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Analysis of Rice Farmers' Income in Baji Pa'mai Village, Cenrana District Maros Regency

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Abstract: The aim of this research is a quantitative type of research with the aim of determining the income of rice farmers in Baji Pa'mai Village, Cenrana district, Maros Regency. Agriculture is a vital sector in Indonesia's economy, particularly in rural areas. Rice, as the main agricultural commodity, serves as the primary source of income for farmers in Baji Pa'mai Village, Cenrana District, Maros Regency. However, high production costs, limited land area, and variations in productivity often hinder farmers from achieving optimal income. This study aims to analyze the factors affecting rice farmers' income, focusing on capital, productivity, and land area. This research employs a quantitative approach using multiple linear regression. Primary data were collected from 25 rice farmers through questionnaires and interviews. The independent variables include capital (total production costs), productivity, and land area, while income serves as the dependent variable. The analysis was conducted using classical assumption tests, t-tests, F-tests, and the coefficient of determination. The results indicate that capital has a significant negative effect on income, while productivity and land area have significant positive effects. Simultaneously, all three variables significantly influence farmers' income, with an R^2 value of 0.873, meaning that 87.3% of income variation is explained by the model. The study concludes that increasing productivity and optimizing land use are more influential in improving farmers' income than increasing production costs.

Keywords: Farmers' Income, Capital, Productivity, Land Area, Rice Farming

1. Introduction

Agriculture plays a fundamental role in Indonesia's economy, particularly in supporting food security, rural livelihoods, and regional economic development. As an agricultural country located predominantly within the tropical zone, Indonesia possesses substantial natural resources that support the cultivation of various food crops. Among these crops, rice is one of the most important agricultural commodities because it serves as the staple food for the majority of the Indonesian population. Consequently, rice production is not only essential for meeting domestic food demand but also contributes significantly to farmers' livelihoods and the sustainability of the agricultural sector. The productivity of rice farming is influenced by several factors, including land fertility, farming practices, and the application of appropriate agricultural inputs, such as organic fertilizers (Fatmawati, 2013; Hasrimi & Moettaqien, 2012).

At the regional level, agriculture remains an important sector supporting economic activity in Maros Regency, South Sulawesi, Indonesia. According to the Maros Central Bureau of Statistics (BPS Maros, 2016), agriculture contributed 15.25% to the regional gross domestic product (GRDP), ranking third among the 21 business sectors, after transportation and warehousing (41.79%) and manufacturing (18.14%). The development of agriculture in Maros Regency is supported by the availability of natural resources, human resources, and agricultural infrastructure. In 2016, the regency had approximately 25,952 hectares of paddy fields, 86,409 hectares of non-paddy agricultural land, and 49,551 hectares of non-agricultural land. Of the total paddy-field area, approximately 15,657 hectares were irrigated, while 10,295 hectares were non-irrigated. These resources provide a substantial foundation for rice cultivation and create opportunities to improve agricultural productivity and farmers' economic welfare.

Rice farming in Maros Regency is also supported by farmers' accumulated agricultural experience and the development of food-crop production technologies. According to the Ministry of Agriculture of the Republic of Indonesia (2020), the regency had approximately 33,382 rice farmers. Data reported by BPS Maros (2020) indicate that rice yields across the 14 districts of Maros Regency ranged from 6.13 to 8.96 tons per hectare. These figures suggest considerable production potential in the region, although differences in agricultural conditions, farming practices, input utilization, and production costs may influence the economic returns obtained by individual farmers. High rice productivity does not necessarily translate into high farm income, particularly when production costs, input prices, and selling prices vary across farming households.

Rice is a strategic food commodity that requires sustained attention from both farmers and policymakers. Government support for rice production can take several forms, including the provision of high-quality seeds, fertilizers, pesticides, irrigation infrastructure, agricultural credit, and capital assistance. Such interventions are intended to improve production capacity and strengthen farmers' access to essential agricultural resources. Nevertheless, the economic performance of rice farming should not be assessed solely in terms of production volume or yield per hectare. Farm income also depends on the relationship between total revenue and the costs incurred throughout the production process. Therefore, examining farmers' income is essential for understanding whether rice cultivation provides adequate economic returns and supports the long-term sustainability of rural livelihoods.

Despite the considerable rice production potential of Maros Regency, an assessment of farm income at the village level remains important because aggregate regional statistics may not fully reflect the economic conditions experienced by individual farming communities. Differences in landholding size, production inputs, labor requirements, farming methods, and rice selling prices may result in variations in profitability across locations. Accordingly, a context-specific analysis is needed to determine the income generated by rice farming and to provide empirical information that can support more effective agricultural development policies.

