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Determinant Factors of Rice Paddy Land Conversion into Oil Palm Plantations and Strategies for Controlling It in Muara Padang Sub-District, Banyuasin Regency

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ABSTRACT

Indonesia is an agrarian country where agricultural land plays an important role in ensuring food security. However, the increasing conversion of paddy fields into oil palm plantations has raised concerns regarding the long-term sustainability of rice production in major rice-producing regions. This study aims to analyze the process of paddy land conversion into oil palm plantations, identify the factors influencing farmers' decisions, and formulate strategies to control land conversion in Muara Padang Sub-district, Banyuasin Regency, South Sumatra, Indonesia. The study employed a mixed-methods approach combining field surveys, structured interviews, binary logistic regression analysis, and SWOT analysis. A total of 92 farmers were selected as respondents using the Slovin formula with a 10% margin of error. The respondents were 46 rice farmers and 46 oil palm farmers, selected through quota sampling. The results indicate that land conversion occurs through several stages, including land evaluation, economic and social considerations, and land conversion implementation. Binary logistic regression analysis shows that farm income significantly influences farmers' decisions to convert paddy fields into oil palm plantations ($p = 0.025$). The model demonstrates good fit based on the Hosmer–Lemeshow test ($p = 0.764$) and explains 91.9% of the variation in land conversion decisions (Nagelkerke $R^2 = 0.919$). The SWOT analysis places the land conversion control strategy in Quadrant I (Strength–Opportunity), indicating that internal strengths can be utilized to maximize existing opportunities. These findings suggest that improving rice farming productivity, strengthening farmer institutions, and providing economic incentives are essential to maintain sustainable paddy land and support national food self-sufficiency. This study contributes to the understanding of farmers' land-use decisions and provides strategic policy recommendations for controlling agricultural land conversion in rice-producing regions.

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1. Introduction

Rice production in Indonesia decreased by 2.43 percent from 2023 to 2024 (BPS, 2024). Based on data from the Indonesian statistics agency (BPS, 2024), the comparison between 2024 and 2023 shows a decrease in rice harvested area of 0.17 million hectares (1.64 percent). This situation raises concerns about meeting the average per capita rice consumption in 2024, which reached 6.499 kg per month. Rice, as the primary staple food for most Indonesian households, remains a central component of food sovereignty and national stability. The government has emphasized the importance of food security through long-term development agendas, including the vision of “Indonesia as a '*Lumbung Pangan Dunia*' or World Food Reserve 2045” (Sulaiman *et al*., 2018). Inadequate food supply may trigger social, economic, and political instability, making the protection of agricultural land an urgent national priority (Wulandari, 2024).

Despite its strategic importance, Indonesia faces increasing challenges in maintaining sustainable rice production. One of the most critical issues is the brisk conversion of rice fields into oil palm plantations. This issue has intensified due to structural economic shifts toward plantation-based agriculture, higher economic returns from oil palm, and weak enforcement of land-use regulations (Pratomo & Wijayanti, 2023). The negative outcome of this land-use change is a long-term decline in regional and national rice production in the long term, leading to increased dependence on imports. Historically, Indonesia achieved rice self-sufficiency in the 1980s; however, this achievement has been difficult to sustain, partly due to the high rate of agricultural land conversion (Sulaiman *et al*., 2018).

South Sumatra is considered one of Indonesia’s major rice-producing provinces. Supported by data from the Indonesian statistics agency (BPS, 2024), South Sumatra ranked fifth among provinces in rice production in 2024. Within this province, Banyuasin Regency consistently records the largest harvested paddy area, although significant fluctuations have occurred in recent years. These dynamics reflect complex interactions among land conversion pressures, environmental conditions, and policy interventions. To safeguard food-producing land, the local government has enacted a regional regulation. Regent Regulation No. 44 of 2019 concerning the Sustainable Food Agricultural Land Protection Plan (PLP2B) in Banyuasin Regency. It covers an area of 104,973 hectares across 20 districts within Banyuasin Regency (Pemerintah Kabupaten Banyuasin, 2019). In line with this regulation, the Banyuasin government has conducted socialization programs for farmers on protecting rice fields from land conversion. These efforts were aimed at increasing farmers’ awareness and knowledge. Moreover, mapping activities across 20 sub-districts are essential for improving monitoring and controlling land conversion

