

# A Comparative Analysis of Agricultural Practices, Costs and Yields of Pre- and Post-Malaysian Sustainable Palm Oil (MSPO) Certification for Independent Smallholders in Malaysia

Fauziah Arshad\*; Siti Mashani Ahmad\*; Kamalrudin Mohamed Salleh\*; Khairuman Hashim\*; Mohd Shahrin Rahami\*; Balu Nambiappan\* and Azman Ismail\*

## Article history:

Received date: 16 Dec. 2019

Accepted: 25 Feb. 2020

Available online: 25 March 2020

\* Malaysian Palm Oil Board,  
6 Persiaran Institusi,  
Bandar Baru Bangi,  
43000 Kajang, Selangor, Malaysia.  
E-mail: fauziah@mpob.gov.my

## ABSTRACT

*The study aims to assess the monetary costs borne by independent smallholders associated with Malaysian Sustainable Palm Oil (MSPO) certification and the benefits of MSPO certification for these smallholders, specifically with regard to yield improvement and good agricultural practices. Ensuring a supply of sustainably produced palm oil is essential as palm oil contributes significantly to the social and economic development of Malaysia. The contribution by independent smallholders is very significant because they account for 0.99 million hectares (16.7%) of the total oil palm planted area in the country. Based on the findings of this study, it was observed that MSPO certification resulted in an increase in fresh fruit bunch (FFB) yield from 17.88 t/ha/yr before certification to 21.24 t/ha/yr after MSPO certification. Also, MSPO certification led to an improved adoption of good agricultural practices and increased fertiliser use from 4.18 kg/ha/yr before certification to 6.53 kg/ha/yr after certification. Even though the increase in fertiliser use increased costs for the independent smallholders after MSPO certification, the FFB yield was also improved, resulting in a net additional income of RM489/ha. Nevertheless, these findings were based on a limited number of samples, taking into consideration that the number of independent smallholders who were MSPO-certified at the time of the study (2017/18) was very small, i.e., less than 1% of the total number of independent smallholders in Malaysia.*

**Keywords:** MSPO certification, independent smallholders, FFB yield, good agricultural practices, cost of sustainable palm oil production.

## INTRODUCTION

With increasing global trade, production and consumption patterns pose challenges in satisfying the demand for sustainability management (Geibler, 2013). The emergence of numerous sustainability references and standards for palm oil shows how important it is for this industry to transform itself so that sustainable practices become institutionalised over time (Chandran, 2014). The definition of sustainability is still very broad (Choong and McKay, 2014). The definition by the Brundtland Commission has been widely quoted as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987). Various initiatives for global sustainability standards and certification schemes have emerged over the years to provide solutions to overcome the unsustainable use of resources in the global economy (Conroy, 2007; Prakash and Potoski, 2006).

Sustainability is one of the main issues confronting the Malaysian oil palm industry. The development of this industry is very well regulated, and current practices remain committed towards the three components of sustainability, namely, people, planet and profit (Choo *et al.*, 2013). The oil palm industry plays a major role in poverty eradication by providing employment to an estimated half a million people in the country. The introduction of land development schemes under the Federal Land Development Authority (FELDA) provided thousands of rural landless farmers with land to plant economic crops such as oil palm as a means to earn a living and raise their income levels (Ahmad Tarmizi, 2008). In relation to the planet, there are numerous laws in Malaysia that serve to protect the environment, while

good agricultural practices (GAP) are implemented as part of the sustainable development of the oil palm sector. The implementation of GAP is further strengthened by the introduction of the MPOB Codes of Practice for the palm oil supply chain to help raise oil palm yield and assure quality (Choo *et al.*, 2013). The third component, profit, is clearly reflected in the total revenue generated from the exports of palm oil and its products, which was valued at RM64.84 billion in 2019 (DOSM, 2020).

