The Oil Palm Industry and Sustainable Development Goals Agenda: Evidence from the Socio-economic Profiles of Smallholders in Johor, Malaysia

Shri Dewi Applanaidu ¹, Norhaslinda Zainal Abidin ², Mohammed Baba Abdullahi* ³, Mukhtar Mustapha ⁴, Joseph Viandrito ⁵

 ^{1,3,4} Department of Economics and Agribusiness, School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Sintok, Kedah, Malaysia
 ² Department of Decision Sciences, School of Quantitative Sciences, College of Arts and Sciences, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
 ⁵ University of Indonesia, Jakarta Email: ³mbabdullahi01@gmail.com

Abstract

The agricultural literature have debated issues related to environmental, social and economic implications of agricultural production in relations to achievement of sustainable development goals (SDGs). The role of oil palm in catalysing smallholders out of poverty, ensuring food access, quality education and as vital SDGs have been a critical subject of recent literature. While the search for framework integrating these SDGs remains a major concern. This study endeavours to develop a framework of interactions between SDGs by exploring the link between socio-economic factors of oil palm smallholders in Johor with relevant SDGs. Primary data comprising of socio-economics factor of oil-palm smallholders in Johor, Malaysia was collected through well-structured questionnaire. Descriptive statistics were used to analyse social and economic condition of the smallholders and extent of SDGs achievement. Furthermore, t-test and correlation analysis were used to examine the relationship between selected socio-economic profiles and SDGs. Findings indicate that smallholders have attained considerable number of SDGs including SDG1 (No poverty); SDG 2 (Zero hunger); SDG 4 (Quality education) and SDG 5 (Gender equality). Their average income was above national and international poverty line. Over 90% of smallholders attained at least primary education. Women engagement was up to 10% and comparatively the women performed better in terms productivity and income.

Keywords : Descriptive analysis, Socio-economics, SDGs, Oil palm, Income, Smallholders, Quality education

I. INTRODUCTION

In general, agriculture is considered a binding force that links the 17 Sustainable Development Goals (SDGs). Consequently, investing in agricultural development is considered a major effort to drive the SDGs across most developing countries (FAO, 2019). Thus, oil palm like other agricultural crops represents a major tool to eradication of hunger and malnutrition, poverty, water and energy use; climate change; and unsustainable production and consumption. Arguably, debates are ongoing on the role of palm oil in attainment of the SDGs. As a perennial oil producing crop with an average production lifespan of 25 years, there is upsurge of interest on the future growth of the oil palm industry. This oil has a major advantage compared to other alternative vegetable oil because of its significantly higher oil output per hectare which also makes it more profitable, a better income source and the supply is also guaranteed and reliable (Khatun et al., 2017; Abdullah & Wahid, 2010).

Issues of controversies on the sustainability of oil palm production have attracted several debates in literature. A side of the argument have highlighted negative challenges related to environmental sustainability of oil palm production. The proponent of this negative environmental impact therefore continues to put various criticisms forward linked to deforestation, peat destruction, exploitation and loss of biodiversity (Abdul Majid, Ramli, Sum, & Awang, 2021; Ching, et al., 2019; Cazzolla, Liang. Velichevskava. & Zhou. 2019). However, most of these environmental challenges are not unique to oil palm alone, like any other agricultural production activity, the much debated environmental effect of oil palm production arises from land expansion through deforestation as a result of increased demand. Palm oil is also the most widely traded vegetable oil glob- ally accounting for nearly 60% of global oilseed exports (Carter et al., 2007) with demand projected to increase substantially in the future (Vijay et al., 2016).

While it is inevitable to expand production to meet increasing demand, it is only justifiable that sustainable approaches be adopted to sustain the environment. Sustainable approach ensures that businesses are conducted through processes that incorporates environmental and economic concerns (Wardhani & Rahadian, 2021). In response to the much argued issues demanding sustainability practices in palm oil production, several efforts have emerged to ensure environmentally sustainable practices. Notable among these efforts includes, the implementation of integrated strategies aimed at expanding oil palm plantations in areas with low carbon stock (Khatun et al., 2017; Permpool et al., 2016), avoiding deforestation of natural forests, raising yield per unit of land thus reducing the need for expansion (Khatun et al., 2017; Permpool et al., 2016). Alternative approaches include minimal use of inorganic fertilizers, replacing fossil fuel with biodiesel and several environmental friendly management practices (Rivera-Mendez et al., 2017:

Gerardetal., 2017). Also in Indonesia and Malaysia, the practice of using non-forested land for new oil palm plantations was adopted to eliminate or reduce deforestation, and peat land expansion (Austin et al., 2017; Leijten et al., 2020).