Empirical studies consistently show that economic considerations dominate farmers’ tendencies to convert paddy fields into oil palm plantations. Factors such as suitability, income expectations, and investment prospects have been identified as major drivers of paddy land conversion, with the process typically occurring gradually through stages of land assessment, decision-making, land preparation, and plantation maintenance (Yunita *et al*., 2024). Quantitative evidence using binary logistic regression further confirms that income, production costs, and education significantly influence farmers’ conversion decisions (Fitriyana, 2018). In addition, economic incentives combined with environmental and technical factors, such as irrigation conditions and the ease of cultivation also explain a substantial proportion of farmers’ land-use decisions (Murdy & Nainggolan, 2020).

Beyond identifying determinants, several studies have examined strategies to control land conversion using SWOT analysis. These studies highlight the importance of zoning regulations, infrastructure improvements, and strengthening farmer institutions as key measures to curb land conversion in agricultural regions such as Banyuasin Regency (Fitriyana, 2018). Furthermore, effective control strategies depend on both internal factors, including farm productivity and farmers’ capacities, and external factors such as institutional support and consistent enforcement of spatial planning policies (Hofizer *et al*., 2020).

Although existing studies provide valuable insights into the drivers and strategic responses related to land conversion, most research tends to address either the determinants or the control strategies separately. There is limited empirical research that integrates a quantitative analysis of farmers' land conversion decisions with a structured strategic formulation approach within a specific local context, particularly in tidal swamp areas such as Muara Padang Sub-district. This gap is significant given the increasing pressure on food-producing land and the strategic role of Banyuasin Regency in supporting regional and national food security. Social and economic factors are crucial in influencing farmers' decisions on land-use change, as previously explained in However, previous studies don't address policy interventions, which also play a significant role. Therefore, in this study also adds farmers' knowledge of land use and land management to regional regulation.

Accordingly, this study evaluates the process and determinants influencing farmers' decisions to convert paddy fields into oil palm plantations using binary logistic regression and formulates appropriate land conversion control strategies through SWOT analysis in Muara Padang Sub-district, Banyuasin Regency. By integrating quantitative analysis of farmers' decision-making with strategic policy formulation, this study provides empirical insights and policy-relevant strategies to support sustainable land management and strengthen national food security.

2. Methodology

This study employed a quantitative survey design with an explanatory approach to analyze determinants of farmers' decisions to convert paddy fields into oil palm plantations using binary logistic regression and to formulate strategies for controlling land conversion through SWOT analysis. Primary data were collected through field observations and structured face-to-face interviews using questionnaires administered to rice farmers and farmers who had converted their paddy fields into oil palm plantations. The research was conducted in Muara Padang Sub-district, Banyuasin Regency, covering Daya Utama Village, Daya Makmur Village, Margo Mulyo 20 Village, and Tirta Jaya Village. The study area was purposively selected because the sub-district is one of the main rice-producing areas in Banyuasin Regency and has recently experienced an increase in the conversion of paddy fields into oil palm plantations. Field data collection was carried out from November 2025 to January 2026.

The study population consisted of all rice farmers and those who had converted their rice fields to oil palm in the four selected villages. The minimum number of samples was calculated using the Slovin formula with a 10% error tolerance. The Slovin formula is commonly used when detailed information regarding the distribution of population characteristics is not fully available (Nalendra *et al*., 2021). Based on SIMLUH data of Banyuasin Regency 2024, the population comprised 1,220 rice farmers and 566 oil palm farmers from four selected villages. This research selected 10% margin of error, considering field accessibility constraints and the relatively homogeneous socio-economic characteristics of farmers in the study area. The following is the Slovin formula used in this study.

