

Oil Palm Smallholders' Inclusiveness Possibility in the Industry 4.0: RSPO Sustainability Certification Case in the Palm Oil Global Supply Chain

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Keywords: Industry 4.0, Smallholders, Palm Oil, Certification.

Abstract: The palm oil industry is big, involving long supply chains with smallholders as part of the chain. In contrast with the significant increase in the smallholder plantation areas' share, significant innovations are found in neither development of oil palm smallholders' cultivation techniques nor marketing and management aspects. Using 320 smallholder samples' data in 2012 and 315 in 2018 purposively selected in North Sumatra, such conditions are descriptively analysed. In particular, Roundtable Sustainable Palm Oil (RSPO) certification is chosen as the case for analysing the smallholders' inclusiveness possibility in industry 4.0. The results show that only 10 out of 39 (25%) RSPO certification principles are possibly related to the character of industry 4.0, particularly in connection and precision aspects. On average, smallholders' implementation scores for these principles are still low. Such a condition is significantly influenced by the smallholders' experience, level of income and participations. Comparing the 2012 and 2018 data, all of these possible implementation scores' increased, showing potential improvement in RSPO P&C implementation. However, with a 25% relevant P&C and low level of implementation, it can be concluded that RSPO certification is still not effective in improving smallholders' inclusiveness in industry 4.0.

1 INTRODUCTION

Palm oil is one of the largest industries in the world, both in scale and scope. For a multinational company, the plantations' and mills' scale can reach almost 300,000 ha, while the scope can cover all type of commodities and products from the Fresh Fruit Bunches to end products (Gerard, 2017). Smallholders appear as one of the bottom players of the wide and long palm oil supply chain. The Indonesian palm oil supply chain mostly distribute to the global market, which recently demands sustainable certified palm oil (CSPO). Physically CSPO is not different with uncertified crude palm oil (CPO), certification only proves that the palm oil is produced in a sustainable way. To obtain the Roundtable Sustainable Palm Oil (RSPO) certification, growers need to fulfill 8 principles, 43 criteria and 139 indicators. Therefore, CSPO needs to be sold at a premium price to cover extra costs and effort needed to meet the principles and criteria (P&C), thus CSPO market can be seen as a high value-adding market. In fact, from the CSPO total

production in the world, only half are sold with premium prices (RSPO, 2017). This can partly be explained by the complexity of the global palm oil supply chain. Information about how much and where CSPO are needed are not fully received by the growers, traders or processors (RSPO, 2018). Growers and millers tried to produce markets' demand based on information they receive and interpret. In theory Industry 4.0 provides automation and data exchange in manufacturing, in which players along the supply chain would utilize technologies to connect and communicate. However, agricultural supply chain is relatively complex, as it links different characteristic of subsystems along the supply chain. Smallholders that are seasonal and scattered links to processors that are operating on a daily basis with a larger scale. Marketing and distributions have their own characteristics as well. The supply chains do not only encompass the flow of product, but also the knowledge and information among stakeholders and consumers (Braun *et al*, 2018). To participate, the players need to have knowledge and skills related to new technologies and processes of industry 4.0.

Otherwise, they could be excluded. With more than 40% share of the smallholders' total area, the exclusion could significantly influence the Indonesian palm oil industry. This study is conducted to analyze the smallholders' inclusion possibility through RSPO certification facing the Industry 4.0 era. Findings from this study are expected to provide inputs for policymakers in preparing programs for the Indonesian palm oil industry development.

2 METHOD

This study was conducted in 2012 and 2018 in 4 palm oil smallholder centers in North Sumatra Province, namely Asahan, Labuhanbatu, Labuhanbatu Utara and Labuhanbatu Selatan. This study uses data from a previous study (Chalil and Zein, 2012) and primary data. Data are collected from 320 samples in 2012 and 315 samples in 2018, which are determined using cluster sampling method, based on the type of management. Certified palm oil market is treated as the high-value adding market. The possibility of inclusiveness is analyzed descriptively by comparing the required and existing conditions of implementing RSPO P and C that are relevant with the industry 4.0 aspects.