Based on this background, this study aims to analyze the income of rice farmers in Baji Pa'mai Village, Cenrana District, Maros Regency, South Sulawesi, Indonesia. By examining the economic returns obtained from rice cultivation, this study is expected to provide useful information for farmers, policymakers, and other stakeholders in evaluating the economic viability of rice farming and identifying opportunities to improve farmers' welfare. The findings may also contribute to the development of locally relevant agricultural strategies aimed at strengthening farm profitability and sustaining rural economic development.

2. Method

2.1. Research Design

This study employed a descriptive quantitative research design to analyze the income of rice farmers in Baji Pa'mai Village, Cenrana District, Maros Regency, South Sulawesi, Indonesia. Descriptive quantitative research aims to systematically describe phenomena using numerical data and quantitative analysis (Nazir, 2014). This approach was adopted to calculate farm income and examine its relationship with production capital, productivity, and cultivated land area. Descriptive analysis was used to assess the economic performance of rice farming, while multiple linear regression was employed to examine the relationships between the explanatory variables and farmers' income.

2.2. Research Location and Period

The research was conducted in Baji Pa'mai Village, Cenrana District, Maros Regency, South Sulawesi, Indonesia. The location was purposively selected because rice farming constitutes an

important source of livelihood for the local community. The fieldwork was conducted over two months, from July to August 2025.

2.3. Types and Sources of Data

This study used quantitative and qualitative data to support the analysis of rice farmers' income. Quantitative data consisted of numerical information, including production costs, production volume, cultivated land area, farm revenue, and farmers' income. These data were used to calculate the economic performance of rice farming and conduct the statistical analysis. Qualitative data consisted of descriptive information obtained through direct interviews with farmers and other relevant sources. These data provided contextual information about farming activities, production practices, and the economic conditions of rice farmers. The study relied on both primary and secondary data. Primary data were collected directly from rice farmers through structured questionnaires and interviews. The questionnaires were designed to obtain information about farming activities, land ownership or cultivated land area, production inputs, production costs, output, and revenue. Secondary data were obtained from relevant publications, previous research, statistical reports, and official documents issued by the Central Bureau of Statistics (BPS) and other institutions associated with agricultural development. These sources were used to provide contextual information and support the interpretation of the research findings.

2.4. Population and Sampling Technique

The population comprised 95 rice farmers residing in Baji Pa'mai Village, Cenrana District, Maros Regency. A population refers to the entire group of individuals or units that share characteristics relevant to a research investigation (Siyoto & Sodik, 2015). This study employed purposive sampling, a non-probability sampling technique in which respondents are selected according to predefined criteria relevant to the research objectives (Sugiyono, 2016). Specifically, eligible respondents were farmers who actively cultivated rice and had engaged in rice farming for at least the two most recent planting seasons. A total of 30 rice farmers were selected as research respondents. The sample size was determined based on the study's practical considerations and the availability of eligible respondents. The resulting sample was used to examine farm income and the relationships between the selected explanatory variables and farmers' income. The demographic and farming characteristics of the respondents, including age, cultivated land area, and educational attainment, were recorded to describe the sample.

Table 1. Characteristics of the Rice Farmers Included in the Study

No.	Respondent	Age (years)	Land area (ha)	Education
1	Rustam	40	0.25	Junior high school
2	Abd Asis	50	0.30	Senior high school
3	Bahar	39	0.22	Senior high school
4	M. Arsyad	42	0.60	Junior high school
5	Baco Ali	55	0.28	Elementary school
6	Abd Majid	42	0.35	Junior high school
7	Muksin	47	0.20	Senior high school
8	Ambo Enre	51	0.55	Elementary school
9	Adnan	36	0.27	Diploma
10	Mursalin Zakir	52	0.40	Junior high school
11	Muhtar	40	0.32	Elementary school
12	Muh Nur	48	0.58	Senior high school
13	Akmal	43	0.18	Junior high school

14	Siddik	51	0.34	Elementary school
15	Saripuddin	38	0.60	Junior high school
16	Abd Malik	46	0.26	Junior high school
17	M. Basri	54	0.38	Elementary school
18	Takdir	41	0.17	Elementary school
19	Subair	49	0.56	Junior high school
20	Anwar	37	0.31	Elementary school
21	Suradi	53	0.24	Senior high school
22	Amar	44	0.60	Junior high school
23	Muh. Ali	40	0.26	Senior high school
24	Herman	56	0.38	Elementary school
25	Suardi	35	0.17	Junior high school
26	Jafar	47	0.56	Senior high school
27	Ridwan	50	0.31	Junior high school
28	Firdaus	39	0.24	Senior high school
29	Abd. Rasak	45	0.60	Junior high school
30	Makbul	48	0.26	Junior high school

Source: Primary data, processed by the researchers.