Malaysia also recognises the need to have a Malaysian standard for the sustainable production of palm oil as an alternative to other currently available palm oil sustainable certification schemes such as the Roundtable on Sustainable Palm Oil (RSPO) and the International Sustainability and Carbon Certification (ISCC). The Malaysian Standard for Sustainable Palm Oil (MSPO) was initiated by MPOB at the request of the stakeholders of the Malaysian oil palm industry. The MSPO standards were then developed in consultation with all stakeholders and relevant agencies of the oil palm industry. The objectives of the MSPO standards are to develop a national standard on sustainability that is applicable to all categories of the oil palm industry, which cover small, medium and large; to develop a standard that complies with Malaysian laws and ratifies international agreements/conventions; and to act as a tool for ensuring that all oil palm premises in Malaysia are sustainably certified.

MSPO addresses sustainability issues and challenges in relation to the multi-stakeholders involved in the industry. The standard prescribes the sustainability requirements for the production of palm oil throughout the supply chain, and is applicable to the three main sectors of the industry, namely, smallholders, plantations, and mills (DSM, 2013). For independent smallholders, the

sustainability requirements are embedded within the following principles (DSM, 2013):

- Principle 1: Management commitment and responsibility
- Principle 2: Transparency
- Principle 3: Compliance with legal requirements
- Principle 4: Social responsibility, health, safety and employment conditions
- Principle 5: Environment, natural resources, biodiversity and ecosystem services
- Principle 6: Best practices
- Principle 7: Development of new planting

The criteria under these seven principles are supported by indicators, which assist the independent smallholders in the actions to be taken to implement the MSPO requirements. A set of guidelines have also been drawn up by the Technical Working Committee with the objective of guaranteeing harmonious and credible auditing of the standard (Ainie and Mohd Shahrin, 2016).

The draft Malaysian Standard for MSPO was approved by the Government on 5 September 2013, and was announced by YAB Deputy Prime Minister of Malaysia on 19 November 2013 during the PIPOC International Palm Oil Congress 2013 (MPIC, 2014). Currently, the adoption of the MSPO standard, the implementation of which was started on 1 January 2015, is on a voluntary basis. The Minister of Plantation Industries and Commodities announced in 2017 that the adoption of the MSPO standard by smallholders will be made mandatory by 1 January 2020 (The Star, 2017).

The Malaysian Standard for MSPO for independent smallholders groups them into Sustainable Palm Oil Clusters (SPOC) and other forms of group management to establish and

maintain a management system which enables each SPOC or group to undertake a systematic approach in improving their operational practices, and thus ensure the sustainable production of palm oil (DSM, 2013).

The MSPO standard has been drawn up with due attention given to balancing strictness and compliance against the achievable goals by smallholders. The MSPO standard, therefore, supports smallholders' sustainability certification, and standardises sustainable practices which are already obvious in the industry. Given that MSPO is a set of Malaysian Standards, it can be used for government-to-government negotiations and trade, thus facilitating market access. Equally important is the fact that the MSPO standard can be used to support the branding of Malaysian palm oil. The challenge now is to work towards widespread national implementation, and for international recognition and acceptance of this set of auditable standards (MPIC, 2014).

The contribution of the independent oil palm smallholders to the Malaysian oil palm industry is huge in view of the fact that they account for 0.99 million hectares (16.7%) of the total oil palm planted area. The independent smallholdings in Peninsular Malaysia, Sabah, and Sarawak cover 545 074, 212 199 and 234 122 ha, respectively. In terms of number, there are a total of 260 352 independent smallholders in Malaysia as at 31 December 2019. Peninsular Malaysia has the highest number of independent smallholders, i.e., 187 368, followed by Sarawak with 40 418 and Sabah with 32 566 (MPOB, 2020). A breakdown of the independent smallholders in Malaysia is shown in *Table 1*.

