International Journal of Informatics, Information System and Computer Engineering

Sustainable and Digitized Certification of Palm Oil Production : Its Impact on the Environment in Indonesia

Angga Fauzan Pratama
Wageningen University and Research
E-mail: anggafp@gmail.com

ABSTRACTS

The purpose of this study was to explain sustainable and digitized certification of palm oil production and its impact on the environment in Indonesia. In Indonesia, palm oil producers consist of private plantations as the largest national producers (54%), smallholders (39%), and state-owned plantations (7%). The management of smallholder oil palm still have limitations to accessing technology, production facilities, institutions, and marketing. That is the reason all the palm oil companies need certification to make them standard in facing environtment problems. With the system of digitizing certificate, especially for smallholder companies, it enable to help them transformed the business processes as well as waste treatment.

ARTICLE INFO

Article History:
Received 13 Nov 2021
Revised 20 Nov 2021
Accepted 25 Nov 2021
Available online 26 Dec 2021

Keywords:
Sustainable and Digitized, Palm Oil, Production, Impact, Environment

1. INTRODUCTION

Deforestation gives an adverse effect on the environment, including climate change. Forest cover conversion releases CO2 into the atmosphere, which worsens the greenhouse effect. Besides altering the carbon level in the atmosphere, deforestation also leads to a change in surface temperature. In the subtropics, deforestation leads to a cooler temperature, while in the tropics, deforestation leads to a warmer temperature (Longobardi et al., 2016). Deforestation was found to be affecting the moisture cycle as well, and therefore, affecting regional precipitation (Chambers and Artaxo, 2017).

In Indonesia, palm oil plantation becomes the dominant drivers of deforestation. Increasing global palm oil demand compels stakeholders to clear more forest for more expansive plantation. Between 2001-2016, two million hectares of forest (26% of total deforestation) has been cleared for palm oil plantation (Austin et al., 2019). At the same time, palm oil contributes positively

to the Indonesian economy. Palm oil is the main export commodity of Indonesia agriculture exports and has become Indonesia's strategic industry. Palm oil plantation also contributed to the development of the rural community (Rist et al., 2010). Study shows that palm oil farmer in the rural is more prosper than farmers of other commodities (Kubitza et al., 2018). These positive impacts on the economy and development hinder the government of Indonesia (GOI) from stopping palm oil expansion. The forest cover loss by palm oil expansion has been noticed by international communities and leads to the discouragement of using palm oil. Several standards and certifications for sustainable palm oil (SPO) were introduced to prevent further discouragement. The Roundtable of Sustainable Palm Oil (RSPO) is the most prominent SPO certification body. RSPO established the first sustainability standards for palm oil production and has certified over two million hectares of palm oil plantation in Indonesia (RSPO, 2020).

The management of smallholder oil palm still have limitations to accessing technology, production facilities, institutions, and marketing. That is the reason all the palm oil companies need certification to make them standard in facing environtment problems. With the system of digitizing certificate, especially for smallholder companies, it enable to help them transformed the business processes as well as waste treatment. The digitization of Sustainable Smallholder Oil Palm Plantations is designed to transform the business processes carried out by oil palm farmers who join cooperatives into a form of digital work patterns while still providing roles and appreciation for their permanent work from farmers, by farmers, and for farmers, so that smallholder oil palm plantations are industrial-based agricultural activities. era 4.0 [2]. The RSPO certification is derived from the sustainable development pillars, which are the environmental pillar, economic pillar, and social pillar. This review will solely focus on the environmental pillar of RSPO certification. In RSPO certification, the environmental sustainability concern is represented in the seventh principle, which is to protect, conserve and enhance ecosystems and the environment (RSPO, 2020). This principle is implemented in several criteria for the production process, which includes greenhouse gas (GHG) emission reduction, forest fire ban, and deforestation prohibition (RSPO, 2020)

Palm producing countries, including Indonesia, try to improve palm oil image through supporting and implementing SPO certification, including RSPO. Despite the certification effort, palm oil is still viewed negatively. In 2018, under Renewable Energy Directive, the European Union (EU) members agreed to stop using palm oil for biofuel by 2030 due to palm oil's link to deforestation. The sustainable effort by GOI that has been conducted through standards and certification seems to be neglected or considered to be not enough by the EU.

The author interested in writing a literature review related to the arising issue and raises a research question:

"How has and how can sustainable palm oil certification impact the environment of Indonesia?"

