The Role Of Various Social Economic Variables To Support Sustainable Practices: Study In The Smallholder Rubber Plantations In North Sumatera

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Abstract: The research aims to understand the influence of various social-economic variables in the practice of fertilizing smallholder rubber plantation into sustainable agriculture in North Sumatra. A quantitative descriptive method was applied to understand the various social-economic issues that support their rubber plantation sustainability. Some social economy variables as independent variables are farmer's age, number of dependents, education, land area, land status, rubber age, seedling source, seedling quality, and seedling planter. The dependent variable is the fertilization treatment of compost and manure as a sustainable behavior. The analysis was conducted with a Chi-square test to determine the relationship of the independent variable with the dependent variable. The results showed that fertilization behavior determined by land area, land status, source of seedling, quality of seedlings, and planter. These findings suggest that efforts to go on sustainable by doing fertilization will be made by the farmer when they can increase revenue confidently. Besides, it shows farmers with extensive land tenure tend not to fertilize due to resource limitations.

Index Terms: rubber plantations, local custom, sustainable, socio-economic, institutions.

1 INTRODUCTION

Smallholder rubber plantations in Indonesia estimated by the Indonesian Bureau of Statistics, reaching 3.1 million hectares or 85 percent of the total national rubber plantation area. In North Sumatra, in 2015, with a total area of 378.423 ha dominated by smallholder rubber plantation, reached 65.78 percent. But its productivity is low below 1 ton per hectare per year. Low production is due to the low management of the farmer [1]. Some of the problems often found in the field are the dominance of old rubber, low production, inefficient marketing, and the provision of superior seedling and other inputs [2]. The problems such as delays in rejuvenation and the traditional pattern of cultivation make the smallholder rubber plantations less productive. These problems force the shifting from the rubber crops into others, such as oil palm, and in the long term, can threaten the sustainability of rubber plantations in North Sumatra. Nonetheless, the problem of sustainability of the rubber plantations is not only about physical factors and management but also involved the socio-economic and cultural [3]. A sustainable community rubber plantation model offers a new solution. Sustainable development, according to Strange [3], was not a certain point of harmony, but rather a process of change. Therefore, an approach of sustainable agriculture development has been complex and has various concepts, and cannot be clearly defined. Jules[4] argued that a system approaches with participatory methods is needed to drive sustainability. It argues that sustainability largely determined by human factors or farmers who got involved in managing a farming business.

