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A COMPARISON OF ECONOMIC EFFICIENCY RATE IN THE JAJAR LEGOWO AND TEGEL PLANTING SYSTEMS: A CASE OF THE RICE FARMING IN EAST MANGGARAI REGENCY, INDONESIA

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ABSTRACT

Escalating rice production through technical efficiency becomes an essential alternative as the extensification path is getting tough to take. Rice productivity declines while the consumption rate continues to rise. This study aims to analyze the technical, allocative, and economic efficiency rates of the Jajar Legowo and Tegel Planting Systems. Factors of efficiency are included in the research. The research was conducted in the village of Nanga Buntal, East Manggarai, a rice production centre district in the Province of NTT. Among 152 rice farmer respondents, 102 are from the Jajar Legowo planting system and 50 from the Tegel planting system. The stochastic frontier Cobb-Douglass method is used in data analysis. The allocation and economic efficiency are analyzed using the Stochastic frontier cost function. This analysis also uses multiple linear regression analysis. The average rates of technical, allocative, and economic efficiency of the Tegel planting system are respectively 72 %, 76 % and 56 %. These rates are lower than that of the Jajar Legowo Planting system (84 %, 86 %, and 73%). The periods of farming, land area, dummy of farmer group members, and the dummy of planting systems are factors that significantly and positively influence technical and allocative efficiency. Factors that negatively affect efficiency are farmers' age and credit access dummy. Further intensive training for the Jajar Legowo planting system is needed.

Keywords: *economic efficiency, jajar legowo, rice*

BACKGROUND

Paddy is a food crop commodity that plays an important role in household food security. Approximately 90% of the Indonesian population consume rice as a carbohydrate source. Rice consumption in the country continues to rise along with population growth. Rice consumption is 1,569/kg/capita/week (BPS, 2021). The stabilization of national food security requires rice production to be quantitatively and qualitatively upgraded.

Food security is one of the main concerns of both the Indonesian government and the East Manggarai regency local government. In 2018, rice production in the research area was only 3,90 tons/hectares (BPS, 2018). This number was far below the national rice productivity of 5,2 tons/ hectare BPS (2021). Productivity issues are related to technical efficiency Oyetunde-Usman & Olagunju (2019). The low rate of agricultural input utilization, high cost of agriculture inputs, inadequate cultivation technology, and insufficient technical knowledge are responsible for the detentions.

The development and research agency of the ministry of agriculture recommends utilizing cultivation technology that can increase rice productivity which is the Jajar Legowo planting system.

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By adjusting the spacing pattern, the technology aims to escalate rice production. This cropping pattern alternates between two or more rows of rice plants and one empty row (Purbata et al., 2020).

Numerous studies showed distinctions in productivity and farming income between the Jajar Legowo and Tegel planting systems. According to Permata & Widjaya (2017), the rice productivity and the farming income of the Jajar Legowo planting system are 12% higher than the other systems. In the jajar legowo planting system, it is easier for farmers to cultivate crops, and have wide access to plants, making it easier to maintain, fertilize, and control pests and diseases. In the Legowo jajar system, more sunlight is absorbed, this is related to the process of photosynthesis. Moreover, the rice productivity of the Jajar Legowo Planting system type 2:1 is much more than type 4:1. Accordingly, this outcome is in line with Istiyanti (2021) study which confirms that rice farming with the Jajar Legowo system provided more income than the Tegel planting system.

Nowadays, only a few farmers from Nangal Buntal Village of Elar sub-districts East Maggarai Regency apply for the Jajar Legowo Planting System. Most of them utilize a random planting system with irregular spacing and are unorganized. Consequently, it is effortful to conserve rice plants, eliminate weeds, fertilize, and spray the pests. Farmers at Nanga Buntal Village who practised the Jajar Legowo planting system obtained counselling and training from an agricultural field officer (PPL). They apply the Jajar Legowo planting system type 2:1 and use Inpari 48 rice varieties (one of rice varieties). The results of observations at the research location showed that 55% of the respondent farmers were less efficient in the use of agricultural inputs, this was related to access to obtain both organic and inorganic fertilizers and pesticides in controlling planthopper pests. Fertilizer prices at the farm level are relatively quite expensive.