Despite the sustainability standard and certification schemes

**TABLE 1. NUMBER OF AND PLANTED AREA BELONGING TO INDEPENDENT SMALLHOLDERS ACCORDING TO STATE AS AT 31 DECEMBER 2019**

State	Number of independent smallholders	Total area (ha)
Johor	80 701	224 751
Kedah	6 689	28 735
Kelantan	2 263	7 715
Melaka	3 138	13 082
Negeri Sembilan	6 091	27 264
Pahang	14 047	53 393
Perak	47 610	125 788
Perlis	36	174
Pulau Pinang	1 875	9 286
Selangor	21 201	42 209
Terengganu	3 717	12 677
Sabah	32 566	212 199
Sarawak	40 418	234 122
<b>Peninsular Malaysia</b>	<b>187 368</b>	<b>545 074</b>
<b>Sabah and Sarawak</b>	<b>72 984</b>	<b>446 320</b>
<b>Malaysia</b>	<b>260 352</b>	<b>991 394</b>

Source: MPOB (2020).

currently available for palm oil, implementation of and compliance to the sustainability criteria are still low among the independent smallholders. As of December 2019, only 94 003 ha had been MSPO-certified (MPOCC, 2020).

#### METHODOLOGY

This study used survey data which were collected through face-to-face interviews with independent oil palm smallholders who had already obtained MSPO certification; a structured questionnaire was used. The survey included information on the fresh fruit bunch (FFB) yields before and after MSPO certification and the agricultural management practices of the smallholders, such as fertiliser use and weed management. To test the questionnaire's effectiveness and the reliability of the data to be obtained through the survey, a pilot test was conducted involving 10

independent smallholders in the state of Selangor.

The list of independent smallholders who had already received MSPO certification was obtained from MPOB's database and used to represent the whole independent smallholder subsector in Malaysia. Those in the study were the smallholders from SPOC that were MSPO-certified as at 31 December 2016, the cut-off point. This is because the smallholdings that became MSPO-certified only in 2017 or later are too recent to show any change in FFB yield arising from any changes to the agricultural practices adopted after MSPO certification.

Based on the formula by Krejcie and Morgan (1970), the minimum sample size for the independent smallholders in the five states which had already received MSPO certification is 248 respondents. However, for this study, a total of 257 respondents were used for

the five states. A breakdown of the respondents according to state is shown in *Table 2*.

Sarawak). For the rest, 24.90% and 11.28% of the respondents earned between RM1001 and RM3000 per

Sarawak (*Table 5*). For Peninsular Malaysia and Sabah, almost all the palms were planted on mineral soils. However, for Sarawak, peat soil represented 56.05% of the planted area.

78.92% of the holdings in the studied areas were located on flat terrain, while 11.18% and 9.90% were on undulating land and hilly terrain, respectively (*Table 6*). On a regional basis, the holdings in Peninsular Malaysia were defined primarily by flat areas (93.93%), while those on undulating areas were more significant in Sabah (15.53%) and Sarawak (16.59%), and those on hilly terrain were only prominent in Sarawak (20.85%).

**TABLE 2. SAMPLE SIZE OF INDEPENDENT SMALLHOLDERS (ISH) WHO HAD ALREADY OBTAINED MSPO CERTIFICATION ACCORDING TO STATE**

State	Number of MSPO-certified ISH	Number of respondents
Johor	285	120
Perak	40	16
Pahang	31	13
Sabah	42	17
Sarawak	233	91
<b>Total</b>	<b>631</b>	<b>257</b>

## RESULTS AND DISCUSSION

### Overview of the Respondents

The study found that 57.98% of the respondents were from Peninsular Malaysia, while 6.61% were from Sabah and 35.41% came from Sarawak (*Table 3*). This breakdown is based on SPOC that received MSPO certification during the timeline of the study. The majority of the respondents were Malay (70.82%), followed by Iban (18.67%) and Kadazan (4.67%). In line with the general demographic profile of Malaysian oil palm smallholders, the study found that 76.26% of the respondents were male and most of them were in the age range of 61-80 years (42.80%), followed by those who were 41-60 years old (36.57%), while only 5.84% were 21-40 years old. In terms of level of education, 44.36% of the respondents completed secondary education while 35.41% only completed primary education. The majority of the respondents (60.31%) earned between RM800 and RM1000 per month which is around the minimum wage level at that time (RM1000 for Peninsular Malaysia and RM900 for Sabah and

month and between RM3001 and RM6000 per month, respectively. Very few of them (3.51%) earned more than RM6000 per month. The income came either solely from the smallholdings which had been MSPO-certified, or also from other oil palm smallholdings for which the respondents were responsible in managing, such as through leasing from the landowners.