Descriptive method is used in estimating the RSPO P&C implementation score for both schemed and independent smallholders; each principle in the RSPO P&C was given a value of one if the samples applied it, and zero otherwise. The implementation for each principle in each sample is measured by:

$$a_{ij} = \frac{n}{m} \tag{1}$$

where $i = 1, \dots, 10$ (number of relevant principles) and $j = 1, \dots, n$ (number of samples in each district/kabupaten). n_i = total score for principle i and m_i = number of criteria in principle i . Each principle does not necessarily have the same number of criteria. By using a_{ij} for all samples, the average implementation level value of each sample is determined with

$$s_j = \frac{\sum a_{ij}}{37} \tag{2}$$

and the average implementation value of each principle is determined with:

$$c_i = \frac{\sum a_{ij}}{30} \tag{3}$$

c_i is then used to calculate the score of each principle in each district. The score is divided into 5 levels, comprising (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, respectively. The possible influencing factors included are smallholders' age, level of formal education, experience, number of dependence, land size, income and participation, and regressed with the Binomial Logit Model. The statistics of the 2012 condition of the influencing factors are then compared with the 2018 condition.

3 RESULTS AND DISCUSSION

One of the main differences between the 3.0 and 4.0 industry is the connection between players along the supply chain. In RSPO certification, the connection and communication between smallholders from the bottom downstream and end consumers from the end upstream is linked through the principle and criteria (P&C) of the certification. Consumers and producers do not meet, but producers fulfill consumers demand on sustainable managed palm oil production by implementing all of the P&C. Producers in different stages are also directly linked through the supply chain certification. Among 39 sub-criteria for the smallholders' certification, only 10 sub criteria are possibly relevant with the industry 4.0. In particular, 2 sub criteria relate to the connections among players along the supply chain, while the remaining relate to precision agriculture aspects. On average both independent and schemed smallholders have a score of 2, with 25.44% and 38.03% of implementation level, respectively. The details are as follows.

Table 1: RSPO P&C Relevant Sub-Criteria and Smallholders' Level of Implementation.

No	Sub criteria	Industry 4.0 aspect	Independent		Schemed	
			%	Score	%	Score
1.1	Adequate available information for stakeholders about environmental, social and legal issues that are related to the RSPO P&C	Connections	2.67	1	57.69	3
1.2	Documents are publicly available	Connections	50.97	3	41.03	3
2.2	Evidence for land control and usage	Precision	76.00	4	94.87	5
4.2	Maintaining soil fertility practice or where possible improving soil fertility	Precision	5.56	1	30.34	2
4.3	The practice of minimizing and controlling erosion and degradation of soils	Precision	9.64	1	39.74	2
4.4	The practice of maintaining the quality and availability of surface and ground water	Precision	11.78	1	23.50	2
4.5	Invasive pests, diseases, weeds and introduced species are effectively controlled by applying adequate Integrated Pest Management (IPM)	Precision	16.89	1	43.59	3
4.6	Agrochemicals are used in a manner that does not endanger health and environment	Precision	23.20	2	30.98	2
5.3	Waste is recycled, re-used, and disposed of in ways that are environmentally and socially friendly	Precision	32.22	2	17.95	1
5.6	Plans to reduce pollution and emissions, including greenhouse gas	Precision	-	-	0.64	1
Average			25.44	2	38.03	2
Minimum			2.67		0.64	
Maximum			76.00		94.87	

Data Source: (Chalil and Zein, 2012)

Table 1 shows that overall the implementation of the relevant P&C is low, with an average of 25% and 38% for the independent and schemed smallholders, respectively. However, for principle 2.2 about the evidence for land controlling and using is high, reaching 76% and 94.87% for independent and schemed smallholders, respectively. Other precision aspects are still low, indicating the smallholders' less efficient applied cultivation techniques and partly explaining the low productivity.

