oil palm plantations have triggered the growth of new village economic centers that provide convenience for oil palm farmers to access economic centers, health, and social services.

#### d. Partnerships and Peace

Oil palm is also widely cultivated by local communities in various forms of production organization, enabling them to continually adapt to changing local and economic contexts. The studies [96–98] also add that these organizations, such as farmer groups and cooperatives, have integrated local communities with large-scale economies of oil palm companies. These studies show the importance of cooperation between farmers, farmer groups, and other institutions, both formally and indirectly, to achieve the welfare of oil palm farmers' households and the sustainability of their oil palm plantation business. This is an implementation of SDG17: Partnerships for the Goals.

### 5. Conclusions

The Sustainable Development Goals (SDGs) are global goals for equitable and sustainable development at every level, from local communities to more macro levels. Furthermore, the goal is to end poverty, protect the planet and ensure that everyone enjoys prosperity, now and in the future. Despite the controversy regarding the development of smallholder oil palm plantations, it is undeniable that the development of oil palm plantations has brought prosperity and economic growth to the countryside. The above discussion and various studies have explained the SDGs targets of having the potential of contributing to smallholder oil palm plantations. Oil palm plantations have many interrelated functions that cannot be separated. For example, palm oil, which has a higher economic value than other commodities, brings farmers out of poverty and hunger. This achievement will undoubtedly have an impact on other SDGs, such as access to clean water and sanitation. The 13 SDGs in which smallholder oil palm plantations contribute are interrelated and cannot be separated. Likewise, when viewed on a broader dimension or pillar, achieving one dimension or pillar also has consequences on other dimensions.

Apart from having identified 13 relevant SDGs to which oil palm can contribute, there has not been a single study that has attempted to comprehensively examine and quantify the contribution of smallholder palm oil. In fact, there are also many claims or published data showing the important role of oil palm plantations in the Indonesian economy, as previously discussed. The question that needs to be answered is how to prove and answer the hypothesis or claim, while the main challenge to the solution is how to generate the data that is essential in proving the extent to which smallholder oil palm plantation claims contributes to each of the relevant SDGs. It is possible to use a household survey of oil palm farmers to generate the necessary data among the various methods. However, in the case of Indonesia, which has a very large area, this is a challenge in itself in producing data. Therefore, this requires a comprehensive survey study, which is also currently being conducted.

Finally, while this study theoretically highlights and identifies sustainable development targets that smallholder oil palm can play and contribute, not all indicators can be measured at the level or scale of smallholder households. The SDGs indicator framework, which globally includes 231 unique indicators for the 5 SDGs pillars, for this study can only identify 47 identifiable indicators that are relevant for the 3 sustainability, economic, social and environmental pillars. Another weakness is that the impacts or phenomena produced by oil palm may not be due to the impact of smallholder palm oil alone. The impact of water, for example, the impact may not be due to the behavior of people's palm oil, but to the behavior of large oil palm plantations or the behavior of other large plantations or other global phenomena that have an impact on Indonesia. Therefore, additional empirical research is needed that broadens the time horizon to capture the dynamics and improve understanding of the impact of oil palm plantations, not only on smallholder oil palm, but also on large private and state plantations.

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