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Efficiency, risk, and profitability of rainfed rice farming in South Sulawesi, Indonesia

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ABSTRACT

Rice farming is a business that has many risks, and production risks cause fluctuations in production. Productivity influences farming income and profitability. An increase and decrease in production will affect revenue or profitability. The purpose of this study is to analyze the technical efficiency, production risk, and profitability of rainfed lowland rice farming. This research was conducted in two regencies in South Sulawesi Province, namely Maros Regency and Pangkajene Islands Regency. The sample of this study was 100 farmers in rainfed rice fields. This research used quantitative methods with a survey approach. Data were collected using observation, recording, and interview instruments, and were then analyzed using quantitative description coupled with a t-test for independent samples. The results showed that rainfed lowland rice farming in Maros Regency and Pangkajene and Archipelago Regency was technically efficient. Rainfed lowland rice farming in Maros Regency and Pangkajene Regency and Islands is at risk. Rainfed lowland rice farming in Maros Regency and Pangkajene Regency and the islands using profitability analysis generates income and profit, and is feasible to cultivate. Farmers need to use production inputs as recommended to increase production reduce production risk and efficiently use inputs.

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INTRODUCTION

The agricultural sector is one of the sectors that is relied upon to support the rate of national economic growth (Arouna et al., 2021; Prasetyo et al., 2020; Saediman et al., 2020). Rice is included as a strategic food commodity to continue to be developed. This is because rice is still the main food ingredient for Indonesian people both in rural and urban areas (Arifin et al., 2021b; Heriqbaldi et al., 2015; Purba et al., 2020). The government places rice as a strategic commodity in economic development and rice self-sufficiency is a development target (Kerdsriserm et al., 2018; Rasyid et al., 2016). Efforts to increase rice production become very important along with the increase in population and the food industry (Barokah et al., 2022; Rizwan et al., 2020). The large population has resulted in the need for food, especially rice as a staple food for the community, to be very important, needed in large quantities and available continuously (Rani & Singh, 2015; Wardie & Sintha, 2018). Rainfed rice fields have the potential to be used as areas to increase rice production (Arifin et al., 2019). Rainfed lowland rice farming is the highest contributor to national rice production after irrigated lowland rice farming (Arifin et al., 2021a).

Farming activities in obtaining production go through long stages and there are risks. Time and production are parts of determining factors in crop yield (Dewati & Waluyati, 2018). Increasing rice productivity is closely related to the ability of farmers to allocate various production factors efficiently so that they can reach the point of maximum potential in their farming activities (Kerdsriserm et al., 2018). In farming for agricultural commodities, farmers are not always able to achieve the expected level of efficiency and productivity (Hou et al., 2020). The low level of efficiency in the use of production factors shows that the results of farming production carried out by farmers have not been maximized (Mulyadi et al., 2021). Several ways to increase rice production include allocating more land to produce rice, developing and adopting new technologies to increase production, and managing available resources more efficiently (Umar et al., 2020). The allocation of efficient and effective use of production factors, as well as being ability to adapt to climate change, will determine the achievement of farming efficiency (Arifin et al., 2019; Ouedraogo, 2015).

The agricultural sector is a business that is always faced with yield variability in situations of high risk and uncertainty (Dadzie et al., 2022; Obadoba & Umar, 2019). An important source of uncertainty in the agricultural sector is agricultural output (Zakaria & Indah, 2019). Internal sources of risk are production and technical risks that occur due to the technical relationship between output and level of input use (Mitra & Sharmin, 2019). The risk of agricultural production is greater than the risk of non-agriculture because agriculture is strongly influenced by nature such as weather, pests and diseases, temperature, drought, and flooding (Ferrianta et al., 2015). Risk is used more in the context of decision-making because risk is defined as the chance that an adverse event will occur as a result of an action (Lien et al., 2022). Rice farming is a business that has many risks (Kabir et al., 2021). Human resources, production inputs, and natural factors can contribute to production risk (Pervez et al., 2022). Production fluctuations are caused by production risks in the agricultural sector (Arifin et al., 2021a).