2.5. Data Collection Techniques

Data were collected using three techniques:

a. **Interviews.** Direct interviews were conducted using a prepared interview guide to obtain information about farmers' production activities, input utilization, production costs, output, and income (Sugiyono, 2016).
b. **Questionnaires.** Structured questionnaires were administered to respondents to collect quantitative data relevant to the research variables, including cultivated land area, production capital, productivity, and farm income (Arikunto, 2013).
c. **Documentation.** Relevant documents, statistical publications, previous studies, and official reports were reviewed to obtain supporting information and contextual data related to rice farming in the study area (Nazir, 2014).

2.6. Operational Definitions of Variables

The variables used in this study were operationally defined to ensure consistency in measurement and interpretation.

a. **Rice farming.** Rice farming refers to the agricultural activities undertaken by farmers in cultivating rice in Baji Pa'mai Village, Cenrana District, Maros Regency.
b. **Production capital.** Production capital refers to the total financial resources allocated to rice cultivation during one planting season. It includes expenditure on production inputs and other relevant farming costs.
c. **Rice production.** Rice production refers to the total quantity of harvested rice obtained by a farmer during one planting season, measured in kilograms.
d. **Land area.** Land area refers to the total area cultivated for rice production during one planting season, measured in hectares.
e. **Productivity.** Productivity refers to the quantity of rice produced per unit of cultivated land area, measured in kilograms per hectare.
f. **Production costs.** Production costs refer to all expenditures incurred in the rice cultivation process during one planting season, including fixed and variable costs.

g. **Farm income.** Farm income refers to the net financial return obtained from rice farming, calculated as total farm revenue minus total production costs during one planting season.

2.7. Data Analysis Methods

The data were analyzed using descriptive financial analysis and multiple linear regression. Descriptive analysis was used to calculate farm revenue, production costs, net income, return on investment, and rice productivity. Multiple linear regression was subsequently used to examine the relationships between production capital, productivity, cultivated land area, and farmers' income. Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS).

2.7.1. Farm Income Analysis

Farm income was calculated as the difference between total revenue and total production costs:

$$\pi = TR - TC$$

Where:
π = Net farm income (IDR per planting season)
TR = Total farm revenue (IDR per planting season)
TC = Total production costs (IDR per planting season)

Total revenue was calculated by multiplying the quantity of rice produced by its selling price:

$$TR = Q \times P$$

Where:
Q = Total quantity of rice produced (kg)
P = Selling price per unit of output (IDR/kg)
Total production costs were calculated as the sum of fixed and variable costs:

$$TC = FC + VC$$

Where:
FC = Fixed costs (IDR per planting season)
VC = Variable costs (IDR per planting season)

2.7.2. Production Capital and Return on Investment

Production capital was calculated as the sum of fixed and variable costs:

$$K = FC + VC$$

Where:
K = Total production capital (IDR per planting season)
The return on investment (ROI) was calculated as follows:

$$ROI = (\pi / K) \times 100\%$$

Where:
π = Net farm income
K = Total production capital

2.7.3. Rice Productivity Analysis

Rice productivity was calculated by dividing total rice production by the cultivated land area:

$$\mathbf{Prod = Q / A}$$

Where:
Prod = Rice productivity (kg/ha)
Q = Total rice production (kg)
A = Cultivated land area (ha)

2.7.4. Multiple Linear Regression Analysis

Multiple linear regression was employed to examine the relationship between production capital, rice productivity, cultivated land area, and farmers' income. The regression model was specified as follows:

$$\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon}$$

Where:
Y = Rice farmers' net income
α = Regression constant
X_1 = Production capital
X_2 = Rice productivity
X_3 = Cultivated land area
β_1, β_2, β_3 = Regression coefficients
ε = Error term

2.8. Hypothesis Testing

2.8.1. Coefficient of Determination (R^2)

The coefficient of determination was used to assess the proportion of variation in farmers' income explained by the independent variables:

$$\mathbf{R^2 = 1 - (SSE / SST)}$$

Where:
SSE = Sum of squared residuals
SST = Total sum of squares

2.8.2. Simultaneous Significance Test (F-test)

The F-test was used to determine whether the independent variables were jointly statistically significant in explaining farmers' income.
The hypotheses were formulated as follows:

$$\mathbf{H_0: \beta_1 = \beta_2 = \beta_3 = 0}$$

H_1: At least one $\beta_j \neq 0$, where j = 1, 2, or 3.
The null hypothesis was rejected if the p-value was below the 5% significance level ($\alpha = 0.05$).

2.8.3. Partial Significance Test (t-test)

The t-test was used to evaluate the individual statistical significance of each regression coefficient.
The hypotheses for each independent variable were specified as follows:
H_0: $\beta_j = 0$
H_1: $\beta_j \neq 0$
The null hypothesis was rejected if the p-value was below 0.05. The sign of the estimated regression coefficient was used to determine whether the relationship was positive or negative.

