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Analysis of Smallholders' Progress in Implementing Sustainable Management in North Sumatra, Indonesia

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Abstract. The significant increase in oil palm areas has resulted in more concerns to the environmental issues - as majority of farming activities were not conducted in sustainable ways. To address the environmental issues, the Roundtable Sustainable Palm Oil (RSPO) organization has formulated principles and criterias (PnC) for sustainable practices of the oil palm plantation as a guideline, whereby it has to be adhered by all parties involved, including the smallholders. The study is therefore conducted to analyze the sustainable management implementation among smallholders in North Sumatra. In total, 320 and 137 schemed and independent smallholders from four oil palm plantations centers in North Sumatra were interviewed in 2012 and 2018 to see their progress. The levels of implementation for each group were determined based on their scores for each of the criteria, and were compared with the independent sample t-test. The influencing factors for implementation levels were estimated by using multinomial logit model. The results showed that the level of implementation for both schemed and independent smallholders were still low in both 2012 and 2018. Education, experience and participation were identified as factors that significantly influenced their sustainable management implementation levels. Therefore, it is suggested that trainings should be emphasized to improve the sustainable management implemenatation among oil palm smallholders.

Keywords: influencing factors, level of implementation, RSPO, smallholders

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1. Introduction

1.1. Background

The oil palm areas have been expanded steadily over the past decades, especially in Indonesia. Generally, this enormous increase in palm oil areas were driven by production as well as profit factors, which eventually might led to the environmental issues if farming activities were not conducted in sustainable ways. This consideration warrants for a long-term and more environmental friendly solutions for palm oil business management. This consideration led the Roundtable Sustainability of Palm Oil (RSPO) launch in 2004, which purpose to define consensual principles and criteria (PnCs) for a sustainable certification system for palm oil.

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The PnCs were introduced in 2007, and further developed for schemed and independent smallholders in 2009 and 2010, respectively. There are 8 principles with 39 and 36 criteria for the schemed and independent smallholders. Each criteria consists of sub-criteria, giving 80 and 64 total sub-criteria for the schemed and independent smallholders' respectively. The difference between the schemed and independent smallholders is on criteria 5.4, 5.6 and 6.6, which are related to the livestock utilization, pollution and emission matters, and union for employees and contractors. The main reason for developing specific PnCs for smallholders stems from the specific condition of the smallholders. In Indonesia, besides the companies, palm oil is also produced by schemed and independent smallholders. Schemed smallholders cooperate with large companies, either state or private, while the independent do not. Schemed smallholders' area grow rapidly mainly due to their dependencies with the CPO mills. Unlike other plantation commodities that can be processed in a simple way (for example coffee and clove that just need to be dried), fresh fruit bunches need to be processed in the CPO mill at less than 24 hours after harvest. Therefore, growers need to have good relationships with the mills. From 4 provinces in Sumatra, [1] show four types of partnerships. Of these, none takes the plasma form anymore. Different types of partnerships have different accompaniment and activities. The involvement of big companies varies from those which fully cover the whole agribusiness activities to those that only act as customer for the smallholders' FFB. The partnership improves the implementations of the PnC of RSPO. The more intensive the accompaniment the companies, the better the implementation of the RSPO PnCs among the smallholders will be.

In 2013 the PnCs were endorsed in the RSPO certificate, which is updated every 5 years. The agreement has been responded by stakeholders; in 2011, 441 stakeholders were registered as RSPO members, while in 2018 the members significantly increased to 4080 [2] [3]. Initially, the certificate is only given to large manufacturers. However, with the increase of smallholdings' area that continue to suffer from low yield, the RSPO has begun shifting focus towards smallholders' certification. Higher productivity would address the lack of available land and consideration on possible environmental damage.

Accomodating the special condition of smallholders, RSPO task force developed specific certification for smallholders. However, smallholders' certifications are quite challenging. First, to be certified, smallholders need to fulfill the smallholders' PnCs. In fact, many smallholders' existing conditons are still far from the RSPO PnC. For example, the RSPO PnC are dominated by assessment of records and documents. This means that smallholders or their group need to have good recording for their planting activities. However, previous studies in North Sumatra, South Sumatra, Riau and Jambi [1] [4] [5] [6] showed that more than 80% of the smallholders (n=1,740) do not keep any records. Therefore, documentation appears as one of the main challenges in oil palm certification [7]. Second, the ability of certified smallholders –in

managing environmental and social impact, including labour rights, forest and peatland protection is dubious [8].