Economic efficiency analysis was conducted to examine farmers's productivity and income. Efficient producers, technically and allocatively, are considered economically efficient (Ouedraogo, 2015). Comparison of optimal input utilization with minimum cost in the Jajar Legowo planting system will provide the best planting system that escalates farmers' income. Furthermore, using efficient and optimal inputs is essential for farming sustainability (Nwahia et al., 2020). Numerous studies about efficiency have been conducted by previous researchers. These inquiries assist in analyzing the economic efficiency rate of unskilled smallholders with limited resources that apply the Jajar Legowo planting type 2:1, Tegel planting system, and variety Inpari 48. This paper aims to examine the technical, allocative, and economic efficiency of the Jajar Legowo planting and Tegel planting system, and the factors that drive efficiency.

RESEARCH METHODS

The research was conducted from October to December 2021 in the Nanga Buntal Village, of Elar Sub-district, East Manggarai regency. The location was chosen by considering the village as a rice production centre and the Jajar Legowo planting system implementation in the area. The study population is 152 Nanga Buntal Village farmers, consisting of 102 Jajar Legowo planting farmers and 50 Tegel planting implementors. The Census approach was used in data collection, therefore, all farmers in the area involve as respondents. The Stochastic frontier Cobb-Douglass production function was used for data analysis, and the Maximum Likelihood Estimation (MLE) method frontier 4.1c from the Coelli version functions was used as a production function estimation method. The form of the equation is as follows:

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$$\text{Ln } Y = \beta_0 + \beta_1 \text{ In}X_1 + \beta_2 \text{ In}X_2 + \beta_3 \text{ In}X_3 + \beta_4 \text{ In}X_4 + \beta_5 \text{ In}X_5 + E_jD_j + (V_i - u_i)$$

Information:

Y : Production
X_1 : Area (ha)
X_2 : Seeds (kg)
X_3 : Fertilizer (kg)
X_4 : Labours (HOK)
X_5 : Pesticide(liter)
Ej : Dummy
Dj : Variable of planting systems dummy; D_1=1 Jajar Legowo planting system, D_1= 0 Tegel planting system
βi : Coefficient regression (i = 0,1,2,....5)

The rice farming technical efficiency of the i-th farmer is estimated using the below formulas:

$$TEi = \frac{Yi}{Yi^*} = \frac{\exp(xi\,\beta + Vi - ui)}{\exp(xi\,\beta + vi)} = \exp(-ui)$$

TEi represents the technical efficiency of the i-th farmer, Yi defines the actual production rate while yi*is the potential production. Farmer's technical efficiency ranges from 0 to 1 and correlates inversely to the technical inefficiency. The allocative and economic efficiency of farmers were examined using the stochastic frontier cost function approach. The empirical model of Cobb Douglas' stochastic frontier cost function is as follows:

$$\text{Ln } Ci = \alpha_0 + \alpha_1 Ln\, Px_{1i} + \alpha_2 Ln\, Px_{2i} + \alpha_3 Ln\, Px_{3i} + \alpha_4 Ln\, Y_i + E_jD_j + (V_i + U_i)$$

Information:

C : Production Cost (Rp)
X_1 : Seeds Cost (Rp)
X_2 : Fertilizer Cost (Rp)
X_3 : Labor Cost (Rp)
Yi : Total output
Ej : Coefficient of dummy's variables
Dj : Variable of planting systems dummy; D_1=1 Jajar Legowo planting system, D_1= 0 Tegel planting system
Vi+Ui : Error components
α : Estimated parameters

Cost inefficiency is a ratio between total actual cost or observation and total minimum estimated cost (C*). Cost efficiency value ranges from one to infinity. Therefore, CEi is inverse to

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the cost efficiency rate. Cost efficiency is also determined as allocative efficiency (EA). Thus, the formula for allocative efficiency is EA = 1/CEi. EA value ranges between 0 and 1.

$$CE_i = \frac{C}{C*} = \frac{E\ (C\ \ Ui,Yi,Pi)}{E\ (\ Ci\ \ Ui=0,Yi,Pi)} = \text{Exp}\ (\text{-ui})$$