However, the effectiveness of the commitments to sustainable practices needs to be tested as there are always challenges in monitoring deforestation. Against this background, several initiatives to encourage sustainable practices and overcome the negative environmental impact emerged at international and regional levels. This includes, the Roundtable on Sustainable Palm Oil (RSPO) established in 2004 which marked a turning point for the oil palm industry in the fight against the negative allegations and showed its commitment toward sustainable development. Also, at regional levels, producing countries have taken the initiative to establish their own sustainability standards. The Indonesian government established Indonesia Sustainable Palm Oil (ISPO) in 2011 to ensure that all Indonesian palm oil growers, not just those exporting to foreign markets, conform to high standards of sustainable practices. While in Malaysia, the Malaysian Sustainable Palm Oil (MSPO) was introduced. In 2015 as a national standard to show its commitment toward sustainable palm oil production.

Although, much has been done in understanding and responding to impacts on the environment, not so much on the economic and social impacts partly due to a lack of information (Ayompe, Schaafsma & Egoh, 2020). However, palm oil trade contributes to economic growth in many countries where it is grown particularly in Southeast Asia (Aubert et al., 2017). Several large oil palm plantations are established by agro-industrial companies that provide employment to several population and improve their income. Evidently, Indonesia and Malaysia dominated the oil palm industry and in these countries oil palm production substantially contribute to GDP and thus poverty reduction (Ayompe, Schaafsma & Egoh, 2020). Thus oil palm is a strategic commodity that have become a major pillar of the economies of both countries, through export revenues and taxes oil palm commodity contributes to income and GDP of Indonesia. Besides, it is an important source of employment, better livelihood, several business opportunities and regional development (Suryani, Hendrawan, Muhandhis, & Dewi, (2016).

As income of smallholders increases the environmental consciousness increases and so does the adoption of RSPO sustainability practices. This follows the argument of the environmental Kuznets Curve Theory (EKC) that postulated that income growth is initially at the expense of the environment and after a particular level of growth is achieved the population become more environmentally conscious and adopts practices that ensures cleaner environment. Thus, with higher income, proper implementation of sustainable practices are achieved to minimise environmental challenges and consequently maximising the social and economic benefits. In-view the principles of the EKC theory, the adoption of sustainable practices by oil palm smallholders could be fostered by polices that increases the efficiency of their production and income growth. A fast growing field of study with respect to the SDGs is the effort to develop a framework of interaction between the SDGs. Given that there is no agreement or guide on how to approach the sustainable development goals in an integrated manner (Bennich, Weitz & Carlsen, 2020). Although there are strong interactions and linkages between socioeconomic development of smallholders and the SDGs.

Also, there is scarcity of research to establish the linkages and the pattern of interactions between the various SDGs which will be important in provision of guidance to achieving the goals (Bennich, Weitz & Carlson, 2020). It is critical that given these limitations identified, research efforts be committed to better understand the socio-economic conditions of smallholders in the oil palm sector in Major producing country like Malaysia. Therefore our study examines the correlations between the smallholder's income, productivity, education and membership of sustainability organisations (RSPO, MSPO, TUNAS). In order to achieve the main objective of this study, four specific objectives are hereby outlined. That is, to describe the income level of oil palm smallholders and relate them to SDG2 (End poverty); secondly to examine the production and productivity of oil palm smallholder in relation to SDG 1 (End hunger); thirdly, the educational level of oil palm smallholders was related to SDG 4 (quality education) and fourthly, the level of women involvement in oil palm production is analysed based on SDG 7 (women equality). The remaining part of the study is therefore organised as follows, first a review of relevant literature is presented, followed by description of the methodological approach used in this study. Also, the results is presented next followed by discussion and finally recommendation.

II. LITERATURE REVIEW

The oil palm industry has attracted several interest in view of the increasing growth and unique characteristics of the oil palm crop. The trend of literature on oil palm are focused on debating issues related to environmental, economic and social implications of oil palm production. These studies have so far presented divergent views based on environmental, social and economic dimensions. However most recent literature argues on the need a pattern to integrate the SDGs. This section presents a critical assessment of relevant studies based on the dimensions highlighted.

Recent study by Ayompe, Schaafsma, Egoh (2020) argued on the premise of the limited information available regarding the social impact of oil palm production and effects on SDGs. They reviewed studies on the oil palm sector from environmental and human wellbeing dimensions. The results showed that 109 studies indicated negative and 99 studies showed positive and direct impacts on humans. The most frequently studied direct negative conflicts impacts were (25%), housing conditions (18%) and land grabbing (16%). The

studied direct positive impacts were income generation (33%) and employment (19%). The identified negative effects are not directly associated with oil palm but related to land resource scarcity.