However, more data is needed to support such an argument. Third, the RSPO certification is costly but is not always compensated by premium prices [9]. [10] suggest that the success of the certification program is influenced by the consumer's willingness to pay for the premium price. However, India and China, the two largest consumers, do not require and are not willing to pay a higher price for certified CPO. This impacts the premium pricing for certified CPO, in which the price difference with non-certified CPO becomes insignificant. Voluntary certification will be valueable given that there are sufficient numbers of buyers that are concerned about social and the environmental issues [11]. In other cases, the margin of the premium price is not evenly distributed along the value chain [12]. Certified products are generally expected to gain economic benefits, both from the increased selling price and also demand.

In fact, since its introduction in 2012, the certified sustainable palm oil (CSPO) uptake is only fluctuated from a range of 45% to 52% [13]. The remaining were sold as non-certified without additional premium price. Since smallholders' share in producing countries significantly increased, they also become part of important suppliers for CPO production and export. Being part of the palm oil supply chain, such a condition would influence smallholders' selling price and their revenue. In fact, smallholders' certification could be really costly and requires a lot effort if the gap between smallholders' condition and the required performance stated in the RSPO PnCs is relatively big. With such conditions, an empirical study is needed to analyse the progress of certification among smallholders. The results of the study would be useful to be used as inputs for policy makers to determine the direction of the Indonesia's palm oil industry development.

1.2. Objective

The objective of this study are (1) to analyse the RSPO PnC implementation by smallholders depending on the type of management (schemed and independent) and looking at the evolution between 2012 and 2018, and (2) to analyse the influencing factors of the level of implementation.

2. Research Method

2.1. Research Location

The research location is purposively set in the North Sumatra Province, which has 1,342,523 ha of oil palm plantation or 11.98 percent of the total oil palm plantation area in Indonesia [14]. The North Sumatra Province is considered as the first location for the development of oil palm plantations in Indonesia, however only a few of smallholders managed to obtain the RSPO certificate. Among districs in North Sumatra, Asahan, Labuhan Batu, Labuhan Batu Utara and

Labuhan Batu Selatan, those that have the largest oil palm plantation area and number of oil palm smallholders were selected [15].

2.2. Sample

The study used cluster sampling method. Samples were selected based on the type of management, namely the schemed and independent smallholders. For the 2012 case, of 62,633 smallholders, 320 samples were selected from the four districts. This includes 225 and 78 independent and schemed smallholders, respectively. While in 2018 case, 137 samples were selected among 89,526 oil palm smallholder population. This includes 95 and 39 independent and schemed smallholders, respectively.

2.3. Analysis Method

The implementation level and the evolution of implementation of the RSPO PnC of the schemed and independent smallholders are analysed descriptively by comparing their scores. The PnCs used to measure the schemed and independent smallholders' implementation are the 2009 and 2010 smallholders' version for Indonesian National Interpretation. For comparison purpose, only 36 criteria that are covered in both schemed and independent smallholders' PnCs are included in the analyses. The implementation percentage of implementation of each criteria in each sample iscalculated by $\boldsymbol{a_{ij}} = \frac{\boldsymbol{n}}{\boldsymbol{m}}$, where i = 1…36 (number of criteria) and j = 1, 2 (1= number of sample in schemed smallholders and 2 = number of sample in independent smallholders). $\boldsymbol{n_i}$ = total score for criteria i and $\boldsymbol{m_i}$ = number of sub-criteria in criteria i. Each criterion does not necessarily have the same number of sub-criteria. By using $\boldsymbol{a_{ij}}$ for all samples, the average implementation percentage value of each criterion is determined with $\boldsymbol{c_i} = \frac{\sum \boldsymbol{a_{ij}}}{\boldsymbol{n}}$. $\boldsymbol{c_i}$ is then used to calculate the score of each criteria in each district. Then the score is divided into 5 levels, with a range of (a) 0 – 19 percent. (b) 20 – 39 percent. (c) 40 – 59 percent. (d) 60 – 79 percent and (e) 80 – 100 percent for score 1 to 5, showing the very low, low, moderate, high and very high level of implementation respectively. These steps are separately conducted for schemed and independent smallholders in 2012 and 2018, thus giving separate average percentage values and scores for each group in each year.