### Information on Respondents' Holdings

The average age of the oil palm holdings of the respondents which had received MSPO certification in this study was 10.38 years (*Table 4*), which is the prime age for FFB production. The total planted area of all 257 respondents was 1011.98 ha. Dividing the planted area by the number of respondents gave an average holding size of 3.94 hectares per respondent. On average, respondents from Sabah were operating a bigger holding (6.06 ha) than those in the other regions.

74.27% of the oil palm in this study were planted on mineral soils while 25.73% were planted on peat soil, mainly those holdings in

### Agricultural Practices Before and After MSPO Certification

The number of fertiliser applications increased significantly after MSPO certification from 2.30 times per year to 2.92 times per year (*Table 7*). On a regional basis, only respondents from Peninsular Malaysia and Sabah reported a significant increase in the number of fertiliser applications after MSPO certification (42.72% and 51.57%, respectively). There was no significant increase in fertiliser applications by respondents from Sarawak.

The quantity of fertiliser used per palm increased significantly by 56.22%, or by an additional 2.35 kg/palm/yr after MSPO certification (*Table 8*). It was observed that all the regions recorded significant increases in the quantity of fertiliser used, with the highest increase in Sabah at 85.96% and the lowest in Peninsular Malaysia at 46.71%.

The number of weedicide applications also increased significantly after MSPO certification from 2.23 times per year to 2.76 times per year (*Table 9*). On a regional basis, similar to fertiliser applications, only Peninsular

**TABLE 3. GENERAL INFORMATION OF RESPONDENTS**

	Percentage (%)
<b>Gender</b>	
Male	76.26
Female	23.74
<b>Age</b>	
21 – 40	5.84
41 – 60	36.57
61 – 80	42.80
> 80	14.79
<b>Race</b>	
Malay	70.82
Chinese	2.72
Indian	1.17
Others – Kadazan	4.67
Others – Iban	18.67
Others – Dusun	0.78
Others – Sungai	1.17
<b>State/ Location</b>	
Johor	46.67
Perak	6.23
Pahang	5.06
<b>Peninsular Malaysia</b>	57.98
Sabah	6.61
Sarawak	35.41
<b>Education</b>	
Did not receive any education	16.73
Primary education	35.41
Secondary education	44.36
Tertiary education	3.50
<b>Monthly income (RM)</b>	
800 – 1 000	60.31
1 001 – 3 000	24.90
3001 – 6 000	11.28
6 001 – 9 000	1.95
> 9 000	1.56

Malaysia and Sabah recorded a significant increase in the number of weedicide applications after MSPO certification (40.00% and 35.76%, respectively). Again, there was no significant increase in weedicide applications in Sarawak.

Overall, the quantity of weedicide used increased significantly by 26.87% or 1.87 litres/ha/yr. On a regional basis, the increase in weedicide use was only significant in Peninsular Malaysia, *i.e.*, by 39.97% or an extra 3.21 litres/ha/yr, while Sabah and Sarawak recorded no significant changes in the quantity of weedicide used (*Table 10*).

#### **Costs Before and After MSPO Certification**

The study showed that the cost of fertilisers used increased significantly by 102.10% or RM946.88/ha after MSPO certification. The highest increase in fertiliser cost was recorded in Sarawak (205.85%) and the lowest in Peninsular Malaysia (55.75%) (*Table 11*). The increase in cost after MSPO certification was due to the increased amount of fertiliser used coupled with the higher price of fertiliser arising from the use of a higher quality fertiliser to fulfil the MSPO requirements.

The study also showed a significant increase in the cost of weedicide used by RM53.02/ha after MSPO certification (*Table 12*). Significant increases also applied to all the regions, with Peninsular Malaysia recording the highest increase of RM73.79/ha or by 411.09%.

