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Effect of Palm Oil Subsidies on Productivity and Well-Being of Independent Smallholders

(Pengaruh Subsidi Minyak Sawit Terhadap Produktiviti Dan Keberkesanan Penanam Kecil Bebas)

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ABSTRACT

This study aims to investigate the impact of subsidies on productivity and the subsequent effect of productivity on the well-being of oil palm independent smallholders (ISH). It specifically analyses the impact of palm oil subsides on productivity and the well-being of ISH based on the soil types of the palm oil plantation. A semi-structured interview method was used, and 475 questionnaires were validated for data analysis. The Principal Component Analysis (EFA) and Structural Equation Modelling (SEM) were used for data analysis. The well-being index was measured through eight components, namely income and wealth, employment and income, residential conditions, work-life balance, education and skill level, environmental quality, and subjective well-being. The results show that the well-being of independent smallholders whose plantations are based on peat and alluvial soil is higher than those with mineral soils. The findings further show that subsidies are expected to improve the productivity of the smallholders that have plantations with mineral soils, which in turn enhance their well-being. This study extends the existing literature on the well-being of independent smallholders by introducing a well-being index. In improving the productivity of smallholders that ultimately contribute to their well-being, the provision of subsidies should be continued in a targeted manner by the government through agencies such as Malaysian Palm Oil Board.

Keywords: Independent smallholder; productivity; subsidy; well-being; palm oil; structural equation modelling

ABSTRAK

Artikel ini mengkaji kesan subsidi terhadap produktiviti dan seterusnya kesan produktiviti terhadap kesejahteraan pekebun kecil persendirian (PKP). Ia secara khusus menganalisis kesan subsidi minyak sawit terhadap produktiviti dan kesejahteraan PKP berdasarkan jenis tanah ladang sawit. Kaedah temu bual separa berstruktur telah digunakan dan sebanyak 475 soal selidik telah dijawab sepenuhnya. Analisis data menggunakan Analisis Komponen Utama (AKU) dan Pemodelan Persamaan Berstruktur (SEM). Indeks kesejahteraan diukur melalui lapan komponen, iaitu pendapatan dan kekayaan, pekerjaan dan pendapatan, keadaan kediaman, keseimbangan kerja-hidup, pendidikan dan tahap kemahiran, kualiti persekitaran, dan kesejahteraan subjektif. Kesejahteraan PKP di tanah gambut dan lanar adalah lebih tinggi berbanding kesejahteraan PKP secara keseluruhan. Manakala, PKP di tanah pedalaman dan PKP secara keseluruhan menunjukkan subsidi memberi kesan yang positif dan signifikan kepada produktiviti dan seterusnya kesejahteraan mereka. Artikel ini menyumbang dalam meluaskan literatur sedia ada berkaitan kesejahteraan pekebun kecil khusus kepada PKP dengan memperkenalkan indeks kesejahteraan. Bagi menggalakkan produktiviti PKP meningkat dan akhirnya menyumbang kepada kesejahteraan, pemberian subsidi haruslah diteruskan namun dilakukan secara bersasar oleh kerajaan melalui MPOB.

Kata kunci: Kesejahteraan; pekebun kecil persendirian; produktiviti; subsidi
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INTRODUCTION

The term "subsidy" is a widely used concept in economics, but its definition varies between influential organizations such as the International Energy Agency (IEA), International Monetary Fund (IMF), and World Trade Organization (WTO). Among these definitions, the WTO offers the most comprehensive one, defining a subsidy as "different forms of financial contributions, income support, or price support provided by a government, intended to confer a benefit upon the recipient." Government subsidy programs take on various forms and categories, including financial transfers to producers or consumers, instructing private entities to make a transfer, providing goods or services at no cost or below market price, and even regulatory policies creating transfers from one group to another (WTO 2006).

In Malaysia, the government extends a range of subsidies and transfers to enhance the socio-economic well-being of its population, mainly targeting low-income groups. These include subsidies for essential commodities and services like petrol, diesel, liquefied petroleum gas, cooking oil, flour, and electricity, wages, national vaccination fund transfers, and various forms of social assistance (Ministry of Finance Malaysia 2022). Figure 1 illustrates the trend of subsidies and other transfers as a percentage of government operating expenditure from 2012 to 2022. In 2012, the total amount allocated for subsidies and other transfers was RM91 billion. Subsequently, in 2019, 2020, and 2021, these figures increased to RM116 billion, RM108 billion, and RM109 billion, respectively. However, in 2022, the amount reverted to a more typical level of RM71 billion after a sharp increase triggered by the COVID-19 pandemic. This surge was exceptional, and the subsidy amount subsequently returned to a lower level. The percentage of subsidies and transfers in the government's operating expenditure gradually decreased from 44% in 2012 to 25% in 2022, with a notable peak at 47% in 2020, primarily due to the impact of the COVID-19 pandemic. Given that subsidies contribute to the government's budget burden, they must effectively reach their intended targets.

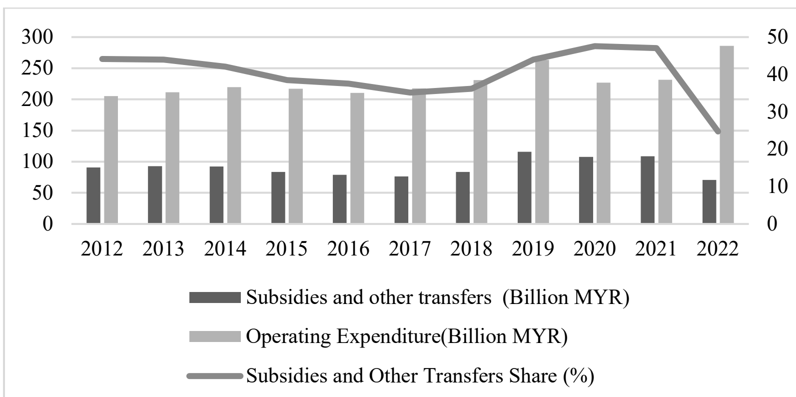

FIGURE 1.Government operating expenditure and subsidies and other transfers
Source.: Annual Economic Report, Ministry of Finance Malaysia (2023)

Subsidies are normally given by the Malaysian Government to products and end users in an industry. The oil palm industry is one of the main contributors to the country's income and constitutes the world's second-largest producer and exporter of palm oil products. The Malaysian Government assists the industry through various subsidy schemes for oil palm smallholders who are categorized into two groups; independent (ISH) and organized (OSH). While both contribute substantially to Malaysia's palm oil production, ISH manages and works independently on their farms, usually planting a maximum of 40.46 hectares. In contrast, OSH are smallholders whose farms are jointly managed by federal or state agencies like the Federal Land Development Authority (FELDA), Federal Land Consolidation and Rehabilitation Authority (FELCRA), and Rubber Industry Smallholders Development Authority (RISDA). OSH benefits from technical, processing, marketing, and financial support from their organizers. ISH on the other hand receives support from Tunjuk Ajar dan Nasihat Sawit (TUNAS) which comprises part of the Extension Services Unit of the Malaysian Palm Oil Board (MPOB).