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A sustainable agriculture approach involves ecological, economic, and socio-cultural sustainability factors. The development of sustainable smallholder rubber plantations also means having to pay attention to those three variablesThis research activity produced the concept of sustainable management of smallholder rubber plantations in North Sumatra. Many studies about sustainable agriculture focused on the physical aspects of farming in its management. On the other hand, sustainability, as mentioned above, cannot be separated from socio-economic activities, although it has not been in enough attention[5]. Sustainable development planned to meet the needs of the present generation and not to reduce the ability to meet the needs of future generations without compromise[3]. Sumodiningrat[6], explained that the goal of sustainable development is to improve the welfare of the community through the development of community structures that emerge from themselves to advance, be independent, prosperous and just. The terms of the economy, sustainability here is shown by continuous productivity in the long run, even between generations (economically viable). Economic sustainability will achieve when farmers may produce enough crops to meet their needs. Then they have sufficient income to return the labor and costs which already spend. In terms of ecological sustainability, there is no degradation in the soil and the environment or is ecologically stable. The quality of natural resources and agroecosystems could be maintained as a whole. The approach is to make improvements in farm management through conservation agriculture. Sinukaban[7] elaborated that the conservation farming systems could guarantee a sustainable practice by equipping farming with conservation as an improved farming system. It can guarantee high productivity and income, low erosion rates, and agricultural technology that is easily adopted and practiced. The combination of local farmers' knowledge and cropping practices (conservation) appropriate to address the local problems. Furthermore, the system can be sustainable, including an understanding of local agroecology and crop cultivation practices that prioritize conservation elements also determine the success of this system[8]. The socio-cultural aspect emphasizes the values of a society where farming was suitable for the community and provided stability and development of the community. The compatibility of culture, tradition, and social structure was a very important factor for the sustainability of the system. The aim of increasing production and income was not important for farmers if it is not a response to their problems[9]. Some studies on sustainable agricultural practices such as organic agriculture considered to be compatible with the economic, social, and environmental dimensions in Sub-Saharan Africa [10]. Another model carried out, such as diversification of plant species in Malaysia in a farming business to meet the needs. It was increasing demand for food, fiber, fuelwood, and animal feed to nourish the environment, with farmers earning more promising income[11]. Biggelaar[12] explained that sustainable agricultural practices and technology could conventionally increase the production of crops and livestock. The practice has minimal impact on environmental damage, while the impact of institutions and social conditions was unclear. Kumbhar et al. [13] and Bruges et al. [14] argued highlight the importance of policies for the effectiveness of sustainable agricultural technology transfer and natural resource management. Farmer factors are the most important actors in sustainable agriculture. Hence, it must have a positive mentality and sufficient knowledge and supported by other parties to support sustainable agricultural practices[15]. Owubah et al. [16] argued few farmers lead to sustainable practices in managing resources when there is less incentive for them. Sustainable agriculture approaches emphasize the existence of these three variables simultaneously. It is related to the control of the resources concerned, in this case, the people's rubber plantations. When the tenure system was able to guarantee the rights of the community, then the creativity of farmers in developing the system can be done, including sustainable management Security obtained when there are local institutions that provide recognition of community rights to land and trees, or it functions as a source of security for community rights. Self-organizing seems to occur if resources have a strong attachment to users, when users understand their problems, and when they have the autonomy to make their own rules, and other attributes[17]. The activities that have been carried out on several studies of the community land tenure system in North Sumatra in 2004-2005. The results indicated that the local communal institution has a key role in encouraging tree planting and maintaining trees on community lands. However, the local institutional system lacked attention, and the function in resource management was poorly implemented[18]. This study illustrates that land tenure conflicts can resolve by involving the local customary institution's elements, namely Mora, Kahanggi, and Anakboru. The role of each of the local customary institution's element needs to be repositioned and strengthened to overcome the conflict. When this role is carried out in land management, early conflict avoided. Another study that has also been carried out is the pattern of land and tree control in smallholder rubber plantations in 2016. The results illustrated that rubber plantations manage by rent or profit-sharing systems are more productive but cannot develop in the long term, such as rejuvenation. If the rubber plantations are self-managed, even though they can manage in the long term, so there are less productive compared to the rent or profit-sharing system.

2. MATERIAL AND METHOD

The research uses a descriptive quantitative method that aims to develop the concept of sustainability towards the smallholder rubber plantations problem. The research intended to analyze the pattern of on-farm management of smallholder rubber plantations in North Sumatra. The approach based on various input activities carried out by farmers to rubber plantation land. The on-farm management pattern will describe the management model by the rubber farmers concerned.

2 .1. Data Collection

The research conducted in North Sumatra Province. The location was chosen purposively based on the distribution of smallholder rubber plantations. The study conducted in April - October 2018. A preliminary survey was carried out on the condition of the study area, i.e., geographical conditions, land use, and the types of staple crops cultivated by the community. Based on the pre-survey in North Sumatra, four regions were chosen as the research locations, namely in Mandailing Natal, Langkat, South Tapanuli, and Central Tapanuli. The location was determined by the criteria that there are dominant smallholder rubber trees. Respondents were determined purposively, namely rubber plantation farmers, indigenous community leaders, and government agencies in the research area. Primary data obtained directly in the field from respondents to describe the profile of on-farm management of smallholder rubber plantations, namely all inputs made by farmers to rubber plantation lands, such as production facilities, labor, and garden management activities. Secondary data obtained from village institutions and related institutions, namely: 1) physical conditions of the study area, soil, and physiographic conditions, topography, and elevation, land use, local climate and forest area, 2) regional demographics concerning the structure of society, namely population, employment, education, etc., and 3) socioeconomic conditions of the community in the study area.
The method and data collection instruments used in this study were; 1) Observation, which conducted before data collection from the field and respondents. 2) Questionnaires (list of questions) made to obtain data relating to the research topic. 3) Interviews conducted to deepen the answers to the research questionnaire. 4) Document studies are carried out as secondary data for complementary primary data.

2. 2. Data Analysis

The analysis was carried out in a quantitative descriptive way to describe the relationship between the variables of farming fertilization activities with socio-economic variables, i.e., Farmer's age, number of dependents, education, land area, land status, rubber age, seedling source, seedling quality, and seedling planting. The relationship between these variables was analyzed using the Crosstab and Chi-Square test. We use SPSS software ver 23.

