Journal of Agri Socio-Economics and Business (JASEB)
Available online at: https://ejournal.unib.ac.id/index.php/jaseb/index
DOI: 10.31186/jaseb.6.2.395-414

ANALYSIS OF TECHNICAL EFFICIENCY OF RICE FARMING ON DIFFERENT LAND AREA STRATA IN BENGKULU PROVINCE

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How to Cite:
Prasania, M,D., K Sukiyono, Romdhon, M,M, 2024. Analysis Of Technical Efficiency Of Rice Farming On Different Land Area Strata In Bengkulu Province. *Journal of Agri Socio-Economics and Business.* 6 (2): 395-414. DOI: https://doi.org/10.31186/jaseb.6.2.395-414

ARTICLE HISTORY
Received [27 Dec 2024]
Revised [30 Dec 2024]
Accepted [31 Dec 2024]

KEYWORDS
Technical Efficiency, Cobb Douglass, Stochastic Frontier, Rice, Land Area Strata

ABSTRACT
Efficiency in utilizing production factors in rice farming is measured by assessing technical efficiency. This technical efficiency reflects how well farmers utilize production input factors to produce output. The problem is, to what extent is the level of technical efficiency of lowland rice farming at different strata of land area? The aim of this research is to (a) analyze differences in the level of efficiency of lowland rice farming in different strata of land area in Bengkulu Province, (b) analyze what factors influence lowland rice farming in different strata of land area in Bengkulu Province. This research method is quantitative, and data is collected by distributing questionnaires to 175 farmers in different land strata in Lebong Regency and South Bengkulu Regency. The data were analyzed using the Cobb-Douglas production function with the Stochastic Frontier approach. The research results show that 1) efficiency varies between each stratum of land area, with an average level of efficiency in stratum I of 96.89%, stratum II of 89.14%, stratum III of 98.40%, and in stratum combined 94.81%; 2) The factors that influence the technical efficiency of rice farming in stratum I consisting of land, urea and female labor, in stratum II consisting of seeds and phonska, in stratum III consisting of land area and seeds. Meanwhile, regarding technical inefficiency in rice farming, the influencing factors in stratum I consist of age, education, experience, and number of dependents; in stratum II, it consists of age, while in stratum III, it consists of age, education, and experience.

INTRODUCTION

The leading commodity for food crops in Bengkulu Province is rice (Oryza sativa L.). Based on information from BPS Bengkulu Province from 2018-2022, several wet-rice farmers in Bengkulu Province experience a decrease in rice production every year due to various factors related to the use of farm production facilities (fertilizers, pesticides, labor, and seeds) due to insufficient farm capital. Therefore, the increase in production is hampered and has experienced a considerable decline. The level of technical efficiency in Bengkulu Province has not reached the maximum point. In addition, based on observations, the low productivity of rice farming is due to several problems often encountered in the field, such as limited resources, especially capital, processing techniques that are still mostly done traditionally, and opportunities for development that are still low. However, the most common problems encountered in rice farming are the improper application of fertilizers and pesticides, lack or excess, and arbitrary seeds.

In 2021, the highest rice production in Bengkulu Province was in South Bengkulu Regency, with 58,495 tons and a harvest area of 12,085 ha with a productivity of 4,840 tons/Ha. The lowest rice production is in Bengkulu City at 6,132 tons, and the harvest area is 1,218 ha, with a productivity of 5,034 tons/ha. In 2022, the highest rice production in Bengkulu Province is Lebong Regency at 50,933.30 tons and a harvest area of 7,830 ha with a productivity of 6,495 tons/Ha. The lowest rice production is Central Bengkulu Regency at 5,485.86 tons and a harvest area of 1,404.75 ha with a productivity of 3,905 tons/ha. Based on Table 1.1, several regencies in Bengkulu Province experienced a decrease in rice productivity, namely South Bengkulu, Rejang Lebong, and Bengkulu City. The decrease in the productivity of paddy rice is due to a decrease in the harvest area or land area (BPS, 2023).

Bengkulu Province has 55,705 hectares of paddy fields (BPS, 2023) spread across almost all regencies ranging from highlands and lowlands. In this study, researchers determined research locations that could represent highland and lowland areas. Two regencies have relatively large rice fields compared to other regencies, namely Lebong Regency and South Bengkulu Regency. With this consideration, these two regions were used as research locations.