The level of farmers' income, in general, is influenced by several components: the amount of production, selling prices, and costs incurred by farmers in their farming (Abdullahi et al., 2021; Chaudhary & Suri, 2022). Productivity has a positive effect on farm income and profitability. High productivity leads to high farmer acceptance with efficient production costs so that farmers' income and farm profitability will increase (Bozkurt & Kaya, 2021). Increases and decreases in production affect farmers' income or profitability and welfare (Ifeoma et al., 2022).

Maros Regency and Pangkajene Islands Regency are regencies whose rice fields are dominated by rainfed rice fields in South Sulawesi Province. Maros Regency has an area of 26,114.06 ha of paddy fields, consisting of 17,072.56 irrigated rice fields and 9,041.50 ha of non-irrigated rice fields. From the paddy field area, production of 324,323.11 tons was obtained with a productivity of 4.70 tons/ha (BPS Kabupaten Maros, 2019). Meanwhile, Pangkajene Islands Regency (Pangkep) has a rice field area of 16,764 ha consisting of 9,929 ha of irrigated rice fields and 6,835 ha of non-irrigated rice fields. Lowland rice production in Pangkajene Islands Regency is 120,903.74 tons with a productivity of 4.60 tons/ha (BPS Kabupaten Pangkajene Kepulauan, 2019).

Research on technical efficiency and production risk for lowland rice farming has been carried out separately in Maros and Pangkajene and Islands districts. However, research that combines technical efficiency, production risk, and profitability has never been carried out in these two districts. Likewise, integration of research at the national and global levels is still rarely carried out. The purpose of this study is to analyze the technical efficiency of rainfed lowland rice farming, the production risk of rainfed lowland rice farming, and the profitability of rainfed lowland rice farming.

RESEARCH METHOD

This research was conducted in two districts in South Sulawesi Province, namely Maros Regency (Lau District, Soreang Village and Tompobulu District, Tompobulu Village), and Pangkajene Islands Regency (Minasatene District, Bonto Kio village and Labakkang District, Pacikong Baja Village). The research location was chosen purposively with the consideration that it is an area that has extensive rainfed rice fields in South Sulawesi. The research period was from October to November 2021.

This study used quantitative research method with a survey approach. Data consisting of primary data and secondary data were collected using observation and interview techniques. The population in this study were farmers who cultivate rainfed rice at the research site. The total population was 1,178 farmers, consisting of 634 farmers from Maros Regency and 544 from Pangkajene Islands Regency. The number of respondents was 100 farmers. Samples were selected using the proportional random sampling method at four research sites. Data were analyzed using the quantitative descriptive technique with an independent sample t-test.

The technical efficiency analysis used is as follows.

$$TER = \frac{Y_i}{\overline{Y}}$$

Where TER is the technical efficiency rate, $\overline{Y}$ is potential production, and Yi is the actual production. If TER value <0.80, it means that farmers are not efficient in using production inputs in rice farming in rainfed rice fields. TER value 0.80 – 1.00 means that farmers are efficient in using production inputs in rice farming in rainfed rice fields (Sumarno et al., 2015).

Production risk was analyzed by determining the magnitude of the coefficient of variation. Production risk can be measured by the magnitude of the variance and standard deviation. The coefficient of variation can mathematically be written as follows.

$$CV = \frac{\sigma}{\overline{X}}$$

$$\sigma = \sqrt{\frac{\sum x^2}{n}}$$

$$x = X - \overline{X}$$

Where CV is the coefficient of variation production, σ is production standard deviation (variance), $\overline{X}$ is production average, n is the number of samples. In this (Asbullah et al., 2017), if CV value 0.50, farmers are protected from production risks in carrying out rice farming in rainfed rice fields. CV value > 0.50 means that farmers are at risk of production in carrying out rice farming in rainfed rice fields.