Similarly, arguing in the context of the socioeconomic implications of oil palm are studies such as; Martin, Rieple, Chang, Boniface and Ahmed (2015); Euler, Hoffmann, Fathoni and Schwarze (2016); Susanti and Maryudi (2016); Bennett, Ravikumar and Cronkleton (2018); Córdoba, Selfa, Abrams and Sombra (2018). These studies analysed the socio-economic impact of oil palm production to affirm the extent of oil palm contribution to several SDGs such as income, food security and education. Particularly, Tambi, Choy, Yusoff, Abas and Halim (2021) assessed the challenges to improve the well-being of smallholder's oil palm communities in Malaysia. Their study identified factors including land shortage, limited credit and loans access, inadequate planting materials, scarcity of training. processing facilities, technological expertise, high fertilizer prices, and poor soil fertility. All these factors was consequently linked the challenges to the SDGs.

Also, Santika, Wilson, Budiharta, et al. (2019) affirmed that the economic benefit of oil palm production differs majorly for villages having past experience in the management of plantations and access to market economy. Two groups of villages were compared in their study, those with low to moderate forest land and those with higher forest land. For the groups with low to moderate forest land, result indicated that oil palm producing villages are better in socio-economic welfare compared to non-oil palm producing villages. While the result is vice versa for the second group. In view of the social and economic importance of oil palm, Syahza, Irianti, and Nasrul (2020) also assessed strategies to empower rural economies through oil palm production and also curtail the environmental impacts from oil palm expansion using the case study of Riau Province area, Indonesia. Findings indicates that oil palm farming has proven to be able to improve the

welfare of the community and reduce poverty. Furthermore the government has directed that relevant policies for the development of oil palm plantations must be integrated with the SDGs.

There exist substantial number of studies laying emphasis on the issue of oil palm and environment sustainability. Among the proponents of the negative environmental impact of oil palm production is Cazzolla Gatti et al. (2019) whom studied the oil palm sector in Indonesia, Malaysia and Papua New Guinea from 2001–2016. Result showed a high rate of forest loss in the certification concession area (about 40%). The effects above have raised concerns about the negative impact that developing the palm oil industry in Indonesia and Malaysia will have on the environment. Following this assertions are; Tey, Brindal, Darham, et al. (2020); Ayompe, Schaafsma, Egoh (2020); Shevade and Loboda (2019); Santika, Wilson, Meijaard, et al. (2019); Svahza, Irianti, and Nasrul (2020). However, in the wave of these environmental concerns of oil palm production is the emergence of RSPO, ISPO and MSPO at International, Indonesia and Malaysia level respectively (Hidayah et al., 2019; Abdul Majid, Ramli, Sum & Awang, 2021).

These oil palm sustainability standards are committed to sustainable production of oil palm through recommendation of packages of sustainable practices and certification of compliant producers responsible for 21% of the global palm oil. The outcome is a major decline in the unsustainable practices across the sector and improvement in the livelihood of producing communities. Consequently several studies (Wardhani & Rahadian, 2021; Abdul Majid, Ramli, Sum & Awang, 2021; Tey, Brindal, Darham, et al., 2020; Laskar & Gopal Maji, 2018; Hidayah et al. 2019) have examined the effectiveness of these sustainability standards in ensuring their primary goal of sustainable practices in the oil palm sector. Specifically, Tey, Brindal, Darham, et al. (2020) used 16 years data from 2000 to 2016 for 39 plantation companies listed on the Kuala Lumpur Stock Exchange in Malaysia. The study affirmed that the plantation companies realised that early adoption of the RSPO is positively related with their return on investment. This positional advantage is likely to yield both operating and capital efficiencies, such as those predicated in the good management practices of the RSPO standard.

Also, Abdul Majid, Ramli, Sum and Awang (2021) carried out a systematic review of 174 related studies published from 2004 to 2019. They showed that majority of the study are focused on RSPO compared with variants like MSPO and ISPO. Consequently, the study recommended further research on MSPO and ISPO to enable understanding of the dynamics of the implementation of sustainability certification. The studies by Laskar and Gopal Maji (2018) and Hidayah et al. (2019) in Indonesia oil palm sector indicates less of environmental concerns, however certification was indicated as a major concern (Wardhani & Rahadian, 2021). Notably, Laskar and Gopal Maji (2018) found that Indonesian companies' disclosure of environmental performance is lower and more dispersed than that of other countries (Japan, South Korea and India). Furthermore, the study indicates that companies pay attention to carbon emission issues, effluent and waste, water management, biodiversity, energy and environmental management certification. However, the sample companies did not pay attention to material and supplier compliance in applying sustainability in environmental aspects.

