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Sustainability Analysis of Independent Palm Oil Plantations in Sintang Regency, West Kalimantan

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ABSTRACT

The goal of this investigation is to examine the impact of institutional, technological, social, and economic factors on the long-term viability of independent oil palm plantations in West Kalimantan's Sintang Regency. The data obtained from interviewing 216 respondents, spread across three sub-districts, namely, the Sintang, Kelam Permai, and Binjai Hulu; and used Multi-dimensional Scaling RAPFISH (Rapid Assessment Techniques for Fisheries) to analyze the data. The research results show that the sustainability index values in different aspects are generally favorable, such as the sustainability index value in the economic aspect is 74.36%, the value in the social aspect is 71.28%, the environmental value is 70.59%, the institutional dimension value is 72.34% and the technology dimension value is 70.14%. Considering the sensitive attributes of this research as decisive factors some efforts should be made to sustained the oil palm plantations. Furthermore, governments and policymakers should strengthen their institutional and organizational role in supporting oil palm plantations to make it easier for farmers to access technology, assistance with plantation facilities, and agricultural extension services.

Keywords: Dimensions, Multidimensional Scaling, Plam Oil Plantation, Sensitive Attribute, Sustainability Analysis

INTRODUCTION

It must be recognized that sustainability plays a consequential role in supporting environmental, economic, and social conditions. Moreover, they must be economically beneficial, environmentally friendly, socially equitable acceptable, and technically appropriate (Irianto, Mujiyo, Qonita, Sulistyo, & Riptanti, 2020). In particular, independent oil palm farmers in Sintang, Kelam Permai and Dedai sub districts in Sintang District, West Kalimantan already have ecological knowledge (Efriani, Utami, & Dewantara, 2020). Nasution, Fajri, Karim, and Romano (2021) said that the sustainability index also state of the plantations of palm oil are sufficient in Nagan Raya Regency, one of the areas that is thought to be the hub of production palm oil in the West Aceh. As a proponent of sustainability, it can believe that the plantations security and social aspects are much lower sustainable than economic and environmental ones. The greater features of the dimension of environmental include forest fires, the social dimension is the growth of communities around plantation projects, and the dimension of economic is the income of farmers.

Status of sustainable palm oil can be improved by maintaining sustainable dimensions. nevertheless, in the oil palm progression program, priority should be given to improving areas that are not sustainable. According to Asti, Falatehan, and Putri (2022), it is stated that improving attitudes toward sustainability and perceived behavioral control can increase small farmers' intention to adopt sustainable practices. Farmers realize that implementing sustainable production practices requires more costs, time, and knowledge. To overcome financial constraints, farmers must look for other sources of income to support the costs of maintaining sustainable palm oil. Maintaining a sustainable will to give an impact on plantation success requires farmers to give a positive contribution while minimizing negative repercussions on their plantations (Dewi, Al Muhtaromi, & Davianti, 2022).

Attitudes towards sustainability, perceived from behavioral control, also past behavior significantly influence smallholder farmers' intentions to implement sustainable production practices. In contrast, subjective norms inaffected farmers' intentions to adopt practices of sustainable production. Improving attitudes towards sustainability and perceived behavioral control can increase smallholder farmers' intention to adopt sustainable practices. Meanwhile, Chiriacò, Belotta, Jusić, and Perugini (2022) found that oil palm plantations play a center part of the improvement economy and livelihood in many developing countries, especially the local communities. The production of Palm oil join a great impact in term of poverty reduction by increasing food safety, or physical, and socio-economic access. All of them is releted to the sufficient, safe and nutritious food in meeting the needs of individuals and communities.

Sustainability certification plays an essential part in the improvement of socio-economic and the eficiency of environmental palm oil production. So, if farmers can boost production efficiency while simultaneously enhancing quality, it has the potential to lower Indonesia's palm oil price, increase export amounts, and enhance the value of palm oil itself (Betrix, Fajri, & Rawung, 2022). Dahliani, Nurdialy, Relawati, and Abduh (2022) found that the well-being from farmers of oil palm in border regions reached a new normal. The high and low of interest of oil palm farmers in remote areas depends on several variables such as age, education level, number of children, occupation and area, income and expenditure. Palm oil companies in border areas are providing sufficient income to farmers in the new normal. The main factor influencing farmers' well-being is age. Older age means better financial planning (savings habits) and greater wealth.

Prosperity levels rise together with income levels and plantation land areas. Meanwhile, autonomous oil palm growers in the Indonesian provinces of Riau and Jambi were mentioned by Raharja et al. (2020) as a means of reinforcing the institutional model. The issue of platforms acting as middlemen in the center of independent smallholders and the companies of palm oil processing, which widen the supply line and undermines adequate separation of the price, as well as the FBB underrated quality production which affects selling prices, all contribute to the mistrust that independent farmers have for cooperatives. The program makes it easier for independent smallholders to get money to expand their businesses.

According to Qaim, Sibhatu, Siregar, and Grass (2020), oil palm farms have substantially smaller carbon stocks and less biodiversity than tropical forests, which is why it is advised to limit the palm oil usage as much as possible, increasing sustainability is doable. However, a total ban on the palm oil is not only causeing an enormous casualty in economic but might also have a negative impact on the environment as other products would be used in its place. Other vegetable oils need more acreage to produce each unit. Small farmers are crucial to society and need specific assistance to overcome resource, technological, and knowledge constraints.