The efficiency of agricultural enterprises is influenced by two main factors, namely non-technical factors and technical factors. Non-technical factors include various conditions that may hinder farmers from adopting the recommended technology, such as age, education level, and farmer knowledge. For example, farming experience and access to transportation, measured by the distance between the farm and the farmer's residence, are indicators of these non-technical factors. On the other hand, technical factors, such as the availability of irrigation water, also play an important role in determining agricultural productivity. The interactions between these two variables influence farmers' decisions regarding inputs such as labor, fertilizer, seeds, and medicines. Therefore, the level of production and productivity of agricultural businesses will depend on the balance of non-technical and technical aspects, especially in wet-rice farming (Laksmi et al., 2014).

Stochastic frontier production function techniques are often used to evaluate the level of technical efficiency. Several studies that seek to provide technical efficiency have utilized this strategy extensively. One such study is Utama's (2015) research on chili cultivation, Maryanto, Sukiyono and Priyono (2018) in potato farrming, and cabbage farming conducted by Darmansyah, Sukiyono, and Sugiarti (2013), and fishing (Sukiyono & Romdhon, 2019). These studies also applied the Cobb-Douglas production function model (Maddala, 2013), as this model allows for easier estimation and interpretation as the parameters used directly reflect the elasticity of each production factor. This study used the Cobb-Douglas production function model to explore the variables affecting wetland rice farming. The analysis of the Cobb-Douglas Stochastic Frontier production function model is expected to provide a deeper technical understanding of efficiency in the context of agriculture.

RESEARCH METHODS

This study is conducted in Bengkulu Province. The research location are selected using three stage cluster sampling. Sukiyono (2018) defines three-stage group sampling as a sampling technique that is carried out in 3 stages. First stage select two regencies that have large rice area, namely in Lebong and South Bengkulu Regency. These regencies have relatively large rice fields compared to other regencies and also represent highland and lowland areas in Bengkulu Province. The next step was to select sub-districts representing these districts, namely Kecamatan Amen and Kecamatan Seginim. The last stage was to select the village area representing the previously selected sub-districts, namely Sukau Rajo Village and Pyang Mbik Village for Amen Sub-district and Babatan Ilir Village and Darat Sawah Ulu for Seginim Sub-district with a total sample size of 175 farmers spread across 4 villages and divided into 3 strata, namely narrow, medium, and large land strata. This research was conducted in November 2023.

Method of Collecting Data

This study used primary and secondary data to obtain information. Primary data was collected using the interview method. Simultaneously, secondary data was collected by retrieving information from books, magazines, and related organizations.

Data Analysis Method

Technical Efficiency Analysis

Mathematically, the Cobb-Douglas production function for paddy rice production(Q) with variable inputs, namely: land (LHN), seed (BNH), Phonska fertilizer (PHONSKA), urea fertilizer (UREA), male labor (TKL), and female labor (TKW) can be described mathematically written with the following equation:

$$Q = \beta_0 LHN^{\beta_1} BNH^{\beta_2} PHONSKA^{\beta_3} UREA^{\beta_4} TKL^{\beta_5} TKW^{\beta_6} e^{(v_i - u\ )} \quad (3.1)$$

The equation is reformulated as a double natural log (Ln) equation for convenience. This approach has several advantages, including bringing the scale of the data closer to avoid heteroscedasticity. In addition, the regression coefficient can be directly interpreted as the elasticity of production. This transformation represent the general form of stochastic production technical efficiency limit is presented as follows (Asmara et al., 2011:

$$\begin{aligned} \ln Q = \ln \beta_0 + \beta_1 \ln LHN + \beta_2 \ln BNH + \beta_3 \ln PHONSKA + \beta_4 \ln UREA \\ + \beta_5 \ln TKL + \beta_6 \ln TKW + (v_i - u_i) \end{aligned} \quad (3.2)$$

Note: β0, β1, β2, β3, β4, β5, β6 = Regression coefficients, v_i= error term related to external factros, u_i = A random variable that is assumed to influence the level of technical inefficiency and related to internal factors