To test the difference between the 2012 and 2018 average implementation score of the schemed and independent smallholders, the independent sample t-test is used. If equal variances applied the t-test will be $= \frac{\bar{x}_{1i} - \bar{x}_{2i}}{s_p \sqrt{\frac{1}{n_{1i}} + \frac{1}{n_{2i}}}}$, otherwise, the t-test will be $\boldsymbol{t} = \frac{\bar{x}_{1i} - \bar{x}_{2i}}{\sqrt{\frac{s_{1i}^2}{n_{1i}} + \frac{s_{2i}^2}{n_{2i}}}}$ in which $\bar{x}_1$: Mean of the schemed or independent average score in 2012, $\bar{x}_2$: Mean of the schemed or independent average score in 2018, n_1 : Sample size of data 2012, n_2 : Sample size of data 2018, s_1 : Standard deviation of data 2012, s_2 : Standard deviation of data 2018, s_p : Pooled standard deviation, i (i=1 : overall smallholders' score in 2012 and 2018, i=2 schemed smallholders'

score in 2012 and schemed 2018, i=3 : independent smallhoders' score in 2012 and independent 2018). The variance equality is tested with Lavene's test.

To determine the influencing factors for PnC implementation, the Multinomial Logit Model is used.

$$ln\frac{P(Y_i=q)}{P(Y_i=1)} = \alpha_q + \sum_{k=1}^{7}\beta_{qk}X_{ik} \quad (1)$$

In which q = 2, 3 and k = 1 – 7, in which X_1 = age, X_2 = formal education, X_3 = experience, X_4 = dependents, X_5 = land size, X_6 = income, X_7 = participation.

3. Results and Discussion

In RSPO certification all of the criteria can be categorized into four namely documents, records, knowledge and implementation. Documents keep the planning what needs to be done, while records document action done. Documents are needed as guidance for appropriately implementing the sustainable management, while records illustrate that the oil palm plantation management has been conducting in accordance with the sustainable PnC. Knowledge is needed to ensure that growers understand the PnC. The details can be seen as follows.

Table 1 shows the composition of document and records, knowledge and implementation components for both schemed and independent smallholders' RSPO PnC. In general, the category is dominated by documents and records. However, most smallholders do not have any documents and records, which might partly explain the slow growth in smallholders' certification [3]. Therefore, helping smallholders to prepare both groups and individual documents and records is of utmost importance for company partners. Another priority is to improve the smallholders' institutional capacity, in that there are at least 18 sub criteria (48.65% of the total sub criteria) that are related to the smallholders' institutional aspects. It is important for smallholders to be in a group because the certication itself is given to groups rather than individuals.

However, the support and involvement of partner companies vary among different types of partnerships. In the 2012 case, the partnership started from the beginning of the smallholdings' establishment through the nucleus-plasma programs. Therefore, all of the company's standard procedure were followed by the smallholders. This includes the usage of certified seeds and recommended fertilizers, provided by the partner companies. Smalholders need to sell their FFB to the mills of partner companies until all of their loans have been paid off before being able to sell their FFB to other traders. However, most of them continue selling to the partner companies.

Table 1. Categories in the RSPO Sub Criteria

No	Category	Type of Management			
		Schemed		Independent	
		Sub criteria	%	Sub criteria	%
1	Documents	1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.8, 1.1.9, 1.1.11, 1.2.1, 1.2.2, 2.1, 2.2, 3.1, 4.1.1, 4.2.1, 4.6.5, 4.7.1, 5.1.1, 5.6.2, 6.1.1, 6.5.2, 6.9, 7.1.2, 7.6.2, 8.1	32	1.1.1, 1.2.1, 1.2.2, 2.1.2, 3.1, 4.1.1, 6.3, 6.9, 6.10.1, 8.1.1, 8.1.2, 8.1.3, 8.1.4, 8.1.5, 8.1.6	23.44
2	Records	1.1.7, 1.1.10, 2.3, 4.1.2, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.5, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.7.2, 4.8.2, 6.2.1, 6.2.2, 6.4, 6.5.1, 6.6, 6.10.2, 6.10.3, 7.2.2	34	2.1.1, 2.3, 4.1.2, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.4.1 4.4.2, 4.5, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.7.2, 5.1.1, 6.2, 6.4, 6.5.1, 6.10.2, 6.10.3, 7.5, 7.6.2	37.5
3	Knowledge	4.8.1, 5.1.2, 5.2, 5.3.2, 5.5.3, 6.1.2, 7.7	9	5.2, 5.3.2, 5.5.3, 6.1, 7.7	7.81
4	Implementation	1.1.1, 4.6.6, 5.1.3, 5.3.1, 5.4, 5.5.1, 5.5.2, 5.6.1, 6.3, 6.7, 6.8, 6.10.1, 6.11, 7.1.1, 7.2.1, 7.3, 7.4, 7.5.1, 7.5.2, 7.6.1	27	2.2, 3.2, 4.6.1, 4.7.1, 4.8, 5.1.2, 5.1.3,5.5.1, 5.5.2, 6.5.2, 6.7, 6.8, 6.11, 7.1.1, 7.1.2, 7.2, 7.3, 7.4, 7.6.1	31.25

