INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

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THE ANALYZE OF FACTORS INFLUENCES IN IMPROVING LATEX PRODUCTION OF RUBBER SMALLHOLDERS IN SOUTH SUMATRA PROVINCE, INDONESIA

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ABSTRACT

The latex production of rubber smallholdings in the South Sumatra Province, on the average, only 0.7 ton per hectare annually. It is lower than the national average production of 1.2 ton per hectare per year. The objective of this study was to analyze the factors that influences in improving latex production of rubber smallholders in the South Sumatra Province. The total sample used for the study was 300 respondents. Data was analyzed using the descriptive statistics and multiple regression analyses. The Results of research indicated that factors such as use of recommended seedlings, fertillisers, pesticide, planting density (rubber trees per hectare) and participation in government programs significantly affect rubber latex outputs. There are two serious problems faced by the rubber farmers, i.e. costly and hard to find of recommended seedlings, fertilizers and pesticides. Besides, the frequency of farmers participation was also very low although the program was free of charge. The rubber farmers have a management problem that affects the quality and quantity of the latex. A significant implication of the study is that smallholders need to use the recommended rubber seedlings, adequate use of fertilizer, use of pesticides and need to attend training programs provided by the government to improve their latex output. Thus government assistance is needed to better improve the rubber smallholdings in the form of subsidy and more trainings and agricultural extension services.

KEYWORDS
latex production, rubber smallholders.

1. INTRODUCTION

Rubber is one of the top foreign exchange earners among Indonesia's primary agricultural commodities. Production per hectare needs to be rapidly increased by improving efficiency and using modern technology as well as cultivating high quality varieties if Indonesia aims to be the biggest rubber producer country in the world. Rubber is a non-oil and non-gas commodity and its export value is increasing consistently. In 2013 rubber exports contribution 4.61 percent of foreign exchange earner in the non-oil and gas sector. Indonesia's export earnings from rubber was aobut US$ 149.92 billion in 2013 (*Departemen Perdagangan*/Commerce Department, 2014).

In an effort to improve Indonesia's rubber producer, it is necessary to develop rubber smallholdings. In addition, development of the smallholding would increase their production and improve farmers' incomes. Eighty percent of the land in Indonesia which is used for the cultivation of rubber consists of smallholdings and the remaining 20 percent are large plantations (*Direktorat Jenderal Perkebunan* / Directorate General of Plantations, 2011).

South Sumatra Province is an important rubber smallholding area in Indonesia. Based on the data from BPS (2013), the total area used for planting rubber in South Sumatra Province is about 1.200.000 hectares or 26.47 percent of the total area of rubber cultivation in Indonesia. The total hectare of rubber smallholdings in this province is 85 percent of rubber cultivation. Thus, only 15 percent of rubber belongs to and managed by big companies and government-owned corporations (BUMN). Generally, the size of rubber smallholders in this province ranges from less than one hectare to five hectares (*Dinas Perkebunan*/Plantations Department, 2012) and less than one percent of the rubber smallholders have more than 5 hectares of land.

The latex production of rubber smallholdings in the South Sumatra Province, on the average, only 0.7 ton per hectare annually. It is lower than the national average production of 1.2 ton per hectare per year (Indonesian Industrial and Beverage Corps Research Institute or Balai Penelitian Tanaman Industri dan Penyegar/BALITRI, 2012). It is evident from these figures that the production rubber smallholdings in this province is low. The objective of this study was to analyze the factors that influences in improving latex production of rubber smallholders in the South Sumatra Province.

2. THEORETICAL FRAMEWORK

Rubber trees are tropical plants which grow well at height of 166 meters above sea level at an optimum temperature of 28° C (Haryanto, 2010). Rubber trees grow well in Indonesia in areas like Sumatra, Java and Kalimantan, including the South Sumatra Province. A rubber plant grows tall and has big trunk. A mature rubber plant can reach 15 to 25 meters. It grows straight up and has braches at the top parts. To have good plants with latex production of good quality and high quantity, farmer should grow good variety of rubber plants. This variety is usually produced as a product of research and examination for years conduct by private and public rubber plant research center. Good variety seedlings have more advantage than plants grown from the old rubber variety. The advantage includes uniformity of plants, short maturity age and high latex outputs when compared to the older rubber varieties. Farmers choose grow the old rubber variety because it is cheaper and easily obtained. Seeds are germinated and let grow until it has a bud after eight months. The seedlings are then planted in the farm (Haryanto, 2010; Setyamidjaja, 2010).