This literature review will discuss five recent literature regarding SPO and its impacts, which are by (Cattau et al.,2016), (Carlson et al., 2018), (Morgans et al., 2018), (Gatti et al., 2019), and Schmidt and (De Rosa., 2020). This literature review

has the purpose of understanding the environmental impacts of SPO certification from different researches. This literature review will be divided into four sections. The first section is the introduction and background of the review topics. The methodology used by each literature will be discussed in the second section. The results of each literature will be discussed in the third section, and the last section will discuss the conclusion of this literature review.

2. METHODOLOGY

This section will discuss the data and method that was used by the authors in assessing environmental impacts of SPO certification. Before comparing the data and method used by each authors, it is worth noting that each authors have different objectives. Research by (Cattau et al., 2016) is trying to reveal the impacts of RSPO in reducing the number of forest fire through 2012-2015 on the island of Sumatera and Kalimantan, Indonesia. (Carlson et al., 2018) study covers broader aspects and wider timespan that (Cattau et al., 2016). (Carlson et al., 2018) investigate the effect of RSPO to forest fire and deforestation in Indonesia from 2001 until 2015. (Morgans et al., 2018) study covers even broader than (Calson et al., 2018) by trying to assess RSPO impacts on all sustainability objectives. (Gatti et al., 2019) are investigating the deforestation on SPO certified plantation in Indonesia between 2001-2016. Meanwhile, (Schmidt and De Rosa, 2020) are comparing greenhouse gas emission from RSPO and non-RSPO plantation.

From these differences in objectives, different data and method are used in the respective research. In general, the methods that were used by the authors can be categorised into spatial analysis and modelling. Four out of five papers in this review, which are (Cattau et al., 2016), (Carlson et al., 2018), (Morgans et al., 2018), and (Gatti et al., 2019), use spatial analysis. Only (Schmidt and De Rosa, 2020) do not use spatial analysis in their research.

(Cattau et al., 2016) are using Indonesia's oil palm concession map obtained from Global Fire Watch (GFW) produced by Indonesia's Ministry of Forestry. (Cattau et al., 2016) also use data from Greenpeace that provides companies' total oil palm concession and total RSPO certified oil palm concession. (Cattau et al., 2016) trying to accommodate the intentional use of fire in oil palm planting and clearing by inspecting through Google Earth imagery to identify oil palm planting and clearing phase, and only compares forest fire in the developed period. (Cattau et al., 2016) use fire detections data from the Moderate Resolution Imaging Spectroradiometer (MODIS) Active Fire Detections by NASA FIRMS.

(Carlson et al., 2018) digitise map from RSPO secretariate and website to obtain SPO certified area. (Carlson et al., 2018) also use data from Greenpeace and Sawit Watch, which are produced by GOI. (Carlson et al., 2018) combine the data and removed smallholders' plantation from the data so that only industrial plantation is being assessed. (Carlson et al., 2018) use MODIS data, same as (Cattau et al., 2016), to identify fire occurrences. Meanwhile, to detect deforestation, (Carlson et al., 2018) are using Shuttle Radar Topography Mission (SRTM). (Carlson et al., 2018) employ a combination of propensity score matching technique and panel methods to determine the impacts of SPO certification.

(Morgans et al., 2018) use palm oil concession map in 2014 from the World Resources Institute (WRI) made by GOI. (Morgans et al., 2018) also use data from RSPO Annual Communication of Progress (ACOP), Sustainable Palm Oil Transparency Toolkit (Zoological Society of London Sustainable Palm Oil Platform) and Global Forest Watch (GFW) to support and verify the WRI's data. (Morgans et al., 2018) use two metrics in assessing environmental sustainability impacts of SPO certification, which are (1) presence and density of orangutan, and (2) number of fire hotspots detected. Morgans et al. (2018) also use a propensity score matching technique to determine impacts of SPO certification.

(Gatti et al., 2019) use forest cover change data from (Hansen et al., 2013) and from GFW (accessed in 2018). (Gatti et al., 2019) also use palm oil production and concession data from GOI, RSPO, and Greenpeace. From these data, (Gatti et al., 2019) determine the number of forests lost in Indonesia by calculating the area of forest cover lost that overlaps concession area.