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{1.276}{1+1.276(0,10)^2}$$

$$n = 92$$

Where:

n	=	Sample size of rice and oil palm farmers in the four villages
N	=	Population of rice and oil palm farmers in the four villages
e	=	Margin of error (10%)

Based on this calculation, a total of 92 farmers were selected as research participants, comprising 46 rice farmers and 46 oil palm farmers. An equal number of respondents from both groups was intentionally applied to allow a balanced comparison between farmers who continue cultivating rice and those who have converted their paddy fields into oil palm plantations. Respondent selection used quota sampling, in which a fixed number of respondents were recruited from each farmer group. Quota sampling is a non-probability sampling technique that involves selecting predetermined numbers of participants from specific subgroups of a population to ensure that each group is adequately represented in the analysis (Bornstein *et al*., 2013).

The primary data acquisition process in this observation involved direct field observations and structured interviews using questionnaires. The interviews were designed to gather in-depth information on the process of land conversion and the factors influencing farmers' decisions to convert paddy fields into oil palm plantations. The interview procedure consisted of three stages: (1) questionnaire preparation, where the survey was developed based on the research objectives and variables to be analyzed; (2) pre-test of the questionnaire, conducted with five farmers who had characteristics similar to the target respondents to ensure that the questions were clear, understandable, and relevant to the research objectives; (3) respondent selection, where respondents were randomly selected from the population of rice farmers and oil palm farmers in each village according to the predetermined sample size; and (4) interview implementation, where face-to-face interviews were carried out with farmers at the research location.

The data analysis method used to achieve the first research objective, namely describing the process of paddy field conversion into oil palm plantations, was descriptive analysis. This analysis was conducted by organizing, reducing, and presenting data from interviews and observations in tables and narrative explanations. To address the second research objective, which was to analyze the factors persuading farmers' decisions to move from paddy fields into oil palm plantations, the binary logistic regression method was employed. This method was selected because the dependent variable is dichotomous (Hosmer *et al*., 2013), distinguishing between farmers who converted their land and those who continued cultivating rice. Data processing was carried out using SPSS software, and below is the logistic regression analysis being formulated:

$$Y = \ln \frac{pi}{1 - pi} = \beta o + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6$$

Where:

Y = Farmer's decision (0 : if the farmer continues cultivating rice, 1 : if the farmer converts paddy fields into oil palm plantations)

p_i = Probability of land conversion

β_0 = Constant

β_1–β_6 = Regression coefficients

X_1 = Land area (ha)

X_2 = Farm income (IDR/year)

X_3 = Farmer's age (years)

X_4 = Number of family members (persons)

X_5 = Education level (years)

X_6 = Farmers' knowledge of land-use and land management regulations (Likert 1–5)

To ensure the reliability of the logistic regression model, diagnostic testing was conducted prior to model estimation. Multicollinearity among independent variables was examined using the Collinearity Diagnostics procedure in SPSS by observing the Tolerance and Variance Inflation Factor (VIF) values (Ghozali, 2016). Classical assumption tests, such as normality, homoscedasticity, and autocorrelation, were not applied because this study used binary logistic regression, where the dependent variable is categorical (0 = farmers continue cultivating rice; 1 = farmers convert paddy fields into oil palm plantations). Unlike linear regression which is estimated using the Ordinary Least Squares (OLS) method, logistic regression is estimated using the maximum likelihood method, which does not require the classical assumptions of normality and homoscedasticity (Hosmer *et al*., 2013). Model feasibility was tested using the Omnibus Test of Model Coefficients, Nagelkerke R Square, and the Hosmer–Lemeshow Test, while the partial effect of each independent variable was tested using the Wald Test with a significance level of $\alpha = 0.05$.