#### **FFB Yields Before and After MSPO Certification**

FFB yields increased from 17.88 t/ha/yr before MSPO certification to 21.24 t/ha/yr after certification, which signified an increase by 18.79% (*Table 13*). The national average FFB yield for independent

**TABLE 4. AVERAGE AGE OF OIL PALM TREE AND PLANTED AREA ACCORDING TO REGION**

Region	Average age of oil palm (yr)	Planted area (ha)	Average holding size (ha/ respondent)
Peninsular Malaysia	9.83	461.58	3.10
Sabah	13.76	103.00	6.06
Sarawak	10.65	447.40	4.92
<b>Malaysia</b>	<b>10.38</b>	<b>1 011.98</b>	<b>3.94</b>

**TABLE 5. TYPE OF SOIL ACCORDING TO REGION**

Region	Peat soil		Mineral soils	
	ha	(%)	ha	(%)
Peninsular Malaysia	10.00	2.17	451.60	97.83
Sabah	0	0	103.00	100
Sarawak	250.00	56.05	196.00	43.95
<b>Malaysia</b>	<b>260.00</b>	<b>25.73</b>	<b>750.60</b>	<b>74.27</b>

**TABLE 6. TOPOGRAPHY OF HOLDINGS ACCORDING TO REGION**

Region	Flat		Undulating		Hilly	
	ha	%	ha	%	ha	%
Peninsular Malaysia	433.6	93.93	23	4.98	5	1.08
Sabah	85	82.52	16	15.53	2	1.94
Sarawak	279	62.56	74	16.59	93	20.85
<b>Malaysia</b>	<b>797.6</b>	<b>78.92</b>	<b>113</b>	<b>11.18</b>	<b>100</b>	<b>9.90</b>

**TABLE 7. AVERAGE NUMBER OF FERTILISER APPLICATIONS PER YEAR BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Before MSPO (number of times)	After MSPO (number of times)	Difference	Paired t-test
Peninsular Malaysia	2.13	3.04	0.91 (42.72%)	-27.745***
Sabah	1.59	2.41	0.82 (51.57%)	-4.667***
Sarawak	2.76	2.81	0.05 (1.81%)	-0.565
<b>Malaysia</b>	<b>2.30</b>	<b>2.92</b>	<b>0.62 (26.96%)</b>	<b>-11.544***</b>

Note: \*\*\*Significance level at 1%.

**TABLE 8. AVERAGE QUANTITY OF FERTILISER USED PER PALM PER YEAR BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Before MSPO (kg/palm/ha)	After MSPO (kg/palm/ha)	Difference	Paired t-test
Peninsular Malaysia	4.26	6.25	1.99 (46.71%)	-27.588***
Sabah	4.06	7.55	3.49 (85.96%)	-4.066***
Sarawak	4.05	6.81	2.76 (68.14%)	-10.919***
<b>Malaysia</b>	<b>4.18</b>	<b>6.53</b>	<b>2.35 (56.22%)</b>	<b>-20.230***</b>

Note: \*\*\*Significance level at 1%.

**TABLE 9. AVERAGE NUMBER OF WEEDICIDE APPLICATIONS PER YEAR BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Before MSPO (number of times)	After MSPO (number of times)	Difference	Paired t-test
Peninsular Malaysia	2.10	2.94	0.84 (40.00%)	-18.342***
Sabah	1.65	2.24	0.59 (35.76%)	-3.050***
Sarawak	2.54	2.57	0.03 (1.18%)	-0.427
<b>Malaysia</b>	<b>2.23</b>	<b>2.76</b>	<b>0.53 (23.77%)</b>	<b>-11.562***</b>

Note: \*\*\*Significance level at 1%.

**TABLE 10. AVERAGE QUANTITY OF WEEDICIDE USED PER HECTARE PER YEAR BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Before MSPO (litres/ha)	After MSPO (litres/ha)	Difference	Paired t-test
Peninsular Malaysia	8.03	11.24	3.21 (39.97%)	-20.452***
Sabah	5.71	6.47	0.76 (13.31%)	-1.496
Sarawak	5.42	5.32	-0.10 (-1.84%)	0.646
<b>Malaysia</b>	<b>6.96</b>	<b>8.83</b>	<b>1.87 (26.87%)</b>	<b>-12.417***</b>

Note: \*\*\*Significance level at 1%.