Ownership statistics reveal that ISH and OSH collectively own 26.8% of the oil palm planted area in the country, with ISH owning 15.1% and OSH owning 11.7%. Approximately 13.6% of Malaysian ISH are family-run enterprises, often lacking adequate knowledge of best agricultural practices, thus adversely impacting their productivity. These families earn an average of RM1600 per month, thus falling below the national poverty line of RM2,208 in 2019. ISH face perennial challenges related to land tenure, limited capital, shortage of workforce, and restricted market access that can ultimately affect their well-being (Ngoma et al. 2021). In comparison, OSH are minimally impacted by these challenges. This study will therefore primarily focus on ISH.

To address the above challenges faced by ISH, the government has implemented several initiatives through MPOB as shown in Table 1. Programs like the Malaysian Sustainable Palm Oil Certification (MSPO Scheme) promote sustainable palm oil production by requiring smallholders to adopt Good Agricultural Practices (GAP). It ensures the quality of palm oil produced and mitigates environmental, social, and economic concerns. Moreover, schemes like the Oil Palm Replanting Scheme (TSSPK) and New Planting Scheme (TBSPK) have supported ISH since 2011 by providing high-quality seedlings, fertilizers, pesticides, cash for land preparation, and other agricultural inputs. The Oil Palm Industry Mechanization Incentive Scheme (OPIMIS) also addresses labour shortages by promoting mechanization in oil palm plantations. Initiatives like the Crop Integration Scheme (ITa) and the Livestock Integration Scheme (ITe) further encourage ISH to optimize land use through planting cash crops such as pineapples, bananas, watermelons, corn, and corn papayas, to diversifying their income sources.

TABLE 1. Schemes implemented to assist ISH.

No.	Schemes	Abbreviation
1	Oil Palm Replanting Scheme	TSSPK
2	New Planting Scheme	TBSPK
3	Palm Fertiliser Assistance Scheme	S.B.S.P.K.
4	Oil Palm Industry Mechanisation Incentive Scheme	OPIMIS
5	Crop Integration Scheme	ITa
6	Livestock Integration Scheme	ITe
7	Quality Oil Palm Seedlings Assistance Scheme	SBABB
8	Stimulus Economic Package II Incentive Scheme	PRE-2
9	Cantas Discount Scheme	SKIDIC
10	Oil Palm Smallholders Replanting Loan Scheme	TSPKS
11	Oil Palm Smallholder Agricultural Input Soft Loan Scheme	IPPKS
12	Malaysian Sustainable Palm Oil certification	Skim MSPO
13	Cash Crop Programme	TKB40
14	Skim Bantuan Sistem Dua Baris	BSDB
15	Bantuan Penyelenggaraan Kebun	B.P.K.
16	Skim Rangsangan Tanam Baru Sawit Pekebun Kecil Persendirian	RTB
17	TUNAS Advisory Assistance	

Source: MPOB.

These schemes assist ISH in their aim to increase productivity, improve palm oil quality, boost income, and enhance their overall well-being. Nevertheless, the productivity of ISH can be low due to various factors such as not implementing sustainable cultivation technologies (Herdiansyah et al. 2020), limited fertilizer application (Herdiansyah et al. 2020), and low yields (Hutabarat et al. 2019). In addition, Mohd Suib et al. (2023) found that low implementation in good agricultural practices (GAP) will reduce productivity and negatively impact the well-being of the smallholders. The impact was also expected to get worse towards the end of 2018 when some of the subsidies (Table 1) were terminated (Hashim K. 2022).

This study will thus assume that the subsidies can help the smallholders increase productivity and, subsequently, their well-being. Various factors influence smallholder productivity, such as fertilization, the weather, crop age and soil type (Maidin 2023). Many soil types are encountered and used in agricultural activities. However, planting is only conducted in the soil type suitable to the crop (Melo-Becerra & Orozco-Gallo 2017; Riar et al. 2020). For the planting of oil palm, analyses were made on the soil type which are mainly mineral soil, peat and alluvial. These three soil types are widely used for oil palm plantations in Malaysia. Each type of soil in the ISH farm has different characteristics and thus requires verification since its fertility can ultimately affect the production of FFB.

This study will elucidate whether subsidies have an impact on productivity and subsequently on the well-being of ISH, given that these have been terminated by the government. The study will therefore aim to identify the influence of subsidies on the productivity of ISH and their subsequent well-being within the context of Malaysian oil palm industry subsidy schemes. A semi-structured interview method was employed for data collection. The Principal Component Analysis (PCA) and Structural Equation Modelling (SEM) techniques were utilized for data analysis. Subsidies are expected to improve the productivity of ISH, and this increase may subsequently improve ISH's well-being (Loo & Harun 2019).

This study shall extend the existing literature in the area of oil palm subsidies through introducing an index for assessing the well-being of ISH, as related to the soil type used. It shall also establish the relationship between the subsidies, productivity, and the well-being of smallholders in Malaysia. The latest study on oil palm subsidy demonstrated its association with increased tree planting activities and its enhancement on tree survival. However, the study did not examine the relationship between subsidy, welfare, and soil types (Karina Brenneis & Bambang Irawan 2023). This current study shall offer valuable policy insights for designing more targeted subsidy programs that ultimately maximize smallholders' well-being.

In the following section, we will conduct a literature review on the impact of agricultural subsidies on both ISH productivity and well-being. Subsequently, we will outline the research framework and detail the methodology employed for our analysis. Following this, we will present the analysis results. Finally, the paper will conclude with policy implications and limitations of the study.

LITERATURE REVIEW

Empirical evidence has shown that certain smallholder agricultural subsidies can significantly enhance productivity. For example, Aragie and Balié (2021) discovered that subsidies for inputs and irrigation development were more effective in improving farmers' productivity than subsidies for infrastructure development. Martey et al. (2019) reported that fertilizer subsidy programs resulted in a substantial 55% increase in land productivity, primarily due to the increased use of mineral fertilizers. Input subsidy programs have also boosted productivity through overcoming access limitations and increasing input intensity (Holden & Lunduka 2010; Woittiez et al. 2018). Furthermore, offering higher subsidy rates for crop insurance can incentivize greater participation among farmers, ultimately leading to increased productivity (Connor & Katchova 2020). Productivity in these studies is often measured through indicators such as output (Aragie & Balié 2021; Martey et al. 2019) and crop yields (Connor & Katchova 2020; Fearon et al. 2015; Holden & Lunduka 2010; Woittiez et al. 2018). In the context of this study on oil palm plantations, many scholars have chosen the FFB as a proxy for productivity, as observed in works by Ismiasih (2018), Juyjaeng et al. (2018), and Puruhito et al. (2019). This study therefore adopted the FFB as a suitable measure due to its dependence on the selling price, which fluctuates according to market conditions. In general, the extant literature clearly states that subsidies influence the productivity of smallholders.