To analyze the profitability of rainfed lowland rice farming, the following formula was used (Adiwinata et al., 2017; Fauzan, 2014):

1. Net Farm Income (NFI)

   NFI = GM – TFC

   GM = TR – TVC

Where GM is gross margin (IDR), TR is total revenue (IDR), TVC is total variable cost (IDR), and TFC is total fixed cost (IDR),

2. Return on Investment (ROI)

$$\text{ROI} = \frac{\text{Profit}}{\text{Production Cost}} \text{ X } 100\%$$

Where Profit is the difference between the production value and the total cost of production (IDR). Production cost is costs incurred during production (IDR). It used the criteria: (i) if ROI > 50%, this means that rainfed rice farming is profitable to carry out, and (ii) if ROI <50%, this means that rainfed lowland rice farming is not profitable to carry out.

3. Break Event Point (BEP)

$$\text{BEP} = \frac{\text{FC}}{1-\frac{\text{VC}}{\text{S}}}$$

Where FC is fixed cost (IDR). VC is variable cost (IDR), S is profit (IDR). It used the criteria (i) if the receipt of rain-fed rice farming > BEP means worth working on; (ii) if the receipt of rain-fed rice farming <BEP means it's not worth the effort.

RESULT AND DISCUSSION

Respondent Characteristics

The characteristics of the respondent farmers are a general description of the condition of farmers who cultivate rice in rainfed rice fields. The characteristics of the respondent farmers in this study consisted of the age of the farmer, the level of education of the farmer, the area of arable land, and experience in rice farming. The characteristics of the respondent farmers are presented in Table 1.

Farmers had an average age of 51.2 years, with a minimum age of 22 years and a maximum age of 76 years. The most dominant age group was 41-60 years (67%), followed by the age group 61-80 years (17%) and 20-40 years (16%). Based on this age group, the productive age of farmers dominates as the main actor in rice farming activities. Productive age is closely related to physical abilities and decision-making abilities. The age of a rice farmer affects performance in production. Younger ages usually have a stronger physique at work (Sari et al., 2022). As the age of the farmer increases, the experience and skills in rice farming will increase, and it will have a positive effect on rice production (Zakaria & Indah, 2019).

Table 1. Respondents' Characteristics

Variable	Frequency	Percentance
	people	%
Farmer's age		
20-40 years	16	16
41-60 years	67	67
61-80 years	17	17
Average (years)	51.2	
Education level		
Elementary school	49	49
Junior high school	11	11
Senior high school	37	37
Bachelor	3	3
Farm size		
0.10-0.50 ha	64	64
0.51-1.00 ha	30	30
1.10-1.50 ha	3	3
1.51-3.00 ha	3	3
Average (ha)	0.4	
Farming experience period		
≤10 years	3	3
10-25 years	37	37
>25 years	60	60
Average (years)	29.6	

The highest level of education of farmers was elementary school graduates, followed by high school, junior high, and undergraduate graduates, respectively. This shows that the level of formal education of farmers is still low. The level of education influences the quality of human resources to manage farms run by farmers and also affects more advanced ways of thinking (Umar et al., 2020). Generally, rice farmers who have a higher level of education will have a better ability to accept innovation when compared to farmers who have never gone through a high level of formal education (Sari et al., 2022). Although their level of formal education was low, the farmers had been running their farm for a long time. Most of the farmers have been running rice farming since they were small and have experience. They also attended non-formal education from various activities like counseling and training. The goal those activities is to increase the knowledge of farmers to support implementation in their farming.

The area of arable land managed by farmers was dominated by an area of 0.10-0.50 ha (64%). This shows that the area of arable land cultivated by farmers is still narrow. To increase production and income obtained by farmers, the area of arable land needs to be increased (Gara et al., 2021; Iskandar & Jamhari, 2020). The addition of land area will increase the population of lowland rice plants. The increase in the population of lowland rice plants can increase lowland rice production. Some farmers worked on their land, and some worked on other people's land with a profit-sharing system. The profit-sharing system applied was that half of the harvest was given to landowners and the other half was given to smallholders (50% each for land owners and sharecroppers in the form of goods/grain or money). Cultivators were responsible for managing their farms from tillage to harvesting.