This is not the case in 2018, where partner companies assisted smallholders with oil palm crop that has reached productive age, but did not supervise them during the planting. More than 70% of the schemed smallholdings still use uncertified seeds and did not apply the recommended fertilizers. During the 2018 survey, partner companies focused more on the smallholders' awareness and implementation on the harvest criteria, which has been considered the reddish colour by most smallholders since 2012. 80.50% of the independent smallholders in 2012 harvest based on the reddish colour, while 69.23% and 84.69% of the schemed and independent smalllholders in 2018 use the same criteria. However, determining the FFB colour for the high trees is not always easy. Therefore, partner companies train smallholders to use loose fruit (berondolan) as a better harvest criteria.

Table 1 also shows that schemed smallholders have a slightly higher percentage in the knowledge aspect, while independents have a higher implementation percentage. The certification to all intents and purposes was designed to implement sustainable management in social, economy and environmental aspects. However, knowledge is needed to implement the sustainable management. Documents and records are also needed to prove that the sustainable management has been implemented. In fact, composition of all of these aspects is unlikely to be proportional and likely to reduce the effectiveness of the RSPO PnC to improve the sustainable management. This is reflected in Table 2, which shows percentage and score of smallholders' implementation for each are still low. Only criteria 2.2, 6.7 and 6.8 reach a score of 5, which relate to the land control, usage of labour child and labour treatment. Most of the criteria in

principle 4 that focuses on Good Agricultural Practice (GAP) are still low, explaining the low productivity of smallholders. Scores of some schemed smallholders in 2018 are lower than those of the 2012, such as 3.1, 4.5, 4.6, 6.2, 6.3, 6.10 and 8.1. These relate to the long term plan, integrated pest management, agrochemical usage, records, procedures, growers and mills' deal and action plans, which indicates the different levels of partnerships in 2012 and 2018. In general, smallholders still focus on short run economic consideration rather than the long run environmental considerations. Some smallholders are only willing to pay additional costs if they also will gain an increase of income, production and financial capability [16] [17].

The partnership in 2018 schemed smallholders is relatively new, thus showing a lower score than those of the 2012. In contrast, some scores improved in 2018, either for the schemed or the independent, which are criteria 2.3, 4.7, 6.1, 6.4, and 6.9 that relate to land usage rights, health and safety plan, social impact, payment and prohibition against women violence. These mostly reflect the general improvement in smallholders' knowledge and awareneness in some issues in oil plam plantations. In general, from 2012 to 2018, the independent smallholder score increased from 1.84 to 2.11, while the schemed decreased from 2.50 to 2.37. Details of the criterias can be seen in Table 2

Table 2. Percentage and Score of Schemed and Independent RSPO PnC Implementation in 2012 and 2018

No	Criteria	Independent		Schemed		Independent		Schemed	
		%	Score	%	Score	%	Score	%	Score
1.1	Available adequate information for stakeholders about environmental, social and legal issues that are related to the RSPO P&C	2.67	1	57.69	3	0.00	1	30,77	2
1.2	Documents are publicly available	50.97	3	41.03	3	46.47	3	50,00	3
2.1	Compliance with all imposed laws and regulations	4.90	1	23.08	2	0.00	1	17,95	1
2.2	Evidence for land controlling and using	76.00	4	94.87	5	85,71	5	94,87	5
2.3	Land usage does not reduce the legal rights or customary rights	6.22	1	37.18	2	33,67	2	74,36	4
3.1	Implemented management plan that aims to achieve economic and financial security in the long term	7.56	2	44.87	3	3,06	1	2,56	1
4.1	Operating procedures are appropriately documented and consistently implemented and monitored	3.33	1	13.46	1	10,71	1	16,67	1