LITERATURE REVIEW

Sustainable Palm Oil

Sustainable agriculture is one of the successful resource managements for agricultural businesses and at the same time to maintain environmental quality and preserve natural resources. Agricultural development or more precisely the development of agricultural progress is basically a long series of changes or improvements in the capacity, quality, professionalism, and productivity of agricultural labor. Using possibilities dynamically and conquering any threats, challenges, hurdles, and interruptions that stand in the way of achieving their desired happiness. Sustainable agriculture systems also include a moral call to care for the natural resource environment by taking into account the five dimensions listed below.

Economic Dimension

The oil palm business also offers a multiplier effect on economic growth. The development of oil palm plantation areas encourages faster mobilization, generates several economic centers, and maintains the continuity of local money circulation in rural areas (Novahadi, Muani, & Imelda, 2013). While it has a beneficial influence on national economic growth and development, in some ways it reserves foreign exchange, creates intensive employment, and adds potential income streams for farmers, offers an additional source of local revenue, encourages accelerated economic development, and promotes rural poverty alleviation (Siradjuddin, 2015). The development of an oilseed processing industry integrated with plantation areas creates employment opportunities for local communities (Buys, Chomitz, De Luca, Thomas, & Wertz-Kanounnikoff, 2017). Cultivation of oil palm by smallholders and abundant plantations can make employment for many millions of Indonesian people and able to provides them with wages that higher than they could earn by growing food crops (Burke et al., 2019). For smallholder households, cultivation of oil palm is can be associated with productivity of high labor, which is the most limiting the input in many parts of rural area in Indonesia (Euler, Krishna, Schwarze, Siregar, & Qaim, 2017).

Social Dimension

On the social sustainability aspect, the implementation of good management practices will ensure the welfare of smallholders. In addition, the social sustainability of sustainable agriculture perspective is very related to the social interaction of the community of farming and the assistance received. It is important to ensure progress in the agricultural industry using the concept of the sustainable agriculture. Cultivation oil palm contributes to increased income, capital accumulation, giving a healthcare, give education to people, and giving a consumer goods with durability in smallholder households (Qaim, Sibhatu, Siregar, and Grass (2020). Households and communities that located in rural area are benefited in terms of farm profits which much higher than usual, opportunities for a new employment, and improved infrastructure in rural area (Gatto, Wollni, & Qaim, 2015). Smallholder households are also generally more prosperous when they grow oil palm than when they do not grow oil palm. Oil palm farmers have more stable revenues and higher levels of food resilience than farmers who are not practicing oil palm or other commercial crops (Baldo & Pham, 2021).

Environmental Dimension

There is potential for more environmental problems such as increased carbon emissions, high deforestation, and forest and ground fires if oil plantations are expanded (Arif, 2016). Even the palm oil has contributed to growing the economic, but it has also had negative environmental impacts in the process. Many studies have recognized the role of oil palm as a major driver of deforestation and land use changes, as well as the corresponding loss of biological diversity and other ecosystem functions (Taheripour & Tyner, 2018). Oil palm is generally produced as a monoculture. As compared to the forests they displace, these monocultures are much more structurally uncomplex, they have only one single canopy layer and not several forest layers, they do not have a complex and rich vegetation underneath, and they are nearly lacking in leaf droppings and wood fragments, all of which are essential to support the rich biodiversity of rainforests. Furthermore, the frequent pesticides, chemical fertilizers and human interference make oil palm plantations intolerable for most forest populations (Rasyid, 2014).

Institutional Dimension

Increasing agricultural productivity through technological improvements may reduce the expansion of crop area and subsequent deforestation worldwide, but it may also locally be an incentive for further forest incursion, especially in the lack of protection policy (Villoria & Lara, 2018). A streamlined legal or organizational infrastructure in palm oil producing nations is necessary (Taheripour, Hertel, & Ramankutty, 2019). An important policy area is the demarcation of clear boundaries between areas of protected forest in combination with strict rules on utilization permits, limitations, and effective punishment systems. Indigenous land rights of local people should be acknowledged (Dauvergne, 2013). If indigenous rights must be circumscribed to accomplish other sustainability objectives, equitable compensatory mechanisms, such as ecosystem service payments, should be established. This is not to say that no oil palm expansion is the most environmentally sustainable strategy (Taheripour, Hertel, & Ramankutty, 2019). Yet, highly environmentally sensitive natural habitats, such as forested peatlands, definitely need special consideration.

Technology Dimension

Technological advancement is a key element of a feasible solution to enhance the availability of agricultural commodities while simultaneously improving the biodiversity of the world's food systems (Tillman, Hartadi, Reksodiprodjo, Prwawirokusomo, & Lebdosoekojo, 2019). Technological improvements have the ability to mitigate or delay deforestation by reducing the area of land required to produce some agricultural commodities. However, as we will argue below, under certain situations, technological

advances may actually hasten deforestation (Baldo & Pham, 2021). Various constraints play a part in farmers' decision-making, including available technology-related production facilities, biophysical or geophysical constructs, constraints on labor and input markets, financing and credit issues, social customs, temporal trade-offs, regulatory constraints, and lack of knowledge and skills (Stoorvogel, Antle, Crissman, & Bowen, 2004). Insufficient knowledge and misinformation on the risks and rewards of implementing a new conservation technology or treatment or a poor knowledge of how to incorporate the technology or treatment will also influence farmers' propensity to implement it (Chavas & Kim, 2020).

Multi-Dimensional Scaling (MDS)

Statistical Procedures Multidimensional scaling, or MDS, is a multivariate technique that can work with ordinal or nominal non-metric data. Also known as the reduced space correction method, this technique. The benefit of this approach is the ability to condense and project the many multidimensional data collected in the field to a lower level. Therefore, the resulting anticipated values can provide researchers with a wealth of quantitative data. In an effort to make multidimensional transformations to smaller dimensions, MDS is also a statistical technique (Fauzi & Anna, 2005).

