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The Strategy of Sustainable Management Optimization the Smallholder's Oil Palm Plantation in Seruyan Regency, Central Kalimantan, Indonesia

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Abstract: *The plantations sector holds a very vital role in economic development in Indonesia. One of them is the oil palm plantations. These commodities have a very good opportunity to be developed in the future. Various issues related to smallholder's oil palm plantation in the Seruyan Regency include productivity bunches (fresh palm fruit) are relatively low when compared to the big companies, limited capital and skills, the bargaining position of farmers is still low in terms of determining the price of oil palm fruit, many land still do not have legal title, lack of role of cooperatives and farmer groups and the lack of attention to environmental sustainability. The purpose of this study was to analyze the strategy of optimizing the management of oil palm plantations of non-governmental sustainably in Seruyan Regency, Central Kalimantan. The research method used explanatory research method and optimization analysis using goal programming method. The results of research showed that in order to optimize harvest productivity then it should be done improvements to the physical condition of the plantation, and also many efforts to improve the ability of farmers through training and short courses.*

Keywords: *smallholder's oil palm plantation, optimization, oil palm plantations sustainably*

I. Introduction

Oil palm plantation is a featured commodity in Seruyan Regency. This is due to the high economic value of the plantation. In addition, the agro-ecological conditions in the region largely correspond to the growth and development of oil palm plantations. The development of oil palm plantation area in this region is fairly impressive. Based on data from the Ministry of Environment and Forestry of Seruyan Regency year 2015, noted that the area of smallholder's oil palm plantation occupies an area of 15.006 ha, with production of 6.265,57 tons.

The presence of smallholder's oil palm plantation in addition has a positive side, is also considered to have a negative side. Various problems put forth from the presence of smallholder's oil palm plantation are relatively low productivity when compared to the big companies, the limited modal and skills, the bargaining position of farmers is still low in terms of determining the price of oil palm fruit, the land is still a lot that has not been legally certified, lack of role of the Village Unit Cooperatives and farmers' groups and the lack of attention to environmental sustainability. Based on these facts seen a trend that growing smallholder's oil palm plantation very difficult to qualify sustainable plantations in accordance with the rules of ISPO (Indonesian Sustainable Palm Oil), it is necessary to the assessment criteria more applicable and simple (Dja'fardan Aklmal, 2005; Rajudinnor, et al., 2015; Arif, 2016).

According to Effendi (2005) revealed that the development of oil palm plantations, especially in Kalimantan has not shown the concept of sustainable plantations. However, when seen on the other side, found a lot of evidence that palm oil plantations are managed properly in accordance with the provisions of the recommended capable of producing excellent results, and providing increased income for farmers. In addition to the above problem, there are other challenges and obstacles that must be faced by farmers of smallholder's oil palm plantation. Problems tenure of the legal and regulatory aspects of the legislation, ecological issues, and social conflict. There are two options of the problem by holding the intensification of plantations with limited land area, and perform other activities on the alternative critical plantations or less productive. Both of these options according to Nurhakim (2014) has the same reach, namely how to improve the productivity of crops and land utilization to increase social benefits for the community around the plantation.

The government of Seruyan Regency actually tried to increase of smallholder's oil palm plantation into a better direction. But in its policy, the government has not referring to research data. Rules and policies are made only based on the mindset and the agreement of the leaders. Therefore, the implementation of the policy is