Table 2. Continued

No	Criteria	Independent		Schemed		Independent		Schemed	
		%	Score	%	Score	%	Score	%	Score
4.2	Maintaining soil fertility practice or where possible improve soil fertility	5.56	1	30.34	2	8,16	1	5,13	1
4.3	Minimizing and controlling erosion and degradation of soils practice	9.64	1	39.74	2	15,99	1	55,56	3
4.4	Maintaining the quality and availability of surface and ground water practice	11.78	1	23.50	2	21,94	1	16,67	1
4.5	Invasive pests, diseases, weeds and introduced species are effectively controlled by applying adequate Integrated Pest Management (IPM)	16.89	1	43.59	3	17,35	1	0,00	1
4.6	Agrochemicals are used in a manner that does not endanger the health and environmental	23.20	2	30.98	2	0,33	1	0,37	1
4.7	Health and safety plan is documented. disseminated and effectively implemented	2.22	1	0.64	1	21,94	2	21,49	2
4.8	All staff, workers, smallholders and contractors are appropriately trained	1.78	1	25.64	2	0,00	1	2,56	1
5.1	Plantation and mill management aspects are implemented and monitored to demonstrate a continuous improvement	0.00	1	1.71	1	6,80	1	8,55	1
5.2	Identification and conservation of endangered species, threatened, or endangered species and high conservation value habitats	64.44	1	44.87	3	6,12	1	16,67	1
5.3	Waste is reduced. Recycled, re-used, and disposed of in ways that environmentally and socially responsible	32.22	2	17.95	1	18,88	1	33,33	2
5.5	Fire usage for waste destruction and land preparation	48.00	3	56.41	3	50,00	3	39,32	2
6.1	Understand the social impacts of plantation	16.96	1	5.77	1	42,86	3	43,59	3
6.2	Smallholders' institution have records of communication and consultation with the community	24.89	2	64.74	4	21,43	2	43,59	3

Table 2. Continued

No	Criteria	Independent		Schemed		Independent		Schemed		
		%	Score	%	Score			%	Score	
6.3	Farmer institutions provide procedures for handling complaints	3.11	1	74.36	4	0,00	1	0	1	
6.4	Proof of compensation payment for the transfer of legal and traditional rights	15.56	1	37.18	2	43,88	3	43,59	3	
6.5	Wages and working conditions for employees and employees meet minimum standards	22.22	2	48.08	3	15,31	1	35,9	2	
6.7	Involving children as labor on the plantation	100	5	100	5	100	5	100	5	
6.8	Equally treat workers. working groups and labor migrants	85.78	5	85.90	5	51,02	3	64,1	4	
6.9	Prohibition against women violence document is available	3.13	1	0.00	1	0,00	1	51,28	3	
6.10	Growers and mills deal fairly and transparently with smallholders and other local businesses	33.33	2	61.11	4	24,49	2	34,19	2	
6.11	Contribution to local development	71.56	4	82.05	5	67.35	4	79,49	4	
7.1	Providing a comprehensive and participative social and environmental impact analysis before establishing a new plantation or expanding the an old one	0.00	1	5.77	1	0,00	1	0	1	
7.2	Recommendations on the plantation establishment on the land from the authorities	4.00	1	4.49	1	0,00	1	69,23	4	
7.3	Plantation does not established from the conversion of primary forests	78.67	4	7.69	1	98,98	5	66,67	4	
7.4	Plantation land is not expanded to steep land	88.89	5	98.72	5	96,94	5	71,79	4	
7.5	Evidence of no public rejection for planting in local communities	100	5	0.00	1	95,92	5	5,13	1	
7.6	Local people are compensated for any land acquisition and with voluntary consents	2.44	1	50.00	3	21,94	2	21,79	2	
7.7	Zero burning land preparation techniques	24.00	2	21.79	2	36,73	2	69,23	4	
8.1	Monitoring and reviewing activities to develop and implement action plans	37	2	62.82	4	0,51	1	24,91	2	
	Average	**26.34**	**1.84**	**38.56**	**2.50**	**29.0776**	**2,11**	**2.06**	**36.43**	**2,37** **2.31**