Economic efficiency (EE) per individual farmer is attained from the technical efficiency (ETi) and allocative efficiency (EAi) multiplication, hence mathematically formulated as follows EEi = ETi x EAi. The technical, allocative, and economic efficiency influencing factors are simultaneously estimated using the OLS method of the frontier production function. Therefore, the linear regression model of technical, allocative, and economic efficiency is written:

$$U_i = \delta_0 + \delta_0 Z_1 + \delta_0 Z_2 + \delta_0 Z_3 + \delta_0 Z_4 + \delta_0 Z_5 + \delta_0 Z_6 + \delta_0 Z_7$$

Informations:
U_i : Technical/allocative/economic inefficiency
Z_1 : Ages
Z_2 : Period of Farming
Z_3 : Frequency of information collection
Z_4 : Land area
Z_5 : Dummy of farmers group member
Z_6 : Dummy of credit access
Z_7 : Dummy of planting system

RESULT AND DISCUSSION

The Distribution of Technical Efficiency Rate

In allocative and economic efficiency measurement, technical efficiency (TE) plays an important role. TE achieves if the enterprise utilizes limited input to gain optimal output in the production process. The best value of the efficiency index is > 0.8. Efficiency is technically reached if TE = 1 (Full efficiency) (Coelli et al., 2005)**.**

Tabel 1. The Technical Efficiency Distribution of Rice Farmers in The Jajar Legowo Planting System and Tegel Planting System

Range of Technical Efficiency Rates	**Jajar Legowo Planting System Farmers**		**Tegel Planting System Farmers**	
	Quantity	**%**	**Quantity**	**%**
Sampai 0,70	-	-	12	24
0,71 - 0,80	27	26	38	76
0,81 - 0,90	72	70	-	-
0,91 - 1,00	3	4	-	-
Total	102	100	50	100
Average of technical efficiency rate	0,8442		0,7236	
Standard Deviations	0,0418		0,0462	
Maximum	0,94		0,79	

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Minimum	0,77	0,63

On average, the technical efficiency of the Jajar Legowo planting system farmers is 84%, with a maximum value of 94% and a minimum percentage of 77%. The standard deviation of the Jajar Legowo system is lower than the other system that depicts the Jajar Legowo actual production variation which is smaller than the Tegel planting system. The average value of technical efficiency shows that the Jajar Legowo farmers reach 84% potential production coming from the input production combination. These farmers have approximately a 16% chance to accelerate rice production. If the Jajar Legowo rice farming is well managed by farmers individually, it is possible to raise the production by 595 kg (Actual production on average 3125). Production potential per hectare; (100: 84) x 3125 = 3720).

The technical efficiency average in the tegel system farming is 72%, and the highest and lowest percentages consecutively are 79% and 63%. The farmers can obtain potential production of approximately 79% by combining all the production inputs. Besides, when the tegel planting farming of every farmer is managed effectively, it is possible to raise rice production by 699 kg. (The actual production rate of Tegel planting system 2631, potential production per hectare; (100:79) x 2631 = 3330).

Farmings that employ the jajar legowo system has higher technical efficiency than the other systems. Farming with the jajar legowo system can escalate rice productivity up to 1.6 tons/hectares, Waluyo & Suparwoto (2021). The driving forces of the distinctions are Jajar Legowo planting system implementation, farmers' experiences, and how much information farmers obtain from the agriculture field officers. However, this finding is diverse from the research by Purbata, et., al (2020), which tells the technical efficiency of the Jajar Legowo planting system and the conventional system are alike.

Influencing Factors of the Technical Efficiency

The data in table 2 portray the F-statistic value (60.142) is significant at α 1 %, Fcount > Ftabel (60,142 > 2,76). This suggests that all the variables simultaneously included in the model have an impact on the technical efficiency level. Partial test results show that variables such as age, the farming period, land area, farmers group members' dummy, an indicator of credit access, and planting systems' indicator exert significant impacts on technical efficiency. The regression coefficient of variable age and access to credit dummy is negative and significant. The age variable describes farmers that are technically older and possess lower efficiency. Elder farmers only have a small possibility to absorb modern knowledge and cutting-edge technology. This finding is in line with the research by Mango et al. (2015), which suggests that older farmers tend to be technically inefficient. However, another research conducted by Tabe-Ojong and Molua (2017)); Tenaye (2020) shows a distinct outcome. The study result tells that age has a positive impact on technical efficiency. The age variable is negative because 65% of the respondent farmers are over 50 years old.

