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EFFICIENCY PRODUCTION OF RICE FIELD IN PUJUNGAN VILLAGE USING THE STOCHASTIC FRONTIER APPROACH

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ABSTRACT

Regional Rice Self-Sufficiency (RASDA) is one of the Government's programs in Malinau District to meet the food needs of the people of Malinau Regency in the border region which is far from food access from other regions. Increased productivity is expected to meet the needs of rice, especially in the village where the study. The purpose of this study was to determine the factors that influence the cultivation of rice field in Pujungan Village and also to determine the level of efficiency of the use of production factors. This research method was carried out in Pujungan Village, Pujungan District, Malinau District. The method of determining the sample is carried out by census with 72 farmers as farmers. Analysis of the data used to determine the efficiency lefel is through the Stochastic Frontier approach model by estimating Maximum Likelihood Estimation (MLE). The results showed that the variable area of land, seeds, herbicides, and labor had a significant positive and significant effect on α = 1 percent and 5 percent of upland rice production. The scale of farming is in the condition of increasing return to scale (CTRS = 1.616). indicates that farmers in Pujungan Village can still rearrange the allocation of the use of production factors in the field rice farming. The average efficiency level that has been achieved is 0.59. This shows that the level of efficiency of farmer in the village of Pujungan is still not efficient because the average level of production efficiency is less than 0.7 (ET ≥ 0.7). frontier). There is still a 23.6 percent chance to increase the production of paddy farmers.

Keywords:

efficiency, paddy field, productin, stochastic frontier

INTRODUCTION

Agricultural development in the future to realize food sovereignty, so that Indonesia as a nation can regulate and meet the food needs of its people in a sovereign manner. Food sovereignty is translated in the form of the nation's ability in terms of: [1] meeting food needs from domestic production, [2] regulating food policies independently, and [3] protecting and prospering farmers as the main actors in food agriculture

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business. Food sovereignty must start from food self-sufficiency which is gradually followed by an increase in the value added of agricultural businesses to broaden the welfare of farmers.

Rice is the main food crop in Indonesia, because most of Indonesia's population makes rice as a staple food source. Increased rice production is not comparable to an increase in rice consumption so Indonesia must import from other countries. Approximately 2 million tons of rice were imported during 2001, making Indonesia the largest rice importer in the world [4]. Therefore efforts to increase rice production through increasing rice productivity and farmers' income are always included in the government's policy agenda in agriculture [5]. National rice production is still very low because the productivity of field rice is far lower than the productivity of lowland rice. However, given the availability of dry land for farm rice farming is still very large, the development of productivity of farm rice has a very promising potential [6].

In general, rice productivity in North Kalimantan is 32.07 ku / ha which is still below the average national productivity of 51.85 ku / ha data dari BPS 2018. In particular, paddy fields in Kalimantan have productivity with a planting period of 1 year. Of course this cannot meet the food needs in the North Kalimantan region. Thus, efforts are still needed to increase productivity

Regional Rice Self-Sufficiency (RASDA) is one of the Government programs in Malinau Regency to meet the food needs of the people of Malinau Regency. This program is expected to be able to meet other regions. Seeing the condition of the region that has enough potential and considerable regional support as well as the majority of the population who have traditionally worked in the agriculture sector became the main supporting factor in the Malinau District Government program to develop the RASDA program. The RASDA program is also very helpful in increasing food sovereignty and security in border areas far from food access from other regions. Increased productivity is expected to meet the needs of rice, especially in the village where the study. The purpose of this study was to determine the factors that influence the cultivation of rice field in Pujungan Village and also to determine the level of efficiency of the use of production factors.

METHOD

This research was conducted in Pujungan Village, Pujungan District, Malinau District. Pujungan Village is a village located on the border between Kalimantan and Malaysia. Because the conditions of the area in the village of Pujungan are highlands and mountains, the cultivation of rice is carried out in the field with a harvest period once a year or a planting period of at least 180 days after planting per planting season. Paddy cultivation in Pujungan Village is still very traditional without intensive processing and care such as in lowland rice cultivation. The type of data used is the cross section data of paddy farming for 1 planting season.

This research uses qualitative and quantitative approaches. Qualitative description is used to describe the cultivation of lading rice in

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Pujungan Village. While the quantitative approach is used to measure the factors that affect rice production and how big is the level of efficiency of farmers in the use of factors of production in the field rice farming.

Qualitative data collection was carried out through: 1) in-depth interviews with field rice farmers about their socioeconomic conditions, facilities and infrastructure in cultivating paddy fields and 2) Literature Study. Whereas 3) quantitative data collection by conducting interviews with respondent farmers regarding quantitative use of production factors in intertwining paddy fields.

The method of determining the sample is done by taking all existing populations or by census. The number of rice farmers in Pujungan Village is 72 field farmers.