3. RESULTS AND DISCUSSION

3.1. Characteristics of farmers

The characteristics of the farmers in data tabulation grouped into several criteria, as in Table 1.

TABLE 1
CHARACTERISTICS OF VARIABLES ON PLANTATION MANAGEMENT AT THE RESEARCH SITE

Criteria	N Valid	Mean	Std. Error of Mean	Std. Deviation	Variance	Minimum	Maximum
Farmer's age	72	43.76	1.068	9.061	82.098	24	67
Number of dependents	72	3.25	0.201	1.71	2,923	0	9
Education	72	2.13	0.13	1.1	1.21	0	5
Land area	72	11080.56	689.633	5851.728	34242715	1500	35000
Land status	72	1.33	0.074	0.628	0.394	1	3
Rubber age	72	18.1	0.901	7.646	58.455	4	50
Seedling source	72	1.92	0.051	0.436	0.19	1	3
Seedling Quality	72	1.49	0.095	0.805	0.648	1	3
Planter	72	1.43	0.09	0.766	0.587	1	3
Fertilized	72	1.22	0.049	0.419	0.175	1	2

Based on Table 1, the average age of farmers is 41-50 years, reaching 37.5 percent. In the wider range of 31-60 years reaches 91.6 percent, but young farmers under 31 years are only 5.6 percent. It is illustrated that an average farmer was a quite old group, but still productive in carrying out various activities in their respective rubber gardens. The majority of education levels graduating from elementary school to high school (93 percent). The average number of dependents 2-5 reached 82 percent, and the majority of them were three dependents. Farmers have highly dependent on their households, which is almost four people in each household. The number of dependents related to economic burden in meeting family needs. Farmers with dependents 2-3 people tend to cultivate their farming land, reaching 50.7percent. While farmers with more than three dependents will increasingly fertilize, and farmers with more than five dependents tend not to fertilize. The average land area was in the range of 5000-15000 m2 reached 79.1 percent. The majority of land ownership was private, reached 75 percent, only 16.7 percent were rented and shared profit by 8.3 percent. Accompanied by an average rubber age range of 11-20 years reached 58.3 percent, and rubber old age 21 to 25 years was 15.3 percent. This illustrates that the smallholder rubber plantations were already old with the sap production which begins to decline. Source seedlings from purchasable reached 80.6 percent, 13.9 percent own seedling, and others 5.6 percent, with an average of good quality 70.8, and 29.1 percent were not clear. Most of the seedling was planted by themselves for 73.6 percent, 9.7 percent of the parent plants, and 16.7 percent of the planting by others. From the overall sample of farmers, 77.8 percent of farmers applied fertilization, 22.2 did not fertilize. Traditional farmers tried to increase their production and income through fertilization efforts.

3.2. Descriptions of Statistics

In this research, we tried to find out why the management of smallholder rubber farmers considered traditional? Hence, it is difficult to encourage a sustainable source of livelihood. Therefore, we make the farmer's activity to fertilize as a barometer of efforts of farmers to get high production following their expectations. The following was the relationship between fertilization activities with various socio-economic variables of farmers and their management characteristics (Table 2).

TABLE 2
THE CHI-SQUARE TEST OF FERTILIZATION RELATIONSHIP WITH VARIOUS SOCIO-ECONOMIC VARIABLES

	Farmer's age	Number of dependents	Education	Land area	Land Status	Rubber age	Seedling source	Seedling quality	Planter
Pearson Chi-Square	.482	.18	.133	.049	.000	.185	.000	.000	.000
Likelihood Ratio	.327	.24	.115	.12	.000	.97	.000	.000	.000
Linear-by-Linear Association	.846	.008	.606	.444	.001	.427	.002	.000	.000
N of Valid Cases	72								