**TABLE 11. AVERAGE COST OF FERTILISER BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION (RM/ha)**

Region	Before MSPO (RM/ha)	After MSPO (RM/ha)	Difference	Paired t-test
Peninsular Malaysia	1 016.98	1 583.96	566.98 (55.75%)	-17.403***
Sabah	1 164.58	2 396.17	1231.59 (105.75%)	-5.032***
Sarawak	736.32	2 252.02	1515.7 (205.85%)	-10.009***
<b>Malaysia</b>	<b>927.36</b>	<b>1 874.24</b>	<b>946.88 (102.10%)</b>	<b>-14.518***</b>

Note: \*\*\* Significance level at 1%.

**TABLE 12. AVERAGE COST OF WEEDICIDE BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Before MSPO (RM/ha)	After MSPO (RM/ha)	Difference	Paired t-test
Peninsular Malaysia	17.95	91.74	73.79 (411.09%)	-44.948***
Sabah	13.75	48.13	34.38 (250.04%)	-6.470***
Sarawak	14.42	36.83	22.41 (155.41%)	-10.655***
<b>Malaysia</b>	<b>16.40</b>	<b>69.42</b>	<b>53.02 (322.78%)</b>	<b>-26.718***</b>

Note: \*\*\* Significance level at 1%.

**TABLE 13. AVERAGE FFB YIELD BEFORE AND AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Pre-MSPO (2015/16)	Post-MSPO (2017/18)	Difference	Paired t-test
	(t/ha/yr)	(t/ha/yr)		
Peninsular Malaysia	18.36	20.64	2.28 (12.42%)	-6.709***
Sabah	18.24	21.12	2.88 (15.79%)	-1.959*
Sarawak	17.28	22.44	5.16 (29.86%)	-6.422***
<b>Malaysia</b>	<b>17.88</b>	<b>21.24</b>	<b>3.36 (18.79%)</b>	<b>-9.070***</b>

Note: \*\*\* Significance level at 1%, \* Significance level at 10%.

oil palm smallholders in 2018 was 16.90 t/ha/yr (Khairuman, 2019). Thus, the FFB yield after MSPO certification was 25.68% higher than the national average for independent smallholders. All regions recorded a notable increase in FFB yields after MSPO certification, with Sarawak recording the highest increase at 29.86% or by an additional 5.16 t/ha/yr.

#### Net Additional Income after MSPO Certification

The study shows that although the increase in fertiliser use significantly increased the cost after MSPO certification for the independent smallholders surveyed, the substantial improvement in FFB yield after certification resulted in a net additional income of RM488.58/ha (Table 14). On a

regional basis, both Sarawak and Peninsular Malaysia recorded notable increases in net income after MSPO certification. However, Sabah showed a decrease in net income by RM27.57/ha due to the sizeable increase in fertiliser cost.

#### CONCLUSION

Based on these findings, it is apparent that MSPO certification had increased FFB yield from 17.88 t/ha/yr before certification to 21.24 t/ha/yr after certification. From this study, it was observed that the increase in FFB yield was most notable in Sarawak. MSPO certification improved the agricultural practices of the independent smallholders by way of optimising their use of fertiliser and weedicide after certification. Fertiliser use increased by 56.22%, from 4.18 kg/ha/yr

before certification to 6.53 kg/ha/yr after, while weedicide use was increased by 26.87%, from 6.96 litre/ha/yr before certification to 8.83 litre/ha/yr after. Even though the increase in fertiliser applications pushed up cost for the independent smallholders after MSPO certification, the resulting improved FFB yield led to a net additional income of RM489/ha. This was based on the average FFB price of RM443/t in 2018.