Technical efficiency is a production process that seeks to use the least amount of input to achieve maximum output. This research automatically displays the value of technical efficiency from the output of Frontier software version four. The technical efficiency formula in the stochastic frontier model is as follows (Farrel (1957) as cited by Sukiyono (2005):

$$ET = \frac{Y_i}{\hat{Y}_i} = \frac{\exp[X_i\beta + (v_i - u_i)]}{\exp(X_i\beta + v_i)} = \exp(-u_i) \quad (3.3)$$

Where 0 ≤ ETi ≤ 1 and exp(-u) is the stochastic production frontier.
With Criteria:

1. Highly efficient if the efficiency index value from the analysis results reaches a value ≥ 0.90
2. Moderately efficient if in the range of 0.70 ≤ ET
3. Considered inefficient if the ET value is <0.7.

Factors affecting the achievement of technical efficiency were determined using the econometric model of Sukiyono (2005). Sukiyono in his study said that the achievement of technical efficiency is influenced by the age of the farmer (AGE), the level of farmer education (EDU), the farmer experience (EXP), and the number of household members (SIZE). Econometrically, the engineering efficiency achievement model is stated as follows:

$$Eff_i = \alpha_0 + \alpha_1 AGE_i + \alpha_2 EDU_i + \alpha_3 EXP_i + \alpha_4 SIZE + \varepsilon_i \quad (3.4)$$

Testing for the model

Coefficient of Determination (R^2)

The ability of the model to predict changes in the dependent variable is measured by the coefficient of determination (R^2). The coefficient of determination has a value range of 0 to 1. R^2 is used to obtain the coefficient of determination. A low coefficient of determination (R^2) indicates that the ability of the independent variables to account for changes in the dependent variable is constrained.

The following is the formula for the coefficient of determination:

$R^2 = r^2 \text{ x } 100\%$

in which r is correlation coefficient value

F-test

The F test can assess whether the regression model used is appropriate. The F test decision-making procedure is as follows:

1. Ho is accepted, and Ha is rejected if $F_{count} \leq F_{table}$, which means there is no simultaneous influence of variable X on variable Y.
2. Ha is accepted, and Ho is rejected if the value of $F_{count} \geq F_{table}$, which means that variable X has a simultaneous influence on variable Y.

t-test

According to Ghozali (2016), the t-test assesses how much an independent variable contributes to explaining the dependent variable. The t-test is at the 95% confidence level with an error rate of 0.05. Based on the calculation results, the following conclusions are drawn.

1. Ho is accepted, and Ha is rejected if count ≤ $_{table}$, meaning there is no partial influence between variables X and Y.
2. Ho is rejected, and Ha is accepted if t-statistic≥ t-table, which means there is a partial influence between variables X and Y.

Comparation Inter-Strata Technical Efficiency Achievement

Analysis of Variance (ANOVA) is one of the comparative tests used in this study to test variations in the mean (average) data of more than two groups. This test assesses differences in the technical efficiency of farming in different land strata. To see the differences in the mean technical efficiency using the *One Way* ANOVA *test* can be seen as follows (Sugiyono, 2007):

$$F = \frac{MST}{MSE}$$

$$MST = \frac{\sum_{i=1}^{k}(T_i^2/n_i) - G^2/n}{k-1}$$

$$MSE = \frac{\sum_{i=1}^{k}\sum_{j=1}^{n_i} Y_{ij}^2 - \sum_{i=1}^{k}(T_i^2/n_i)}{n-k}$$

Note:
MST = Variation between groups (mean sum of squares between)
MSE = Variation in sample selection error (mean sum of inter squares)

RESULTS AND DISCUSSION

Estimation Results Of The Frontier Stochastic Production Model

The results of the estimation of the rice production model in each strata or combination are presented in Table 1. As revealed in the research method, this model is a stochastic frontier model with a Cobb-Douglas functional form. From table 1, independent variables such as land area, seeds, phonska, urea, male and female labor, and urea affect about 96.2% of the variation in production in stratum I. The remaining 3.8% of the difference in production is due to other factors not examined in this study. The remaining 3.8% of production differences were caused by other factors not examined in this study. In stratum II, the same variables accounted for about 89.5% of the variation in production, while other variables accounted for the remaining 10.5%. In contrast, in stratum III, the independent variables accounted for about 80.9% of the output variance, while other variables not covered in this study accounted for the remaining 19.1%. Overall, the combined area coefficient of determination showed 82.9% of the variation in production, while other variables accounted for the remaining 17.1%.