Based on Table 1, the farmers' experience in farming is mostly over 25 years, as many as 60%. This means that most of the farmers have been running rice farming for a long time, and most of the farmers continue the farming that their parents had run. The farmers' experience was inherited from their parents and supported with non-formal education from agricultural extension workers. Farmers developing their farms obtained farming skills from the experience of these farmers. Farmers with longer farming experience have better skills and understanding to manage and run their farms. The length of experience in farming affects the perception of farmers in accepting technological innovations from outside. Farmers who have been farming for longer find it easier to implement innovations than novice farmers (Sari et al., 2022).

Technical Efficiency

Increasing rice production requires improving rice field infrastructure, intensifying the use of rice planting technology, and changing farmers' perceptions about rice farming. The efficiency of rice production can be increased by adding labor, mechanical power, and irrigation to rice fields (Zeng et al., 2023). The technical efficiency of rice farming in rainfed rice fields in two regencies, namely Maros Regency and Pangkajene Islands Regency, can be seen in the difference in the results by using the independent sample t-test. The results of the analysis of the technical efficiency of rice farming in rainfed rice fields can be seen in Table 2.

Table 2 shows that Maros Regency and Pangkajene Islands Regency are technically efficient.

This is based on the criterion of the level of technical efficiency, which is between 0.80-1.00. With this criterion, it is found that more farmers were more efficient than inefficient in the two districts. The results of the t-test analysis of technical efficiency showed that the values of t-count and t-table had significant differences between farmers in Maros Regency and Pangkajene Islands Regency. This means that there were differences in technical efficiency between farmers in the two districts, i.e., the efficiency in Maros Regency was lower than that in Pangkajene Islands Regency. The number of technically efficient farmers in Maros Regency was 54.00%, while in Pangkajene Islands Regency was 74.00%. The number of technically inefficient farmers in Maros Regency was 46.00%, and Pangkajene Islands Regency was 26.00%.

Table 2. Results of Technical Efficiency Analysis of Rainfed Rice Farming in Maros Regency and Pangkajene Islands Regency

Technical Efficiency	Maros Regency	Pangkajene Islands Regency
Average value	0.78	0.81
Minimum value	0.50	0.50
Maximum value	0.97	0.94
Efficient percentage	54.00	74.00
Inefficient percentage	46.00	26.00
Technical efficiency t-test:		
t-count (Maros with Pangkajene Kepulauan)		2.082**
t-table $_{(\alpha = 5\%)}$		(1.990)

Source: Processed Data, 2023

The difference in technical efficiency is due to the area of cultivated land in Pangkajene Islands Regency being larger than Maros Regency. Likewise, the use of urea and phonska fertilizers is greater and closer to the recommended fertilizer use in Pangkajene Islands Regency, which is wider than Maros Regency. Meanwhile, there was no difference in farming experience between the two regencies. Therefore, it can be interpreted that farmers in the Pangkajene Islands Regency are more technically efficient in terms of using production inputs to manage rice farming in rainfed lowland areas (Suharyanto et al., 2015). Farmers were not always able to achieve the expected level of efficiency and productivity even though they had long experience in farming agricultural commodities. This is because one of the influencing factors is the intensity of input use (Iskandar & Jamhari, 2020). The difference in the level of technical efficiency achieved by farmers indicates that the level of mastery and application of technology is different. The use of mobile phones is correlated and significant with reducing the inefficiency of rice farming along with farmer education and the implementation of irrigation (Kusumaningsih, 2023). The different levels of technical mastery of farmers are caused by internal factors within farmers such as education, age, farming experience, frequency of attending counseling, and external factors such as land conditions (Arifin et al., 2019).

Production Risks

Risk in farming is unavoidable because all forms of business must have risks in them. The risk of rice farming production is related to the production obtained by farmers (Rizwan et al., 2020). For the production risk of rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency, the difference can be known by using the chi-square test analysis. The results of the production risk analysis can be seen in Table 3.