Other studies have formed a bridge between the aspects of environmental, social and economic dimensions. Notably is the study by Santika, Wilson, Meijaard, et al. (2019), the study contributed to the debate on both environmental and economics consequence of oil palm production. They assessed the association between the change in land-uses and climate, the change in village primary livelihoods towards monocultural oil palm cultivation, and the change in village welfare after adopting oil palm across Kalimantan, Indonesian Borneo. Their study used data spanning from 2000 to 2014. Findings confirmed that change in village primary livelihoods towards monocultural oil palm cultivation between 2000 and 2014 was associated with complex inter- relations between the expansion of agricultural industries, and conducive climate and market conditions for supporting agricultural production. The shift to oil palm monoculture significant economic brought benefit to villages. However, it is critical to note the importance of experience in maximising the economic benefits as only those with past exposure to plantation management experienced the long term economic improvement.

In the review carried out substantial number of studies have emphasized on the issue oil palm and environment sustainability. However, in general agricultural sector has been responsible for 22% of global carbon emissions (Ben Jebli et al., 2015). Thus, like any other agricultural activity, the production much debated environmental effect of oil palm is not unique to oil palm production. But, it is ultimately driven by increased in land expansion due to high demand for oil palm products. Thus with proper implementation of sustainable practices challenges can be minimised the and consequently maximising the social and economic benefits. In response to the agitations on environmental impact is the evolvement of multi-lateral agencies such as the RSPO at the international level and similar one as MSPO in Malaysia and ISPO in Indonesia at regional or country level (Paul, Ximena, Juan & Isabel, 2020). However again, the literature highlights that these vital economic and social impacts of oil-palm are not uniformly positive, nor negative, and have varied systematically with biophysical locations and baseline socioeconomic conditions of nearby communities prior to oil palm development (Santika, Wilson, Budiharta, et al., 2019). Also, the literature indicates the scarcity of research to establish the linkages and the pattern of interactions between the various **SDGs** (Bennich, Weitz & Carlson, 2020).

In the existing literature, the environmental impact of oil palm production is a well-debated.

Notably, Wardhani & Rahadian, 2021; Laskar & Gopal Maji, 2018; Hidayah et al. 2019 explored environmental impact and oil palm expansion. However, we could not find any notable work concerning social and economic implications of oil palm production among the smallholders categories in Malaysia especially as they relate to the SDGs (Abdul Majid, Ramli, Sum & Awang, 202). Furthermore, the current trend indicates a rising interest in understanding the interaction of various SDGs of which the role of agriculture cannot be neglected. However, we could not find any empirical study that considered the interactions among SDGs based on oil palm smallholders or the agricultural sector in Malaysia despite its vital role in supporting SDG. Besides, there is limited literature available on socio-economic factors and oil palm Production nexus among smallholders in Malaysia. Therefore, this study contributes to the economic literature in three important ways.

First, it attempt to analyse the socio-economic characteristics of oil palm smallholder in Johor. Second, this study examines the correlations between the smallholder's income, productivity, education and membership of sustainability organisations (RSPO, MSPO, TUNAS) with respect to SDGs achievement. Thirdly, we also established a framework on the pattern of interactions between various SDGs in the context of oil palm smallholders as suggested by Bennich, Weitz and Carlson (2020). Thus providing guidance to achieving the SDGs and contributing to understanding veritable opportunities to drive SDGs through linkages between selected socio-economic profiles and SDGs.

III. METHODOLOGY

The detailed methodological approach of this study is organized as follows. The first subsection presents an overview of the study area. The second subsection describes the process of primary data collection used in this study. The third subsection describes the analysis approaches associated with each of the three research questions that we aimed to answer.

3.1 Study Area

Johor is a state in Malaysia and located at the south of the Peninsular Malaysia. Johor has land borders with the other states in Malaysia; Pahang is the border to the north and Malacca, Negeri Sembilan to the northwest. Johor Bahru is the capital city and the centre of the economy. Johor's economy is mainly based on the tertiary sector (Shah, 2018). In 2019, the Gross Domestic Product (GDP) of Johor was RM140.450 billion, the fourth highest among states in Malaysia after Selangor, Kuala Lumpur and Sarawak, while the median income was US\$ 1,317 (RM 5,652) and the unemployment rate was 2.7%. Some major sectors contributing to Johor's GDP includes agriculture (7.2%), Mining and Quarrying (1.1), Manufacturing (6.0%), Construction (6.7%) services (6.2%), and import duty (13.0) (Department of Statistics, Malaysia [DOSM], 2019). Johor state produces a large fraction of Peninsular Malaysia's total palm oil products and also has the largest number of smallholders in Malaysia (Rahman, 2020). The Johor oil palm plantation area, percentage of total plantation area in Malaysia and percentage of state area are 745,630, 13.0%, and 38.8% respectively.