From Table 2, the significance of Pearson chi-square < 0.05 are the following variables, namely land area, land status, seed source, seed quality, and planters. This indicates that the variable has a significant effect on the fertilizing behavior by rubber farmers. While the value of Pearson chi-square variable age of farmers, the number of dependents, education of farmers, and age rubber age showed > 0.05. This indicates that the variables have no significant effect on the fertilization behavior of the rubber farmer. The relationship between fertilization and land area, from the chi-square level, obtained Pearson chi-square significance value = 0.049 < 0.05. It shows between land area and fertilization has a significant relationship. Land area measuring 0.76 - 2 Ha tends to fertilized, this was 78.1percent, but land with a narrow area below 0.5 ha and above 2 ha was more likely not to be fertilized. Farmers have a narrow average land area being the main barrier for farmers to increase their rubber production. It was due to the number of species planted that do not produce well. The main cause was a source of seedling that was not guaranteed. With the average age of rubber cultivation, it was over 20 years old, so production was difficult to increase. Efforts to rejuvenate plants could be made to replace older plants with more productive young plants, but the source of guaranteed seedling was difficult to obtain by farmers. Likewise, with the status of the land, there was a relationship between the status of the land and fertilization, the land itself tends to be fostered by farmers rather than rent or profit-sharing or shared property, with a percentage of fertilization is 87.5percent of its own, rent was the only 5.4percent, and joint property was fostered 7.1 percent. The relationship between seedling sources and fertilization shows the Pearson chi-square = 0,000 < 0.05. It shows there was a significant relationship between the seedling purchased with fertilization. Farmers tend to fertilize when the seedling originating from nurseries reach 92.9 percent. This means that farmers expect that the purchased seedling has good quality or superior seedling, hoping to get better production. While the plants originating from their seedling were only fertilized by 3.6 percent, and seedling from other sources is fertilized, reaching 3.6 percent. The relationship of fertilization with seedling quality, from the chi-square table, obtained significance values of Pearson chi-square = 0.000 < 0.05. It concluded that there was a significant relationship between seedling' quality and fertilization. Seedling with good quality tended to be fertilized by farmers compared to a bad seedling. Seedling with good quality was fertilized by farmers reached 83.9percent. But poor quality seedling was fertilized by farmers only 5.4 percent, and the unqualified ones were fostered at around 10.7percent. The source of seedling was responsible for any problem for the smallholder rubber farmers in the research area. Most of the farmers did not know whether or not the seedling planted were of good quality. As a result, there was no guarantee for the sustainability of later production. That illustration indicated the average age of rubber plants living more 20 years, so the guarantee of seedling quality not obtained dominantly. Good sources of rubber seedlings usually originated from far areas. So any efforts to get quality seedling required greater attempt. Data found farmers tend to plant their seedling with good quality. There was a significant relationship that planted fertilizers. Farmers who planted their rubber trees tend to fertilize. Farmers were to grow their own fertilizing reached 85.7percent, compared to planting by parent 7.1percent, as well as other people who planted 7.1 percent who did the fertilizationAnalysis of the age classification variable revealed that farmer education level, rubber plant age by fertilizing had no significant relationship. It means the farmers were fertilizing more often due to the economic goals; it gained better results. Increasing of Fertilization frequency was found among the farmers who had a higher level of education or have better knowledge, and it happened as rational choices to get increased production. The aim of getting better benefits from farming is an important reason for sustainable agriculture [11]. Azman et al. [15] argued that farmers' knowledge was important for accepting incremental models in managing farms. That was reasonable for traditional farmers who are different from contract farmers, which based on commercial purposes. The ability of farmers to provide fertilizer, however, was an obstacle that hampered the fertilization treatment to land. It can be bound where when the family's economic needs were higher as indicated by a greater number of dependents (more than five people), the farmers prioritized to fulfill the household needs rather than doing fertilization. Sustainability efforts could not be made through improving farmer education or encouraging expansion of farming, but through providing quality and guaranteed rubber seedlings because by obtaining quality seedling, farmers directly managed the crops more optimistically than when the seedling was not qualified and unknown. The aim of farmers to utilize quality seedling was also the technology application to increase production [19]. The importance of demographic variables for farmers to accept a sustainable agriculture approach was demonstrated by Silva, Samah, and Uli [20]; it was indicated by rubber farmers where the number of dependents to a certain extent limited them to fertilize the land.

4. CONCLUSIONS

The characteristics of farmers indicate that they are over 40 years old average, but they are still productive in managing their rubber gardens. Fertilization activities to increase rubber production are significantly related to the land areas, land status, seedling quality, seedling source, and rubber planter.

Farmers are trying to fertilize if they believe the seedlings are planted with good quality, from a good sourced, and planted by themselves. But the fertilization effort is made by farmers with a narrow land to 2 Ha, while farmers with vast land tend not to do fertilization. Efforts to encourage sustainable smallholder rubber plantations should be more focused on a variety of variables input management of the garden that aims as a source of income.

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