The results of the analysis of the different tests of variance are shown in Table 3. The values of Fcount and Ftable have differences that have a significant effect on farmers in Maros Regency and Pangkajene Islands Regency. There were differences in production risk between farmers in the two districts in terms of variance, where the production risk for farmers in Maros Regency was smaller than for farmers in Pangkajene Islands Regency. The difference in production risk happened as farmers in Maros Regency did not dare to take risks, thinking if they wanted greater production results, they also faced greater risks. This is because most farmers in Maros Regency were underprivileged farmers and only relied on labor in the family. Small farmers are more risk-averse and rice farmers face many risks. Risk-averse farmers will allocate their labor to off-farm jobs (Rizwan et al., 2020). The limitations of these farmers had an impact on their ability to use production inputs to increase their farming results. The average use of the input was still lacking and did not meet the recommended recommendations. Risk is used more in the context of decision-making because risk is the opportunity for an adverse event to occur as a result of an action. The higher the level of uncertainty of an event, the higher the risk caused by decision-making (Dewati & Waluyati, 2018).

Table 3. Analysis of Variance and Coefficient of Variation of Rainfed Rice Farming in Maros Regency and Pangkajene Islands Regency

Item	Variant	Coefficient of Variation
Maros Regency	882,886.89	0.70
Pangkajene Islands Regency	3,212,300.00	0.70
Variant Difference Test:		
Fcount (Maros dengan Pangkajene Kepulauan)	16.071***	
Ftable (α = 1%)	(1.998)	
Coefficient of Variation Difference Test:		
χ2-count (Maros with Pangkajene Islands)	0.000 ns	
χ2-table (α = 5%)	(3.841)	

Table 4. Profitability Analysis of Rainfed Rice Farming in Maros and Pangkajene Kepulauan Regency

No.	Item	Maros Regency	Pangkajene Kepulauan Regency
1	Profit (IDR)	5,797,490.00	11,100,092.00
2	Variable Cost (IDR)	2,366,907.00	4,019,530.18
3	Tetap Cost (IDR)	430,800.17	198,701.00
4	Total Cost (IDR)	2,797,707.17	4,218,231.18
5	Income (IDR)	2,999,782.83	6,881,860.82
6	Net Farm Income (IDR)	2,999,782.83	6,881,860.82
	Net Farm Income t-test:		
	t-count (Maros with Pangkajene Kepulauan)		4.354***
	t-table (α = 1%)		(2.414)
7	Return on Investment (%)	95.76	143.17
	Return of Investment t-test:		
	t-count (Maros with Pangkajene Kepulauan)		3.227***
	t-table (α = 1%)		(2.414)
8	Break Event Point (IDR)	802,132.77	353,596.25
	Break Event Point t-test:		
	t-count (Maros with Pangkajene Kepulauan)		4.599***
	t-table (α = 1%)		(2.414)

For the value of the coefficient of variation of farmers in Maros Regency and Pangkajene Islands Regency, there was no difference in production risk, but the two districts were at risk based on the criterion that CV was greater than 0.50. Both districts had a coefficient of variation of 0.70. Based on the results of the analysis of the chi-square test (χ2) in Table 3, it shows that the value of 2count was smaller than the value of 2table. This means that the production risk of farmers in Maros Regency is the same as the production risk of farmers in Pangkajene Islands Regency. There was a similarity between farmers in Maros Regency and Pangkajene Islands Regency, in that they avoided risks in running their farms. According to Mitra & Sharmin (2019), sources of risk in agriculture include production and technical risk, namely production risk that occurs when there is a technical relationship between output and level of input use. The courage of farmers in making decisions is strongly influenced by the risk conditions of their farming. Dadzie et al. (2022) mentioned that the risk of farming is more concentrated on the individual side of small farmers.

Profitability

Profitability analysis is very necessary to find out the profits obtained in the business and is also used as a measuring tool to determine the development of the business that is being carried out (Arifin, 2022). Farming profitability is the ability of farming to generate profits. Two important components in calculating farm profitability are the revenue and costs of rainfed lowland rice farming. In this study, the calculated cost component is the cost incurred by the farmer (cash cost). The results of the profitability analysis can be seen in Table 4.