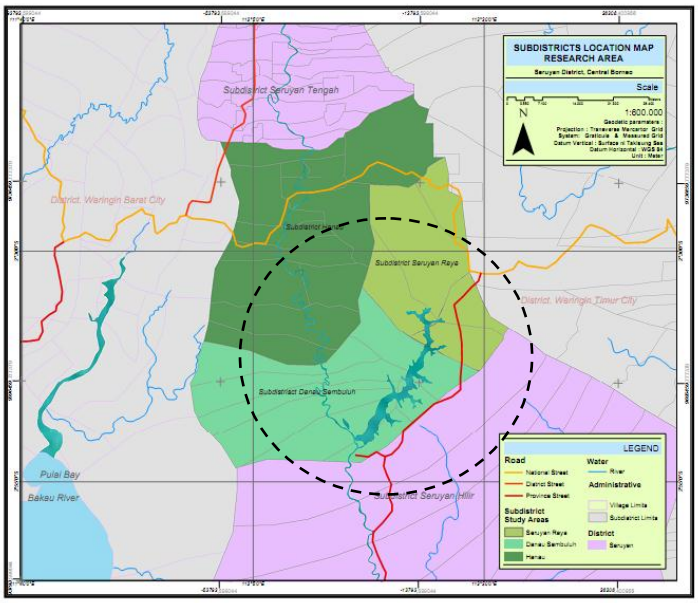
difficult to implement in the field. Therefore it is necessary to do some research to examine critically about the optimization strategy of oil palm plantations in a sustainable manner in the Seruyan Regency. With hope this result, it can be used as a model in determining the development of smallholder's oil palm plantation in Seruyan Regency.

II. Material And Methods

2.1 Research Location

This research was conducted in the Seruyan Regency by taking the focus area of smallholder's oil palm plantation. Location of the study sample intentionally taken out of 3 (three) district's, namely Regency of Danau Sembuluh, Hanau district, and the district of Seruyan Raya. The location was selected because these regions there are six oil palm plantation developments of non-governmental and already in production. The number of farmers who operates a palm oil plantation in the third sub-district is also quite a lot. Additionally, locations were selected based on ease of access to enter the territory. Geographically, the location of research in three district can be seen in Figure 1.

Figure 1. Location of Research



2.2 Data collection methods

The type of data collected in the form of primary data and secondary data. The collection of primary data collected through field surveys and direct interviews with respondents. Interviews were conducted by using tools such as questionnaires and recording devices. Interviews are useful to obtain data from the first hand (primary) (Singarimbun and Effendi, 2006; Usman and Akbar, 2014). The primary data using questionnaires have advantages, including a list of questions can be written with care, allowing more people involved, and makes it possible to interact between researcher and respondent. Primary data needed to optimize the strategy of sustainable oil palm plantations in the summary of the results obtained from the two previous research purposes.

In this experiment, Slovin method for determining the sample size. Slovin method used in this study with precision between 5-10% with the calculation according to Siegel (1990) and Setiawan (2007) as follows.

$$n = \frac{N}{1 + N(e)^2}$$

Remarks :

n = Number of samples of non-governmental oil palm farmers.
N = Total population of non-governmental oil palm farmers.
e = The error rate of 7.5%

Based on the results of these calculations obtained a sample study of 120 people palm farmer of non-governmental that comes from each village located in the Seruyan Regency. The collection of secondary data that examine or look at some source documents that include: data relevant to this research, including previous research that is relevant to this study. Secondary data were obtained from the Central Statistics Agency (BPS) Seruyan Regency (data spacious gardens and palm oil production of non-governmental), the Agriculture

Agency (identity, extensive distribution and possession of of non-governmental oil plantations), Village Office (population and other compliance data) etc.

2.3 Data Analysis

The optimizing oil palm plantations of goal programming method according Muslich (2010). With this concept it is possible to incorporate a variety of purposes in generating optimization solutions. This optimization analysis using statistical software for win 2.0 QM program. Mathematical equations used in this analysis consisted of two kinds, namely (1) the purpose and function equation (2) equality constraint functions. There are four objectives to be achieved in the optimization of oil palm plantation. Goals or objectives consist of: (1) increase the productivity-harvest results, (2) increase the carbon stored, (3) increase farmers' income, and (4) increase the absorption of plantation labor. The objective functions of goal programming models are:

$\text{Min } Z = W_1 (d_1^+ + d_1^-) + W_2 (d_2^+ + d_2^-) + W_3 (d_3^+ + d_3^-) + W_4 (d_4^+ + d_4^-)$.....Pers1.

Description:

W_1=Weights increase crop productivity as a result-purpose

The 1st; W_2=Weights increase the carbon stored as a destination

The 2nd; W_3=Weights increase revenue as a destination

The 3rd; W_4=Weights increase farm employment as a goal

The 4th; Weights and order of priority of each of the different purposes depending on the scenario used in the optimization of oil palm plantations.