Tabel 1 also shows that F-statistic in all three strata are higher than their F table. These results inform that the Cobb – Douglas model for the basis of stochastic frontier technical efficiency can be applied to explain variation of dependent variable expressed by independent variables used in model. In othe words, all independent variables included in the model have significant effects on dependent variable simulatenously. These results also conclude that the stochastic frontier models in this research are suitable. This model is feasible to explain production variations and their influence factors that can examine from t-test results.

Table 1. Estimation Results of Production Function based on land area strata and all strata

Variables	Estimated Coefficient			
	Strata I	**Strata II**	**Strata III**	**All strata**
Constant	2.4616*** (0.4257)	5.2341*** (0.5335)	4.1479*** (0.9583)	8.4865*** (0.88848)
LHN	0.6547*** (0.1317)	-0.0035 (0.0057)	0.4754*** (0.1913)	0.7014*** (0.1362)
BNH	-0.0081 (0.0500)	0.1539*** (0.662)	0.1472*** (0.0597)	0.1396*** (0.0720)
PHONSKA	-0.0232 (0.0989)	0.3330*** (0.1008)	0.0038 (0.0400)	0.0126*** (0.3486)
UREA	0.1291*** (0.0644)	0.1680 (0.1446)	0.0654 (0.0486)	0.4267*** (0.4342)
TKL	0.0546 (0.1150)	-0.0413 (0.1506)	-0.0162 (0.0516)	0.0467 (0.0406)
TKW	0.2859*** (0.1655)	0.1517 (0.1355)	0.1549 (0.1020)	0.0047 (0.3237)
R^2	0,962	0,895	0,809	0.829
F-count	126,108***	48,368***	24,761***	24.154***

Note: The number in parentheses indicates the standard error of the regression coefficient

Intepreting Determinance of Rice Production

Land Area (LHN)

The coefficient of land area in stratum I is 0.6547, meaning that production will increase by 0.6547 if land area increases by 1, provided all other variables remain constant (value 0). In the context of paddy rice cultivation in stratum I, a larger land area will help increase productivity, as indicated by a positive coefficient that shows a positive relationship between land area and production. The t-statistic of 4.9696 for the land area used to grow rice is greater than the t-statistic of 1.663 (t-statistic> t-table) in the t-test at 95% confident interval meaning that the land area positif and significant influences paddy production. This conclusion is similar to the Stratum III and all strata in which LHN has a positif and significant influence on paddy production with the coefficient of land area of 0.4754 and 0.7014 respectively (Table 1). Hovewer, a different result was found in Stata II. The coefficient of land area in stratum II is -0.0035 with the t-statistic (-0.6179) is higher than the t-table of 1.687. This t-test result informs that land area does not have a large effect on the production of paddy rice. This result is different from the findings of Adrias, et al (2018) in Ciamis Regency, West Java Province and Noviwiyanah & Yudhistira (2024) in Indonesia who found that land has a positive and real effect on rice production..

Seeds(BNH)

The results of the t-test showed that the seed production factor (BNH) was positive and significant in the production of rice produced in all strata, except in strata I. This conclusion is based on the results of estimation where the t-statistic value obtained is greater than the t-table value with the exception of strata I which has the reverse result. The results of the insignificant BNH factor on rice production contradict many findings and theories, including Wulan, et al (2022), and Almri et al (2022). However, many studies have also found that the number of seeds used has no real effect on production, for example, the results of Diantoro (2009), Respikasari (2014) and Ragil et al. (2021), which concluded that seeds have a non-real effect on production. One of the factors that is suspected to be the cause of this finding is that the number of seeds used exceeds the recommendations given. Seed use in the research location averaged around 17.95 kg per farm or 33.95 kg per hectare, above the government recommendation of 25 kg per hectare (DTPHP Prov. Bengkulu, 2022).

The regression coefficient of the production model used in the study shows the percentage of increase or decrease in the amount of non-free variables due to an increase in the use of free variables of one percent. The estimation results show that the values of the BNH variabelle regression coefficient are -0.0081, 0.1539, 0.1472, and 0.1396 for Strata I, II, III and all strata respectively. These estimated coefficient regresions can be intepreted as the BNH coefficient in stratum I is -0.0081, *for example*, informing the decrease in production by 0.0081 perecent for every increase in seeds applied by one percent. In stratum II, meanwhile, the BNH coefficience is 0.1539 meaning that if the number of seeds increases by 1 percent, production will increase by 0.1539 percent.