Figure 1: Map of Johor, Malaysia Source: Shahid & Minhans, (2016)

3.2 Data Collection and Sampling

The study used the socioeconomics data of the oil palm smallholders in Johor area. The primary data used for this study was collected using a well-structured questionnaire to elicit relevant information from the targeted respondents which are the oil palm smallholders. A cover letter was also included with the structured questionnaire. In the cover letter the researcher emphasized the importance of the study and confidentially of the participants. Given the population of 69,606 smallholders in Johor about representative sample for the study was determined using the method by Kregcie and Morgan (1970). Thus, a sample size of 327 was determined for this study, followed by systematic random sampling of respondents. The random selection of oil palm smallholders was done by selecting the 5th smallholder from the list of total population of 69,606 smallholders in Johor until the required sample of 327 was achieved. Therefore, a total of 327 smallholders in Johor have been surveyed for this study.

3.3 Data and Analyses

The survey report constitute numeric variables associated with demographic and economic characteristics of smallholders. The data analysis involved the use of the SPSS (version 24). The statistical techniques adopted to analyse the data includes the descriptive statistics, correlation analysis and independentsamples t-test which used to examine the statistical difference in specific socio-economic factors and related SDGs and to determine whether the differences across groups is significant or otherwise. We performed statistics descriptive such as frequency distribution, percentages, measures of central tendency such as mean, median or mode and standard deviation. The graphical representations such as bar charts, pie charts and histogram were used to illustrate the findings.

IV. FINDINGS AND DISCUSSION

The objectives of this study includes: first, analysis of the socio-economic profile of oil palm smallholders. Then specific socioeconomic profiles were related with the SDGs that is, the income level of oil palm smallholders and SDG1 (No poverty); secondly to examine the production and productivity of oil palm smallholder in relation to SDG 2 (Zero hunger); thirdly, to relate the educational level of oil palm smallholders with associated SDG 4 (Quality education) and fourthly, is analyses of the level of women involvement in oil palm production based on SDG 5 (Gender equality). Finally the framework on the interrelationship between the SDGs is presented. In view of the objectives set by this study, the findings are presented beginning with the descriptive statics on the oil palm smallholders socio-economics. This is followed by the analyses of specific profile in relation to the SDGs and finally the framework is presented based on the strength of correlation between the socio-economic profiles.

4.1 Descriptive Statistics Results

Oil palm production activities embraces the 2030 agenda's vision of sustainable development in terms of food, income, people's livelihoods and the management of natural resources. The results from this study will be segregated and presented based on the SDGs associated with oil palm production activities including production of fresh fruit bunches (FFB), productivity, income and other socioeconomic profile of smallholders. Table 1 present the findings on the analysis of the socioeconomics data of the sampled oil palm smallholders in Johor, Malaysia.

Table 1. Socio-economic Profile of Oil Palm Smallholders in Johor, Malaysia

Variables	Number	Percentage	Average
Age			
(0-30)	26	8	
(30-60)	223	68	
(61-Above)	78	24	54 Years
Gender			
Male	293	90	
Female	34	10	
Marital Status			
Married	286	87	
Single	13	4	
Divorced	28	9	
Religion			
Islam	327	100	

Christian	0	0	
Buddha	0	0	
Hindu	0	0	
Ethnicity			
Melayu	327	100	
China	0	0	
India	0	0	
Bumiputra sabah	0	0	
Others	0	0	
Education Classification			
Non-Formal Education	29	8.9	
Primary School Certificate	200	61	
Secondary School Certificate	86	26	
Higher Learning (STPM/Diploma /Institute)	12	4	
Income Classification - Palm Oil			
US\$0-US\$239 (RM0- RM1,000)	113	35	US\$ 222.2 (RM953. 5)
US\$240- US\$479 (RM1,001- RM2,000)	95	29	
US\$479- US\$719 (RM2,001- RM3,000)	65	20	
US\$720-Above (RM3,001- Above)	54	16	
Production Class (MT)			
0 - 5 Mt	284	173.2	4.45 MT
5.1 - 10 Mt	12	7.6	
10.1 - 15 Mt	24	14.9	
15.1 - 20 Mt	2	1.3	
20.1 Mt - above	5	3.1	

The result reveals that, average age of the oil palm smallholders is 54 years. Majority (87%) of the oil palm smallholders are married while male constitute 90% of the oil palm

smallholders and 10% female. All or 100% of the oil palm smallholders were Muslims and of Melayu ethnic group. Age classification shows that 68% of the respondents are within the age group of 30-60 years, 24% were above 60 years and 8% were less than 30 years. In term of main occupation, result indicates that 85% are primarily into oil palm smallholdings while only 15% are into oil palm as a secondary occupation. The latter group as are further classified as those in government work, 16% are businessmen, while 32% are into private businesses. Average years of experience among the oil palm smallholders is less than 21 years old, while majority constituting of about 48% are under the experience classification of 21above years. Unemployed represent the highest job involvement among the respondents before palm oil farming.