In the palm oil industry, plantations, especially smallholders are unlikely to utilize the development of technology. This can be seen by having no significant change in the cultivation method from 1980s until now. An example of technology usage in cultivation is in the Dura marking method. The survey in Labuhanbatu Utara shows that all smallholder samples can differentiate the 2 types of palm oil seeds, Dura and Tenera. Dura has lower oil content

than Tenera, thus considered as a low quality seed. Smallholders identify Dura from their thick shell, which means it can only be observed after the palm oil trees' first harvest. A technology for Dura marking from leaf tissue has been invented. Smallholders do not have to wait until 3 or 4 years until the first harvest, hence avoiding unnecessary costs. The survey shows that none of the smallholder samples know about this technology. Unfortunately, even after receiving the information 28.85% of the samples do not consider the Dura marking service as important, and 51.92% only have minimum willingness to pay (WTP) for obtaining the service.

The 2012 study shows that using the Binomial Logit Model, the RSPO P&C implementation is significantly influenced by experience, income and participation. Fortunately all of these have increased in 2018, which is detailed in Table 2.

Table 2: The Development of Smallholders and Smallholdings' Characteristics in 2012 and 2018.

No	Variables	Measurement	Independent		Schemed	
			2018 ¹⁾ (n=191)	2012 ²⁾ (n=169)	2018 ¹⁾ (n=124)	2012 ²⁾ (n=169)
1	Smallholders' age	Year	47.88	47.56	46.33	45.71
2	Formal education	Year	9.40	8.82	9.85	9.28
3	Experience	Year	16.92	14.25	19.23	15.40
4	Dependents	Persons	3	3	3	3
5	Land area	Ha	2.79	2.25	3.02	2.51
6	Income	million IDR/month/ smallholder	4.70	2.17	7.67	3.89
7	Participation	Percent	48.22	0	100	100

1) Data Source: Chalil and Zein,2012

2) Primary data

The smallholders' income significantly increased around two times for both independent and schemed smallholders, although the land area increase were lesser. Interestingly, in 2018, not only schemed smallholders participate as smallholder groups' members, but 48.22% of the independent smallholders have also recorded as the participants. The estimation results also show that formal education and experience do not significantly influence the level of implementation. On average, smallholders' level of formal education is less than 10 years, both among the independent and schemed smallholders. The condition is only slightly improved from 2012 to 2018. Their experiences are better, with average length around 15 years and improved to 17 to 19 years in 2018. In fact, the surveys show in general both independent and schemed smallholders do not have sufficient knowledge and skill to utilize the Industry 4.0 technology to improve inclusiveness in the global supply chain.

4 CONCLUSION AND POLICY IMPLEMENTATION

Palm oil supply chain is a long and complex supply chain. Potentially the Industry 4.0 that provide automation and data exchange in manufacturing could utilize technologies to connect players along the supply chain. Certification is used as a case of the potential tools of connecting consumers' demand with smallholders' supply. This means that although within a long and complex supply chain, by implementing the RSPO P&C oil palm smallholders would meet consumers' demand on sustainable managed palm oil product. In fact, among the 39 RSPO P&C only 10 are relevant with the Industry 4.0 aspects, particularly connection and precision. Moreover, on average the smallholders'

implementation on the 10 relevant RSPO P&C is still low. Therefore, it can be concluded that RSPO certification is not effective in improving smallholders' inclusiveness in the palm oil global supply chain. On one side this implies the needs for improving the certification P&C to be more relevant with the Industry 4.0 aspects. On the other side, smallholders' knowledge and skill also need to be improved so that implementation could be executed smoothly.

ACKNOWLEDGEMENT

This work was supported in part by a Penelitian Terapan (TALENTA 2018) from Research Center, Universitas Sumatera Utara.

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