Phoska (PHONSKA)

In contrast to the use of seeds, the use of Phonska has no real effect on Strata I and III, on the contrary, on Strata II and All strata. One of the reasons for this different result is the difference in the amount of fertilizer used that is different and not in accordance with the recommended amount, beside other factors such as level of education and experience. In the case of Strata I, for example, the average use of Phonska fertilizer in the research location is about 105,281 kg per farm or 196,171 kg per hectare. , which is still below the average recommended use of the government of 200-300 kg per hectare (Dewi & Destiarni, 2023). This result is in line with the research of Ningsih and Yanuarita (2022), which showed that the use of Phonska fertilizer did not significantly affect the production of paddy rice in Toribulu Village, Toribulu Subdistrict, Parigi Moutong District. In addition, The results of this finding are also different from previous studies such as the study of Saputra et al. (2022) in the case of Ushatani Watermelon.

The coefficient of Phonska fertilizer for Strata I is -0.0232 % and insignificant statitiscally, meaning that production will decrease by 0.0232% for every additional one % of Phonska fertilizer. A negative coefficient indicates a negative correlation between phonska and production, thus causing a decrease in production in the rice paddy farming business in stratum I. The same interpretation results are also for strata III with different coefficient values and positive signs of the regression coefficient.

Urea(UREA)

The coefficient for urea in stratum I and All strata are 0.1291 and 0.4267 with positif sign. A positive coefficient indicates a positive relationship between urea and production. These values inform that if urea increases by 1%, paddy production will increase by 0.1291% and 0.4267% respectively for Strata I and All strata. This increase is also signficant statistically indicating by its t-statistic higher that its t-table at 95% confident interval. At the study site, urea fertilizer averaged 279.747 kg/ha and 148.315 kg/ut/mt, respectively. This finding is in line with the research of Alvio et al. (2017), which states that urea fertilizer significantly affects productivity with a 95% confidence level. Research by Wayan et al. (2017) also concludes taht urea fertilizer has a significant effect on production

The coefficient value for the urea variable in stratum II is 0.1680, which indicates that a 1% increase in production input, especially urea, can increase production by 0.1680% but insignificant statistically. At the 95% significance level, the analysis of the urea fertilizer variable in the Strata II resulted in a t-statistic of 1.4665, which is smaller than the t-table of 1.687. The conclusion is that the urea fertilizer variable has no real effect on rice production in this agricultural production, so the null hypothesis is accepted, and the alternative hypothesis is rejected. This result contradicts the research of Ningsih et al. (2021), which shows that urea fertilizer has a real impact on paddy rice production . Similar conclusion for Strata III where its calculated t-statistic of the all land stata of urea fertilizer variable is less than the t-table (1.3444 < 1.689) at the 95% confidence level. Thus, urea fertilizer has insignificant influence on rice yield at the 95% significant level. The insginificant influence could be caused by less used of UREA by farmers. In the research location, the average use of urea fertilizer was 251.78 kg/ha and 408.929 kg/ut/mt, still less than the government recommendation of 300 kg/ha (Dewi et al., 2022). This result contradicts the research findings of Wayan et al. (2017), which state that urea fertilizer has a significant effect on production. Other studies also show the positive effect of Urea on the production of rice as concluded from the research of Jiang, et al. (2022), Muvidah & Sutiknyo (2021), and Heriyana, et al (2021).

Male Labor (TKP)

The estimation results show that the male labor production factor (TKP) is not an important production factor that affects the amount of rice production. This conclusion is based on the results of the t-test where all t-statistical values in each strata and all strata are smaller than the t-table values at each level of significance (see Table 1). This finding is certainly the same as Opu, et al (2022), Ashar (2018) and Rahmawati, et al (2019) found that labor has no partial influence to production. The insignificant influence of male laborer on the production factor is suspected to be due to the low use of labor, the number of types of jobs that can be replaced by female workers, the experience, age and education level of farmers. However, this conjecture needs to be tested with further research. Field data shows that the average use of male labor is 24.696 HOK – 33.023 HOK per strata.