Analysis of the data used to determine the efficiency lefel is through the Stochastic Frontier approach model with the estimation of Maximum Likelihood Estimation (MLE) [7]. The analytical tool used is Frontier 4.1. The function of the stochastic frontier equation that is thought to influence the level of efficiency in the field of rice farming is:

$$LnY = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + Vi - Ui$$

Ln Y = production rice field (kg)
Ln X1 = land size (Ha)
Ln X2 = seeds (kg)
Ln X3 = herbicide (Liter)
Ln X4 = labor (HOK)
vi-ui = error term (efek inefisiensi dalam model)
β0 = intersep
β1, β2, β3 , β4 = estimation

The stochastic frontier estimation model using the Maximum Likelihood (MLE) method can be measured using the following formula [8]:

$$TE_i = \frac{y_i}{y^*} = \frac{y_i}{\exp(x_i\beta)} = \frac{\exp(x_i\beta + Vi - Ui)}{\exp(x_i\beta + Vi)} = \exp(-u_i) \quad i = 1,2,3,\ldots,N \quad \ldots\ldots\ldots(3)$$

Where Yi is the actual production of observations, and y* is the assumed frontier production obtained from the stochastic frontier production. Technical efficiency for a farmer ranges from zero and one or a TEi value of $0 \leq TEi \leq 1$.

RESULT AND DISCUSSION

Pujungan Village

Pujungan Village is part of the Pujungan Subdistrict, Malinau District, North Kalimantan. The District of Pujungan does not have a coastline, therefore all villages in the District of Pujungan are non-coastal villages. Pujungan Subdistrict is directly adjacent to the State of East Malaysia-Sarawak in the west. The topography of the Pujungan Subdistrict is almost entirely a plateau. Traditions or practices carried out in cultivating paddy fields or shifting cultivation systems have been a tradition of the Dayak tribe for a long time due to environmental factors in the upland and hilly highlands that make farmers have to farm in a nomadic way.

Most of the Pujungan Village people work as paddy farmers to make a living for their family, the farmer's side work during the time of their farming activities usually hunting and looking for forest products (gaharu) for sale. The types of equipment used in field rice farming in Pujungan Village are senso (wood cutting

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machines), lawn mowers, axes, machetes, and beluing used during processing or land preparation, other equipment such as sprayers, mats, baskets, and shaking tools [9].

The use of production factors in field rice farming in Pujungan Village consists of inputs in the form of seeds, herbicides, and labor. Field rice is cultivated for 1 year. For farmers dapi fields in the village of Pujungan seed is referred to as Banie. The seeds used are local seeds produced by farmers themselves. Seeds are produced from previous harvests. Quality seeds according to the respondent farmers are seeds that contain dense, glossy grain, and have no insect or pest marks. Candidates that have been harvested are dried in the sun for several hours and then stored in cans or farmers often call them large black pickets, storing seeds for about 7 months. Herbicides are used to eradicate weeds before planting rice. The workers used are workers in the family and workers outside the family. The average area of land held by respondents was 1.79 hectares. Table 1 shows the average use of production inputs in field rice farming during the 1 growing season.

Table 1. Average Use of Input Factors for Farm Rice Field Production in Pujungan Village Per Hectares

No.	Inputs Type	Units	Amount
1.	Seeds	kg	21.93
2.	Herbicide	Liter	2.59
3.	Labor	HOK	13.89
4.	Production	kg	1089.84

Source: 2019 Primary Data

Table 2. Estimation of Stochastic Frontier Production Function of Farm Rice Field Farms in Pujungan Village Using MLE Method

Variable	Coefisien	Standar-eror	t-ratio
Konstanta	4.290	0.633	6.778
Land size (LnX1)	0.509*	0.064	7.916
Seeds (LnX2)	0.759*	0.058	13.071
Herbicide (LnX3)	0.225*	0.086	2.601
Labor (LnX4)	0.123**	0.056	2.193
Sigma-square (σ^2)	0.098	0.012	8.135
Gamma (γ)	0.999	0.911E-03	1097
L-R test	11.664		
Log LF MLE	-1.636		
Log LF OLS	-12.200		
CTRS	1.616		

Note: * significant at α level of 1%;
** significant at α level 5%

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** significant at α level 5%

The function of producing paddy using the MLE method is considered a model fit because it has fulfilled the Cobb-Douglas assumption. In the stochastic frontier function model, the log likelihood value by the MLE method (- 1,636) is greater than the log likelihood value by the OLS method (-12,200), which means that the production function with the MLE method is good and in accordance with conditions in the field. Sigma squared (σ2) = 0.098 is statistically significant at the level of α = 1 percent which indicates that the variation in production contributed by technical inefficiency (ui) is 9.8 percent. Inefficiency in this case comes from the farmer's internal factors such as age, education, experience of farming, etc. [10],[11]. Value (γ) is a contribution of technical efficiency in total residual effect The gamma value obtained is close to 1, which is 0.99, indicating that the error term is only due to inefficiency (ui) originating from the farmer himself as manager in farming and not from stochastic effects outside the model. the ratio of generalized-likelihood (LR) in the production function model of field paddy farming at 11,664 is still greater than the

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Kodde and Palm table values of 17.76 which is evident at α = 1% which means that there is an effect of efficiency and technical inefficiency of farmers.