3. Results and Discussion

3.1. Results and Discussion

3.1.1. Respondent Characteristics

Table 2. Respondents' Educational Attainment

Educational Attainment	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	1	4.0	4.0	4.0
Elementary School	9	36.0	36.0	40.0
Senior High School	6	24.0	24.0	64.0
Junior High School	9	36.0	36.0	100.0
Total	25	100.0	100.0	

Source: Author processed

Based on the frequency distribution of respondents' educational attainment, the findings indicate that most rice farmers in the study area had completed either elementary school (36%) or junior high school (36%). Meanwhile, 24% of respondents had completed senior high school, and only 4% had obtained a diploma. These findings indicate that the majority of respondents had relatively low levels of formal education. This condition may influence farmers' ability to access information about modern agricultural technologies, manage farming activities using appropriate economic calculations, and make more efficient production decisions. These findings are consistent with Munte (2025), who identified low educational attainment among farmers as one of the major barriers to adopting agricultural technological innovations. Farmers with limited formal education may face greater difficulties in accessing and processing new information and may continue to rely on traditional land-management practices. Nevertheless, extensive farming experience may partially compensate for limited formal education by helping farmers maintain relatively stable production practices.

Therefore, the findings suggest that most respondents have relatively limited formal educational backgrounds, highlighting the need for agricultural extension services, practical training, and intensive assistance from agricultural extension officers. Strengthening farmers' human resource capacity is essential to improving the use of production inputs, increasing land productivity, and ultimately enhancing farm income and household welfare.

3.1.2. Descriptive Statistical Analysis

Table 3. Descriptive Statistics of Respondents

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	25	29	55	42.04	7.508
Farming Experience (years)	25	7	28	16.80	6.164
Number of Dependents	25	2	7	4.32	1.701
Cultivated Land Area (ha)	25	0.14	0.60	0.3112	0.13144
Valid N (listwise)	25				

Source: Author processed

The descriptive statistical analysis shows that the average age of the respondents was 42.04 years, with ages ranging from 29 to 55 years. This indicates that most respondents were within the productive age group and were generally of an age suitable for undertaking physically demanding agricultural activities. Farming experience ranged from 7 to 28 years, with an average of 16.80 years. This finding indicates that the respondents had accumulated considerable experience in managing rice

farming activities. The average number of household dependents was 4.32, indicating that respondents generally had several family members to support financially. Meanwhile, cultivated land area ranged from 0.14 to 0.60 hectares, with an average of approximately 0.31 hectares. This finding reflects the relatively small scale of rice farming among the respondents and suggests that limited land availability may constrain production capacity and potential farm income.

These findings are consistent with Tunas et al. (2023), who reported that farmers' productive age and accumulated experience contribute positively to their farming skills and ability to manage agricultural activities. However, limited cultivated land area may remain a major constraint on income growth. Larger cultivated areas can provide opportunities to increase total production and farm revenue, whereas farmers operating small plots may continue to experience income constraints despite having substantial farming experience. Overall, the respondents possessed considerable farming experience and were generally within the productive age group. However, limited cultivated land area represents a potential obstacle to increasing agricultural output and income. Accordingly, policies promoting collective land management, improved access to agricultural technologies, and farming diversification may help optimize existing human resources and improve farmers' economic welfare.

3.1.3. Normality Test

Table 4. Results of the Normality Test

Variable	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Farm Income (IDR)	0.152	25	0.137	0.929	25	0.081

Note: Lilliefors significance correction was applied to the Kolmogorov–Smirnov test.
Source: Author processed

The normality test was conducted to assess whether the data satisfied the normality assumption relevant to the regression analysis. Two statistical tests were considered: the Kolmogorov–Smirnov test and the Shapiro–Wilk test. The Kolmogorov–Smirnov test produced a significance value of 0.137 ($p > 0.05$), while the Shapiro–Wilk test yielded a significance value of 0.081 ($p > 0.05$). Both values exceeded the 5% significance threshold, indicating that the null hypothesis of normality could not be rejected.
These findings are consistent with Permatasari et al. (2024), who employed the Kolmogorov–Smirnov and Shapiro–Wilk tests to examine the normality of data related to lowland rice production. Their approach highlights the importance of assessing distributional assumptions before proceeding with statistical analysis. However, in regression analysis, the normality assumption primarily concerns the regression residuals rather than the dependent variable itself. Therefore, the results reported in Table 3.3 provide evidence about the distribution of farm income, but the normality of the regression residuals should also be examined before drawing a definitive conclusion about the regression model.