Female Workers (TKW)

Almost the same results occur as in the use of male labor, the use of female labor is also not a production factor that affects the amount of production in all strata, except in Strata I. This conclusion is also based on the results of the t-test where the t-statistic value is smaller than the t-table value, with the exception of the t-test in Strata I. The t-statistical values in strata II, III and All strata are 1.1194, 1.5193, and 0.0 0145 repectively which are smaller than the t-table values at the 95% significance level.

At Strata I, the analysis results show that at the 95% significance level, the t-statistic of the variable of female labor use is greater than the t-table (1.7265 < 1.663), thus supporting the acceptance of the null hypothesis and rejection of the alternative. This shows that the use of female labor significantly has a siginificant impact on rice production. This result is consistent with the research of Mahmud et al. (2022) and Carkini (2014), which shows that output is significantly affected by the use of some production elements of labor.

Achievement of Technical Efficiency Level in Rice Farming

Using the *TE Effect Model* and *Stochastic Frontier function*, the technical efficiency of wet-rice cultivation in Bengkulu Province on various land strata has been investigated. According to Coelli and Battese (1998) in Amira et al (20150 farming efficiency can be categorized as highly efficient if the efficiency index value from the analysis reaches a value ≥ 0.90, moderately efficient if it is in the range of 0.70 ≤ TE, and considered inefficient if the TE value is less than 0.7. Table 2 provides information on the findings of the technical efficiency analysis of wet-rice farming on several land strata in Bengkulu Province (strata I, II, III, and All strata).

Table 2. Estimation of Technical Efficiency of Rice Paddy Farming in Different Land Area Strata in Bengkulu Province

Efficiency Level	Strata I		Strata II		Strata III		All strata	
	Freq. (person)	(%)	Freq. (person)	(%)	Freq. (person)	(%)	Freq. (person)	(%)
70.1-85	1	1.12	13	29.55	0	0.00	14	8.00
85.1-90	3	3.37	4	9.09	0	0.00	7	4.00
90.1-95	7	7.87	11	25.00	4	9.52	22	12.57
95.1-100	78	87.64	16	36.36	38	90.48	132	75.43
Average (%)	96.89		89.14		98.40		94.81	
Minimum	0.7722		0.7583		0.9015		0.7583	
Maximum	0.9904		0.9999		0.9999		0.9999	

Based on Table 2, it can be seen that the average value of the technical efficiency of wet-rice farmers in stratum I is 0.9689. This value informs that the average farmer in stratum I can be considered efficient because the efficiency ability reaches 96.89%. The minimum value of technical efficiency is 0.7722, while the maximum value is 0.9904. For stratum II, the average technical efficiency of wetland rice farmers is 0.8914, indicating that the average farmer in stratum II can also be categorized as efficient, with its efficiency ability reaching 89.14%. The minimum value of technical efficiency is 0.7583, while the maximum value is 0.9999. In Stratum III, the average technical efficiency of wetland rice farmers is 0.9840, indicating that the average farmer in Stratum III can also be categorized as efficient as its efficiency ability reaches 98.40%. The range of minimum and maximum technical efficiency values is 0.9015 to 0.9999. For the combined strata, the average value of the technical efficiency of wet-rice farmers is 0.9481. This value means the average farmer in the combined stratum can also be considered efficient because the efficiency ability reaches 94.81%. The range of minimum and maximum technical efficiency values is 0.7583 to 0.9999.

The average technical efficiency found in this study is greater than the research conducted in Langkap Village, Burneh District, Bangkalan Regency by Nafisah and Fauziyah (2020), which amounted to 0.70 or equivalent to 70%. According to research by Noer et al. (2018), farming fields in Sidomulyo District, South Lampung Regency, have an efficiency score of 0.71 or 71%. Meanwhile, research conducted by Sulistyaningsih (2019) on rice cultivation in Bantul Regency, Yogyakarta Province, showed a crop efficiency of 72% or 0.72.

The difference in technical efficiency results in rice farming is thought to be caused by farmers' lack of implementation of the use of inputs by the recommended dosage by production input providers or agricultural extension workers (Firdaus & Fauziyah, 2020). This variation is reflected in the minimum and maximum technical efficiency values. In addition, according to Rivanda et al. (2015), variations in farmers' efficiency levels may be caused by farmers' lack of knowledge in applying technology, land ownership status, experience in farming, and education level, which can affect farmers' decisions in the use of inputs in farming activities.