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Table 2. Influencing Factors of Technical Efficiency in the Jajar Legowo Planting System and Tegel Panting System.

Variables	Coefficient	Standard Error	t-ratio
Constant (Z_0)	0,516***)	0,039	13,229
Ages (Z_1)	-0,003***)	0,001	-3,113
Period of Farming (Z_2)	0,005**)	0,002	2,246
Frequency of information collection (Z_3)	0,001	0,004	0,178
Land area (Z_4)	0,021*)	0,015	1,753
Dummy of farming group member (Z_5)	0,070***)	0,015	4,785
Dummy of credit access (Z_6)	-0,017**)	0,008	-2,213
Dummy of planting system(Z_7)	0,114***)	0,020	5,712
R2 = 0,864, F StatistiStatistic = 60,142			

Information:
1. Independent variable of allocative efficiency
2. Ftabel (α = 0,01 df 1 = 7, df 2 = 144) = 2,76
3. Ttabel α 0,01 = (0,01,df 144) = 2,61 ***) Significant at α 1 %
4. Ttabel α 0,05 =(0,05,df 144) = 1,97 **) Significant at α 5 %
5. Ttabel α 0,10 =(0,10,df 144) = 1,65 *) Significant at α 10 %

The dummy of credit access gives a negative signal that indicates having credit access will decline technical efficiency. Facts on the ground show the misuse of finance that most of the farmers use the cash for their other necessities such as wedding ceremonies, funerals, and school tuition. This result contradicts research conducted by Backson, et al (2020); Oyetunde-Usman & Olagunju (2019); Ng'ombe & Kalinda (2015), which shows that owning access to credit will reduce technical inefficiency.

The coefficient regression of the farming period is significant and positively influences efficiency. The greater the period of farming, the higher the technical efficiency, which is closely in line with the finding that 80% of rice farmers have more than 11 years of farming experience. This result correspondent with the research by Tasila Konja, et al (2019); Trong &Napasintuwong (2015); Itam et al. (2015); Lanamana & Supardi (2020).

The variable of land area and the dummy of farmer group members indicate positive and significant signs. Land area and becoming a member of a farmer group can escalate technical efficiency. This situation correlates with Ele & Nkang (2014); Jaya, (2021); Musaba & Bwacha (2014) research results. The Dummy of the planting system also shows a significant and positive influence on efficiency, which means the Jajar Legowo planting system can raise the technical efficiency. Compared to the Tegel planting system, in the Jajar Legowo planting system, the farmer is more easily managed and reaches the rice plant. This fact relates to research by Abas, et al (2018). There are wide rows in Jajar Legowo planting that give access to farmers to maintain the plants, fertilize and control the pets. In the Jajar Legowo planting system, plants can absorb more sunlight for the photosynthesis process, and fertilization and pets control become easy (Sumarsih, et al 2020).

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The Impact of Jajar Legowo and Tegel Planting System on Allocative Efficiency Cost Function of Stochastic Frontier

The MLE method estimation in Table 3 shows that the MLE method is better than the OLS method. The cause is sigma-squared, and the log-likelihood values of the MLE method are higher than that of the OLS method. Gamma (ϒ) coefficient value is 0,6341, which means the variation of the random error is more dominant because of 49.41% cost efficiency. The likelihood ratio test value is 2,2151 < $X2$ = 193,77. This value tells that both planting systems are not fully efficient.

The price of seeds, fertilizer, labour wages, and production has significant and positive influences. Additional seeds, fertilizer, labour wages and 1% of production will increase the production expenditure by 0,2131, 0,3214, 1,7321 and 0,4321 consecutively. The rice variety used was Inpari 48. The dummy of the planting system shows a significant and positive signal, meaning the production outcome of the Jajar Legowo system is greater than the Tegel system. However, the rice productivity and profits of the Legowo system are also higher than that of the other system. The result is in line with research by (Purbata, et al 2020).

Table 3. Estimation Result of Production Function in The Jajar Legowo Planting System and The Tegel System Using MLE method.