3.1.4. Autocorrelation Test

Table 5. Results of the Autocorrelation Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin–Watson
1	0.934	0.873	0.855	1,350,501.045	2.245

Predictors: Constant, Cultivated Land Area, Productivity, and Production Capital (IDR). Dependent variable: Farm Income (IDR).
Source: Author processed

The autocorrelation test was conducted to examine whether regression residuals were correlated across observations. The regression output produced a Durbin–Watson statistic of 2.245. As a general guideline, values close to 2 may indicate limited first-order autocorrelation. Nevertheless, a definitive conclusion requires comparison with the appropriate Durbin–Watson critical values or consideration of the relevant testing procedure. The result may suggest that substantial first-order autocorrelation is not evident in the estimated model. However, because this study uses cross-sectional data collected from individual farmers, the relevance of the Durbin–Watson test should be considered carefully. Unlike time-series observations, cross-sectional observations do not necessarily have a meaningful temporal order.

Consequently, the Durbin–Watson statistic of 2.245 should be interpreted in conjunction with the study's data structure and the other diagnostic tests. The independence of observations and the appropriateness of the regression specification remain important considerations when evaluating the reliability of the estimated relationships between production capital, productivity, cultivated land area, and farm income.

3.1.5. Heteroscedasticity Test

Table 6. Results of the Glejser Test

Variable	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
Constant	-2,593,904.682	859,382.570	—	-3.018	0.007
Production Capital (IDR)	1.089	0.447	1.027	2.435	0.024
Productivity	136.414	67.097	0.379	2.033	0.055
Cultivated Land Area	-2,112,603.787	2,768,028.686	-0.340	-0.763	0.454

Source: Author processed

The Glejser test was conducted by regressing the absolute residuals (ABS_RES) on the independent variables, namely production capital, productivity, and cultivated land area. The results indicate that productivity had a significance value of 0.055 ($p > 0.05$), while cultivated land area had a significance value of 0.454 ($p > 0.05$). These results indicate that neither variable was statistically significant at the 5% level in explaining the absolute residuals. However, production capital had a significance value of 0.024 ($p < 0.05$), indicating a statistically significant relationship with the absolute residuals. This result provides evidence of potential heteroscedasticity in the regression model. Therefore, the assumption of constant residual variance cannot be considered fully satisfied based on the reported Glejser test.

This finding highlights the importance of evaluating heteroscedasticity carefully rather than concluding that a model is free from the problem simply because most explanatory variables are statistically insignificant. A significant result for one explanatory variable in a Glejser test warrants further examination of the residual structure. Accordingly, additional diagnostic procedures are recommended, including an examination of the residual-versus-fitted-value plot and, where appropriate, the use of heteroscedasticity-robust standard errors. These procedures would help determine whether the estimated regression coefficients can be interpreted reliably and whether the statistical significance of the relationships remains robust.

3.1.6. Multiple Linear Regression Analysis

Table 7. Multiple Linear Regression Results

Variable	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
Constant	-6,739,813.473	1,832,718.631	—	-3.677	0.001
Production Capital (IDR)	-2.195	0.954	-0.477	-2.301	0.032
Productivity	1,301.823	143.091	0.834	9.098	0.000
Cultivated Land Area	39,757,837.981	5,903,095.922	1.474	6.735	0.000

Source: Author processed

Based on the coefficients reported in Table 3.6, the estimated multiple linear regression equation is expressed as follows:

$$\mathbf{Y = -6{,}739{,}813.473 - 2.195X_1 + 1{,}301.823X_2 + 39{,}757{,}837.981X_3}$$

Where:
Y = Farm income
X_1 = Production capital
X_2 = Productivity
X_3 = Cultivated land area

The multiple linear regression results indicate that production capital, productivity, and cultivated land area exhibit statistically significant relationships with rice farmers' income, although their estimated coefficients differ in direction and magnitude. Production capital has a regression coefficient of -2.195, with a significance value of 0.032 ($p < 0.05$). This result indicates a statistically significant negative association between production capital and farm income, holding the other explanatory variables constant. In the estimated model, an additional IDR 1 in production capital is associated with a decrease of IDR 2.195 in farm income, assuming the other variables remain unchanged. This relationship may reflect differences in cost efficiency, although the interpretation must account for the way farm income and production capital are measured.

In contrast, productivity has a positive coefficient of 1,301.823 and a reported significance value of 0.000 ($p < 0.001$). This result indicates a statistically significant positive association between productivity and farm income. The coefficient suggests that an increase of one unit in the productivity measure is associated with an increase of IDR 1,301.823 in farm income, conditional on the other variables. The precise economic interpretation depends on the unit used to measure productivity. Cultivated land area also exhibits a positive and statistically significant relationship with farm income, with a coefficient of 39,757,837.981 and a reported significance value of 0.000 ($p < 0.001$). This result suggests that an additional hectare of cultivated land is associated with an increase of approximately IDR 39.76 million in farm income, holding productivity and production capital constant.