A total of 2,002 individuals constituted the overall family size of oil palm smallholders, with an average of 6 individuals in a family. Further classification of family size reveals that, majority are within 5-8 representing about 62%. While, 79% of the full time labour in the oil palm plantations are accounted by non-family full time labour with an average of 2 full time non-family labour, while average family full time labour is estimated at one individual per family. Distances cover by the palm oil farmers from home to farm is two (2) km averagely, the closest factory from the palm oil farmers from the farm is estimated at 11 km and the closest average to the fruit collecting centre from the farm is estimated at six (6) km.

Total monthly income of the oil palm smallholders is estimated at US\$134,176 (RM575,615), while monthly average is estimated at US\$410 (RM1,760), this translated into a daily average of US\$14 (RM59). Further classification of income reveals that, majority are within the income group of US\$0-US\$239 (RM0-RM1,000) monthly, while about 16% are within the income group of US\$720-above (RM3,001-above). Other family member's income apart from palm oil income is estimated at US\$13,949 (RM59,840) monthly, while average income from non-palm oil income is estimated at US\$43 (RM183) with about 91% under the income classification of US\$0-US\$239 (RM0-RM1,000). Main source of family member income apart from palm oil include remittance, assistance, pension and the rest representing 89%. In term of educational level, an estimated 37% and 18% of the palm oil respondents have completed primary and secondary education respectively. Education classification on the other hand, shows that, 61% have primary school certificate. The relationships between relevant socio-economic profiles and SDGs are presented in subsequent sections.

4.2 Monthly Production and Productivity of Fresh Fruit Bunches (FFB) and Hunger Eradication (SDG 2)

The improvement of production and productivity of oil palm is a major contributor to SDG2 which relates to zero hunger. This section presents the total monthly production of oil palm FFB in tons among the smallholders in Johor (see Figure 2).



Figure 2: Frequency distribution of smallholders based on monthly FFB production in Johor, Malaysia. Majority of the smallholders or about 86.85% produces between 0 - 5 MT of FFB annually, the small land size could be responsible for the observed quantity of production by smallholders. While 7.34% of the smallholders produces between 10-15 MT FFB per annum. Only 3.67% of smallholders produces between 5.1-10MT of FFB, 1.53% produces above 20 MT and the only few (0.61%) produces 15.1-20 MT of oil palm per year. The average production of FFB was also found to be 4.45 Mt/acre (see Table 1).





Similarly increased productivity can help to address hunger challenges for the palm oil smallholders. More than three-quarters (77%) of the increased food required by 2030 will have to come from increased productivity (FAO, 2018). Consequently, the productivity in tons per acre of the oil palm smallholders is presented in Figure 3. The average productivity of the smallholders is 0.45 MT/acre. The lowest or minimum productivity was 0.1 MT/acre for the smallholders in Johor. Oil palm productivity improvement will promote sustainable agriculture and has a major contribution to SDG2, more specifically target 2.3, which is concerned with "doubling the agricultural productivity and incomes of smallholder agricultural producers by 2030". This result indicates that oil palm smallholders in Johor have good FFB productivity since the average value of 0.4 is better than national average hence contributing to SDG2.

 Table 2: Average Monthly Income (Acre)

Statistics	Monthly Income US\$ (RM)
Average	222.2 (RM 953.4)
Minimum	74.1 (RM 317.85)
Maximum	329.9 (RM 1415.25)

Indirect contributions to SDGs include helping to meet the demand for food as oil palm is widely used as a component of various food products. Also, considering the land efficiency of oil palm compared to other oil crops, it will be at a comparative advantage in reducing the conversion of natural environment and forests for additional oil production (SDG15: Life on land and SDG13: Combat climate change and its impact). Furthermore, ending hunger does not stop at enhancing productivity, but also relates to increasing income and strengthening markets so that people can access food in the event of challenges that may hinder production (FAO, 2018). The next sub-section therefore relates income from oil palm smallholders to poverty eradication.

4.3 Oil Palm Smallholder's Income and Poverty Eradication (SDG1)

The study presents the income of oil palm smallholders in Johor and relates to Malaysia's national Poverty Line Income (PLI) of US\$ 228.4 (RM 980) per month in 2018 (Department of Statistics Malaysia [DOSM], 2018). Although, the DOSM have provided a revised PLI from have RM 980 to RM 2,208 in 2020. Similarly, comparison was made with the international poverty line of US\$ 1.90 (RM 8.2) per day at 2011 PPP (World Bank, 2019). Results are presented in both Figure 4 and Table 2 as follows.



Figure 4: Monthly oil palm income by smallholder categories

The income from oil palm is categorized based on the demarcation of Malaysian households in the 11th Malaysian Plan (Economic Planning Unit [EPU], 2018). Based on the income categories, all the smallholders have income above national PLI, while only 0.3% of smallholders have income below PLI. The result indicates majority or about 63% of the oil palm smallholders earn monthly income of US\$ 1218 (RM 5,229) and above. Table 1 indicates that on average the smallholders earns between US\$ 222.2 (RM 953.4) monthly/acre.