Variable	Parameter	Coefficient	Standard Error	t-ratio
Intercept	β_0	10,6321$^{***)}$	15,8721	2,5621
Px_1 (Seed price)	β_1	0,2131$^{***)}$	0,2132	3,0124
Px_2 (Fertilizer price)	β_2	0,3214$^{***)}$	0,4321	2,5432
Px_3 (labor wages)	β_3	1,7321$^{**)}$	1,6432	2,0021
Y (Production)	β_4	0,4321$^{***)}$	0,0356	5,2134
Dummy of planting system	β_5	0,2134$^{***)}$	0,1256	2,9216
Sigma square	σ^2	0,02541		
Gamma	ϒ	0,4941		
Log Likelihood function		14,2764		
LR test = 2,2151				
X^2 = 193,77				

Information:
1. Independent variable of allocative efficiency
2. Ftabel (α = 0,01 df 1 = 7, df 2 = 144) = 2,76
3. Ttabel α 0,01 = (0,01, df 144) = 2,61 $^{***)}$ Significant at α 1 %
4. Ttabel α 0,05 = (0,05, df 144) = 1,97 $^{**)}$ Significant at α 5 %
5. Ttabel α 0,10 = (0,10, df 144) = 1,65 $^{*)}$ Significant at α 10 %

The Distribution of Allocative Efficiency Rate

According to table 4, the average rate of farmers' allocative efficiency in employing the Jajar Legowo system is 86%, with a maximum of 94% and the lowest of 80%. The average value of 86% means the average minimum cost rate achieved by farmers with the Jajar Legowo planting system is approximately 86% of the frontier cost. When the farmers reach the most efficient cost, they will have additional profits of (1-0,80/0,94) = 15 %.

Table 4. The Distribution of Farmers Allocative Efficiency in Applying The Jajar Legowo Planting System and Tegel Planting System

The Range of Allocative Efficiency's Rate	Jajar Legowo System Farmers		Tegel System Farmers	
	Quantity	%	Quantity	%
Up to 0,70	-	-	-	-
0,71 - 0,80	-	-	45	90
0,81 - 0,90	91	89	5	10
0,91 - 1,00	11	11	-	-
Total	102	100	50	100
The average of Allocative efficiency's rate	0,8641		0,7640	
Standard Deviation	0,0337		0,0271	
Maximum	0,94		0,83	
Minimum	0,80		0,72	

The average value of allocative efficiency in employing the Tegel system is 76%, with a maximum of 83% and a minimum of 72%. The average of 76 % means the minimum cost reached by farmers is 76% of the threshold (frontier). Whether the farmers hit the highest cost efficiency, they get an extra increment of (1-(0,76/0,83) = 9 %. Meanwhile, the most inefficient farmers will have an additional profit of (1-(0,72/0,83) = 14 % if they can combine input cost and the number of outputs as efficiently as the farmers with the highest cost-efficiency.

The average allocative efficiency of farmers who practice the Jajar Legowo planting system is higher than the Tegel system farmers. This number proves that the Jajar Legowo System farmers can produce outputs with a minimum cost of the best input. This finding is similar to the research by Purbata, et al (2020), the jajar legowo cropping system is more efficient allocatively and economically than the conventional system, because farmers in the jajar legowo cropping system use inputs in optimal proportions to more optimal prices.

The Driving Factors of Allocative Efficiency

The statistic value of F as shown in table 5 is 48.215, where the value of Fcount > Ftabel (48,216 > 2,76). These numbers explain that all variables involved jointly in the model significantly impact the allocative efficiency rate. The regression coefficient of the age variable is negative and significant, meaning that the older the farmers, the lower the allocative efficiency. This information corresponds to the farmer's ages. The older the farmers, the lower their abilities to work, adapt to the alterations, take a risk, and experiment with novelty technology. This study is similar to Rahaman et al. (2020) inquiry but inverses Girei, et al (2016) finding that the older the farmers, the higher economic efficiency when considering that older farmers possess more experience in farming.

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Table 5. The Driving Factors of Farming Allocative Efficiency in ApplyingThe Jajar Legow Planting System and The Tegel Planting System.