Functional Constraints are constraints that bordered in achieving these objectives is limited ownership of land for oil palm plantation business, lack of capital to manage oil palm plantations and cost limitations for the maintenance of oil palm plantations.

III. Results And Discussion

According to the eligibility criteria to grow palm oil, classroom suitability for research that Seruyan Regency is generally very suitable (S1) with the main limiting factors that can be improved is the depth. According Pahan (2008) explains that oil palm plantations require cultivation techniques that correct for each phase with each other closely connected, an error at some stage will affect the success for the other stages. Based on the survey results revealed that the majority of oil palm farmers have been using oil palm seeds which are not certified or unclear origin, not in spite of the demand and supply of seeds are not balanced, the average age of the oil that has been planted in the garden between the ages of 12-14 in order to avoid pests such as wild pigs and rats, 100 percent of farmers do fertilizer by means of sowing fertilizer around the disc at a distance of 1 meter from the base of the stem towards the disc. The majority of farmers do monoculture, only a small percentage of farmers do intercropping patterns because it is used to fulfill their lives while waiting for crops to harvest palm. Lonsum palm plant varieties are excellent for most farmers in the Seruyan Regency. Fertilization is carried out by farmers in each village is still relatively low. This is because the fertilizer recommendation should be given to oil palm plantation is 6 kg tree-1, however Farmer of non-governmental giving of only 5.62 kg tree-1. The use of pesticides by farmers in one year ranged from 11-29 liters hectares -1, however farmer of non-governmental giving weighing only 5.62 kg tree-1. The use of pesticides by farmers in one year ranged from 11-29 liters hectare, as for the age of oil crops and yields productivity gains can be seen in the following table.

Table1. Age Plant Oil and Results productivity of Harvest in Every Village

No	Village	Average Age of Plant Oil	Productivity (Ton Ha^{-1} Th^{-1})
1.	Sembuluh I	5,9	10,61
2.	Sembuluh II	7,1	10,25
3.	Tabiku	6,1	11,45
4.	Bangkal	5,4	7,05
5.	Pembuang Hulu I	6,1	13,79
6.	Pembuang Hulu II	7,8	18,23

On the goal in this study stated that the activities of farmers of oil palm plantations in the self Seruyan Regency can be optimized through several steps optimally in order to achieve increased productivity, enhancement of carbon stocks, increase acceptance, employment on land with a minimum cost and capital is relatively affordable. Optimization of this research is intended to maximize the benefits of oil palm plantation of nongovernmental while ensuring sustainable productivity and properly maintained. Here are the results of the optimization of oil palm plantations in the Seruyan Regency using Goal Programming:

Table2. Results Output Optimization of Oil Palm Plantation Seruyan Regency

Optimization of Oil Palm Plantation			
Item			
Decision variable analysis	Value		
X1	20,81		
X2	106,73		
X3	6084501		
X4	2		
X5	3,33		
X6	1571092		
X7	14916510		
Priority analysis	Nonachievement		
Priority 1	0		
Priority 2	0		
Priority 3	0		
Priority 4	0		
Constraint Analysis	RHS	d+ (row i)	d- (row i)
1	0	0	0
2	0	0	0
3	4513409	0	0
4	2	0	0
5	3,33	0	0
6	1496510	0	0
7	1571092	0	0

Based on output above, obtained the optimum solution for oil palm plantations governmental organizations that are solved by using Goal Programming model it can be concluded that all the goals in each variable can be fulfilled which include the total productivity of the crop of fresh palm fruit bunches, total carbon saved, total oil palm plantation farmers' income and employment with limited ownership of land, the cost of maintenance and the cost of processing oil palm plantations. Overall optimization of oil palm plantations in the Seruyan Regency obtained by taking into account the financial aspects, the environmental and socio-economic. The scenario used in obtaining optimization in Seruyan Regency is on the condition that increased production of fresh palm fruit bunches at least reach 6.25 tonnes hectares-1 year-1, total carbon saved at least 32,05 tonnes hectares-1, farmers' income of at least Rp 4,513,409.00 with an increase in employment of at least 2 hectares -1 on land with an area of 3.33 hectares and a minimum of modal must be issued least Rp 14.916.507,00 hectares-1 year-1 as well as plantation maintenance costs least Rp 1.571.093,00 hectares -1. Based on the results in the output in Figure 4.1, it can be seen that the objectives will be achieved when the whole palm plantations in Seruyan Regency has met the total productivity-harvest of 20,81 ton hectares-1 year-1, a total of 106,73 tons of carbon stored hectares-1, total income of farmers reached Rp 6.084.501,00, and total employment of 2 people hectares-1 with a barrier in achieving the limitations of ownership of land for palm plantation with an area of 3.33 hectares and lack of capital to manage oil palm plantations amounting to Rp.14.916.510,00 hectares-1 year-1 and limited cost to maintain oil palm plantations Rp 1.571.092,00 hectares-1.