To achieve the third research objective, which was to formulate strategies for controlling the transition of paddy land into oil palm cultivation, a SWOT analysis was conducted. This analysis distinguished between internal factors (strengths and weaknesses) and external factors (opportunities and threats) that influence the sustainability of paddy fields. These factors were determined through a literature review and field data collected through observations, interviews, and questionnaires with farmers and related stakeholders. The identified factors were then evaluated using the Internal Factor Evaluation (IFE) Matrix and the External Factor Evaluation (EFE) Matrix, where each factor was assigned a weight (0.0–1.0) and a rating (1–4) based on its level of importance using expert judgment involving researchers, agricultural extension officers, and farmer representatives. The results were subsequently mapped into a SWOT quadrant to determine strategic positions and formulate alternative strategies, including SO, ST, WO, and WT strategies (Karenina *et al*., 2016). It is hypothesized that land area, farming income, age, household size, education level, and farmers' knowledge of land-use regulations significantly influence the decision to convert paddy land to a palm oil agribusiness, and that an integrated SWOT-based strategy can effectively support land conversion control in the study area.

3. Results and Discussion

3.1. Process of Paddy Land Conversion to Oil Palm

The transition of rice farms into oil palm agribusiness in Muara Padang Subdistrict occurred through several interconnected stages. Field findings indicate that the process did not occur instantly but followed a gradual decision-making pathway shaped by production risk, economic expectations, and land characteristics.

3.1.1 *Evaluation of Land and Rice Farming Performance*

Farmers first assessed declining paddy productivity, dependence on irrigation, pest attacks (especially rats), constraints of peat soil, and unstable grain prices. These conditions reduced the perceived economic viability of rice farming. Farmers in Daya Utama, Daya Makmur, Margo Mulyo 20, and Tirta Jaya villages reported that rat infestations increased after the surrounding land was converted to oil palm, while several paddy fields experienced seasonal dryness. Similar findings among farmers in Kedurung Subdistrict, South Bengkulu Regency, who converted their paddy field to oil palm plantations due to insufficient irrigation water and low land productivity (Zamhari *et al*., 2019).

3.1.2 *Economic and Social Consideration*

Income comparison between rice and oil palm farming became the dominant consideration. Information circulating among farmers in Banyuasin Regency indicates that oil palm is perceived to provide more stable and continuous income with lower labor intensity. This perception encourages farmers to convert their paddy fields into oil palm plantations. There is an approximate income ratio of 1:2 between rice farming and oil palm per hectare per year in East Tanjung Jabung Regency, with oil palm being more profitable (Daulay *et al*., 2018). Social characteristics such as age, landholding size, and education influenced farmers' confidence in adopting oil palm. Farmers with larger landholdings and higher levels of education tend to be more willing to convert their land to oil palm plantations because they possess greater capital capacity and better access to information (Todaro & Smith, 2020).

3.1.3 *Land Conversion Implementation*

Rice cultivation stopped, followed by land clearing, drainage modification, and oil palm planting. his stage involved permanent physical land change. It takes about 3–4 years to reach first harvest, and it produces economically for about 20–25 years (Sulardi, 2022).

3.2 Factors Influencing Farmers' Conversion Decisions

The process of converting rice farming into oil palm farming is influenced by various factors presumed to play a role in farmers' decisions to change land use. These factors include land area, farm income, farmers' age, number of family members, education level, and farmers' knowledge of government regulations related to land-use planning. These variables were analyzed using binary logistic regression in SPSS version 25. This analysis aimed to identify the factors influencing farmers' decisions to either convert or not convert their rice fields into oil palm plantations in Daya Utama Village, Daya Makmur Village, Margo Mulyo 20 Village, and Tirta Jaya Village, Muara Padang Subdistrict, Banyuasin Regency.

3.2.1 *Multicollinearity Test*

Convergent validity is assessed using factor loadings to ensure that each indicator adequately represents the latent construct. The results of the factor loading test are presented in Figure 3 below.