Test of Differences in Technical Efficiency Achievements Between Strata

As explained in the research method, Analysis of Variance (ANOVA) was used to understand the differences in technical efficiency of farms in different land area strata. The independent sample t-test was used to determine if there was a difference in the means of two unpaired samples. The results showed variation in technical efficiency among the different land area strata. The estimation results show that the Fstatistic value is 9.206 with a significance level of 0.0056. These results indicate that there is a significant difference in the achievement of technical efficiency levels among the analyzed strata. Furthermore, the analysis of the difference in the achievement of efficiency levels between strata was estimated using the t-test. The results of the t-test are presented in the following Table 3.

Table 3 Estimation results of the interstrata t-test

		Strata			Average TE (%)
		I	II	III	
Strata	I	-			96.89
	II	9.160 (1.656)	-		89.14
	III	1.957 (1.656)	8.823 (1.988)	-	98.40

Note: The number in parentheses indicates the value of t-table

Based on the estimastion of the t-test of technical efficiency of stratum I and stratum II at a significant level of 0.05 and the degree of freedom (db) = 131 obtained the value of t-statistic= 9.160 and t-table = 1.656 which means there is a significant difference in technical efficiency of stratum I with stratum II. Similar results have also been found between Strata I and III, as well as between strata II and III. Between Strata I and III, the estimastion of the t-statistic value (1.957) is higher than t-table (1.656) at a significant level of 0.05 and free degree (db) = 129. This indicates that there is a difference in technical achievement the technical efficiency between Strata I and Stratum III. Between Strata II and III, there is also significant difference in technical efficiency achivement. This conclusion is based on t-test of technical efficiency of Strata II and Strata III at a significant level of 0.05 and free degree (db) = 84. The value of t-statistic= 8.823 while the t-table is 1.988 which means that there is a significant difference between the technical efficiency of stratum II and stratum III.

Determinant Factors of Technical Efficiency Level Achievement

A number of factors are believed to cause technical inefficiency in wet-rice farming on different strata of land area in Bengkulu Province, including age, education level, farming experience, and number of dependents. The results of the analysis of the factors causing technical inefficiency are presented in Table 4.

Table 4. Technical Inefficiency Factors in Rice Farming with Different Land Area Strata in Bengkulu Province

Variables	**Coefficient Regression**			
	Strata I	**Strata II**	**Strata III**	**All Strata**
Constant	-0.6586 (0.6283)	0.5688 (0.5312)	-0.2416*** (0.1284)	1.0936 (0.5736)
Age	0.6429*** (0.2768)	-0.1928*** (0.1678)	0.0611*** (0.0265)	0.0969*** (0.104)

Variables	Coefficient Regression			
	Strata I	Strata II	Strata III	All Strata
Edu	-0.2798***	-0.0224	0.0199***	0.0146
	(0.1418)	(00687)	(0.006)	(0.0365)
Exp	-0.4406***	. 01159	-0.017***	-0.0315
	(0.1451)	(0.074)	(0.0018)	(0.034)
Size	-0.4144***	0.0029	0.0017	-0.0014
	(0.1278)	(0.0548)	(0.009)	(0.01)
R^2	0.3701	0.6524	0.805	0.6273
t-table	1.663	1.684	1.687	1.653
F-statistic	2.597	1.769	2.557	3.036
F-table	2.213	2.364	2.38	2.15

Age

The estimation results using the stochastic frontier function model show that in stratum I, the age factor has a t-statistic of 2.3220 at the 95% significance level, indicating that the age of farmers significantly and positively affects the level of technical inefficiency in rice farming. Stratum II shows the same result, with a t-statistic of 1.8153, indicating the existence of inefficiency associated with the age factor in that stratum. Stratum III shows different results where the t-statistic is 2.3036 > t-table 1.687, which means age affects rice production inefficiency in Stratum III. As for the combined land, it shows the same results with strata I, II, and III, that there is an inefficiency of age in rice production, showing the value of count 1.9315 > 1.653 at the same confidence level. This indicates that the older the farmer in the practice of rice farming, the higher the level of inefficiency, or it can be said that farmers become less technically efficient.