All priorities or the goal in the Seruyan Regency achieved. It is seen by nonachievement column that shows the value zero. In the survey data of respondents in the Seruyan Regency, of 120 respondents only 16 respondents farmer who now has reached the total productivity of the crop of fresh palm fruit bunches. For the total carbon saved, there is currently no respondents who reached optimal. While the total income of farmers, the current that has reached the optimal total revenue is already 77 respondents. For total employment and oil palm plantation area, today no one can been able to achieve optimal only 31 respondent farmers. While in the capital and the costs incurred farmer plantation in Seruyan Regency, there are 42 respondents who have reached optimal.

Strategies to realize the optimization of the management of oil palm plantations in a sustainable manner should be done integrated taking into account all the strengths, opportunities, weaknesses or threats to the oil palm plantation itself. By identifying in detail is expected to be able to produce a good strategy (Table 3).

Table 3. Strengths, Weaknesses, Opportunities and Threats faced in the development of Palm Oil

No	**Analysis**
1.	**Strengths (S):**
1.1.	Seruyan districts have suitable land conditions for oil palm plantations.
1.2.	Based on economic calculations, the implementations of non-governmental oil palm plantations as well as feasible, and if done with the proper management of which will provide maximum results.
1.3	The human resources sufficient available in each district.
1.4.	Has great potential for development efforts in quality and quantity.

2.	**Weakness (W):**
2.1	Usage (superior oil palm seeds) is still very low by independent smallholders.
2.2	Farmers still low skills in managing oil palm plantations.
2.3	Accessibility to the plantation folk is still disrupted.
2.4	The application of the technology is still low and many farmers are applying the old technology (10 years ago).
2.5	The lack of capital support from the government towards the palm Farmers governmental organizations.
3.	**Opportunities (O):**
3.1	Total production of fresh palm fruit bunches can reach more than 20 tons of hectares^{-1}year^{-1}.
3.2	Modal to manage oil palm plantationsoptimally Rp.14.916.510,00hectares^{-1} year^{-1}.
3.3	Total cost of maintenance optimally amounted Rp. 1.571.092,00hectares^{-1}.
3.4	Total income of farmers optimally reach more than 6 million rupiah hectares^{-1} year^{-1}.
3.5	Employment optimally by 2 people each hectares^{-1}.
3.6	Area of land for oil palm plantation business optimally with widely 3,33 hectares.
3.7	)on that saved optimally amounted to 106,73 ton hectares^{-1}.
4.	**Threats(T):**
4.1	The potential conflicts that disrupt business continuity of oil palm plantations of non-governmental.
4.2	The scarcity of fertilizers and pesticides.
4.3	Prices of fertilizers and pesticides are expensive and unreached by the farmers.
4.4	The existence of a fire hazard plantation in the dry season.
4.5	The presence of pests and diseases attack.

After the identification and classification of SWOT, then in drafting several strategic factors policy will use the SWOT matrix. Rangkuti (2006) explains that this matrix showing clearly how the opportunities and internal threats encountered can be adapted to the internal strengths and weaknesses owned. The matrices can produce four sets of the possibility of strategic alternatives, as shown in Table 4 below.