Variables	Coefficient	Standard error	t-ratio
Constant (Z_0)	0,803***)	0,034	23,466
Age (Z_1)	-0,001**)	0,001	-2,047
The period of farming (Z_2)	0,001*)	0,002	1,759
Frequency of information collection (Z_3)	0,005	0,004	1,244
Land area (Z_4)	0,0208*)	0,012	1,624
Dummy of farmers group member (Z_5)	0,028**)	0,012	2,226
Dummy of credit access (Z_6)	-0,014**)	0,006	-2,153
Dummy of planting system(Z_7)	0,081***)	0,017	4,851
R2 = 0,838, F Statistic = 48,216			

Information:
1. Independent variable of allocative efficiency
2. Ftabel (α = 0,01 df 1 = 7, df 2 = 144) = 2,76
3. Ttabel α 0,01 = (0,01, df 144) = 2,61 ***) Significant at α 1 %
4. Ttabel α 0,05 = (0,05, df 144) = 1,97 **) Significant at α 5 %
5. Ttabel α 0,10 = (0,10, df 144) = 1,65 *) Significant at α 10 %

The coefficient regression of the variable farming period positively and significantly impacts the allocative efficiency. The longer the period of farming, the higher the allocative efficiency. The farming period relates to experiences and training attained during the time. Owning skill and experience, a farmer tends to manage and distribute sources wisely. This fact is in line with studies by Tasila., et al (2019), Ouedraogo (2015); Aamir Munir et al. (2015); Sanusi & Singh (2015). The land area variable has a significant and positive impact, which correlates to Beshir et al. (2012) research result.

The dummy of farmer’s group members variable significantly and positively influences efficiency. Membership in farmer groups enhances; allocative efficiency. By doing so, farmers obtain information regarding inputs’ cost and agriculture output, technology, and credit assistance. Approximately 75 % of respondents are members of the farmer group. Andaregie, Worku, & Astatkie (2020) also mentioned this in their research. On the contrary, Dogba, et al (2020) described in their study that getting into a farmer group will reduce the allocative efficiency due to its miss management.

The dummy credit access variable gives a significant and positive sign which means obtaining the credit will result in low allocative efficiency. Many farmers do not use the loan for rice productivity but other social events. This finding is divergent to the study by Joseph, Lavela (2016); Biam, et al (2016). The dummy planting system variable gives a positive and efficient signal to allocative efficiency. The Jajar Legowo farmers are more efficient in managing farming and able to combine low-cost inputs anytime the price is altered. Speaking of knowledge and skills, the Jajar Legowo's farmers can combine agriculture inputs at a low range cost. Most of the Jajar Legowo system farmers involve actively in the farmer groups and have a channel to the input and output markets. Mulyadin (2020) mentioned in his research that total cost spending by the Jajar Legowo System farmers is lower than Tegel system farmers, which gives them more profits.

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The Distribution of Economic Efficiency Rate

Table 6 tells that the economic efficiency rate reached by the Jajar Legowo planting system farmers is 73%, with a maximum percentage of 85%, and the minimums is 63%. When the average of Jajar Legowo farmers reaches the highest efficiency, the farmer can save the cost of (1-(0,7330/0,8556) = 14,33 %. Otherwise, the most inefficient farmers in that system will save the fund of (1-(0,6391/0,8556) = 25,31 % by estimating that the highest economic efficiency can be achieved.

Table 6. Economic Efficiency Rates of Farmers in Employing Jajar Legowo Planting System and Tegel Planting System**.**

The Range of Allocative Efficiency Rates	The Jajar Legowo Planting System Farmer		The Tegel Planting System Farmer	
	Quantity	**%**	**Quantity**	**%**
Up to 0,70	26	25	50	1.00
0,71 - 0,80	69	68	-	-
0,81 - 0,90	7	7	-	-
0,91 - 1,00			-	-
Total	102	100	50	100
The average of technical efficiency rate	0,7330		0,5600	
Standard Deviation	0,0478		0,0398	
Maximum	0,8556		0,6318	
Minimum	0,6391		0,4536	

The Tegel system rice farmers will be able to save the cost of (1-(0,5600/0,6318) = 11,37 % if they are reach the highest economic efficiency, while inefficient farmers will be able to save (1-0,4536/0,6318) = 28,21 % of the fund. Moreover, the data in table 6 depicts that the average rate of economic efficiency is higher when farmers apply the Jajar Legowo planting system than the other system. The Jajar Legowo farmers are more streamlined in benefiting from the agricultural inputs which support them to gain a high rate of productivity using low-cost inputs. As a results, they collect maximum profit.