The literature on the impacts of oil palm subsidy programmes on smallholders is rather limited as compared to that of other agricultural crops. For example, oil palm smallholders in Indonesia relied strongly on subsidised fertilisers since limited fertiliser applications have led to lower plantation productivity (Woittiez et al. 2018). In contrast, the few studies on Malaysia's oil palm subsidy programmes have revealed enhanced smallholders' productivity. Such programmes included the Malaysian Sustainable Palm Oil (MSPO) certification scheme (Serina 2020), Replanting Assistance scheme (Mohd Noor Izuddin et al. 2022), Oil Palm Replanting Scheme (TSSPK) and New Planting Scheme (TBSPK) (Mohd Ishak et al. 2020), etc. More studies are required to elucidate the impacts of comprehensive subsidy programmes on oil palm smallholders, as the schemes may simultaneously benefit the smallholders' productivity and well-being.

There are several studies on the impact of subsidy schemes on the productivity of oil palm smallholders (Ismail et al. 2003; Mohd Ishak et al. 2020; Woittiez et al. 2018). Woittiez et al. (2018) found that fertilizer subsidies significantly influenced oil palm smallholders' choices. However, most farmers often chose subsidized fertilizers that failed to provide the correct nutrient balance, resulting in reduced plantation productivity. In a Malaysian case study, Ismail et al. (2003) demonstrated that lower yields and earnings among ISH did not equate to lower cost-effectiveness due to their lower input costs, such as less fertilizer and labour expenses. Mohd Ishak et al. (2020) examined the impact of the TSSPK and TBSPK, which included high-quality seedlings, agricultural inputs (fertilizers and pesticides), and cash for land preparation. Following participation in these schemes, FFB production decreased slightly due mainly to the 2016 El Nino occurrence. These studies were survey-based since the unorganized nature of ISH limited access to updated data and information regarding their performance. It is worth noting that these studies did not specifically discuss on subsidies' impact on smallholders' productivity. Further research is thus necessary to enhance our understanding of the impacts of oil palm subsidies on productivity of ISH.

Many studies have discussed the factors that affect well-being. Some empirical studies have shown that agricultural subsidies can positively affect smallholders' well-being by impacting various indicators such as their income (Martey et al. 2019; Mason et al. 2020) and poverty reduction (Aragie & Balié 2021; Awotide et al. 2013; Li et al. 2022). Additionally, years of education are also determinants of smallholder well-being (Awotide et al. 2013). Subsidies have been found to drive a slight increase in labour wage rates due to increased labour demand (Holden & Lunduka 2010; Ricker-Gilbert 2014), since they alleviate constraints related to inputs, cash, or credit, allowing smallholders to diversify their activities (Chibwana et al. 2012; Mason 2011). Furthermore, subsidies could minimise non-renewable inputs, improve soil and environment quality (Martey et al. 2019) and benefit human health (Flora 2010). However, Mohd Suib et al. (2023) showed that factors such as technology, optimal resources, insurance, market pricing, and tax policy would firstly affect economic well-being before influencing social well-being.

While subsidies play a crucial role in improving smallholders' welfare, it is essential to identify efficient subsidy allocation methods. Subsidies may not directly affect welfare but do so indirectly through other factors. Theoretical arguments suggest that subsidies could potentially increase productivity, thereby sustainably enhancing the well-being of agricultural smallholders. However, empirical evidence is crucial to establish this relationship. Despite extensive literature on the effects of subsidies on various agricultural aspects, minimal research has investigated the relationship between subsidies, productivity, and well-being of smallholders, particularly within the context of oil palm industry.

METHODOLOGY

LOCATION

The study was conducted in Malaysia and involved 162 Sustainable Palm Oil Clusters (SPOC). SPOC was established to provide MSPO certification to ISH. It is formed by grouping ISH into several small clusters, typically consisting of 1000 to 2000 in each cluster (Kannan et al. 2021). Each ISH under the same SPOC will thus be jointly certified under one MSPO certificate. Figure 2 illustrates the geographical distribution of SPOC clusters across Malaysia, as managed by the MPOB.

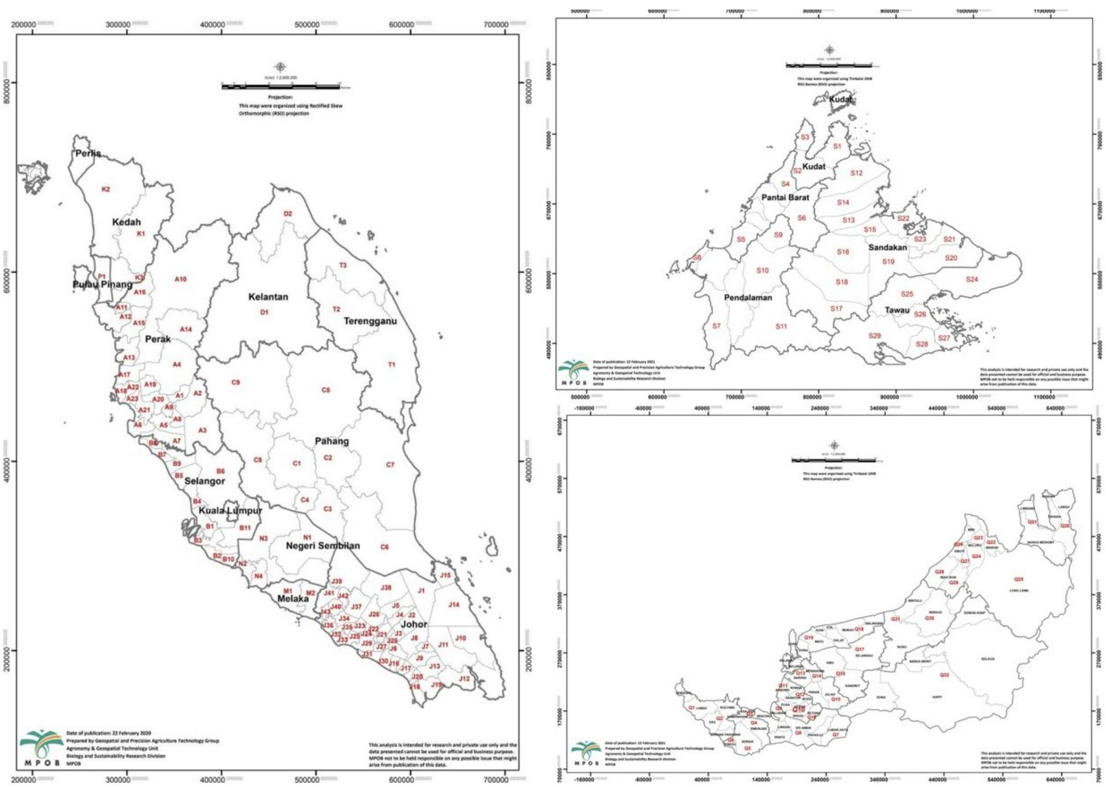

FIGURE 2. Distribution of SPOC in Malaysia
Source: Kannan et al. (2021)

This study accordingly focused on ISH who had obtained the MSPO certificate and thus constitute the target population. As illustrated in Table 2, a total of 129,307 ISH had obtained MSPO certification by 2020. To ensure a meaningful sample for our research, we employed the purposive sampling method (PS) which allows for the selection of individuals or groups with specific experience related to the research being conducted, as advocated by Cresswell et al. (2011). Given the size of the population, we used the Total Population Sampling (TPS) technique, which is highly practical when working with subgroups within a large population. Since each SPOC consists of 1,000 to 2,000 ISH, we selected two or three ISH from each SPOC to be the respondents of this study. In addition to their knowledge of subsidies, the selection of potential respondents also considered their years of experience in managing oil palm for at least a minimum of six (6) years. This criterion was applied because TPS is a method that involves all individuals within the population who meet specific criteria, such as skill sets and experience. This is in alignment with other studies (Etikan et al. 2016).