The scale condition of farming or elasticity of paddy farming in Pujungan Village is indicated by the CTRS value. CTRS obtained from the sum of the regression coefficients in the production function model of rice field farming is 1,616 which means that if all production inputs are increased by 10 percent then production will also increase by 16.16 percent. Addition of the elasticity coefficient of production factors that is more than 1 indicates that the portion of the addition of production factors will produce additional production with a greater proportion [12]. As in the study [13] because Ire- lasing returns to scale have been achieved, it can be interpreted that technically increasing the allocation of production factors in paddy farming is still possible. This indicates that farmers in the Pujungan Village can still rearrange the allocation of the use of production factors in the paddy farming.

Estimation of the production function by the MLE method in paddy farming produces coefficients of all variables of positive and real value. Variable area of land, seeds, and herbicides have a significant effect with a significance level of α 1% while the variable use of labor α 5%. Variable land area, seeds, herbicides, and labor significant positive and significant effect on the production of paddy fields. A similar study found that the area of production [14], seed variables [15] had a significant effect on paddy production. The use of herbicides is applied by farmers to eradicate weeds that are in the farmer's land before planting. In addition to herbicides, farmers are more inclined to use the "beluing" tool to clear their paddy fields to eradicate weeds due to limitations in buying expensive herbicide drugs. Labor that is used in farming activities is family labor and labor outside the family. Outside family labor Outside family labor is used for activities such as felling, cutting down trees, spraying weeds, planting and harvesting. Labor outside the family is usually done with the mutual cooperation system and daily wages. The mutual cooperation system is carried out as in planting and harvesting activities.

Table 3. Distribution of Technical Efficiency Levels in Rice Field Farming in Pujungan Village

Technical Efficiency Level	Farmer	Percentage (%)
< 0.30	2	2.78
0.31-0.40	3	4.17
0.41-0.50	22	30.56
0.51-0.60	16	22.22
0.61-0.70	12	16.67
0.71-0.80	5	6.94
0.81-0.90	7	9.72
0.91-1.00	5	6.94
Jumlah	72	100.00
Maksimum	0.99	
Minimum	0.23	
Average	0.59	

Source: 2019 Primary Data (processed)

From 72 respondent farmers, the average level of efficiency achieved was 0.59. This shows that the level of efficiency of patani paddy fields in the village of Pujungan is still not efficient because the average level of production efficiency is less than 0.7 (ET ≥ 0.7). The highest level of efficiency is 0.99 and the lowest (minimum) is 0.23. The value (γ) is close to 1, which is 0.99, indicating that the error term only comes from the inefficiency (ui) originating from the farmers

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themselves as managers in farming and not from stochastic effects outside the model.

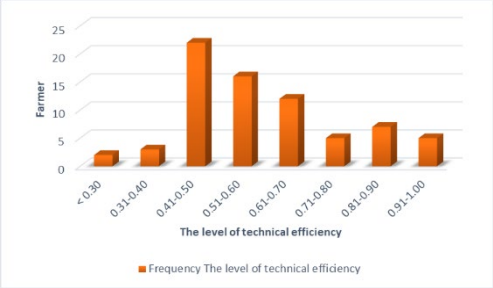

Figure 1: Distribution of Technical efficiency levels for paddy farmers. Source: 2019 Primary Data (processed)

Referring to [16] that a farm is said to have been efficient if the efficiency is greater or equal to 0.70. As many as 76.4 percent of respondents farmers have not been technically efficient or have not reached their frontier production. There is still a 23.6 percent chance to increase the production of paddy farmers. Increased production can be done through increased use of production inputs such as land areas, seeds, herbicide use, and labor. Inefficiency in production is caused by internal factors from farmers as managers [17]. It can be seen from the results of the estimation of the frontier production function that the variation of production contributed by technical inefficiency (ui) is 9.8 percent. The habits of the paddy farmers in Pujungan Village are the lack of time to focus on farming, the farmers only carry out their activities several times in each stage of the paddy farming activities and fill more free time with activities outside of their farming.

CONCLUSION

The average area of land held by respondents was 1.79 hectares. Analysis of the data used to determine the efficiency lefel is through the Stochastic Frontier approach model showed that the variable area of land, seeds, herbicides, and labor had a significant positive and significant effect of upland rice production. The scale of farming is in the condition of increasing return to scale (CTRS = 1.616) indicates that farmers in Pujungan Village can still rearrange the allocation of the use of production factors in the field rice farming. The average efficiency level that has been achieved is 0.59. This shows that the level of efficiency of farmer in the village of Pujungan is still not efficient because the average level of production efficiency is less than 0.7 (ET $\geq$ 0.7). frontier). There is still a 23.6 percent chance to increase farmers' rice production by increasing the factors that cause inefficiency (ui), namely factors originating from farmers such as age, farming experience, and frequency of attending counseling and others.

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