In terms of contribution to SDGs, the oil palm income analysis contributes highly to eradication of poverty (SDG1) since only 0.3% of smallholders fall below the poverty level. Consequently, income from oil palm contributes to other SDGs indirectly such as:

- End hunger, achieve food security and improved nutrition and promote sustainable agriculture (SDG2)
- Access to affordable, reliable, sustainable and modern energy (according to Environmental Kuznet Curve: More income leads to concerns for cleaner environment) (SDG7).
- Decent work and economic growth in rural areas, oil palm can be a foundation of employment and pro-poor economic growth (SDG8).

4.4 Women Participation in Oil Palm Production and Gender Equality (SDG5)

In terms of participation of women in oil palm production, the study examined the ratio of female to male, and compared income variations across genders; result is presented in Figure 5 and Table 3.



Figure 5: Distribution of Smallholders by Gender



Productivity/A cre (Mt)	Male	Female			
Average	0.36	0.44			
Minimum	0.10	0.19			
Maximum	0.69	0.67			
Income/Acre US\$					
Average	202.7	243.5			
	(RM 869.4)	(RM 1044.8)			
Minimum	55.6	105.6			
	(RM 238.4)	(RM 452.9)			
Maximum	382.0 (RM1638.7)	370.4 (RM 1589.0)			

RM Equivalent in parenthesis (),

RM: Malaysian Ringgit

The result indicates that about 10% of women participate in oil palm production as smallholders in Johor. Comparing the productivity between the men and female smallholders we have 0.36 Mt/acre and 0.44MT/acre respectively, implying that female have a better monthly average productivity than men. Consequently, the monthly average income/acre per female smallholder is US\$ 243.5 (RM 1044.8) compared to the male counterpart of US\$ 202.7 (RM 869.4). While the lowest or minimum income per acre by the male oil palm smallholder is US\$ 55.6 (RM 238.4) which is lower than that of the female US\$ 105.6 (RM 452.9). Considering that women in oil palm are not only able to produce as much as the male counterpart but have a relatively higher average monthly income shows that oil palm smallholders contributes to SDG 5 (Gender Equality). Involving women in oil palm production also indirectly contributes to other SDGs such as: Zero Hunger, Poverty eradication. Education. and Female Α Comparison of selected socio-economic factors between male and female smallholders using the independent sample T-test is as shown in Table 4.

 Table 4. Independent Sample T-test Socioeconomics Profiles between Genders

Socio- economic	Male (N=29 3)	Fema le (N=3 4)	t-test for Equality of Means		
factors	Mean	Mean	t	df	Sig.
Income	1728.6	2032. 9	- 1.54	56.6 1	0.13
Education	2.96	2.91	0.21	46.0 1	0.83 3
Productiv ity	0.246	0.375	- 1.66	41.8 6	0.10 4
Productio n	0.725	0.852	- 1.54	56.6 1	0.13

The result in Table 4 revealed that both female and male smallholders do not differ in all the four socio-economic dimensions examined including the level of income earned from oil palm production, educational attainment. productivity per unit of land and the total monthly production of oil palm in Johor. In all the socio economic profile of smallholders assessed in comparison to both genders the Pvalues were greater than 0.05 (p < .05) as shown in Table 4. That is, the income derived from oil palm production by female smallholders (M= 2032.99) are not significantly higher than male smallholders (M = 1728.6), t (98) = -1.54, p > .05. Similarly for other socioeconomic factors, the values for females are not statistically different from those of the male counterpart since all the P-values are greater than 5%. This study therefore infers from the result in Table 4 that both female and male smallholders have equal chances of excelling in the oil palm business. Thus contributing to gender equality or SDG 5.

4.5 Education Attainment of Oil Palm Smallholders and Quality Education (SDG 4)

Indeed the importance of education on the livelihood of smallholders cannot be over emphasized. Education is central to several sustainable development goals especially those knowledge or education that could help to improve productivity, production, market access and adoption of sustainable practices among smallholder. Therefore quality education (SDG 4) is central the sustainability goals and indirectly linked to zero hunger (SDG2), no poverty (SDG1), Gender equality (SDG5) as education leads to more empowerment of Through agricultural extension women. services, oil palm smallholders have access to the skills, tools, inputs, and knowledge required to improve their productivity and livelihood. As presented in Figure 6, only 8.9% of the oil palm smallholders have no formal education, about 61% have basic primary education, 26.30% have attended high school and 3.7% attended higher institution. Thus, the profile of oil palm smallholders shows a high level of attainment of the SDG 4 in Johor.