TABLE 2. Total MSPO ISH certificate ownership by region (2013-2020)

Area	Total Ownership of MSPO ISH Certificates								
	2013	2014	2015	2016	2017	2018	2019	2020	Total
Peninsular	-	82	113	438	776	4142	15732	56798	78081
Sabah	-	-	42	42	113	1021	3418	16758	21394
Sarawak	-	-	233	233	521	869	7670	20772	29832
Total	-	82	155	480	1410	6032	26820	94328	129307

Note: There is no certificate ownership by ISH in 2013 since MSPO was launched in that year

Based on Cohen et al. (2017), Awang et al. (2021), Hair Jr et al. (2021) and Krejcie & Morgan (1970), this study requires a sample size ranging from 260 to 382 out of 129,307 ISH individuals who have received MSPO. The study interviewed 564 ISH participants who responded to the prepared questionnaire. However, only 475 completed questionnaires were received from the respondents. Figure 3 presents a sample framework for this study.

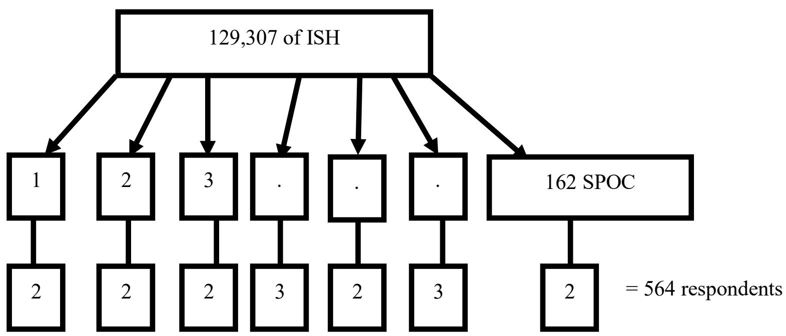

FIGURE 3. Purposive sampling framework

INSTRUMENT AND DATA COLLECTION

This study used a semi-structured interview method. A total of 475 completed questionnaires were collected from oil palm ISH in Peninsular Malaysia, Sabah and Sarawak between April and November 2022. These were verified for data analysis. The questionnaire consists of three parts. The first part surveyed smallholders' demographic profile and farm information centred on 6 items. The second part contained questions related to oil palm subsidies. The third part comprised 50 questions related to respondents' well-being and was constructed from eight components; namely IW, EI, R, WB, H, ES, EQ, and SW. The questions in the first part were multiple-choice, two-choice, and open-ended. The questions in the other parts were measured by a Likert scale, ranging from 1 to 5, from "strongly disagree" to "strongly agree", respectively.

This survey was conducted twice, as a pilot test and a final survey. Questionnaires in the pilot test were distributed to five oil palm ISH, and two lecturers with expertise in agricultural economies. The pilot test survey results verified the questionnaire's validity and reliability. The final survey was subsequently conducted. The respondents were assured that the survey would be strictly confidential and used only for academic purposes.

Data collection was carried out by TUNAS officers who were enumerators appointed to distribute questionnaires and interview potential respondents. Internal Control System (ICS) officers served as TUNAS officer supervisors, who explained the need for the study, reviewed the questionnaire and informed the results of the briefing. They also gave briefing to TUNAS officers to ensure that interviewers thoroughly understand the needs and requirements to implement data collection.

DATA ANALYSIS

Data were analysed using the Principal Component Analysis (PCA) and Structural Equation Modelling (SEM). STATA 14 was used to conduct PCA, and Smart-Partial least squares (SmartPLS) software, version 3.0., was applied for S.E.M. SmartPLS calculated the path estimates and the model parameters without the concern of normality of data and is suitable for both large and small samples (Hulland 1999).

The PCA technique is commonly used for analysing datasets and increasing interpretability by reducing its dimensionality while minimising information loss. Thus, the variation in the data can be described with fewer principal components or lower-dimensional data than the initial large datasets (Jollife & Cadima 2016). PCA has been wildly applied to make predictive models through exploratory data analysis. This method is superior to others when the variables have high correlation. If all variables were uncorrelated, each eigenvalue (λ) would equal 1. If λ <1, the component should not be used, because it provides less information. Additionally, the components should explain more than 50% of the total variance (Kaiser 1960). For this study, the PCA technique was used to create an index of well-being. To better interpret the results of the study and realise the forecast, the index will be transformed by using the rank of percentiles and taking values between 0 and 1. A linear scale of the index will be used to measure well-being from one year to another.

The SEM approach, through its generality, can be extensively applied to analyse processes and phenomena occurring in sociology, social policy, and other sciences. It is superior to other statistical models or approaches for its capacity to integrate different aspects of theoretical constructs or multidimensional reality issues (Tarka 2018). In particular, multigroup analysis and structural model are conducted for SEM. Multigroup analyses is able examine whether the difference between samples in different sections is significant (Teo et al. 2009). The structural model analysis can indicate how correlations between variables can be linked by examining the values of the coefficient of determination (R^2), predictive relevance (Q^2) and path coefficients in the structural model (Tarka 2018). Based on the literature, there are some restrictions on these empirical values. R^2 statistics indicate the variance in the endogenous variables explained by the exogenous variables, the value of which if greater than 50% is acceptable. The value of Q^2 should be greater than 0, indicating predictive relevance. In detail, if the values of Q^2 are 0.02, 0.15 and 0.35, they respectively indicate that the construct has weak, moderate, and strong predictive relevance to the model (Cohen 1988). The value of the path coefficient cannot be less than 0.10 (Lohmoller 1989) or 0.20 (Chin 1998), with t-statistics (1.645, 1.96, and 2.576 critical values) at a significant level (p-value: 0.1, 0.05, and 0.01) respectively (Ringle et al. 2005). Thus, the above method is suitable for identifying the relationship between subsidy, well-being and productivity and for comparing the findings from distinct ISH based on soil types, i.e., mineral, peat, or alluvial.