Impacting factors of Economic Efficiency

In table 7, the F statistic value is (89,294, significant at α 1 %, and the value of Fcount > F tabel (89,294 > 2,76). All the included variables in the model are significantly impacting the economic efficiency rate. The coefficient regression of the age variable negatively and significantly affects economic efficiency. The driving factors are determined, taking the risk, bare use of advanced technology and innovation. This finding is in accordance with the inquiry by Hassan (2021); Biam et al (2016). However, the age of farming variable significantly and positively impacts economic efficiency. The longer the farming is running, the higher the economic efficiency is. The last-mentioned variable is related to the farmer's experiences. This result is in accordance with the study conducted by Kareem & Şahinli, Mehmet (2018), Lanamana & Supardi (2020).

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Table 7. Impacting Factors of Economic Efficiency in The Jajar Legowo and Tegel Planting System

Variables	Coefficient	Standard Error	t-ratio
Constant (Z_0)	0,390***)	0,044	8,878
Age (Z_1)	-0,002**)	0,001	-2,096
The farming age (Z_2)	0,004*)	0,003	1,876
Frequency of information collection (Z_3)	0,005	0,005	1,105
Area (Z_4)	0,029	0,016	1,342
Dummy of farmers group members (Z_5)	0,028*)	0,015	1,942
Dummy of credit access (Z_6)	-0,021**)	0,008	-2,609
Dummy of planting system (Z_7)	0,156***)	0,023	6,779
R2 = 0,902 , F statistic = 89,294			

Information:
1. Independent variable of economic efficiency
2. Ftabel (α =0,01 df 1 = 7, df 2 = 144) = 2,76
3. Ttabel α 0,01 = (0,01, df 144) = 2,61 ***) Significant at α 1 %
4. Ttabel α 0,05 = (0,05, df 144) = 1,97 **) Significant at 5 %
5. Ttabel α 0,10 = (0,10, df 144) = 1,65 *) Significant at 10 %

The farmers' group member dummy positively and significantly influences economic efficiency. It reveals that a member of the group contributes to escalating efficiency. This fact confirms an inquiry by Mutoko et al. (2015); Lanamana & Supardi (2020). Additionally, the credit access variable shows significant and negative affects efficiency as obtaining credit reduces economic efficiency. The finding confirms that instead of using finance for farming, many farmers use the fund for other social occasions. This result diverges from research conducted by Biam et al. 2016); Degefa et al. (2017), same as finding Dziwornu & Sarpong (2014).

The dummy of the planting system variable is significantly and positively driving efficiency. Farmers who apply the Jajar Legowo planting system are more efficient. They use low-cost input to attain optimum profit. This corresponds to research conducted by Sumarsih, et al (2020), which is describing that implementing the Jajar Legowo planting system increases the efficiency of resource area utilization, labor, assets, and inclining rice production up to 18.25%. Besides, and raises the profit by approximately 40%. Purbata et al. (2020); Permata et al. (2017) discover that production and profits per hectare during every planting session of Jajar Legowo farming are higher than that of the conventional system. Hence, the Jajar Legowo planting system can be elaborated in the surrounding with the wider area.

CONCLUSION AND SUGGESTION

The average rate of technical, allocative, and economic efficiency of the Tegel system farmers is 72%, 76% and 56% consecutively. These numbers are lower than that of rice farmers who employed the Jajar Legowo planting system. Conditions that significantly and positively impact the technical and allocative efficiency are the age of farming, area, dummy of farmer group members, and the dummy planting system. However, age and the indicator of credit access showed a negative impact. Furthermore, factors that have an insignificant influence are the frequency of receiving

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information and the area. Therefore, further intensive training about all types of the Jajar Legowo Planting system are needed for rice farmers in East Manggarai Regency. Further research needs to be done to measure efficiency using Data Envelopment Analysis (DEA). This concept has a different character from the concept of efficiency in general, where the object of observation is the application of the row planting system for paddy rice with various types and other conventional planting systems.

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