Education

Analysis of the effect of education on rice paddy production at the 95% confidence level shows that farmer education has a significant inefficiency effect on rice paddy production in stratum I with a count of 1.9730 > table 1.663 and in stratum III with a count of 3.3132 > table 1.687. The effect of education on rice production inefficiencies in strata I and III may be due to the average education of farmers in the research area, which only reaches the level of senior high school (SMA). However, the results are different from those of stratum II and combined land, which shows no inefficiency of education on rice production. This can be seen from the t-statisticvalue, smaller than the t-table in stratum II, namely t-statistic0.3263 < t-table 1.684, and combined with a t-statistic of 0.4020 < t-table 1.653. Nevertheless, in this study, education has no influence on rice production. This may be because the education in question is formal education that is not directly related to agricultural practices.

Farming Experience

With a calculated t-statistic of -3.0356 < -1.663 at the 95% significance level, the farming experience variable in stratum I shows a significant and negative influence on technical inefficiency in rice farming. Stratum III also shows the effect of farming experience on the technical inefficiency of rice farming with a t-statistic of -8.9916 < t-table1.687. This shows how the farmer's farming experience factor strongly influences technical inefficiency in rice production. Different results were shown in stratum II and combined analysis where in stratum II count value 1.5655 < t-table1.684 and in the combined stratum count value -0.9277 > t-table-1.653 at 95% confidence level, which means it shows that the farming experience of farmers has no significant impact on technical inefficiency.

The majority of farmers in this study have 5-10 years of rice farming experience, which can be seen in the narrow land stratum with 40 people or around 44.94%, the medium land stratum with 22 people or around 50%, and the large land stratum with 23 people or around 54.76%. Meanwhile, there are 13 people in the narrow land stratum (14.60%), 6 people in the medium land stratum (13.63%), and only 3 people in the large land stratum (7.14%) who have more than 25 years of experience.

Farming experience reflects farmers' duration in carrying out paddy rice farming activities as a source of income. The longer a person is involved in the job, the more skillful they are in carrying out their duties and the more mature they are in the way they think and act to achieve the goals that have been set. This finding is supported by the research findings of Hidayati (2021) and Sulistyaningsih & Waluyati (2020), which show that the increasing level of technical inefficiency in rice farming may be caused by farming experience.

Number of Family Dependents

A variable number of family dependents of farmers in stratum I shows the value of count -3.2403 < t-table-1.663, which means there is an influence of the number of family dependents on the technical inefficiency of rice farming. Different results were shown by stratum II. Different results are shown by stratum II, III, and the combined strata where at a significance level of 95%, the t-statistic is smaller than the t-table , so it means that the number of family dependents of farmers does not have a real influence on technical inefficiency. The largest number of family dependents is in the range of 1-3 people, namely 57 people in the narrow stratum (64.04%), 20 people in the medium stratum (45.45%), and 28 people in the broad stratum (66.66%). The least dependents are found in the large land strata (Strata III), with only one person (2.38%).

CONCLUSIONS AND POLICY IMPLICATIONS

Conclusions

1. Efficiency varies between each land area stratum, with an average efficiency level in stratum I of 96.89%, stratum II of 89.14%, stratum III of 98.40%, and in the combined stratum of 94.81%.
2. Factors that influence the technical efficiency of rice farming on different land area strata are in stratum I, consisting of land, urea, and female labor; in stratum II, consisting of seeds and phonska; in stratum III, consisting of land area and seeds. It is influenced by land, seed, phonska, and urea. Meanwhile, in terms of the technical inefficiency of rice farming, the influencing factors in stratum I consist of age, education, experience, and number of dependents, in stratum II consist of age, while in stratum III consist of age, education, experience and overall or combined production factors that affect age.

Suggestion

1. Farmers are expected to maintain and improve the technical efficiency of rice farming, such as increasing the use of land input factors, seeds, phonska fertilizer, and female labor (TKW) in accordance with what the government and agricultural extension workers have recommended and maintaining the use of urea fertilizer and male labor (TKL) to increase rice production optimally.
2. Rice farmers should be able to improve their performance regardless of age so that the impact of the age factor as a cause of technical inefficiency can be reduced.
3. To complement this study's findings, future researchers should investigate other variables that could potentially affect inefficiency in rice farming.

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