RAPFISH Ordination Analysis

The RAPFISH ordination analysis is carried out in steps, as follows (Firmansyah, Widiatmaka, Pramudya, & Budiharsono, 2016). The dimensions and attributes that selected is reflected on a variety of literature reviews, professional judgments, and field observations of actual conditions. next, depending on a scale of relevance, each property in each dimension is weighted/scored (pairwise comparison). The rating might be anything from terrible to good, depending on how it affects sustainability. A high number represents the most ideal rice availability circumstances, while a low score represents the most unfavorable circumstances. Next, the good value and bad value (middle value) are the bad points and the good points. These two additional main reference points become the reference for vertical direction (up and down). After that, create an additional reference point called an anchor which acts as a stabilizer and forms a kind of control circle so that the status value points are not outside it. Anchor points are also useful in regression analysis in MDS, namely in calculating stress values. Then standardize the score value for each attribute and calculate the distance between positions. Then coordinate all the attributes for each dimension based on aspects of the multidimensional scaling analysis algorithm. Regressing the Euclidian distance in point i towards point j with the origin yields an estimate of the distance between two objects or points.

RESEARCH METHOD

This research used quantitative research methods with questionnaires as a tool. The research respondents among independent oil palm farmers were 216 people, spread across three sub-districts, namely, Sintang sub-district, Kelam Permai sub-district, and Binjai Hulu sub-district in West Kalimantan.

In determine about the condition and status of the sustainability from independent oil palm cultivation in the Sintang district in terms of each dimension (economic, social, environmental, institutional legal, and technological) an MDS (Multi-Dimensional Scaling) analysis was carried out. General sustainability status assessment uses RSI (Rapid Sustainability Index) software (Firmansyah, Widiatmaka, Pramudya, & Budiharsono, 2016), this software is a remodel on the programs from RAPFISH (Rapid Assessment Techniques for Fisheries).

ALSCAL algorithm technique is used to regress the equation (Fauzi & Anna, 2005). The sustainability index scale for each dimension ranges from 0% (Poor) to 100% (Good). An indicator value greater than 50% indicates that the investigated system is sustainable, while less than 50% from the system idicated as unsupportable. The sustainability index values range from 0 to 100. Sustainability situations was divided into the four categories based on the MDS analysis index, as in the Table 1.

Table 1. Catagories of Sustainability Status Based on MDS Analysis Index Values

No.	Index Value	Category Status
1	0.00 – 25.00	Poor (not sustainable)
2	25.01 – 50.00	Less (less sustainable)
3	50.01 – 75.00	Fair (quite sustainable)
4	75.01 – 100.0	Good (very sustainable)

An ordination scale between two extreme points, the poor extreme point, and the good extreme point, each with an index value between 0 and 100, can be used to represent sustainability status as a horizontal line. It is considered to be unsustainable if the sustainability index value is less than or equal to 50. It is deemed sustainable if the sustainability index value is greater than 50 and less than 100. After analyzing each dimension, a comparison of sustainability across dimensions will be made, and this comparison can be visualized as a kite diagram.

RESULTS

The outcomes of the sustainability study demonstrated that all examined elements were producing reliable findings. This is evident can be see in the stress value with average of 0.1693 and also the average of R2 coefficient with the determination value of 0.9275. If the value of stress indicated less than 0.25 and the determination coefficient (R2) shows value of 1, sustainability analysis utilizing RAPFISH (Rapid Assessment Techniques for Fisheries) is deemed valid. Based on these criteria, it can be determined that oil palm farms are sustainable and self-sustaining because all the factors used in each dimension have been considered.

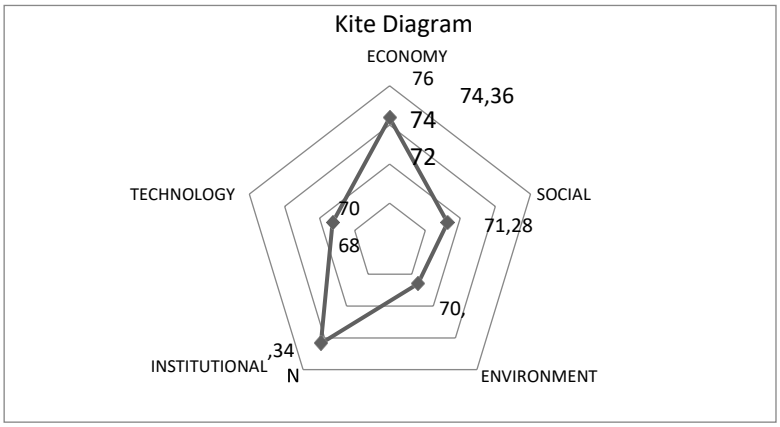
Table 2. Descriptive Statistics Example

Dimensions Sustainability	Sustainability Index	Stress Value	R^2 Value
Economy	74,36%	0,1441	0,9506
Social	71,28%	0,1725	0,9387
Environment	70,59%	0,1791	0,9164
Institutional	72,34%	0,1683	0,9273
Technology	70,14%	0,1824	0,9046
Average	71,74%	0,1693	0,9275

According to the results of RAPFISH (Rapid Assessment Techniques for Fisheries) analysis, the sustainability index of independent oil palm plantations at Sintang Regency, West Kalimantan Province is 71.74%, and the sustainability status belongs to the “moderately sustainable” category.