Table 2. shows that the overall averages for schemed and independent smallholders in 2012 and 2018 range from 26.34% to 37.91%, meaning that the smallholders could only fulfill less than 60% of all of the required sub criterias. However, they have 7 sub criterias with a score of 3, 4 and 5, including land titles, the use of fire and steep land, contribution to local development, and not converting plantation area from primary forests. In general, smallholders' land comes from rubber plantations, and use of fire for land clearing is not practiced. They also do not have child labor. Some smallholders learn and understand about these RSPO PnC through their working experience at a certified company, while others observed from their adjacent certified plantations. As a part of the community, in general smallholders have good relationships with others. With relatively high incomes, they always provide financial assistance for the development of public facilities. They also hire labors from surrounding communities and migrants. However, over the past 6 years, smallholders' implementation in North Sumatra has not improved. The condition for documents is even worse for the independents, from score 2 in 2012 to score 1 in 2018. This indicates the slow improvement in smallholders' performance, which is not in line with the significant increase in their land area and production share. The score of each of the RSPO PnC component can be seen in Table 3.

Table 3. Smallholders' RSPO PnC Performance Based on Categories

Description	2012		2018	
	Scheme	Independent	Scheme	Independent
Documents	2	2	2	1
Record	2	2	2	2
Knowledge	3	2	3	2
Implementation	2	3	2	3

The lack of smallholders' record and documentation for proofing payments, operating procedures or work plan can partly be explained by their lack of knowledge and skill. Some smallholders believe that records and documents exist only for estimating current benefits, not for constructing plans. Some do not have the ability to produce the short and long-term economic planning as required in sub criteria 3.1. In addition, in criteria 4.3-4.6 smallholders also need to record environmentally friendly practices, while in fact some of them do not fully understand about such practices. The lack of records and documents might also stem from the practical considerations. For example, the requirement for recording negotiation process with the community are mentioned in sub-criteria 6.3, 6.4 and 7.6, while in fact, to do so might sometimes interfere with the process because it seems to indicate mistrust.

In general schemed smallholders have similar weaknesses to the independents, but the former seem to have better management and documentation. For example, while independent smallholders have no documents save for the land document, schemed smallholders have documents of wage payment, records of communication and consultation meetings in KUD and a management plan procedure for handling complaints. With the help of KUD, schemed smallholders also have better documentation in laws and regulations, thus having a better score

in them. However, schemed smallholders have lower scores in land use because most of their lands are the conversion of primary forests through the government transmigration program.

To determine factors that influence the level of implementation, it is then regressed with the smallholders' characteristics. From 320 smallholders' data set, 83 are identified as outliers, leaving 169 independent and 68 schemed smallholders' data set to be used. Average values and ranges of these characteristic data can be seen in the following Table 4.

Table 4. Sample Variables

Variables	Unit	2012				2018			
		Independent (n=169)		Schemed (n=68)		Independent (n=169)		Schemed (n=68)	
		Range	Average	Range	Average	Range	Average	Range	Average
Age	Year	24-77	47.56	25-66	45.71	26-80	49.46	28-78	53.59
Education	Year	6-17	8.82	6-17	9.28	0-16	9.45	6-28	10.69
Experience	Year	2-36	14.25	2-30	15.40	2-43	19.28	2-40	23.79
Dependents	people	0-7	3	0-7	3	0-7	2.58	0-8	2.22
land area	Ha	0.1-6.5	2.25	0.5-6	2.51	0.2-20	2.34	0.5-14	2.93
Income	million IDR/month/ smallholder	2.20-7.70	2.17	1-12	3.89	0.31-32.48	4.32	0.41-30.41	5.51
Participation	score	0-0	0	1-1	1	0-1	0	0-1	1

Table 4. shows that both schemed and independent smallholders in 2012 and 2018 are in the productive age group, with an average value of 47.56 and 45.71 years, respectively. In general, respondents in 2018 have higher education and experience than those in 2012. Both have a low formal education, but have sufficient experience. Usually, for both the smallholders and their peers, experience is more influential to the way smallholders cultivate than formal education. However, formal education may influence the way smallholders keep their record and documentation. Most smallholders do not have records and documents, and find it is complicated and time consuming to prepare the records and documents, though both are important aspects required in RSPO certification. The average smallholders' land area is not improving, which is still less than 3 ha per individu. They provide around IDR 2 to IDR 4 million per household per month, which is bigger than UMP 2012 (IDR1,375,000) and 2018 (IDR2,132,168). In addition, most of them have side jobs, either in other plantation, construction, government office, entrepreneurs or as stockmen. With three dependents, smallholders can usually give part of their income to participate in establishing or maintaing public facilities. The compare mean test result between the smallholders'characteristics can be seen in Table 5. The result shows that beside the land size and age, there are significant differences between the smallholders'characteristics in 2012 and 2018.