The good varieties seedlings recommended for rubber smallholder plantation in Indonesia is AVROS 2037, BPM 24, GT 1, PR 26, PR 300 and PR 303 (Setyamidjaja, 2010). In South Sumatra recommends using the type of GT-1 cloning for rubber plants seedling and PR 300 for rubber plants (Haryanto, 2010). The both types are good for South Sumatra condition. The definition of suitable use as recommended (good quality for high production) refers to the use of usage rules, quality, quantity, and frequency recommended by the Department of Plantation or Central of Research and Development of Agriculture Department (Ministerial Regulation No. 39/Permentan/OT.140/8/2006).

A research project carried out in Indonesia, where the GT 1 clone was planted on yellowish brown podzolic soil, concludes that the effect of N, P, and K on mature rubber trees during the first four years is not significant. In summary, studies of fertilizer impact on latex production suggest that if the plantation is under a well cultivated system during the immature period, fertilizer application can be started four years after commencement of tapping. The nutrient status of the trees should be monitored at 3-5 years intervals. Generally, rubber trees can be tapped up to 6 years after planting and have an economic life to 25 years. In the first two to three years of the immature period, leguminuos cover plants can be planted between the rows of rubber trees. When rubber trees are mature, latex is harvested by cutting a slope with a tapping knife.

The rubber plants cannot be tapped every day because there must be a period of rest. To avoid stress on the plant, rubber plant should be tapped 5 days with 2 days rest period (Haryanto, 2010; Setyamidjaja, 2010). For that generally in some rubber plant literatures and research, measuring of rubber latex production is per year. After maturity, maintenance of the plantation requires fertilisation, pest and disease control, and weeding. Experimental results indicate that with fertiliser application, the grace period before tapping is reduced from eight years to five years as compared to that of control plots (Forbes et al., 1996). For a mature rubber tree, fertilisation is used to increase production, mainly to achieve sustainable growth. The use of pesticide in rubber plantation will solve problems on pests and diseas which will hamper and even hill the plants. A pesticide comprises insecticide, fungicide, rodenticide, bactericide, hervicide and nematicide. For rubber plants, keep away the most disease from the plants such as fungus because it can kill the plants, as well as area of tapping disease, root disease and leaf disease. According to Sembawa Research Center of Agriculture (2011), the plant diseases often cause significant losses in rubber plants is fungus. That is why the use of pesticide is very important for the treatment of rubber plants. Soil and nature are important determinant in the latex production.

In Indonesia generally, and especially in Sumatra, ideally the number of rubber trees per hectare is 500 trees with a spacing at 4 x 5 meters. This mean that the addition of the rubber tree will only increase latex up to a maximum of 500 rubber trees per hectare, after that each additional tree reduces latex productions.

In agricultural production, human capital is associated with people's knowledge, experience and skills involved in the production process. The education, training and extension directly affect them. The use and utilization of technology are very important because they can affect the allocation of resources and production. as illustration, a labor force who is well-trained and well-educated is considered to have a better position to assess changing conditions and make necessary adjustments. His/her ability becomes increasingly important, particularly in the commodity markets which need fast responses. Investment in human capital includes both investments in formal schooling and post-school and on-the-job training and in the form of improved health and family care. Whereas, social capital refers to one's ability to utilize social networks and institutions. It can be affected by social status, education, and the available range of social institutions. This social capital is very necessary because it affects the access to physical capital, land title, credit and cooperatives. All of these imply the resource allocation and production.

The research conducted by Supriadi et al. (2004) showed that the rubber farmers in Kabupaten Ogan Komering Ulu, South Sumatra Province that have longer experience will be able to produce more latex tapping better than the farmers who still lack experience. Similarly, farmers who participate more in government training program have better latex production than those who did not participate. This is because they acquire learning in applying management and technology to improve production of latex.