The sustainability index for the economic aspect is 74.36%, indicating a fairly sustainable situation, the index for the social aspect is 71.28%, indicating a fairly sustainable situation, the index for the environmental aspect is 70.59%, indicating a fairly sustainable situation. For the institutional aspect, the index is 72.34%, which is a fairly sustainable situation. For the technology aspect, the index is 70.14%, which is also a fairly sustainable status. As it shown in the kite diagram for each of dimension in the Figure 6.

Figure 1. The Kite Diagram of Each Dimension



To ascertain the error rate of the Rap-Palm analysis, a 95% confidence level Monte Carlo analysis was carried out. The findings of Monte Carlo values and difference values are displayed in Tables 3. The table demonstrates that the Monte Carlo values are not significantly different from the MDS values at a 95% confidence level. This suggests that there was very little mistake in the data analysis that was done. The difference between the Monte Carlo and MDS values for each dimension is less than 1, which shows: (1) that evaluation errors for each attribute are generally minimal (2) that evaluation fluctuations resulting from disparities are generally modest; (3) that MDS is extensively constant and (4) that it is possible to avoid making substantial mistakes in data input or omission.

Table 3. Descriptive Statistics Example

Sustainability Dimensions	Value of the Sustainability Index (%)		Difference
	Monte Carlo	MDS	
Economy	75,51%	74,36%	-1,15
Social	70,53%	71,28%	0,75
Environment	69,95%	70,59%	0,64
Institutional	73,25%	72,34%	-0,91
Technology	68,76%	70,14%	1,38

Based on RAPFISH (Rapid Assessment Techniques for Fisheries) software and a Multi-Dimensional Scaling technique, the status of sustainability of independent oil palm plantations in Sintang Regency, West Kalimantan Province, is assessed. By modifying field conditions, the MDS analysis examines the identification of dimensions and attributes based on the findings of prior studies and literature reviews. Economic dimensions (8 attributes), social dimensions (8 attributes), environmental dimensions (8 attributes), institutional dimensions (8 attributes), and technical dimensions (8 attributes) are among the dimensions that were looked at in this study.

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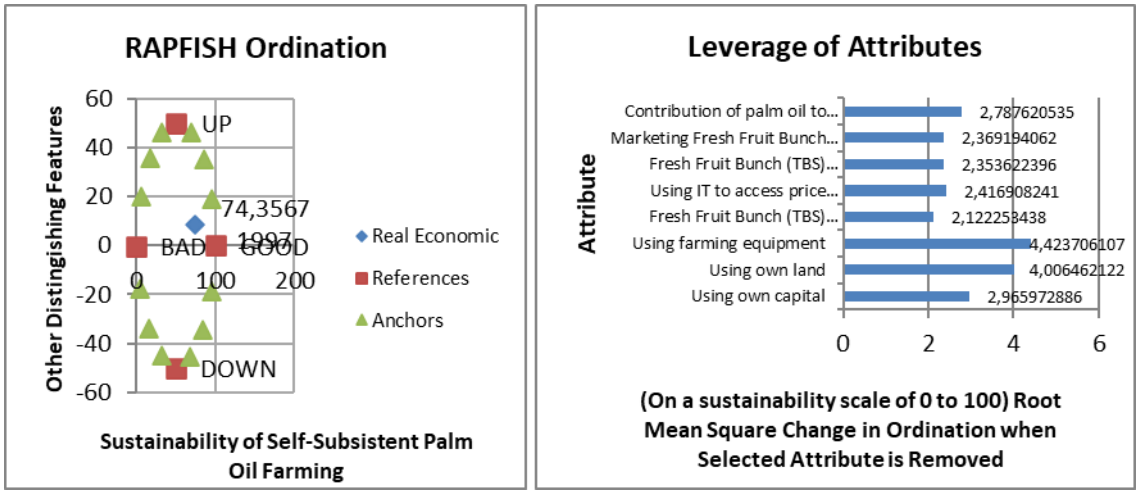
Economic Dimensions

According to the outcome of the MDS analysis, the dimension of economic index value is 74.36, meaning it is quite sustainable. The tension value is 0.14 (<0.25) and MOREOVER R2 is 0.95 (close to 1). Based on the quality of the adjustment results, the economic aspect shows good results. The tension value is 0.14 (<0.25) and R2 is 0.95 (close to 1). Based on the goodness of fit results, the economic dimension provides good results. The Monte Carlo analysis produced a value of 73.50, so the dissimilarity both of the MDS and Monte Carlo values are 0.86, meaning there are insignificant difference when using the 95% confidence level value.