Table 3 summarises the value of the descriptive variables used in Smart PLS. The mean number of subsidies accepted by ISH in the surveyed region is 1.7705, and the minimum and maximum numbers are 0 and 6, respectively. However, the total number on types of subsidies provided by MPOB that were surveyed in the questionnaire was 16. This result showed that not all the subsidies were given to ISH. On average, smallholders received 1 to 2 types of subsidies. Some smallholders received no subsidy at all, while some get up to 6 types of subsidies.

The mean output of FFB from the ISH was 19.79 (T/Ha/Year), while the minimum and maximum output were respectively 5.00 (T/Ha/Year) and 30.36 (T/Ha/Year), with a standard deviation of 5.91. For the index of well-being, the mean value was 0.62, and some smallholders were strongly dissatisfied with the subsidy programmes, although some were strongly satisfied. The standard deviation was 0.24.

TABLE 3. Descriptive variable model

Variable	Minimum	Maximum	Mean	Standard Deviation
Number of subsidies	0.00	6.00	1.7705	0.91862
FFB	5.00	30.36	19.7920	5.90852
Index well-being	0.00	1.00	0.6186	0.23830

RESEARCH FRAMEWORK

Figure 4 illustrates the research framework of this study, depicting the causal relationships between subsidies, productivity, and the well-being of oil palm ISH. The well-being index was measured through eight components, namely income and wealth (IW), employment and income (EI), residential conditions (R), work-life balance (WB), education and skill level (ES), environmental quality (EQ), and subjective well-being (SW). The well-being index estimated was obtained through the PCA. The single-headed arrow indicates a one-way causal relationship, pointing from the cause to the effect, using partial least squares.

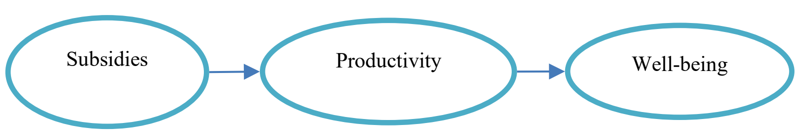

FIGURE 4. Research framework of this study

SUBSIDY IMPACT ON PRODUCTIVITY

To model the influence of various types of subsidies on FFB production in oil palm cultivation, a partial least square was assessed through bootstrapping analysis technique. This was employed to gain insights into both the direction and magnitude of the impact of subsidies on FFB output which is influenced by 17 types of subsidies. A partial least squares method was used to illustrate how subsidies affect productivity. The subsidy value received by smallholder oil palm farmers is calculated by:

$$Smallholder\ of\ palm\ oil\ subsidy\ ratio = \frac{n}{N} \quad (1)$$

Where, n is the number of subsidies received, and N is the total subsidy. The smallholder subsidy ratio is obtained by dividing the subsidies received by smallholders by the total subsidy.

The evaluation of the Subsidy Impact on Productivity (FFB Output) is based on the following function:

$$Productivity = f(Smallholder\ of\ palm\ oil\ subsidy\ ratio) \quad (2)$$

PRODUCTIVITY IMPACT ON WELL-BEING INDEX

Similarly, the influence of productivity on the well-being index was investigated using partial least squares assessment through bootstrapping analysis technique. The evaluation on the well-being index is based on the following function:

$$Well - being\ index = f(Productivity) \quad (3)$$

This analysis was conducted using SmartPLS 3.0, through which simultaneous assessments of the impact of subsidies on productivity and the impact of productivity on the well-being index were conducted.

RESULTS

This section will elaborate on respondent profile, PCA, and the relationship between subsidy, productivity, and well-being.

PROFILE OF RESPONDENTS

Table 4 shows that 39.4% of ISH respondents received education at SPM & MCE level and 18.1% at SRP, LCE & equivalent level. About 72.8% of the ISH respondents have experienced managing oil palm plantation for 1 to 20 years, followed by 16.6% with 21-40 years' experience and 9.5% with 41-60 years. The result showed that 38.5% of respondents planted oil palms certified by MSPO from 2001 to 2010, followed closely at 34.9% by those who subsequently planted between 2011 to 2018. This is consistent with the age of trees planted, with 49.1% between 11 to 20 years old and 36.6% between 4 to 10 years old.

Almost 50% of respondents produced a FFB yield between 10.01 (Ton/Ha/Year) and 20.00 (Ton/Ha/Year), and 44.4% of respondents harvested between 20.01t/ha/year and 30.00t/ha/year. About 92.8% of farm size owned by respondents was smaller than 9.99ha. Farm acreage smaller than 4.99ha and spanning 5.00-9.99ha accounted for 74.5% and 18.3%, respectively. The soil in the oil palm plantations studied was classified into mineral, peat, and alluvial. Most ISM plantation was in mineral soil accounting for 79.4%. For further details of the results, refer to Table 2.

TABLE 4. Profile of respondent

Information	Frequency	Percentage (%)
Level of Education:		
Non-formal education	27	5.7
UPSR & equivalent	60	12.6
SRP, LCE & equivalent	86	18.1
SPM & MCE	187	39.4
Skills Certificate	15	3.2
Diploma/Matriculation	51	10.7
Degree	36	7.6
Masters	13	2.7
Experience Managing Oil Palm (Year):		
1-20	346	72.8
21-40	79	16.6
41-60	45	9.5
Above 61	5	1.1
Year of started planting		
1957-1990	43	9.1
1991-2000	83	17.5
2001-2010	183	38.5

Information	Frequency	Percentage (%)
2011-2018	166	34.9
Age of Palm Oil (Year):		
4-10	174	36.6
11-20	233	49.1
21-30	67	14.1
31-40	1	0.2
FFB (Tan/Ha/Year)		
1.00-10.00	26	5.5
10.01-20.00	137	49.7
20.01-30.00	211	44.4
Above 30.01	2	0.4
Farm Size (Ha):		
0-4.99	354	74.5
5.00-9.99	87	18.3
10.00-14.99	14	2.9
15.00-19.99	7	1.5
20.00-24.99	5	1.1
25.00-29.99	4	0.8
30.00-34.99	2	0.4
30.00-39.99	2	0.4
Type of Soil:		
Mineral	377	79.4
Peat and alluvial	98	20.6

PRINCIPAL COMPONENT ANALYSIS (PCA)

The PCA contained eight constructs (income and wealth, employment and income, residential, work-life balance, health, education and skill, environmental quality, and subjective well-being). The values of each construct were measured by a Likert scale in the questionnaire, ranging from 1 (strongly disagree) to 5 (strongly agree). Table 5 presents the mean values of each construct, which are all greater than 2.50, indicating that respondents "agree" with each construct statement. The Pearson correlation coefficient was analysed to measure the linear correlation among the eight constructs used in the PCA analysis. Table 6 shows the observed values of the correlation matrix. Correlations among the variables are statistically highly significant for all variables at level 0.01($p < 0.01$).