Table 5. Compare Mean Test Results

	Age		Education		Experience		Dependent		Land size		Income	
	Mean	**Sig**	**Mean**	**Sig**	**Mean**	**Sig**	**Mean**	**Sig**	**Mean**	**Sig**	**Mean**	**Sig**
2012 – 2018 (over all)												
2012	47.04	0.00	8.95	0.00	14.56	0.00	3.13	0.00	2.30	0.02	1,324,665.15	0.00
2018	50.66		10.07		20.69		2.40		3.08		4,534,732.44	
2012 – 2018 (sch)												
2012	45.66	0.00	9.32	0.04	15.34	0.00	3.19	0.01	2.45	0.17	1,625,955.88	0.00
2018	53.49		10.68		24.19		2.35		3.45		5,080,944.54	
2012 – 2018 (ind)												
2012	47.59	0.17	8.80	0.02	14.25	0.00	3.10	0.00	2.25	0.06	1,203,435.74	0.00
2018	49.56		9.83		19.33		2.42		2.93		4,321,997.20	

To estimate the influence of these characteristics on the level of implementation, they are then regressed with Multinomial Logit Regression. After conducting the outliers test, 369 observation were included in the analysis. Estimation results are as follows. In this study the implementation level with a score of 1 (the lowest level of implementation) is set as the reference value. All regressors' correlation are less than 0.80, showing that there is no multicollinearity problem among them. The Goodness of Fit test shows that the significant value of Chi-Square can not reject the null hypothesis, therefore it can be concluded that the multinomial logit model is fit for the data. In addition, model Fitting Information shows that at least one of the independent variables included in the model significantly affect the variation of the RSPO P&C implementation level.

Table 6. Estimation Results of Multinomial Regression

	Adoption Score	**B**	**Std. Error**	**Wald**	**Sig.**	**Exp(B)**
2,00	Intercept	-,043	1,134	,001	,970	
	Age	,029	,016	3,087	,079	1,029
	Education	,109	,055	3,893	,048	1,116
	Experience	,004	,019	,034	,854	1,004
	Dependence	-,011	,093	,014	,905	,989
	Land size	,009	,098	,009	,925	1,009
	Income	,000	,000	,609	,435	1,000
	[Participation=,00]	-1,543	,424	13,242	,000	,214
	[Participation=1,00]	0[b]	.	.	.	.
3,00	Intercept	-1,508	1,507	1,001	,317	
	Age	,000	,024	,000	,987	1,000
	Education	,144	,071	4,096	,043	1,155
	Experience	,050	,028	3,186	,074	1,051
	Dependence	-,016	,129	,015	,903	,984
	Land size	,063	,131	,233	,629	1,065
	Income	,000	,000	3,691	,055	1,000
	[Participation=,00]	-2,163	,506	18,269	,000	,115
	[Participation=1,00]	0[b]	.	.	.	.

Table 5. shows that respondents with a score of 2 (low level of implementation) in age, education and participation can signifcantly influence the level of implementation. The values of exponential coefficient (odd ratio) of age and education variables that scored more than 1 show that the increase in these variables will increase the probability to improve the implementation score from 1 to 2. The value of uninvolvement in smallholder group (participation = 0) that scored less than 1 show that this will increase the probability to be in the reference (implementation score = 1) condition. In other words, smallholders that are not involved in any groups are likely to have a low implementation score.

For respondents with a score of 3 (moderate level of implementation) in education, experience, income and participation can signifcantly influence the level of implementation. Values of exponential coefficient (odd ratio) of education, experience and participation are similar with those that scored 2 in the level of implementation, thus similar interpretations apply. In addition, income appears to also significantly influence the probability of implementation level. However, the unitary odd ratio value shows that the probability of income to improve the level of implementation from score 1 to 3 is very low.

4. Conclusion

This study shows that RSPO PnC could be used to analyze the sustainable management among oil palm smallholders. However, both schemed and independent smallholders' level of implementation in RSPO PnC are still low. Such a condition has not improved from 2012 to 2018. Education, experience and participation significantly influence the probability for improvement. Therefore, relevant trainings through groups could be utilized to improve the implementation of sustainable management among the oil palm smallholders.

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