Figure 2. MDS Analysis of Economic Dimension

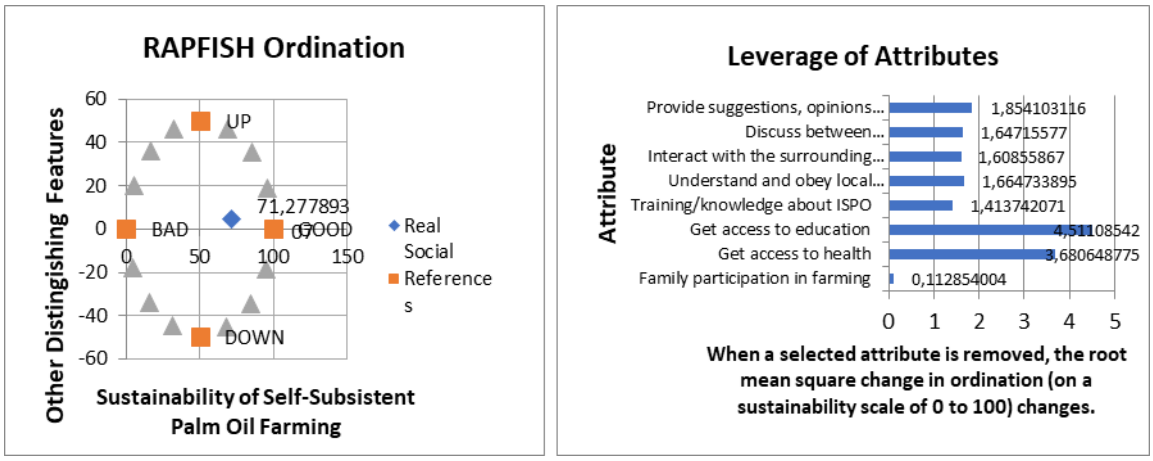


Refecting on the results of the analysis of leverage at the sustainability of independent oil palm farming businesses in Sintang Regency, West Kalimantan in the economic dimension, it is known that of the eight (8) attributes analyzed three (3) sensitive attributes influence independent oil palm farming businesses. The analysis of leverage shows that the most sensitive characteristics are the contribution of oil palm to total income (2.79), the use of own capital (2.97), the use of own land (4.01), and the use of agricultural machinery (4.42).

Social Dimensions

The MDS analysis results indicate that the social component has an index value of 71.28, which is quite sustainable. R2 is 0.95, which is quite near to 1, and the tension value is 0.14 (0.25). The economic factor yields positive outcomes based on goodness of fit findings. The Monte Carlo computation produces a value of 70.53 with a 95% confidence level, indicating that there is no discernible difference both of the MDS and Monte Carlo values.

Figure 3. MDS Analysis of Social Dimension

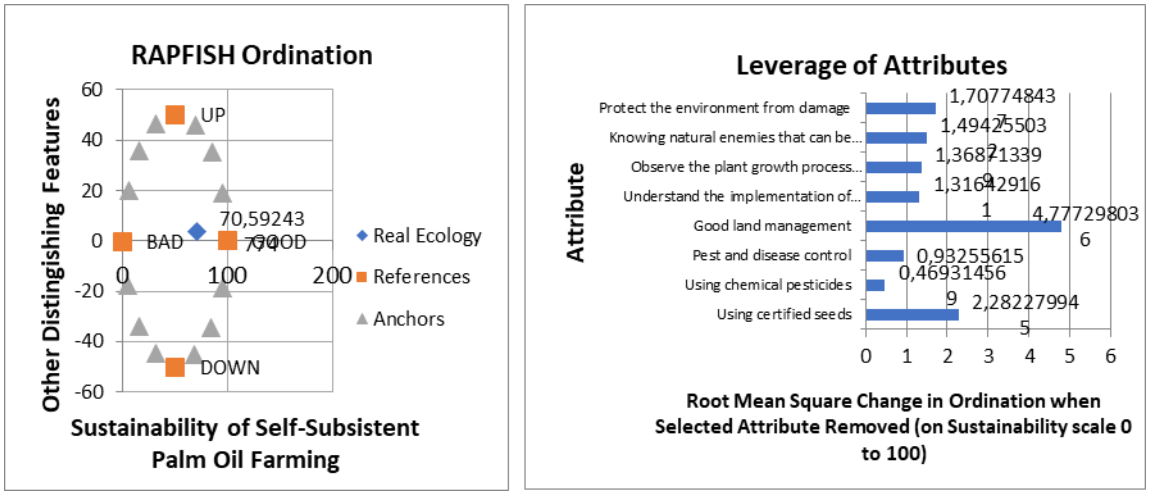


Based on the analysis of leverage of the sustainability of independent oil palm farming businesses in Sintang Regency, West Kalimantan on the dimension of social, it is from of the eight (8) attributes analyzed, three (3) sensitive attributes influence independent oil palm farming businesses, namely (1) gaining access education; (2) getting access to health; and (3) providing advice and opinions on the activities carried out. Leverage analysis shows that the most sensitive attributes are getting access to health (3.68) and getting access to education (4.51).

Environmental Dimensions

As a result of the MDS analysis, the value of the environmental aspect is 70.59, which means quite sustainable. The tension value is 0.14 (<0.25) and R2 is 0.95 (close to 1). Based on the goodness of fit results, the economic dimension provides good results. Monte Carlo analysis produces a value of 69.95, so the dissimilarity from both of the MDS and Monte Carlo values are 0.64, meaning that there is insignificant difference using the 95% confidence level value.

Figure 4. MDS Analysis of Environmental Dimension

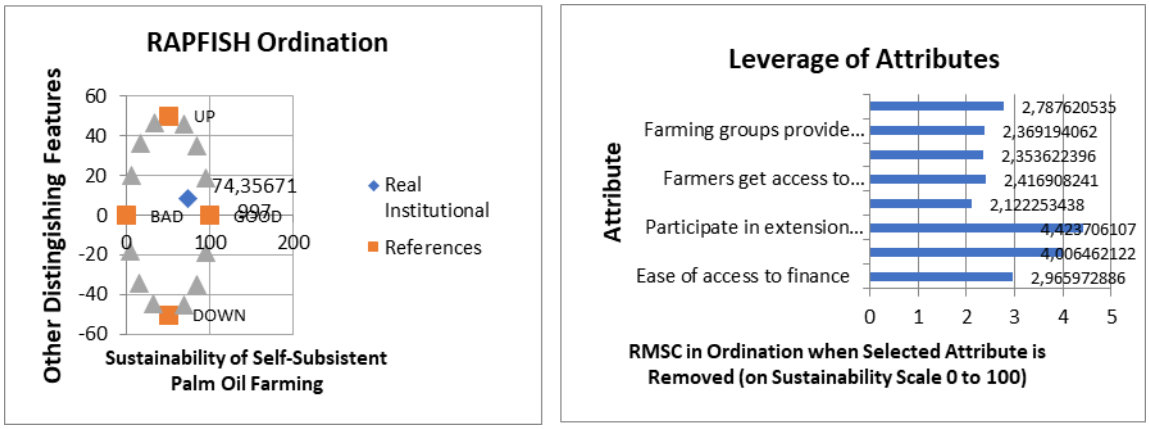


Based on the analysis results of the sustainability leverage of independent oil palm farming businesses at Sintang Regency, West Kalimantan on the environmental dimension, it is known that of the eight (8) attributes analyzed three (3) sensitive attributes influence independent oil palm farming businesses, namely (1) carrying out management soil properly, (2) using certified seeds, and (3) protecting the environment so that it is not damaged. From the leverage analysis shows that the attribute that most sensitive is good land management (4.78).