The research conducted by Boerhendhy et al. (2007) also showed that the monitoring by Field Extension Officers (*Petugas Penyuluh Lapangan/PPL*) in the use of technology to increase the production of smallholders in Tabalong District, South Kalimantan was instrumental in increasing the production of latex.

Another related study is on the contribution of education to increase production of rice farmers conducted by Syafaruddin M. Syawwal and Muhammad Arsyad (2010). This study used multiple linear regression analysis. The result of the study showed that the extension program has a significant affect on rice production. In addition variables such as education, farming experiences and the land area also have a positive effect on rice production.

3. RESEARCH METHOD

This research was carried out in South Sumatra Province. Kabupaten Banyuasin and Kabupaten Muara Enim was chosen for the study because both Kabupaten is the biggest rubber smallholdings areas in South Sumatra. The total sample used for the study was 300 respondents and Kabupaten Muara Enim also 150 respondents. The sample was taken using random sampling with accidental technique. Data was analysed using the descriptive statistics and multiple regression analysis. Descriptive analysis is used to analyze the constraints faced by farmers to improve production. Multiple regression analysis is used to analyze the factors such as quality of rubber seedlings, fertilizers, pesticides, number of rubber trees per hectare and participation in government training program contributing to production of rubber smallholders.

The unit of measurement of latex produced in ton per year per hectare. The production of rubber smallholder is influenced by:

i. **Seedlings (X_1).** The seedlings are used to grow new plants is areas away from the parent plant. In this research, the quality of seedlings is a dummy variable where:

1 = Good quality seedlings (i.e. if rubber smallholder uses the seedlings recommended by the Department of Plantation or Centre of Research and Development of Agriculture Department)

0 = if otherwise.

ii. **Fertilizers (X_2)** are used to increase production. in this research, the quality of fertilizers is a dummy variable where:

1 = Good quality fertilizers (i.e. if rubber smallholder uses kinds of fertilizers recommended by Department of Plantation or Centre of Research and Development of Agriculture Department)

0 = if otherwise

iii. **Pesticides (X_3)** are substances that help protect plants against molds, fungi, rodents and insects. The measurement of pesticides in this research is a dummy variable where:

1 = Using pesticides (i.e. if rubber smallholder uses kinds of pesticides recommended by Department of Plantation or Centre of Research and Development of Agriculture Department)

0 = if otherwise

iv. **Number of rubber trees per hectare (X_4)** is the total number of rubber trees owned and managed by a farmer per hectare. Based on the Department of Plantation or Center of Research and Development of Agriculture Department, smallholders plant a average of 500 trees per hectare.

v. **Participating in government training program (X_5)** refers to the the number of times the farmer has participated in training programs per year.

The rubber smallholding production modes in an ordinary least square (OLS) model. According to Studenmund (2001), on the OLS model, the class of unbiased linear estimators has a minimum variance, that is they are BLUE (best linear unbiasedness property). The equation for rubber smallholders production is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

This research equation is used to identify the influence of explanatory variables X_1, X_2, X_3, X_4 and X_5 on the dependent variable (Y). Variables X_1, X_2, and X_3 are nominal-scale variables which are defined as follows:

X_1 : 1 = use seedlings as recommended
: 0 = otherwise

X_2 : 1 = use fertilisers as recommended
: 0 = otherwise

X_3 : 1 = use pesticides as recommended
: 0 = otherwise

And variables X4 and X5 are defined as follows:

X_4 : Number of rubber trees / hectare is data of the number of rubber plants.

X_5 : Participation in government training program.

4. DATA ANALYSIS

Many studies in agricultural economics have explained farm latex production and tis include studies by Zhengfei et al. (2006), Hayami & Ruttan (1985) and Ahearn et al. (1998). This study identifies factors such as the use of recommended seedlings, fertilizers and pesticides, the number of rubber trees per hectare and farmers participation in government agricultural training programs.