The multicollinearity test method is conducted to observe whether independent variables are strongly correlated within a regression model (Ghozali, 2016). To verify whether there are multicollinearity issues in this regression model, the Collinearity Diagnostics test in SPSS was used to evaluate tolerance and the variance inflation factor (VIF). The model can be considered free of multicollinearity when tolerance values are above 0.1, and VIF values are below 10. Further details of the test result can be observed in more detail in Table 1 below.

Table 1. Results of the Multicollinearity Test for Independent Variables in the Logistic Regression Model

Collinearity Statistics		
Model (Constant)	Tolerance	VIF
Land Area (X_1) (ha)	.957	1.045
Farm Income (X_2) (Rp)	.935	1.069
Farmer's Age (X_3) (years)	.684	1.463
Number of Family Members (X_4) (persons)	.678	1.476
Education Level (X_5)	.815	1.227
Knowledge of Land Use and Land Management (X_6)	.889	1.124

Source: Processed Primary Data, 2026

Referring to the multicollinearity test results in Table 1 above, using Tolerance and Variance Inflation Factor (VIF) scores, each independent variable has a tolerance value greater than 0.10 and a VIF value less than 10, suggesting the absence of multicollinearity problems in the model. It meaning that each variable can independently explain variations in farmers' land conversion decisions.

3.2.2 *Model Feasibility*

The goodness-of-fit of the binary logistic regression model is assessed using the SPSS Hosmer-Lemeshow test. The Hosmer-Lemeshow Test serves as a goodness-of-fit (GoF) measure applied to determine whether the constructed model is appropriate. The model is considered appropriate when the predicted values do not show a statistically significant difference from the measured values (Field, 2013). A more detailed explanation of the test results and their interpretation is presented in Table 2 below.

Table 2. Results of the Hosmer and Lemeshow Test Hosmer and Lemeshow Test

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	4.937	8	.764

Source: Processed Primary Data, 2026

Referring to Table 2, the significance score result is 0.764, surpassing the threshold of 0.05 (Sig > 0.05). In addition, the Chi-square value is 4.937, and the critical Chi-square value at 8 degrees of freedom and the 0.05 significance level is 15.507. Since the calculated Chi-square value of the Hosmer and Lemeshow Test (4.937) is smaller than the critical value (15.507), H_0 is accepted. It suggests that the model does not differ significantly from the observed values. Therefore, the logistic regression model is acceptable and has a good level of goodness of fit, allowing further hypothesis testing (Hosmer *et al.*, 2013).

3.2.3 *Overall Model Significance*

The overall test, or simultaneous test, assesses the joint influence of the independent variables on the dependent variable in a binary logistic regression model. This observation appears in the SPSS output under the Omnibus Test of Model Coefficients table, which provides an overview of the extent to which all independent variables jointly influence the dependent variable (Gujarati, 2004). The test's outcomes are important for determining how well the constructed model explains the dependent variable's variability. Table 3 below presents the detailed results and interpretation of this test.

Table 3. Results of the Omnibus Test of Model Coefficients

Omnibus Test of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	107.450	6	.000
	Block	107.450	6	.000
	Model	107.450	6	.000

Source: Processed Primary Data, 2026

Based on the outcome shown in Table 3.3, the Chi-square score is 107.450, having a significance of 0.000, indicating it is smaller than $\alpha = 0.05$. This demonstrates that all independent variables included in the model collectively have a significant role in farmers' decisions to transform rice fields into oil palm plantations (Lusty *et al*., 2017). Therefore, the null hypothesis (H_0) is rejected at the 5 percent significance level, meaning that at least one independent variable influences farmers' land conversion decision. Therefore, the logistic regression model is statistically significant and suitable for explaining the determinants of land conversion decisions and can be employed for further analysis.