Institutional Dimensions

The institutional dimension's index score is 74.36, which indicates that it is quite sustainable, according to the findings of the MDS study. R2 is 0.95, which is quite near to 1, and the tension value is 0.14 (0.25). The economic factor yields positive outcomes based on goodness of fit findings. The result of the Monte Carlo analysis is 73.25, and since there is no difference of degree significant using the 95% confidence level value, the difference from both of the MDS and Monte Carlo values are 1.11.

Figure 5. MDS Analysis of Institutional Dimension



Reflecting on the oucomes of the analysis of leverage of the sustainability of businesses in independent oil palm farming at Sintang Regency, West Kalimantan from the dimension of institutional, it is understand that of the eight (8) attributes analyzed, three (3) sensitive attributes influence independent oil palm farming businesses, namely (1) participating in activities counseling; (2) participating in farmer group activities; and (3) farmer groups providing capital to members. Leverage analysis shows that the most sensitive attributes are resolving problems complained about by farmers (2.79), easy access to finance (2.97), participating in farmer group activities (4.01), and participating in extension activities (4.42).

Technological Dimensions

The MDS analysis results indicate that the technology dimension has an index value of 71.28, which is quite sustainable. R2 is 0.95, which is quite near to 1, and the tension value is 0.14 (0.25). The economic factor yields positive outcomes based on goodness of fit findings. The result of the analysis of Monte Carlo is valued at 70.51, and as there is no significant difference using the 95% confidence level, the dissimilarity from both of the MDS and Monte Carlo values is 0.77.

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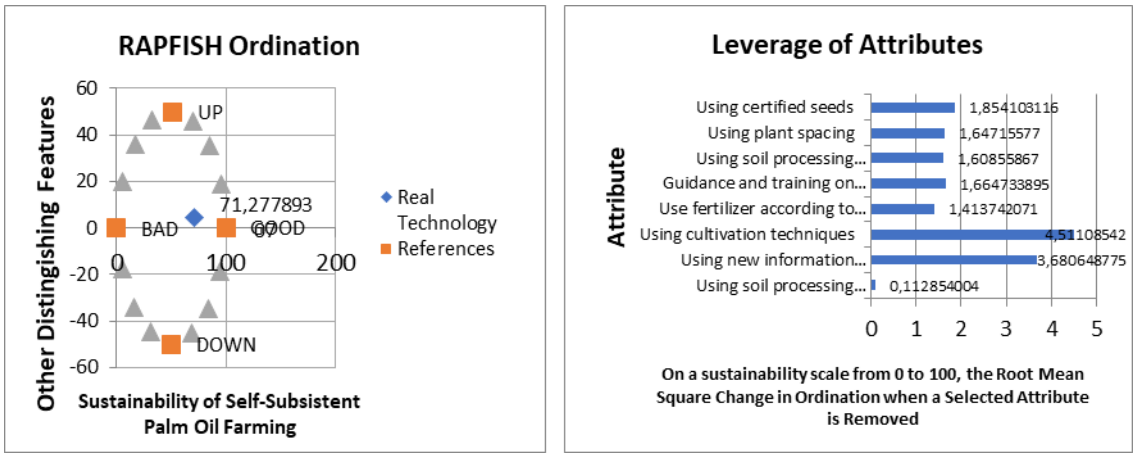
Figure 6. MDS Analysis of Technological Dimension



From on the outcomes of the analysis of leverage in the sustainability of independent oil palm farming businesses at Sintang Regency, West Kalimantan on the technological dimension, it is known that of the eight (8) attributes analyzed, three (3) sensitive attributes influence independent oil palm farming businesses, namely (1) use of fertilizer, according to recommendations, (2) using soil processing technology, and (3) using planting distance. Leverage analysis shows that the most sensitive attributes are using new information technology which will speed up work completion (3.68) and using cultivation techniques (4.51).

DISCUSSION

The economic dimension in the sustainability index value means that independent oil palm farming businesses in Sintang Regency, West Kalimantan, and farmers already have sufficient savings from oil palm farming businesses. Some of the savings are good for capital for oil palm cultivation as well as for meeting daily living needs. This shows that oil palm farming can improve the economy. Palm oil income is sufficient to meet daily needs, this is because good palm oil productivity influences the results obtained. So that the results obtained can finance the daily lives of farmers who can manage oil palm farming well. Independent oil palm farming businesses need to be maintained or continued in their current condition so that they will be sustainable in the future for the children and grandchildren of independent oil palm farmers.

The social dimension in the sustainability index value denotes that social sustainability is constructing superior locations that encourage prosperity by knowing what people require from a place to reside and work. Social sustainability includes the actual and design realms of social infrastructure for supporting the social and cultural life, social amenities, mechanisms of civic participation, and a place for people to thrive. Social sustainability will arise when both of official and informal systems is actively promoting the current and future generations' abilities to develop livable and healthy communities. Sustainable communities that are connected, varied, fair, democratic, and provide a high-quality of lifestyle. This is already done by providing access to quality education and health care. Moreover, what is more important in social sustainability is how to unite communities with different backgrounds.