Based on the results of the profitability t-test analysis shown in Table 4, the values of t-count and t-table had a difference and had a significant effect on farmers in Maros Regency and Pangkajene Islands Regency. This means that there are differences in profitability in NFI, ROI, and BEP between farmers in the two districts. For Net Farm Income, the results show that there was a difference in value, where Pangkajene Islands Regency was greater than Maros Regency. The difference in values in the two districts can be proven by the results of the t-test analysis with a 99% confidence level or 1% error.

For the Return on Investment (ROI) the result obtained was 95.76% for Maros Regency and for Pangkajene Islands Regency was 143.17%. The ROI results obtained from the two districts were greater than 50%, meaning that the efficiency level of capital use in rainfed lowland rice farming for one harvest season exceeds or is greater than the criteria. It can also be interpreted that for every IDR1 that Maros Regency farmers spent, they had a profit of IDR95.76 or 95.76% when compared to production costs. For Pangkajene Islands Regency farmers, each IDR1 expenditure earned them a profit of IDR143.17 or 143.17% when compared to production costs. Thus, rainfed lowland rice farming in Maros and Pangkajene Islands is profitable. Both regencies provide profits of 50% or more. One of the reasons is that most farmers used family labor in their farming activities, especially from tillage to maintenance. Only some farmers used labor from outside the family to harvest. This way, farmers could save on labor costs. One component that incurs a lot of labor costs in farming activities is planting and harvesting costs. Based on the results of ROI and t-test analysis with a 99% confidence level or 1% error, there are differences in the two districts. The value of ROI and profits obtained by Pangkajene Kepulauan Regency is greater than that of Maros Regency.

The Break Event Point (BEP) was IDR802,132.77 in Maros Regency and IDR353,596.25 in Pangkajene Islands Regency. The BEP results obtained from the two districts were lower than the average actual revenue. The average actual revenue of Maros Regency is IDR5,797,490.00 and Pangkajene Islands Regency IDR11,100,092.00. Thus, rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency is feasible. The BEP results were lower than the actual revenues of the two districts, indicating that the income earned by farmers from their farming results exceeds the variable and fixed costs that must be incurred. Based on the results of BEP and t-test analysis with a confidence level of 99% or an error of 1%, there were differences in the two districts. The BEP value and the actual average revenue obtained by Pangkajene Islands Regency were greater than that of Maros Regency.

Research Implication

There are various ways to increase production, i.e., by increasing land area, making new technological innovations, optimizing land use, and increasing technical efficiency through the use of existing resources. Increasing production through technical efficiency is relevant to be done at this time and also necessary for farmers in Maros Regency and Pangkajene Islands Regency. Increasing productivity is currently not possible through land expansion and in the short-term technology adoption is difficult (Rani & Singh, 2015). Efforts to increase production and obtain maximum profit from lowland rice farming should be done by taking into account the technical efficiency of the use of the production factors used (Khounthikoumane et al., 2021). In corn farming, it has been found that the technical efficiency of corn farmers who use mobile phones in the production process is greater than those who do not (Kusumaningsih, 2023). It is important to increase productivity through technical efficiency. The higher the efficiency, the more profitable it will be because efficiency can explain the optimal combination of various factors of production. The achievement of efficiency is not only influenced by the number and types of production factors and management but it is also influenced by environmental factors in which farming is developed (Arifin et al., 2019).

Rice farming carried out by farmers will face various kinds of situations, both beneficial and detrimental. Adverse situations are commonly referred to as risks (Mitra & Sharmin, 2019). All agricultural commodities, in this case, rainfed lowland rice farming, are cultivated by farmers both in Maros Regency and in Pangkajene Islands, where the main problem lies in production. Production problems are related to the nature of farming which always depends on nature and is supported by risk factors. The production risks that cause the most losses to farmers are the presence of pests and diseases, the frequency of floods, and droughts that cannot be predicted in advance (Arifin et al., 2019). Production risk occurs due to the technical relationship between output and the level of input use, prices, finance, government policies, and individuals (Zakaria & Indah, 2019). The size of the risk faced by farmers will have an impact on the level of production and income obtained by farmers. The higher the risk faced by farmers, the higher the chance of experiencing losses (Andayani et al., 2020). One of the efforts that can be taken to reduce and minimize the risk of lowland rice farming is taken increase the ability of farmers in their farming through extension activities.

Rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency uses profitability analysis with the approach of NFI, ROI, and BEP to generate income and profit while the crop is feasible to cultivate. Farmers' incomes are generally influenced by several components, namely the amount of production, selling prices, and costs incurred by farmers in their agricultural businesses (Ifeoma et al., 2022). The optimal allocation of inputs affects the costs that must be incurred. The increase and decrease in production will affect farmers' income (Suyatno et al., 2018). The implementation of rice farming by farmers must have the right considerations in production to obtain the best profit (Defidelwina et al., 2019). The best or maximum profit is achieved when the production level is optimal. To obtain the optimal level of production, the producer must take into account the amount of production that is in a position of balance or profit, and if it is reduced/added it will lose. Optimal production occurs when production activities provide the largest difference between revenues and costs. Efficient use of costs is the first step in determining optimal production (Arifin, 2022).

Based on the findings of this research, in terms of efficiency, most farmers are technically efficient. This indicates that the use of production inputs is as recommended as expected. Farming efficiency is very important to find sources of agricultural productivity growth. The success of increasing agricultural productivity is determined by the ability to create technology that can be applied and developed ecologically and economically in each region (Adhiana et al., 2021; Aprianti et al., 2020). The findings of this research can provide an overview of the positive impact on national and global economic development as expected and sustainable.

The agricultural sector has an important role in human life because it can provide the life basic needs, especially food. The agricultural sector is a source of income that improves community welfare and supports the rate of national economic growth (Rahmat et al., 2017). This indicates that agriculture has an important role in the national economy. Rain-fed rice fields is one type of land that can be used to provide national food needs. One of the crops cultivated in rainfed rice fields is rice. Rainfed rice fields have low fertility and water availability but are still a source of income for farmers (Sahara & Supriyo, 2022).

Current and future agricultural development is not limited to increasing productivity, but also formulating policies that support sustainable development by increasing human resources and enabling farmers to play a role in the development process (Ramlawati, 2020). Agricultural development in Indonesia is directed towards sustainable agricultural development, as a part of the implementation of sustainable development. Agriculture in the sustainable development paradigm is a development system that comprehensively utilizes human resources, natural resources, and technology to improve community welfare (Sidharta et al., 2021). Efforts for sustainable agricultural development can be achieved by carrying out effective and efficient land intensification (Arham et al., 2019).

Continuous development has resulted in many agricultural lands being converted to non-agricultural purposes. High land prices are one of the trigger factors for farmers to relinquish their land ownership to investors for conversion. South Sulawesi experienced land conversion of 105,154.84 ha. This phenomenon shows that the conversion of agricultural land is still high, especially for rice fields in South Sulawesi Province. Moorland or dry land is also used for seasonal crops, including rice, to support increased rice production in paddy fields. Dry land in South Sulawesi is not very wide, only 3,711 ha with a production of 13,483 tons (BPS-Provinsi Sulawesi Selatan, 2019). The socio-economic conditions of farmers are related to the level of welfare of the farmer's family. The main parameters used to determine the level of welfare of farming families are farming income or the social conditions of farming households (Suprianto et al., 2019). For socio-economic conditions in the research area, generally, the main livelihood is as a farmer. Dependence on farming is very large, especially rice farming, to support the needs of the farmer's family.

CONCLUSION AND SUGGESTION

Based on the results of the study, it can be concluded that rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency is technically efficient. Rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency is at risk. Rainfed lowland rice farming in Maros Regency and Pangkajene Islands Regency uses profitability analysis with the approach of NFI, ROI, and BEP to generate income, profit and is feasible.

Farmers need to use production inputs as recommended to increase production reduce production risk and achieve efficient use of inputs. Efforts to reduce risk can be made through technological improvements, namely using varieties that are resistant to pests and diseases, high production, and good adaptability to the plant-growing environment.

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