3.2.4 *Coefficient of Determination*

The coefficient of determination (R^2) test is used to assess and predict the extent to which independent variables collectively explain the variation in the dependent variable (Reza *et al*., 2024). The results show a Nagelkerke R^2 of 0.919, indicating that approximately 91.9% of the variation in farmers' land conversion decisions can be explained by the independent variables in the model. Detailed results of the R^2 test are presented in Table 4.

Table 4. Results of the R2 Test

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Negelkerke R Square
1	20.089	.689	.919

Source: Processed Primary Data, 2026

The land area, farm income, farmers' age, number of household members, education level, and farmers' knowledge of land-use regulations variables are able to explain 91.9 percent of the variation in farmers' decisions to convert paddy fields into oil palm plantations. Meanwhile, the remaining 8.1 percent is influenced by other factors outside the model that were not included in this study.

3.2.5 *Partial Test*

The partial test is a method used to evaluate the effect of each independent variable individually on the dependent variable while holding the other independent variables constant (Reza *et al*., 2024). In addition, the partial test provides binary logistic regression results showing the contribution of each factor in influencing farmers' decisions to convert paddy fields into oil palm plantations (Nurrizqi *et al*., 2022). The results of the partial test in the binary logistic regression are presented in detail in Table 5 below:

Table 5. Results of Binary Logistic Regression

Variable	B	S.E.	Wald	df	Sig.	Exp (B)
Intercept	-50.343	28.044	0.000	1	0.997	0.000
Land Area	4.795	1.017	0.000	1	0.995	5.720
Farm Income	0.000	.312	5.002	1	0.025	0.497
Farmer's Age	0.084	.120	0.494	1	0.482	1.088
Number of Household Members	-0.823	.809	1.035	1	0.309	0.439
Education Level	1.574	.944	2.780	1	0.095	4.828
Farmers' Knowledge of Government Regulations on Land Use	-0.495	1.114	0.197	1	0.657	0.610

Source: Processed Primary Data, 2026.

Based on Table 5, the regression equation can be expressed as follows:

$$Y = Log\ [\frac{P_1}{1-P_1}] = -50.343 + 7.795\ (X1) + 0.000\ (X2) + 0.084\ (X3) - 0.823\ (X4) + 1.574\ (X5)\quad 0.495\ (X6)$$

According to the binary logistic regression results, only the farm income variable is significantly associated with farmers' decisions to convert their paddy fields into oil palm plantations ($p < 0.05$). This approach is consistent with the interpretation used in previous Indonesian logistic regression research, in which variables with p-values less than 0.05 are considered statistically significant in affecting the dependent variable (Nurdiya *et al*., 2024). The farm income variable has a significance value of 0.025, which is smaller than $\alpha = 0.05$. The Odds Ratio value for the income variable is 0.497, indicating that an increase in rice farming income can reduce the probability of farmers converting their land to oil palm plantations. In other words, farmers who obtain higher income from paddy cultivation are less likely to switch to oil palm farming. These results suggest that economic considerations are the main factor in land conversion decision-making. Farmers tend to choose oil palm because it is considered capable of providing more stable, sustainable income than paddy farming, especially in the long term. This finding is consistent with studies by Rasoki *et al*. (2022) and Nurrahma *et al*. (2024), which state that income differences among commodities are a driving factor in agricultural land conversion. Findings from Setiawati *et al*. 2025) also show that economic factors, including income, have a significant influence on the conversion of paddy fields into oil palm plantations in Seruyan Hilir Timur District, whereas environmental and technical factors do not. This phenomenon can also be explained by rational economic behavior theory, which assumes that individuals act as rational agents who make decisions based on cost-benefit considerations in order to maximize their expected utility or profit (Semenova, 2019). In the context of agricultural land use, farmers evaluate the potential returns, risks, and income stability of different commodities before deciding how to allocate their land resources. When oil palm plantations are perceived to provide higher or more stable economic returns than paddy cultivation, rational farmers are more likely to convert their land to oil palm.