TABLE 5. Mean construct of well-being

Construct	Mean
Income and wealth (IW)	3.859
Employment and income (EI)	3.735
Residential (R)	4.019
Work-life balance (WB)	3.804
Health(H)	4.115
Education and skills (ES)	4.248
Environmental quality (EQ)	4.085
Subjective well-being (SW)	4.457

TABLE 6. Pearson Correlation Matrix of the eight construct used in the PCA analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income and Wealth (1)	1.0000							
Employment and Income (2)	0.6677*	1.0000						
Residential (3)	0.7918*	0.6238*	1.0000					
Worklife balance (4)	0.7062*	0.5829*	0.7166*	1.0000				
Health (5)	0.7744*	0.6275*	0.7638*	0.7108*	1.0000			
Education and skill(6)	0.7050*	0.5608*	0.6855*	0.6442*	0.8413*	1.0000		
Environmental Quality (7)	0.6870*	0.5939*	0.6427*	0.5891*	0.7590*	0.7465*	1.0000	
Subjective Well-Being (8)	0.6615*	0.5044*	0.6845*	0.6180*	0.7656*	0.7715*	0.6930*	1.000

*Significant at level 0.01

Table 7 illustrates the eigenvalues for principal components and the eigenvectors related to each of the principal eigenvalues. An eigenvalue of 1 means that the principal component would explain one variable's worth of variability. Thus the eigenvalue criterion requires that only components with eigenvalues greater than 1 can be retained (Kaiser 1960). The PCA result shows that only Component 1 ($\lambda 1 = 5.797$) meets the above criterion and can be maintained. Meanwhile, the proportion of Component 1 is 0.725, indicating that this principal component can preserve roughly 72.5% of the total variance. Therefore, Component 1 can be used to reduce dimension. Table 8 shows the Kaiser-Meyer-Olkin (KMO) coefficient measure of sampling adequacy of the first principal component for the eight constructs. The overall value of KMO is 0.9401, and all the other KMO values of each variable are also greater than 0.9, indicating that it is suitable to conduct

Component 1 the factor analysis (Kaiser 1974). After standardisation, the coefficients of the eight constructs in Component 1 are all positive and almost equal, implying that the eight variables weigh equally in the formation of Component 1. Therefore, the formula of the well-being index can be proposed as follows:

$$\text{Well-being index} = 0.3664_{IW} + 0.3118_{EI} + 0.3613_{R} + 0.3393_{WB} + 0.3826_{H} + 0.3650_{ES} + 0.3489_{EQ} + 0.3487_{SW} \quad (4)$$

TABLE 7. Principal components analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	5.797	5.204	0.725	0.725
Comp2	0.593	0.144	0.074	0.799
Comp3	0.449	0.147	0.056	0.855
Comp4	0.302	0.019	0.038	0.893
Comp5	0.283	0.045	0.035	0.928
Comp6	0.238	0.043	0.030	0.958
Comp7	0.195	0.052	0.024	0.982
Comp8	0.143	.	0.018	1.000
Number of observations		475		
Number of components		8		
Trace		8		

TABLE 8. Kaiser-Meyer-Olkin (KMO) and coefficient measure of sampling adequacy (MSA) of the first principal component for the eight constructs

Variable	KMO	Coefficient
Income and wealth (IW.)	0.9360	0.3664
Employment and income (EI.)	0.9555	0.3118
Residential (R)	0.9335	0.3613
Work life balance (C)	0.9619	0.3393
Health (H)	0.9263	0.3826
Education and skill (ES.)	0.9187	0.3650
Environmental quality (EQ.)	0.9549	0.3489
Subjective well-being (SW.)	0.9475	0.3487
Overall	0.9401	

Table 9 presents the mean values of the well-being index categorized by soil types. In the context of the CPA analysis, the well-being index ranges from 1 to 0, with 1 representing the highest level of well-being (Kurek et al. 2022). The overall mean well-being value for oil palm ISH in Malaysia is 0.6186. The results indicate that the average well-being value for ISH planting in peat and alluvial soil is 0.6248, which is higher than the overall average. In contrast, the mean well-being value for ISH planting in mineral soil is 0.5947, which is the lowest among the three soil types. It's noteworthy that the well-being value for all these smallholder groups are higher than the midpoint value of 0.5, indicating a level of well-being that leans towards satisfaction rather than dissatisfaction. To further assess whether there are statistically significant differences in the well-being of ISH planting across mineral, peat, and alluvial soil types, a mean analysis was conducted (Jollife & Cadima 2016). The results showed the F-test statistic at 1.975, which is significant at the 0.050 level. This suggests that there is indeed a difference in the well-being of ISH based on soil types.

TABLE 9. Analysis mean of well-being index according to type of soil

Soil	Index
Mineral	0.5947
Peat+alluvial	0.6248
Overall	0.6186
Compare mean	
F-test	1.975**

** significant at level 0.050

RELATIONSHIP BETWEEN SUBSIDY, PRODUCTIVITY AND WELL-BEING

This section illustrates the results of multigroup analysis and the assessment of hypotheses testing for the structural model.

MULTIGROUP ANALYSIS

Structural equation modelling (SEM) was employed as the main method of analysis in this study. A multigroup analysis was conducted to test whether there is a difference in the path coefficient value between mineral, peat, and alluvial, and whether the difference was significant. An invariant analysis was required to test whether the two groups are invariant to perform the multigroup examination (Cheah et al. 2023). The multigroup analysis can be carried out when the measurement invariance assessment (MICOM) is supported and established. Table 10 presents the result of MICOM that proves invariance between mineral and peat and alluvial groups, and that multigroup analysis is suitable for this research.

TABLE 10. Measurement invariance test using MICOM.

Construct	Original Correlation	5.0%	Compositional Invariance
Subsidy	1.000	1.000	Yes
Productivity	1.000	1.000	Yes
Well-Being	1.000	1.000	Yes
Construct	Mean Original Difference	95% Confidence Interval (CI)	Equal Mean Value
Subsidy	0.119	[-0.189, 0.189]	Yes
Productivity	0.130	[-0.213, 0.172]	Yes
Well-Being	0.127	[-0.187, 0.194]	Yes
Construct	Variance Original Difference	95% Confidence Interval (CI)	Equal Variance
Subsidy	0.250	[-0.345, 0.356]	Yes
Productivity	0.303	[-1.088, 1.384]	Yes
Well-Being	-0.289	[-0.200, 0.236]	No

Table 11 presents the path coefficients for the mineral (M) group and peat and alluvial (P+A) group, respectively, the difference between each pair of path coefficients for both groups (M group and P+A group) and their corresponding p-values. If p-values are greater than the value of $\boldsymbol{\alpha} = 0.05$, the difference in relationships is not significant. The relationship between subsidy and productivity of different types of soil is different. The result indicated that the difference in path coefficients is 0.282, and the significance value is 0.008. Meanwhile, the relationship between productivity and well-being does not differ. The result showed that the difference in path coefficients is 0.084, and the significance value is 0.237. Though only subsidy to productivity differs, the model can be investigated further based on the types of soil (Tarka 2018).