Table 4. The Development Strategy of Non-Governmental Oil palm plantation in the Regency Seruyan

No	Analysis
1.	**Strategy SO (*Strengths and Opportunities*)**
1.1.	Seruyan District Government should establish a policy on the importance of certifying all the activities of oil palm plantations of non-governmental.
1.2.	Seruyan District Government should establish policies that protect smallholders of non-governmental.
1.3.	Seruyan District Government must ensure the stability of the investment climate in the district.
1.4.	Seruyan District Government should facilitate business partnership agreement between the farmers of non-governmental with a large-scale company.
1.5.	Seruyan District Government should encourage investors to increase the number of palm oil processing factories that exist in this region.
2.	**Strategy ST (*Strengths and Threats*)**
2.1	Apply customary law to address the issue of conflict in the region Seruyan District.
2.2	Seruyan District Government should supervise the distribution channels of fertilizers and pesticides.
2.3	Seruyan District government would have to subsidize fertilizers and pesticides.
2.4	Applying early prevention systems fire hazard area in coordination with the villagers.
2.5	Applying the appropriate spacing to minimize the impact of fire hazards in the area.
2.6	Applying the use of organic fertilizer or compost.
3.	**Strategy WO (*Weakness and Opportunities*)**
3.1	Encouraging farmers' groups combined to play an active role in providing information about good plantation management.
3.2	Encouraging Seruyan District Government to issue a policy on replacing all of the palm trees that are not superior seeds.
3.3	Encouraging Seruyan District Government to provide compensation to farmers on the application of superior seeds.
3.4	Encouraging Seruyan District Government to issue a policy on the use of the latest technologies in managing oil palm plantations of non-governmental.
3.5	Encouraging Seruyan District Government to make micro-economic institutions based cooperatives and Islamic system.
3.6	Utilizing the village funds from the Central Government for the development of oil palm cultivation.
3.7	Seruyan District Government should facilitate cooperation between the farmer and the Company in the utilization of the Company's access roads used by farmers.
3.8	Encouraging Seruyan District Government to issue a policy on the minimum price of fresh palm fruit bunches prevailing in this region to protect farmers from speculators.
4.	**Strategy WT (*Weakness and Threats*)**
4.1	Encouraging Seruyan District Government to provide training and improving the quality of judges customary.
4.2	Encouraging people to apply local knowledge to cope with the disaster.
4.3	Encouraging people to adopt the use of biological agents that are environmentally friendly for the eradication of pests and diseases.
4.4	Do counseling and a short course on the use of compost that is integrated with the oil palm plantation.
4.5	Encourages the Government to conduct surveillance in maintaining the stability of the price of fresh palm fruit bunches in the Seruyan District.

Several strategies are carried out as steps above are expected to increase the productivity of oil palm land of non-governmental and maintaining the continuity of palm oil plantation itself. According Pardamean (2014) states that for obtaining the maximum harvest of folk oil palm plantations, in addition to improving the

physical condition of the plantation, also required efforts to improve the ability of farmers. Improving the ability of farmers can be done by various measures such as providing more intensive counseling program, direct assistance, and the organization of short-term courses. Moreover, oil palm plantations non-governmental are in the land sour that lacking in nutrients. The availability of nutrients in part can be added through the use of leguminous plants, especially on dry land as a cover crop (Broughton, 1977; Agamuthu et al., 1981). Proper nutrient management is necessary to balance the nutrient input and loss are different. This is particularly important with a ratio of N:K and K:Mg, and also with micro-nutrients in soils, such as peat. On soils with low K content, balance K-N fertilizers were both able to give better results even than oil crops grown on sandy soils (Ollagnier and Ochs, 1973).

V. Conclusion

Based on the research we concluded that the strategy should be done by the farmer of the oil palm plantation of non-governmental in the Seruyan Regency for the optimum results by improving the physical condition of the plantation, and also many efforts to improve the ability of farmers through training and short courses. The study recommends that the farmer ought to get the optimal order harvest use of seeds that have a certificate and make improvements in aspects of nutrient availability with an effort to increase levels of organic matter and soil depth should be added again in accordance with the requirements of growing oil palm plants so that the palm trees get more nutrients. Moreover the farmers of non-governmental can take advantage of the village fund from the central government as working capital for the purchase of fertilizer and seed supply the best, so that the public can obtain better results independently.

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