In contrast, land area does not have a significant effect on farmers' decisions to convert paddy fields into oil palm plantations. It showed that the land area variable's significance value is 0.995, which is greater than α = 0.05. The study area is characterized by relatively uniform land allocation patterns, which are common in transmigration-based agricultural settlements. Many of the sample farmers are transmigrants who received similar land allocations (Malta, 2019). As a result, most farmers cultivate similar-sized plots, making land area less relevant in determining land conversion decisions. This finding also happened in Tanjung Lago District, Banyuasin Regency. It is found that land area did not significantly influence farmers' decisions to convert paddy fields into oil palm plantations (Fitriyana, 2018).

Similarly, the farmer age variable has a significance value of 0.482, which is greater than α = 0.05, indicating that age does not significantly affect land conversion decisions. This suggests that the decision to convert paddy fields into oil palm plantations is not significantly different between younger and older farmers. The age distribution of farmers across the four study villages shows a relatively even spread between those maintaining paddy farming and those who have converted their land. This condition indicates that no specific age group dominantly drives land conversion. Therefore, age is not a primary determinant in land conversion decisions; rather, such decisions are more influenced by economic considerations and income prospects. This finding is in line with Fitriyana (2018), who found that farmers' age did not influence their decision to convert paddy fields into oil palm plantations.

Likewise, the number of household members variable has a significance value of 0.309, which is greater than α = 0.05. Thus, it does not significantly influence farmers' decisions to convert paddy fields into oil palm plantations, as found by Dianti *et al*., (2025). This condition indicates that family dependents are not a primary factor in land conversion decisions, as farmers may have other sources of income outside paddy farming. Based on the data on farmers' secondary occupations in this research, many farmers hold additional jobs, such as entrepreneurship, laboring, civil service, village officialship, cooperative management, or organization administration. These secondary occupations contribute additional income to farm households, meaning family economic needs do not rely entirely on paddy farming. Therefore, even if the number of dependents increases, farmers are not directly driven to convert paddy fields into oil palm plantations. Land conversion decisions are more influenced by long-term economic considerations, such as farm income levels, yield stability, and profit prospects from oil palm, rather than demographic factors alone.

Furthermore, the education level variable has a significance value of 0.095, which is greater than α = 0.05, indicating that it does not have a statistically significant effect on farmers' decisions to convert paddy fields into oil palm plantations. Similar results to the study by Hengki *et al*. (2021) which reported that the education level of rubber farmers did not significantly influence their decision to shift to oil palm cultivation. There are variations with both lower and higher education levels, which can be found in both groups, resulting in no clear tendency for education to influence land conversion decisions. Moreover, decisions regarding land conversion are often based more on practical farming experience, economic considerations, and information obtained from fellow farmers, regardless of education level. In rural agricultural communities, knowledge about crop profitability, market conditions, and cultivation practices is often shared through informal social networks, farmer groups, and direct observation of neighboring farms (Pratiwi & Suzuki, 2017).

The variable representing farmers' knowledge of government land-use and land management regulations has a significance value of 0.657, which is greater than α = 0.05.

This indicates that farmers' knowledge of land-use regulations does not significantly affect their decision to convert paddy fields into oil palm plantations. This condition suggests that even when farmers are aware of land-use regulations, economic factors remain the primary consideration in land conversion decision-making. It is related to the implementation challenges of the Sustainable Food Agricultural Land Protection policy (LP2B). Farmers have a limited understanding of the concrete implications of LP2B regulations and do not feel directly affected by these policies in their day-to-day farming decisions (Nugara & Rudiarto, 2017).In some cases, LP2B policies have only reached the stage of identifying protected agricultural land, lacking strong enforcement mechanisms, leaving supervision and control of land conversion limited (Ansari *et al*., 2020). Research on LP2B implementation also shows that economic interests often conflict with land protection policies, making it difficult to fully prevent agricultural land conversion when farmers perceive greater financial benefits from alternative land uses (Radana *et al*., 2025).