TABLE 11. Path coefficient differences and their corresponding p-values ($\boldsymbol{\alpha} = 0.05$)

Relationship	M-Group ($\boldsymbol{\beta}$mineral)	P+A-Group ($\boldsymbol{\beta}_{peat+alluvial}$)	Difference	p-Values
Subsidy -> Productivity	0.205	-0.077	0.282	0.008
Productivity -> Well-Being	0.143	0.059	0.084	0.237

ASSESSMENT OF HYPOTHESES TESTING FOR THE STRUCTURAL MODEL

This section discusses the R^2 value, the statistical significance of the Q^2 value, and path coefficient values, which were used to measure the structural model by exploring the capacity of constructs. Figure 5 illustrates the structural model. Table 12 shows the result of R^2 and Q^2 for productivity and well-being respectively. The values of R^2 obtained for productivity and well-being are 0.026 and 0.016, which means that 2.6% of the variance in subsidies is explained by productivity, and 1.6% of the variance in well-being is explained by productivity. Meanwhile, the values of Q^2 for each construct are 0.021 (productivity) and 0.015 (well-being), which are more than 0.0, indicating that the model supports its predictive relevance (Cheah et al. 2023).

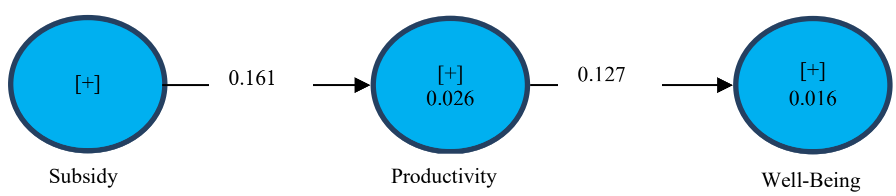

FIGURE 5. Hypothesis testing of the general model

TABLE 12. R square and Q square

Construct	R Square	R Square Adjusted	Q Square
Productivity	0.026	0.024	0.021
Well-Being	0.016	0.014	0.015

Based on all the above discussions, the relationship between subsidy, productivity and well-being can be further investigated based on general and different soil types. In general, this relationship shows the impact of subsidy on productivity and the influence of productivity on well-being. Table 13 shows the results of the hypotheses tests for the structural model for the general, M group and P+A group, including path coefficients of each pair, their t-values, and p-values. For the general hypothesis test, the path coefficients for the relationship between subsidy, productivity, and productivity and well-being are 0.161 (along with t-value=2.979; p-value=0.003) and 0.127 (along with t-value=3.008; p-value=0.003), respectively. Thus, for the general hypothesis analysis, the causal relationship between subsidy, productivity and well-being is considered positive and significant, indicating that H_1 and H_2 are supported. Thus, subsidies can improve productivity, and productivity can enhance well-being. However, the results of the hypotheses tests based on different types of soil show that there is a positive and significant relationship for ISH in the mineral group between subsidies and productivity (β=0.205; t-value=3.641; p-value=0.000) as well as relationship between productivity and well-being (β=0.143; t-value=3.454; p-value=0.001), indicating that H_3 and H_4 are supported (Forkman et al. 2019). However, for ISH in the peat and alluvial group, the results of the hypotheses tests show that both relationships are not significant. Therefore, H_5 and H_6 are rejected.

TABLE 13. Hypothesis test

Type of soil	Relationship	Path Coefficients (β)	Standard Deviation	T Statistics	P Values
General	Subsidy → Productivity (H_1)	0.161	0.054	2.979	0.003
	Productivity → Well-Being (H_2)	0.127	0.042	3.008	0.003
Mineral	Subsidy → Productivity(H_3)	0.205	0.056	3.641	0.000
	Productivity → Well-Being(H_4)	0.143	0.041	3.454	0.001
Peat and alluvial	Subsidy→ Productivity(H_5)	0.059	0.070	1.097	0.273
	Productivity→ Well-Being(H_6)	-0.077	0.117	0.504	0.614

These findings align with the study by Sharpe & Mobasher Fard (2022), which explored the two-way linkages between productivity and well-being. Their study suggests that policies and programs aimed at improving well-being can lead to enhanced productivity, reflecting a positive two-way relationship. However, it's important to note that the effects of subsidies on productivity can vary. Managi (2010) assessed the unintended policy outcomes of government subsidies in the forestry sector and found that subsidies could have unintended negative effects on productivity. Similarly, Ding et al. (2022) reported that the impact of subsidies on productivity depends on the income-to-sales ratio, resulting in both positive and negative effects. Given these varying effects, it is reasonable to suggest that the relationship between subsidies and productivity is not statistically significant for ISH operating on peat and alluvial soils.

CONCLUSION

This study investigates the impact of subsidies on productivity and the subsequent effect of productivity on the well-being of oil palm independent smallholders (ISH) as categorized by the soil types of their plantations. Our findings indicate that ISH with peat and alluvial soil experience higher well-being levels compared to the average Malaysian ISH, whereas those with mineral soil report the lowest level of well-being. Furthermore, the study explored the relationship between subsidies, productivity, and well-being among different ISH groups. Empirical evidence indicates that subsidies have a positive and significant impact on productivity and, subsequently, on well-being for overall Malaysian ISH and ISH with mineral soil. These overall findings suggest that the subsidy programs implemented by the MPOB have the potential to enhance the productivity of Malaysian oil palm ISH, ultimately contributing to the ISH's well-being. Thus, it is advisable to continue the subsides that were terminated earlier. Given this relationship, it is advisable to design subsidy programs in a way that focuses on enhancing productivity, ultimately fostering sustainable development and prosperity within these communities.

There are limitations to this study that need to be addressed in future research. This study basically focused on a specific industry, the oil palm sector. This may limit the generalizability of its findings to other sectors. Future studies should provide a more comprehensive understanding of the intricate relationship between subsidies, productivity, and well-being in other agricultural sectors.

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REFERENCES

Aragie, E. & Balié, J. 2021. Public spending on agricultural productivity and rural commercialization: A comparison of impacts using an economy-wide approach. *Development Policy Review* 39(S1): O21–O41.

Awang, A.H., Rela, I.Z., Abas, A., Johari, M.A., Marzuki, M.E., Faudzi, M.N.R.M. & Musa, A. 2021. Peat land oil palm farmers' direct and indirect benefits from good agriculture practices. *Sustainability (Switzerland)* 13(14): 1–18.