These findings suggest that productivity and cultivated land area are positively associated with farmers' income, whereas production capital has a negative estimated association. Nevertheless, the relative importance of these variables should be interpreted carefully because their measurement scales differ and the model includes variables that may be economically interrelated. The results are broadly consistent with Mamondol and Sabe (2016), who reported that production costs can reduce farm income, whereas improvements in productivity can increase the economic returns obtained from agricultural activities. Their findings also suggest that cultivated land area can contribute to higher

income when accompanied by adequate productivity. The present study similarly highlights the importance of cost management, productivity improvement, and efficient land utilization in strengthening rice farmers' economic performance.

Overall, the regression estimates indicate that production capital is negatively associated with farm income, while productivity and cultivated land area are positively associated with income. These results support the relevance of examining production costs, agricultural productivity, and land availability when assessing the economic performance of rice farming. However, the findings represent estimated statistical associations and should not be interpreted as definitive causal effects without further consideration of the research design and model specification.

3.1.7. Coefficient of Determination (R^2)

Table 8. Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin–Watson
1	0.934	0.873	0.855	1,350,501.045	2.245

Source: Author processed

The coefficient of determination was used to assess the extent to which the independent variables explained variations in rice farmers' income. Based on the model summary in Table 3.7, the R Square value was 0.873. This indicates that production capital, productivity, and cultivated land area collectively accounted for 87.3% of the observed variation in farmers' income within the estimated sample. The Adjusted R Square value of 0.855 indicates that the model explained 85.5% of the variation after adjustment for the number of explanatory variables. The remaining 12.7% of the variation, based on the unadjusted R Square, was not explained by the variables included in the model and may be associated with other factors, such as rice selling prices, weather conditions, labor efficiency, access to agricultural inputs, and farming experience.

The standard error of the estimate was 1,350,501.045, indicating the estimated dispersion of the observed income values around the model's fitted values, expressed in the units of the dependent variable. These findings are comparable in a general sense to Rahayu (2022), who reported an R Square value of 0.998 in an analysis of rice-farming income in Sumbawa Regency. Differences in the coefficient of determination across studies may reflect differences in sample characteristics, explanatory variables, measurement procedures, and model specifications. The R Square value of 0.873 indicates that the model has substantial explanatory power within the observed sample. However, a high R Square value does not independently establish the validity of the model, demonstrate causality, or guarantee strong predictive performance in other populations.

Therefore, the coefficient of determination supports the conclusion that production capital, productivity, and cultivated land area jointly explain a substantial proportion of the variation in farmers' income in the study sample. Further diagnostic testing and model validation are nevertheless necessary before the model can be used confidently for broader prediction or policy evaluation.

3.1.8. Simultaneous Significance Test (F-test)

Table 9. Results of the Simultaneous F-test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	263,388,819,453,091.500	3	87,796,273,151,030.500	48.138	0.000
Residual	38,300,914,546,908.484	21	1,823,853,073,662.309	—	—
Total	301,689,734,000,000.000	24	—	—	—

Source: Author processed

The simultaneous F-test was conducted to determine whether production capital, productivity, and cultivated land area were jointly associated with rice farmers' income. Based on the ANOVA results in Table 3.8, the estimated F-statistic was 48.138, with a reported significance value of 0.000 ($p < 0.001$). Because the p-value was below the 5% significance threshold, the null hypothesis that all three regression coefficients were simultaneously equal to zero was rejected. This indicates that at least one explanatory variable was statistically associated with farmers' income and that the regression model was statistically significant overall. The result is consistent with the R Square value of 0.873, which indicates that the explanatory variables collectively accounted for a substantial proportion of the observed variation in farm income. Nevertheless, the F-test does not establish that every independent variable is individually significant; individual significance must be evaluated using the corresponding t-tests.

These findings are broadly consistent with Pungan et al. (2021), who reported that economic variables, including cultivated land area, production costs, harvest output, and selling prices, were jointly associated with rice farmers' income. Their findings emphasize that agricultural income reflects the interaction of several economic factors rather than the influence of a single variable. The results of the present study therefore suggest that rice farmers' income should be examined through an integrated approach that considers cost efficiency, productivity improvement, and effective land utilization. However, the model's diagnostic results and the potential interrelationships among the explanatory variables should also be considered when developing policy recommendations.

3.1.9. Partial Significance Test (t-test)

Table 10. Results of the Partial t-test

Variable	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
Constant	-6,739,813.473	1,832,718.631	—	-3.677	0.001
Production Capital (IDR)	-2.195	0.954	-0.477	-2.301	0.032
Productivity	1,301.823	143.091	0.834	9.098	0.000
Cultivated Land Area	39,757,837.981	5,903,095.922	1.474	6.735	0.000

Source: Author processed

The partial t-test was conducted to examine the individual relationship between each independent variable and rice farmers' income, while controlling for the other variables included in the regression model. The results show that production capital had a t-statistic of -2.301 and a significance value of 0.032 ($p < 0.05$). This indicates a statistically significant negative association between production capital and farm income. In practical terms, higher production expenditure may reduce net

income when the additional costs are not accompanied by a sufficient increase in revenue. This may occur when production inputs are used inefficiently or when additional labor and input expenditures do not generate proportional increases in output.