(Schmidt and De Rosa, 2020) apply the life cycle assessment (LCA) to compare the total greenhouse gas emission produced by SPO certified palm oil and non-certified palm oil. Life Cycle Assessment (LCA) calculates the total emissions of a product by summing the emissions produced at different phases of the production to consumption (Mukarjee and Sovacool, 2014) and it fit to assess the environmental performances of products or production systems (Schmidt and De Rosa, 2020). To be able to calculate the total emission, a background database is needed in LCA. (Schmidt and De Rosa, 2020) uses the latest version of the global hybrid environmentally extended multi-regional input-output (EEMRIO) database on EXIOBASE v3 as the background database for the model. Meanwhile, for data in the production processes, (Schmidt and De Rosa, 2020) use various sources, such as RSPO reports, statistical data, and modelling approaches.

3. RESULT

In general, the findings by the authors can be grouped into three categories, which are (1) SPO certification impact on forest fire, (2) SPO certification impact on deforestation, and (3) SPO certification impact on GHG emissions.

The impact of SPO certification on forest fire was studied by (Cattau et al., 2016), (Carlson et al., 2018), and (Morgans et al., 2018). The three authors have different findings. (Morgans et al., 2018) have the most general approach in assessing SPO certification impacts on the environment. (Morgans et al., 2018) only distinguish SPO-certified plantation and non-SPO-certified. It was found that there is no significant impact of SPO certification on forest fire and forest fire increased on both categories between 1999-2015 (Morgans et al., 2018). (Carlson et al., 2018) find a different result by discovering that most fire activity in Indonesia's forest occurs before SPO certification initiated by GOI. However, based on significance statistics, (Carlson et al., 2018) also agree that SPO certification has no impact on fire activity. The decrease in fire activity happens not only in SPO-certified plantations but also in non-SPO-certified plantations. The study by (Cattau et al., 2016) is distinguishing the land types (peatlands and non-peatlands), weather (dry and wet years), and certification

status (SPO-certified and non-SPO-certified). (Cattau et al., 2016) are able to find significant difference reduction of fire activity on non-peatlands during wet years. However, in peatlands and non-peatlands in a dry year, fire activity is not significantly different (Cattau et al., 2016).

SPO certification impact on deforestation was covered by two studies in this review. (Carlson et al., 2018) noted that deforestation has higher rate before SPO certification initiative, although deforestation still continues even after SPO certification implementation. Forest area of 91 km2 was lost in certified plantation area with 24 km2 of peat and 23 km2 of primary forest (Carlson et al., 2018). Significance statistics shows that SPO certification contributed to a 33% reduction of deforestation and prevents 21 km2 ± 2.8 km2 of forest loss through 2015 (Carlson et al., 2018). (Carlson et al., 2018) noticed a bias in SPO certification pattern and mentioned that lower deforestation on SPO certified plantation is mostly due to the less forest available. However, (Carlson et al., 2018) are optimistic that certification on plantations with more forest can leads to more significant forest saving. (Gatti et al., 2019) disapproves (Carlson et al., 2018) statements and points the proportion of deforestation in certified concession compared to the total deforestation is still relatively high, and even in 2015, the deforestation in certified concession was higher than in non-certified concession. The SPO certification is also not sustainable because the plantations that are currently sustainable related to high forest degradation in the past (Gatti et al., 2019).

In this review, the reduction of GHG in the palm oil production process through SPO certification was solely studied by (Schmidt and De Rosa, 2020) .Modelling by (Schmidt and De Rosa, 2020) finds that SPO-certified production is significantly more environmental-friendly than non-certified production. SPO-certified product has a lower carbon footprint than a non-SPO-certified product. It was found that SPO-certified product has 36% lower GHG emission than the non-SPO-certified product. Higher yields, peatland and nature protection, and biogas capture potential in SPO certification promotes the benefits of GHG emission reduction (Schmidt and De Rosa, 2020).

4. DISCUSSION

The modelling by (Schmidt and De Rosa, 2020) proves that SPO certification has the potential to reduce palm oil negative contribution to the environment. Lower GHG emission can generate more sustainable palm oil production. However, in practice, SPO certification is not convincing, which is depicted by the conflicting results of some studies.