Equation 1 is used to identify the influence of explanatory variables X_1, X_2, X_3, X_4 and X_5 on the dependent variable. Variable X_1, X_2, and X_3 is nominal data:

X_1: 1 = if the farmers used the recommended seedlings

0 = otherwise

X_2: 1 = if the farmers used the recommended fertilisers

0 = otherwise

X_3: 1 = if the farmers used the recommended pesticides

0 = otherwise

While, variables X4 and X5 are as follows:

X_4 : Number of rubber trees / hectare

X_5 : Participating in government training is number of programs attended per year

The result of the regression model for rubber plantation production in in South Sumatra Province can be written as follows:

Y = 67.423 + 380.352X1 + 325.504X2 + 198.091X3 +7.462X4 + 15.483X5

With 95 percent of confidence level (α = 5%), all the independent variables (explanatory variables) affect the dependent variable (Y) significantly. The amount of contribution of all independent variables in explaining the variation in the production of rubber (Y) is as much as 79.9 percent given the value of adjusted R^2 = 0.779, the remaining 22.1 percent is determined by other variables that are not taken into account in the model. In addition, the results of the F test shows that the F-statistic (i.e. 2.87) which implies that the explanatory variables' regression coefficients in the underlying population are not all zeros.

This study was also carried out tests to multicollinearity problems. According to Studenmud (2001), multicollinearity test is to see whether or not there is a high correlation between the independent variables in a multiple linear regression model. Results of tolerance and VIF values shows that the variables used in the study do not have multicollinearity problems.

The value of the t-statistic for each variable exceeds the critical value at 95 percent confindence level. This implies that each variable has a significant influence on rubber production. based on research data, the rubber smallholders in South Sumatra generally acknowledge the benefit of using the recommended seedlings, fertilisers and pesticides. The high price and the difficulty of getting the recommended seedlings, fertilisers and pesticides explain why 63 percent of the rubber farmers do not use the recommended seedlings. It is noted that the high cost is a greater deterrent than the problem of availability of the recommended seedlings.

Rubber smallholdings in South Sumatra, based on observations, are monoculture units. Monoculture means planting only one type of plant, i.e. rubber trees. In fact, rubber trees can be interspersed with vegetable crops, i.e. vegetables can be planted on the margins of the rubber farm and this does not interfere with the rubber plants as long as proper planting distance is observed. The rubber farmers in South Sumatra are of the impression that they can get more latex with more trees planted per hectare. however, if the plaing exceeds the limit, young and old trees are interspersed and this will create a management problem. Young rubber trees usually need more treatment than the old ones. It will raise problems in the use of land fertility and old trees will cover up the young ones. This condition affects the quality and quantity of the latex.

Agricultural knowledge helps farmers very much in increasing their agricultural production. The farmers' knowledge is very helpful in adding insight and absorption of agricultural technology. Improving knowledge of farmers can be done through participating in government programs (Supriadi et al., 2004; Boerhendhy et al., 2007). In South Sumatra the program is in a form of training and counseling programs conducted by the Office of Agriculture. The results of these findings also directly refute the notion of the rubber farmers that participation in government programs is not useful, that approximately 50,7 percent of the smallholders farmers did not participate in the activities of agricultural extension or training conducted by the government. The participation was taken part 4 times a year at the most and it was even participated by only a few farmers. In fact, after having cross-checked with the Office of Plantation of South Sumatra, the agricultural extension and training programs were conducted twice a week by Field Extension Officers *(Petugas Penyuluh Lapangan (PPL)*. The meeting is carried out in certain places determined by the *PPL* and they name it Farmer Group Meeting. In additon to the low level of formal education of the family heads of the rubber farmer households, particularly poor farmers, the frequency of their participation was also very low although the program was gree of charge. This affects the production of the latex.

5. CONCLUSION AND RECOMENDATION

A significant implication of the study is that smallholders need to use the recommended rubber seedlings, adequate use of fertilizer, use of pesticides and need to attend training program provided by the government to improve their latex output. Thus government assistance is needed to better improve the rubber smallholdings in the form of subsidy and more trainings and agricultural extension services to improve rubber smallholder's outputs. The government assistance is needed in improving latex production of rubber farmer's smallholding in the form of subsidy and more trainings and agricultural extension service.

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