#### ACKNOWLEDGEMENT

The authors would like to acknowledge the officers from the Extension Services Unit of the Smallholders Development Research Division, MPOB, who provided assistance in conducting the interviews with the sampled independent smallholders. The authors would also like to thank the

**TABLE 14. NET ADDITIONAL INCOME AFTER MSPO CERTIFICATION ACCORDING TO REGION**

Region	Cost increment (RM/ha)		FFB yield increment (t/ha) <sup>c</sup>	FFB price in 2018 (RM/t) <sup>*d</sup>	Additional income (RM/ha) <sup>e</sup>
	Fertiliser <sup>a</sup>	Weedicide <sup>b</sup>			
Peninsular Malaysia	566.98	73.79	2.28	468	426.27
Sabah	1 231.59	34.38	2.88	430	-27.57
Sarawak	1 515.7	22.41	5.16	411	582.65
<b>Malaysia</b>	<b>946.88</b>	<b>53.02</b>	<b>3.36</b>	<b>443</b>	<b>488.58</b>

Note: Additional income: e = (c x d) – a – b.  
Source: \* = MPOB (2019).

officers and supporting staffs from the Techno-Economics Research Unit, especially to Mohd Noor Helmy Abd Kadir and Syuhadatul Fatimah Omar, for their assistance and commitment throughout the whole process of this study.

## REFERENCES

- Ahmad Tarmizi, A (2008). Felda - A success story. *Global Oils and Fats*, 5(1): 6-11.
- Ainie, K and Mohd Shahrin, R (2016). Malaysian Standard on Sustainable Palm Oil. In: *Selected Readings, 36<sup>th</sup> Palm Oil Familiarisation Programme*, Kuala Lumpur, Malaysia.
- Chandran, M R (2014). A perspective on the multiple benchmark for sustainable palm oil. *The Planter*, 90 (1061): 607-610.
- Choo, Y M; Tan, Y A and Nik Aznizan, N I (2013). Sustainability of oil palm. In: *Selected Readings, 33<sup>rd</sup> Palm Oil Familiarisation Programme*, Kuala Lumpur, Malaysia.
- Choong, C G and McKay, A (2014). Sustainability in the Malaysian palm oil industry. *J. Cleaner Production*, 85: 258-264.
- Conroy, M E (2007). *Branded! How the Certification Revolution Is Transforming Global Corporations*. New Society Publishers, Gabriola Islands, BC, Canada.
- DOSM (2020). *Export Value of Palm Products, 2019*. Department of Statistics, Malaysia.
- DSM (2013). *Malaysian Standard MS 2530-2:2013. Malaysian Sustainable Palm Oil (MSPO) Part 2: General Principles for Independent Smallholders*. Department of Standards, Malaysia.
- Geibler, J V (2013). Market-based governance for sustainability in value chain: Conditions for successful standard setting in the palm oil sector. *J. Cleaner Production*, 56: 39-53.
- Khairuman, H (2019). Average FFB production for independent smallholders in 2018. Personal communication.
- Krejcie, R V and Morgan, D W (1970). Determining sample size for research activities. *Educational and Psychological Measurements*, #30: 607-610.
- MPIC (2014). *Implementation of the Malaysian Sustainable Palm Oil (MSPO) Certification Scheme*. Media statement by the Ministry of Plantation Industries and Commodities, Malaysia. Retrieved on 22 February 2017 from <http://www.kppk.gov.my/mpic/index.php/en/arkib/arkib-siaran-media/kenyataan-akhbar-tahun-2014/418>
- MPOB (2019). *Malaysian Oil Palm Statistics 2018*. MPOB, Bangi.
- MPOB (2020). *Maklumat Berkaitan Keluasan Tanaman Sawit dan Hasil BTS*. MPOB, Bangi.
- MPOCC (2020). *Malaysian Palm Oil Certification Council*, Kuala Lumpur.
- Prakash, A and Potoski, M (2006). *The Voluntary Environmentalists: Green Clubs, ISO 14001 and Voluntary Regulations*. Cambridge University Press.
- The Star (2017). *MSPO Certification Mandatory by 2019*. The Star Online, 25 February 2017, accessed on 21 March 2017 from <http://www.thestar.com.my/news/nation/2017/02/25/mspo-certification-mandatory-by-2019-govt-aims-for-sustainable-oil-palm-industry/>
- World Commission on Environment and Development (1987). *Report of the World Commission on Environment and Development: Our Common Future*, accessed on 17 December 2018 from [http://mom.gov.af/Content/files/Bruntland\\_Report.pdf](http://mom.gov.af/Content/files/Bruntland_Report.pdf)