The environmental dimension in the sustainability index value means creating a good and healthy living environment by consistently and continuously involving community participation and considering the importance of implementing sustainable development in the environmental sector. Committed to avoiding or minimizing the environmental impact of the activities carried out. Strive to conserve resources and raw materials to provide sustainable environmental benefits. The environment needs to be managed well and responsibly so that it remains sustainable to support the lives of people and other living creatures.

The institutional dimension in the index value of sustainability has the meaning of farmers' institutions in rural areas which are often found and are fundamental, namely the institutions for procuring production facilities, farmer institutions, including more than one farmer group in one village and only as a place or forum for farmers. As well as a combination of all farmer groups in the local village or sub-district environment, capital institutions, and marketing/post-harvest institutions. POKTAN (Farmer groups) and GAPOKTAN (Association of Farmer groups) must be able to revitalize themselves into business groups (business units) so that the economic benefits can be felt directly by their members. The development of POKTAN and GAPOKTAN is expected to provide incentives for member farmers. This makes farmers loyal and committed to joining and being active in POKTAN and GAPOKTAN.

The technological dimension in the index value of sustainability means that the development of information technology is currently growing rapidly. The increasingly advanced development of information technology is changing society's paradigm in seeking and obtaining information. Searching for information is no longer limited by time and space. One of the technological developments is in the agricultural sector. Technology plays role in increasing the productivity efficiency and enlargement growth of agricultural activities. Apart from that, the application of technology has the potential to create great added value so that people's purchasing power for agricultural products will increase. Technological innovation in agriculture can take the form of using superior seeds, using agricultural machinery, and fertilizing. Superior seeds are a seed that have guaranteed quality so they can guarantee the success of farming. Agricultural tools and machines can improve the quality and efficiency of cultivating agricultural land. Fertilization is done to provide nutrients to plants to increase production.

CONCLUSION

The index value of sustainability for the economic aspect is 74.36%, so it has a fairly sustainable status, consisting of using farming equipment, using land, and capital. The social dimension sustainability index value is 71.28%, so it has a fairly sustainable status, consisting of getting access to education, getting access to health, and providing advice and opinions in the activities carried out. The environmental sustainability index value is 70.59%, so it has a fairly sustainable status, consisting of managing the land well, using certified seeds, and protecting the environment so that it is not damaged. The index value of sustainability for the institutional aspect is 72.34%, so it has a fairly sustainable status, consisting of participating in extension activities, participating in farmer group activities, and farmer groups providing capital to members. The sustainability indicator value of the technological dimension is 70.14%, so it has a fairly sustainable status, consisting of using fertilizer according to recommendations, using soil processing technology, and using planting distances.

Certification, training, and better input supply chains can benefit small farmers, but certification costs can be risky. Taking into account both social and environmental factors is essential for sustainable policies. In the palm oil sector, sustainability assessment requires a broader perspective, focusing on landscape and jurisdictional approaches due to its environmental impact.

Replanting old or underperforming oil palm trees in response to this is a crucial approach to boost yields while also improving the sustainability and environmental effect of oil palm plants. The sensitive qualities of this study should subsequently be taken into account as variables prior to the oil palm plantations sustainability at Sintang Regency to promote the sustainability of smallholder oil palm crops. Furthermore, to make it simpler for farmers to obtain technology, help with plantation facilities, and agricultural extension services, governments and politicians should strengthen their institutional and organizational roles in supporting oil palm plantations.

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DECLARATION OF CONFLICTING INTERESTS
We certify that the manuscript is free from potential conflicts of interest with any party, including any financial, personal, or other relationships with other individuals or organizations that could influenced or perceived to be influenced inappropriately. We confirm that the article has not been previously published, has not been considered for publication elsewhere, and that the manuscript has not been simultaneously submitted elsewhere.

REFERENCES

Arif, A. (2016). Analisis yuridis pengerusakan hutan (deforestasi) dan degradasi hutan terhadap lingkungan. *Jurisprudentie, 3*(1), 33-41. doi:10.24252/jurisprudentie.v3i1.3622

Asti, P. D. A., Falatehan, A. F., & Putri, E. I. K. (2022). Implementasi peremajaan sawit rakyat (Studi kasus: KUD Tunas Muda Kabupaten Siak-Riau). *Forum Agribisnis, 12*(2), 126-137. doi:10.29244/fagb.12.2.126-137

Baldo, B. A., & Pham, N. H. (2021). Classification and Descriptions of Allergic Reactions to Drugs. In *Drug Allergy* (pp.15-35). New York: Springer Cham.

Betrix, B., Fajri, H. C., & Rawung, S. S. (2022). Competitiveness of Indonesia's crude palm oil in international markets: Based on database 2018. *Journal of International Conference Proceedings, 5*(2), 106-115. doi:10.32535/jicp.v5i2.1677

Burke, P. J., Widnyana, J., Anjum, Z., Aisbett, E., Resosudarmo, B., & Baldwin, K. G. H. (2019). Overcoming barriers to solar and wind energy adoption in two Asian giants: India and Indonesia. *Energy Policy, 132*, 1216-1228. doi:10.1016/j.enpol.2019.05.055

Buys, P., Chomitz, K. M., De Luca, G. D., Thomas, T. S., & Wertz-Kanounnikoff, S. (2017). *Publication: At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests.* Washington DC: World Bank.