SPO certification was found to decrease fire activity in a specific land type (non-peatland) during a specific period (wet years) (Cattau et al., 2016). However, forest fire reduction due to SPO certification cannot found on peatlands and dry years (Cattau et al., 2016). Studies that do not classify forest and see the forest as a whole also cannot find any significant impact of SPO certification on forest fire incidence (Carlson et al., 2018; Morgans et al., 2018). The comparison of these three studies shows that the scope of study affects the observed result. Detailing the scope of study will reveal a more accurate picture of the impacts of SPO certification. Concerning the SPO certification policy, indicates that SPO certification only positively impacts in a particular condition and have not been able to make a broad impact.

Difference in opinion can also be found on the claim of SPO certification impacts to deforestation rate. (Carlson et al., 2018) state that SPO certification able to decrease deforestation rate and can have a more significant impact if it is implemented more widely (Carlson et al., 2018), but (Gatti et al., 2019) challenge the claim and states no significant impact of SPO certification on deforestation rate. In this case, a difference in perspective is the cause of different opinion. In addressing the environmental impacts of palm oil plantation, (Gatti et al., 2019) also consider the preceding land cover in the existing plantation. Gatti et al. (2019) regard the forest clearance that was required to open the SPO-certified plantations as deforestation. On the other hand, (Carlson et al., 2018) only count the deforestation that occurs in the existing plantation and disregard the previously existing forest in the plantation area.

5. CONSCLUSION

SPO certification is initiated as an action to reduce the negative impacts of oil palm plantations. If SPO certification is enacted properly, GHG emission of Indonesia will be reduced. However, in practice, the implementation of SPO certification in Indonesia has not brought a convincing result. The positive impact of SPO certification on reducing forest fire and deforestation is still limited and not convincing. More studies are required to discover the source of ineffectiveness and improve the effectiveness of the policy.

Deforestation and forest fire in palm oil plantation are still occurring in Indonesia, and we still need to work against nature destruction and degradation. Although so far SPO certification implementation in Indonesia have not brought a convincing result, a study has proven that SPO certification has the potential to bring significant benefits. The stakeholders (governments, industries, and societies) need to work together to maximise the potential benefits of SPO certification that are yet to be achieved

REFERENCES

Austin, Kemen G., et al. "What causes deforestation in Indonesia?." Environmental Research Letters 14.2 (2019): 024007.

Carlson, Kimberly M., et al. "Effect of oil palm sustainability certification on deforestation and fire in Indonesia." Proceedings of the National Academy of Sciences 115.1 (2018): 121-126.

Carter, Claire, et al. "Palm oil markets and future supply." European Journal of Lipid Science and Technology 109.4 (2007): 307-314.

Cattau, Megan E., Miriam E. Marlier, and Ruth DeFries. "Effectiveness of Roundtable on Sustainable Palm Oil (RSPO) for reducing fires on oil palm concessions in Indonesia from 2012 to 2015." Environmental Research Letters 11.10 (2016): 105007.

Chambers, Jeffrey Q., and Paulo Artaxo. "Biosphere–atmosphere interactions: Deforestation size influences rainfall." Nature Climate Change 7.3 (2017): 175-176.

Gatti, Roberto Cazzolla, et al. "Sustainable palm oil may not be so sustainable." Science of The Total Environment 652 (2019): 48-51.

Goodland, Robert. "The concept of environmental sustainability." Annual review of ecology and systematics 26.1 (1995): 1-24.

Kubitza, Christoph, et al. "The economics behind an ecological crisis: livelihood effects of oil palm expansion in Sumatra, Indonesia." Human Ecology 46.1 (2018): 107-116.

Longobardi, Patrick, et al. "Deforestation induced climate change: Effects of spatial scale." PloS one 11.4 (2016): e0153357.

Morgans, Courtney L., et al. "Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives." Environmental Research Letters 13.6 (2018): 064032.

Rist, Lucy, Laurene Feintrenie, and Patrice Levang. "The livelihood impacts of oil palm: smallholders in Indonesia." Biodiversity and conservation 19.4 (2010): 1009-1024.

RSPO. "Principles and Criteria for the Production of Sustainable Palm Oil." Roundtable on Sustainable Palm Oil (2020), https://rspo.org/resources/certification/rspo-principles-criteria-certification. Accessed 18 October 2020.

Schmidt, Jannick, and Michele De Rosa. "Certified palm oil reduces greenhouse gas emissions compared to non-certified." Journal of Cleaner Production (2020): 124045.

"Impact." Roundtable on Sustainable Palm Oil. RSPO, 2020. https://www.rspo.org/impact. Accessed 18 October 2020.