Cheah, J.H., Amaro. S. & Roldán, J.L. 2023. Multigroup analysis of more than two groups in PLS-SEM: A review, illustration, and recommendations. *Journal of Business Research* 156: 1-19.
Chin, W.W. 1998. The partial least squares approach to structural equation modeling. 295-336. In *Modern Methods for Business Research*, edited by G. A. Marcoulides, 295–336. New Jersey: Lawrence Erlbaum Associates Publisher.
Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences.* New York: Routledge.
Cohen, L., Manion, L. & Morrison, K. 2017. Approaches to qualitative data analysis. In *Research Methods in Education*, edited by Cohen, L., Manion, L. & Morrison, K., 643–656. New York: Routledge.
Connor, L. & Katchova, A.L. 2020. Crop insurance participation rates and asymmetric effects on U.S. Corn and soybean yield risk. *Journal of Agricultural and Resource Economics* 45(1): 1–19.
Cresswell, J.W. & Plano Clark, V.L. 2011. *Designing and Conducting Mixed Method Research. Edisi ke-2*. Thousand Oaks, CA. Sage.
Ding, J., Wang, J., Liu, B. & Peng, L. 2022. 'Guidance'' or "Misleading''? The government subsidy and the choice of enterprise innovation strategy."' *Frontiers in Psychology* 13: 1-14.
Etikan, I., Musa, S.A. & Alkassim, R.S. 2016. Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics* 5(1): 1–4.
Fearon, J., Adraki, P.K. & Boateng, V.F. 2015. Fertilizer subsidy programme in Ghana: Evidence of performance after six years of implementation. *Journal of Biology, Agriculture and Healthcare* 5(21): 100–107.
Forkman, J., Josse, J. & Piepho, H.P. 2019. Hypothesis tests for principal component analysis when variables are standardized. *Journal of Agricultural, Biological, and Environmental Statistics* 24(2): 289–308.
Hair Jr, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M., Danks, N.P. & Ray, S. 2021. An introduction to structural equation modeling. In *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook.* Cham: Springer.
Hashim, K. 2022. Interview Related to Soil Type in Malaysian Oil Palm Plantation, Bangi, Malaysia. *Interviews.*
Holden, S. & Lunduka, R. 2010. Too poor to be efficient? Impacts of the targeted fertilizer subsidy programme in Malawi on farm plot level input use, crop choice and land productivity. *Working Paper, Department of Economics and Resource Management, Norwegian University of Life Sciences, Norway*: 1–55.
Hulland, J. 1999. Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal* 20(2): 195–204.
Ismail, A., Simeh, M.-A. & Noor, M.-M. 2003. The production cost of oil palm fresh fruit bunches: The case of independent smallholders in Johor. *Oil Palm Industry Economic Journal* 3(1): 1–8.
Ismiasih, I. 2018. Technical efficiency of palm oil production in West Kalimantan. *Habitat* 28(3): 91–98.
Jollife, I.T. & Cadima, J. 2016. Principal component analysis: A review and recent developments. *Philosophical Transactions of the Royal Society* 374(2065).
Juyjaeng, C., Suwanmaneepong, S. & Mankeb, P. 2018. Technical efficiency of oil palm production under a large agricultural plot scheme in Thailand. *Asian Journal of Scientific Research* 11(4): 472–479.
Kaiser, H.F. 1960. The application of electronic computers to factor analysis. *Educational and Psychological Measurement* 20(1): 141–151.
Kaiser, H.F. 1974. An index of factorial simplicity. *Psychometrika* 39(1): 31–36.
Kannan, P., Mansor, N.H., Rahman, N.K., Peng, T. & Mazlan, S.M. 2021. A review on the Malaysian sustainable palm oil certification process among independent oil palm smallholders. *Journal of Oil Palm Research* 33(1): 171–180.
Karina Brenneis, Bambang Irawan, M.W. 2023. Promoting agricultural technologies with positive environmental effects: Evidence on tree planting in Indonesia. *Ecological Economics* 204(B).
Krejcie, R.V. & Morgan, D.W. 1970. Determining sample size for research activities. *Educational and psychological measurement* 30(3): 607–610.
Kurek, K.A., Heijman, W., van Ophem, J., Gędek, S. & Strojny, J. 2022. Measuring local competitiveness: Comparing and integrating two methods PCA and AHP. *Quality and Quantity* 56(3): 1371–1389.
Lohmoller, J.-B. 1989. *Latent Variable Path Modeling with Partial Least Squares.* Springer.
Loo, S.Y. & Harun, M. 2019. Responses of firms and households to government expenditure in Malaysia: Evidence for the fuel subsidy withdrawal. *Jurnal Ekonomi Malaysia* 53(2): 29–39.
Managi, S. 2010. Productivity measures and effects from subsidies and trade: An empirical analysis for Japan's forestry. *Applied Economics* 42(30): 3871–3883.
Martey, E., Kuwornu, J.K.M. & Adjebeng-Danquah, J. 2019. Estimating the effect of mineral fertilizer use on Land productivity and income: Evidence from Ghana. *Land Use Policy* 85: 463–475.
Mohd Ishak, S., Aman, Z. & Mat Taib, H. 2020. An Evaluation on Outcome of Oil Palm Replanting Scheme (Tsspk) and New Planting Scheme (Tbspk). *International Journal of Modern Trends in Social Sciences* 3(14): 129–148.
Mohd Noor Izuddin, Z.B., Parthiban, K., Rahmahwati, R., Norkaspi, K. & Zaki, A. 2022. Factors affecting independent oil palm smallholder ' s decision to participate in government replanting assistance scheme in Malaysia. *Malaysian*

Journal of Social Sciences and Humanities 7(9): 1-12.
Ngoma, H., Machina, H. & Kuteya, A.N. 2021. Can agricultural subsidies reduce gendered productivity gaps? Panel data evidence from Zambia. *Development Policy Review* 39(2): 303–323.
Puruhito, D.D., Jamhari, J., Hartono, S. & Irham, I. 2019. Technical efficiency and sources of inefficiency in smallholder oil palm plantation in North Mamuju district, West Sulawesi Province, Indonesia. *American-Eurasian Journal of Sustainable Agriculture* 13(1): 1–18.
Ringle, C.M., Wende, S. & Will, A. 2005. *Smart PLS 2.0 M3.* Hamburg: University of Hamburg.
Serina, R. 2020. Malaysian independent oil palm smallholders and their struggle to survive 2020. *ISEAS Perspective*(144): 1–16.
Sharpe, A. & Mobasher Fard, S. 2022. *The Current State of Research on The Two-Way Linkages Between Productivity and Well-Being.* International Labour Organization.
Tarka, P. 2018. An overview of structural equation modeling: Its beginnings, historical development, usefulness and controversies in the social sciences. *Quality and Quantity* 52(1): 313–354.
Teo, T., Lee, C.B., Chai, C.S. & Wong, S.L. 2009. Assessing the intention to use technology among pre-service teachers in Singapore and Malaysia: A multigroup invariance analysis of the Technology Acceptance Model (TAM). *Computers and Education* 53(3): 1000–1009.
Woittiez, L.S., Slingerland, M., Rafik, R. & Giller, K.E. 2018. Nutritional imbalance in smallholder oil palm plantations in Indonesia. *Nutrient Cycling in Agroecosystems* 111(1): 73–86.
WTO. 2006. World Trade Report 2006: Exploring the links between subsidies, trade and the WTO. *World Trade Report*: 7–26.

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