Chavas, J. P., & Kim, K. (2010). Economies of diversification: A generalization and decomposition of economies of scope. *International Journal of Production Economics, 126*(2), 229-235. doi:10.1016/j.ijpe.2010.03.010

Chiriacò, M. V., Bellotta, M., Jusić, J., & Perugini, L. (2022). Palm oil's contribution to the United Nations Sustainable Development Goals: Outcomes of a review of socio-economic aspects. *Environmental Research Letters, 17*(6). doi:10.1088/1748-9326/ac6e77

Dahliani, L., Nurdialy, M., Relawati, R & Abduh, M. (2022). The prosperity level of plasma palm oil farmer's family in the state border area during the new normal era. *Jurnal Sosial Ekonomi Pertanian, 16*(2), 155-168. doi:10.24843/SOCA.2022.v16.i02.p03

Dauvergne, P. (2013). *Handbook of Global Environmental Politics* (2nd ed.). Massachusetts: Edward Elgar Publishing.

Dewi, A. A. S. M., Al Muhtaromi, C. U., & Davianti, A. (2022). Disclosure of wood processing industry sustainability: Economic, social, or environment?. *Journal of International Conference Proceedings, 5*(3), 59-78. doi:10.32535/jicp.v5i3.1743

Efriani, E., Utami, D., & Dewantara, J. A. (2020). Sosialiasi Sustainable Palm Oil pada petani Sawit Mandiri. *Journal of Character Education Society, 3*(2), 246-257. doi:10.31764/jces.v3i2.2309

Euler, M., Krishna, V., Schwarze, S., Siregar, H & Qaim, M., (2017). Oil palm adoption and nutrition among smallholder farmers in Indonesia. *World Development, 93*, 219-235. doi:10.1016/j.worlddev.2016.12.019

Fauzi A., & Anna S. (2005). *Pemodelan Sumberdaya Perikanan dan Kelautan untuk Analisis Kebijakan*. Jakarta: Gramedia Pustaka Utama.

Firmansyah, I., Widiatmaka, W., Pramudya, B., & Budiharsono, S. (2016). Sustainability status of rice fields in the rice production center of Citarum Watershed. *Advances in Agriculture & Botanics, 8*(1), 13-25.

Gatto, M., Wollni, M & Qaim M. (2015). Oil palm boom and land-use dynamics in indonesia: the role of policies and socioeconomic factors. *Land Use Policy*, 46, 292-303. doi:10.1016/j.landusepol.2015.03.001

Irianto, H., Mujiyo, M., Qonita, A., Sulistyo, A., & Riptanti, E. W. (2020). The development of Jarak Towo Cassava as a high economical raw material in sustainability-based food processing industry. *AIMS Agriculture and Food, 6*(1), 125-141. doi:10.3934/agrfood.2021008.

Nasution, A., Fajri, F., Karim, A., & Romano, R. (2021). Sustainabilty status and index of Aceh palm oil in central production of West Region Nagan Raya District. *IOP Conference Series: Earth and Environmental Science, 800.* doi:10.1088/1755-1315/800/1/012023

Novahadi, R., Muani, A., & Imelda, I. (2013). Analisis tingkat kesejahteraan keluarga petani kebun plasma kelapa sawit PT. Prakarsa Tani Sejati (studi kasus di Desa Muara Jekak Kecamatan Sandai Kabupaten Ketapang). *Jurnal Sains Pertanian Equator, 2*(3), 1-10.

Qaim, M., Sibhatu, T., Siregar, H & Grass, I. (2020). Environmental, economic, and social consequences of the oil palm boom. *Annual Review of Resource Economics, 12*(1), 321-344. doi:10.1146/annurev-resource-110119-024922

Raharja, S., Marimin, M., Machfud, M., Papilo, P., Safriyana, S., Massijaya, M. Y., …, & Darmawan, M. A. (2020). Institutional strengthening model of oil palm independent smallholder in Riau and Jambi Provinces, Indonesia. *Heliyon, 6*(5), 1-17. doi:10.1016/j.heliyon.2020.e03875

Rasyid, F. (2014). *Permasalahan dan dampak kebakaran hutan*. *Jurnal Lingkar Widyaiswara, 1*(4), 47-59.

Siradjuddin, I. (2015). Dampak perkebunan kelapa sawit terhadap perekonomian wilayah di Kabupaten Rokan Hulu. *Jurnal Agroteknologi, 5*(2), 7-14. doi:10.24014/ja.v5i2.1349

Stoorvogel, J. J., Antle, J. M., Crissman, C. C., & Bowen, W. (2004). The tradeoff analysis model: integrated bio-physical and economic modeling of agricultural production systems. *Agricultural systems, 80*(1), 43-66. doi:10.1016/j.agsy.2003.06.002

Taheripour, F., & Tyner, W. E. (2018). Impacts of possible Chinese 25% tariff on US soybeans and other agricultural commodities. *Choices, 33*(2), 1-7.

Taheripour, F., Hertel, T. W., & Ramankutty, N. (2019). Market-mediated responses confound policies to limit deforestation from oil palm expansion in Malaysia and Indonesia. *Proceedings of the National Academy of Sciences, 116*(38), 19193–19199. doi:10.1073/pnas.1903476116

Tillman, A. D., Hartadi, H., Reksodiprodjo, S., Prwawirokusomo, S., & Lebdosoekojo, L. (2019). *Ilmu Makanan Ternak Dasar*. Yogyakarta: Gajah Mada University Press.

Villoria, E., & Lara, L. (2018). Assessment of the hospital anxiety and depression scale for cancer patients. *Revista médica de Chile*, *146*(3), 300-307.