Figure 6. Educational attainment of oil palm smallholders in Johor

4.6 Correlation Analysis of Socio-economic Profiles of Oil Palm Smallholders

Understanding the correlation of socioeconomic background of oil palm smallholders in the context of SDGs is important to identifying the contribution of the oil palm sector to several SDGs. This will also identify the SDGs with the strongest relation to oil palm production. On this backdrop, this study used the spearman rank corelation in an attempt to understand the SDGs with the strongest relation to oil palm based on socio-economic profiles of smallholders in Johor. The result is presented in Table 5 below.

 Table 5. Correlation between Selected Socioeconomic Profile of Oil Palm Smallholders

	Educa tion	Smallh older Type	Farm Size	Experience (Years)	Inco me	Pro duc tivi ty	HH Size	Gender
Education	1							
Smallhold er (type)	0.04	1						
Farm Size	0.018	0.46	1					
Experience (Years)	-0.09	0.03	-0.04	1				
Income	0.066	-0.48	-0.32	-0.068	1			
Productivity	0.064	-0.49	-0.52	-0.052	0.799	1		
HH Size	0.150	-0.02	-0.04	0.096	- 0.004	0.0 27	1	
Gender	0.010	0.17	0.154	0.064	- 0.058	0.0 89	- 0.008	1
Production	0.067	-0.48	-0.32	-0.068	0.910	0.7 99	- 0.004	-0.06

According the results in Table 5, the correlations values between socio-economic characteristics of smallholders (education, income, productivity, gender) varies strongly. The values of corelation ranges between 0 and 1. The values between 0 and 0.3 indicate a weak linear relationship, values between 0.3 and 0.7 implies a moderate linear relationship, while the range of value between 0.7 and 1.0 indicate a strong positive linear relationship. The negative and positive signs indicates an inverse or direct relationship respectively. There are strong interactions and links between Oil palm production and SDGs.



Figure 7 Framework on the interconnection between the oil palm production and SDGs

As presented in Figure 7, and the correlation result, the linear association between the production of oil palm and education was weak (r=0.01), the relationship between income and oil palm production was found to be perfect (r=0.910). This is expected since oil palm was the major source of income for the smallholders, thus oil palm production could be considered strongly contribute to SDG1 (No poverty). While considering the multiplier effect of income increase, attaining higher income can be linked to more quality education (SDG 4). Additionally based on the EKC theory with higher income comes better awareness on the environment thus the adoption of sustainable practices in the production processes thus contributing to responsible production and consumption (SDG 12); decent work and economic growth (SDG 8); climate action (SDG 13). Also, correlation between productivity of oil palm and total production was the second highest (r=0.799), this implies productivity is vital to achieve better oil palm production and contributes highly to SDG2 (Zero hunger). Also, in terms of gender equality, the correlation value between gender of smallholder and oil palm production capacity was found to be weak and negative (r=-0.004). This implies there is no difference between the production of both male and female smallholders thus implying the weak or absence of gender discrimination in the sector.

V. CONCLUSIONS AND RECOMMENDATIONS

This study serves to inform and highlight relevant policy recommendations on the key socio-economic profiles of smallholders related to SDGs and essential indicate the potentials of oil palm to contribute to the 2030 SDGs Agenda. Based on the analysis of oil palm smallholders in Johor and their contribution to SDGs, oil palm can be considered a veritable tool for achievement of the SDG agenda. It promotes poverty eradication by contributing to income growth of oil palm producers. The rural populations make up 70% the world's extreme poor and are mostly smallholders' category (Food Agriculture Organization [FAO], 2018). Although proportion of women in oil palm smallholders is just about 10%, bridging this gap could reduce global hunger. Women contribute significantly to the income generation and definitely to some of the key SDGs such as poverty eradication, gender equality, and education.

In the long term, the advantages and potential smallholders of are numerous. Firstly. smallholders embody a diversity of ownership of cropping systems, landscapes, biological organizations, cultures, and traditions. A variety of farm structures contributes to biodiversity, diverse landscape, and open space. Secondly, smallholders are relatively efficient in managing its natural resources through a number of empowerment strategies and appropriate government support. Smallholders need access to trainings, subsidies and other benefits derived from been part of groups and organizations. The oil palm smallholders close contact with nature and its surroundings, makes it better manage their farms. Third, family farms are the best premise to raise children. The skills of farming are passed on from one generation to another under family ownership structures. When farm children do not continue to farm, farming knowledge, skills, and experience are lost. That's the main reason that we are depending more to foreign workers.

The study therefore recommends investing in smallholder oil palm production as it will go a long way in addressing a number of economic challenges and contributes strongly to SDGs, from eradication of hunger and malnutrition to other SDGs such as poverty eradication; gender equality; water and energy use; climate change; and sustainable production and consumption. To achieve this emphasis should be placed in developing all the factors having positive effect on sustainable production of oil palm and fulfilment of the SDGs such as the MSPO and RSPO membership, education, access to market, access to productive land, training and gender equality.

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