This finding is consistent with Najoan, Kaunang, and Rumagit (2020), who examined rice-farming income in Tountimomor Village and emphasized the importance of production-cost structures in determining farmers' economic returns. Their findings support the view that efficient cost management is an important consideration in improving agricultural profitability. Productivity had a t-statistic of 9.098 and a reported significance value of 0.000 ($p < 0.001$), indicating a statistically significant positive association with farm income. This suggests that higher rice output per unit of cultivated land is associated with higher farm income, conditional on the other explanatory variables. From an economic perspective, productivity improvements can increase the quantity of output generated from available land and may consequently increase total revenue.

These results are consistent with Tulaina, Kusumawaty, and Edwina (2023), who identified productivity as an important contributor to rice-farming income in Muara Uwai Village. Their research highlighted the potential benefits of using high-quality seeds, applying fertilizers at appropriate rates, and managing water resources effectively. Such practices can improve harvested output and strengthen farmers' economic returns. In areas characterized by limited land availability, increasing output per hectare may be particularly relevant to improving farm income. Cultivated land area also had a positive and statistically significant relationship with farm income, as indicated by a t-statistic of 6.735 and a reported significance value of 0.000 ($p < 0.001$). This result suggests that farmers managing larger cultivated areas tend to obtain higher farm income, conditional on production capital and productivity. Larger cultivated areas may provide greater production capacity, although the actual income gains also depend on production efficiency, input availability, and selling prices.

This finding is consistent with Cemda, Pirngadi, and Siregar (2024), who compared the income of organic and conventional rice farmers in Perbaungan District. Their research highlighted cultivated land area as an important factor associated with differences in farmers' income. Larger cultivated areas can provide opportunities to increase total output under both farming systems, provided that the land is managed effectively and the associated production costs remain economically viable. Taken together, the partial regression results indicate that production capital, productivity, and cultivated land area were each statistically significant at the 5% level, although their estimated relationships with income differed in direction. Production capital was negatively associated with income, whereas productivity and cultivated land area were positively associated with income.

These findings suggest that improving rice farmers' income requires attention to production-cost efficiency, productivity enhancement, and effective land utilization. In particular, the results highlight the importance of increasing output from existing land while ensuring that additional production expenditure generates sufficient economic returns. The first hypothesis, which proposed that production capital was associated with rice farmers' income, was supported by the statistically significant negative coefficient. The hypothesis concerning productivity was supported by the positive and statistically significant coefficient. Likewise, the hypothesis concerning cultivated land area was supported by the positive and statistically significant coefficient. These conclusions should be interpreted as evidence of statistical associations rather than definitive causal relationships.

4. Conclusions

4.1 Conclusion

This study examined the effects of production costs, productivity, and cultivated land area on rice farmers' income in Baji Pa'mai Village, Cenrana District, Maros Regency, Indonesia. The regression results indicate that the three explanatory variables jointly have a statistically significant relationship

with farmers' income, with an F-statistic of 48.138 and a significance level of $p < 0.001$. The coefficient of determination (R^2) of 0.873 indicates that the model explains 87.3% of the observed variation in farmers' income, while the remaining 12.7% is attributable to factors not included in the model. At the individual level, production costs have a negative and statistically significant association with farmers' income ($\beta = -2.195$, $p = 0.032$). This finding suggests that increases in production expenditure do not necessarily translate into higher net income and highlights the importance of efficient input allocation. Productivity exhibits a positive and statistically significant association with income ($\beta = 1{,}301.823$, $p < 0.001$), indicating that higher agricultural output per unit of the relevant productivity measure is associated with greater farm income. Cultivated land area also shows a positive and statistically significant association with income ($\beta = 39{,}757{,}837.981$, $p < 0.001$), suggesting that farmers cultivating larger areas tend to have greater income-generating potential. Overall, the findings highlight the importance of combining cost efficiency, productivity improvement, and effective land management in strengthening the economic performance of rice farming. However, these results should be interpreted in light of the study's cross-sectional design and the operational definitions of the variables. In particular, the negative coefficient for production costs should not automatically be interpreted as evidence that all additional production expenditure reduces income, because the relationship depends on how effectively expenditure generates additional output and revenue.

4.2 Theoretical Implications

The findings have several practical implications for rice-farming management. First, farm-income improvement strategies should not focus solely on increasing expenditure or expanding cultivated land. Instead, farmers need to evaluate whether additional inputs generate sufficient increases in production and revenue to justify their costs. Input planning, appropriate fertilizer and pesticide application, and systematic recording of farm expenditures can help farmers identify inefficient spending and improve net returns. Second, productivity improvement should be treated as a central component of farm-income strategies. Access to high-quality seeds, appropriate cultivation techniques, effective pest and disease management, and reliable irrigation can help farmers improve yields and use production resources more efficiently. These interventions should be adapted to local agroecological conditions rather than applied uniformly across farms. Third, land management should emphasize both the scale and efficiency of cultivation. Although larger cultivated areas may provide greater production potential, land expansion alone does not guarantee higher profitability. Farmers with limited land can also improve economic performance through better cultivation practices, collective purchasing of inputs, shared agricultural machinery, and coordinated marketing arrangements. These measures may help reduce transaction costs and strengthen farmers' bargaining positions.

4.3. Recommendations for Rice Farmers

Rice farmers in Baji Pa'mai Village are encouraged to adopt more systematic financial and production-management practices. They should prepare production budgets before each planting season, record expenditure by input category, and compare realized costs with harvest revenue. Such practices can help identify cost components that require adjustment and support more informed decisions about input use. Farmers should also prioritize productivity-enhancing practices, including the use of certified or locally suitable high-quality seeds, balanced fertilization, timely planting, and integrated pest and disease management. Where feasible, farmers can collaborate through farmer groups or cooperatives to purchase inputs in bulk, share equipment, exchange technical knowledge, and improve access to market information. For farmers operating small plots, collective farming arrangements, crop diversification where agronomically appropriate, and coordinated post-harvest

activities may offer opportunities to improve operational efficiency. Nevertheless, these strategies should be evaluated according to local conditions, household resources, and market demand. The objective should be to increase net farm income sustainably rather than simply maximize production volume or cultivated area.

4.4. Policy Recommendations for Local Government and Agricultural Extension Services

Local government agencies and agricultural extension services should strengthen support for rice farmers through integrated programs addressing productivity, cost management, and market access. Extension activities could include practical training in farm budgeting, efficient input utilization, modern cultivation techniques, post-harvest handling, and basic profitability analysis. Such programs would help farmers assess the financial consequences of production decisions rather than relying exclusively on traditional practices. Public investment in agricultural infrastructure should also be prioritized, particularly irrigation systems, access to quality seeds and fertilizers, appropriate agricultural technology, and post-harvest facilities. Improving the reliability and affordability of these resources may enable farmers to raise productivity without incurring disproportionate production costs. Access to suitable financing should be facilitated through transparent and affordable mechanisms that reflect seasonal agricultural cash flows and farmers' repayment capacity.

Furthermore, local authorities should encourage farmer organizations and cooperatives to strengthen collective purchasing, access to financing, information sharing, and marketing. Partnerships among farmer groups, agricultural extension officers, financial institutions, and buyers could improve farmers' bargaining power and reduce avoidable transaction costs. Policy implementation should be accompanied by monitoring and evaluation to determine whether these interventions improve net income, productivity, and the resilience of smallholder rice farming.

4.5. Limitations and Directions for Future Research

This study has several limitations that should be considered when interpreting its findings. First, the analysis focuses on production costs, productivity, and cultivated land area within a specific geographical setting. Other potentially relevant determinants of farm income, including paddy prices, input-price fluctuations, access to credit, irrigation reliability, technology adoption, farmers' education, labor costs, climate variability, and household socioeconomic characteristics, were not comprehensively examined. Future research could incorporate these variables to develop a more complete explanation of income differences among rice farmers. Second, the study uses cross-sectional data, which limits its ability to capture changes in production conditions, input expenditure, and income across planting seasons. Future studies could employ panel data covering multiple growing seasons to examine how changes in input use, productivity, and land management relate to income over time. Research involving a larger sample and multiple villages or districts would also help assess whether the findings can be generalized to other rice-producing areas.

Third, future research should ensure that the operational definitions of production costs, productivity, and farm income are conceptually and statistically distinct. Because net farm income is calculated as total revenue minus total production costs, including production costs as an explanatory variable may introduce a mechanical relationship between the variables. Researchers should therefore consider alternative model specifications and conduct appropriate diagnostic tests, including heteroscedasticity assessment and robustness checks. Where the data permit, the use of cost-efficiency measures, yield per hectare, and clearly defined net-income indicators may improve interpretability.

Finally, future studies could combine quantitative analysis with qualitative interviews to explore farmers' decision-making processes, institutional constraints, and experiences with agricultural support programs. Such an approach would provide a broader understanding of the mechanisms linking

farm management practices to income outcomes. These research directions could strengthen the empirical evidence available to policymakers and support the development of more effective and context-sensitive strategies for improving the welfare and economic resilience of rice farmers.

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