Strategies to control land conversion are necessary, considering the important role of paddy fields in supporting food security. Therefore, a strategic analysis was conducted to examine both internal and external factors influencing the sustainability of paddy farming. The analysis employed the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices, followed by a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis (Nuarie *et al*., 2024), to identify appropriate strategies for controlling the conversion of paddy fields into oil palm plantations.

3.3 Strategy for Controlling the Conversion of Paddy Fields into Oil Palm Plantations

The strategy for controlling the conversion of paddy fields into oil palm plantations was formulated based on the analysis of internal and external factors influencing farmers' decisions (Karenina *et al*., 2016). The approach used includes Internal Factor Evaluation (IFE), External Factor Evaluation (EFE), followed by a SWOT quadrant diagram analysis (Ridwan & Syamsu Roidah, 2025). This analysis aims to identify the strategic position of paddy land conversion control in the study area in order to formulate appropriate and applicable strategies. The study area covers Daya Utama Village, Daya Makmur Village, Margo Mulyo 20 Village, and Tirta Jaya Village, Muara Padang District, Banyuasin Regency, which are major rice-producing areas but are facing pressure from land conversion to oil palm plantations.

3.3.1 *Internal Factor Evaluation (IFE)*

Internal factors were analyzed using the IFE matrix, based on the identification of internal conditions. This analysis aims to develop strengths that can be utilized and identify weaknesses that must be addressed (Saragih *et al*., 2024). Internal factors influencing the conversion of paddy-farming land to oil palm include strengths in weaknesses. The strength and weakness factors were obtained from questionnaire data from 92 farmer respondents, then weighted and rated according to their importance and actual field conditions. The results of weighting and rating the internal factors are presented in the following Table 6. below:

Table 6. IFE (Internal Factor Evaluation) Matrix

Internal Strategic Factors	Weight	Rating	Score (Weight*Rating)	Total
Strengths				**3.02**
High Paddy Rice Productivity	0.20	3	0.62	
Paddy Fields are Suitable in Terms of Soil and Climate Conditions for Rice Cultivation	0.20	3	0.60	
Farmers are Active in Farmer Groups	0.20	3	0.61	
Rice Farming Provides Stable Income	0.20	3	0.59	
Adequate Availability of Irrigation Water in Paddy Fields	0.20	3	0.60	
Weaknesses				
Farmers' Paddy Fields are Located on Peatlands. Making Them Less Suitable for Rice Cultivation	0.33	2	0.66	**1.66**
Simultaneous Cropping Pattern Makes Farmers Less Flexible in Managing Planting Time	0.33	2	0.66	
Limited Irrigation Infrastructure to Farmers' Fields	0.34	1	0.34	

Source: Processed Primary Data, 2026.

The total strength score is 3.02, with major strengths including high rice productivity, land suitability for paddy cultivation, active participation of farmer groups, relatively stable income from paddy farming, and sufficient irrigation water supply. These conditions indicate that internally, paddy farming still has a strong supporting capacity to be maintained. Meanwhile, the total weakness score is 1.66, with the main weaknesses including peat soil conditions that are less suitable for paddy cultivation, simultaneous planting patterns that limit farmers' flexibility, and limited irrigation infrastructure. These factors may encourage farmers to convert land to more profitable uses, such as oil palm cultivation. The difference between strengths and weaknesses is +1.36, indicating that internal strengths outweigh weaknesses, suggesting that farmers still have the capacity to maintain paddy land if supported by appropriate strategies.

3.3.2 *External Factor Evaluation (EFE)*

External factors were analyzed using the EFE matrix, identifying opportunities and threats affecting farmers' decisions (Ekasari *et al*., 2024). The results of weighting and rating of external factors are presented in the following Table 7. below:

Table 7. (EFE) External Factor Evaluation Matrix

External Strategic Factors	Weight	Rating	Score (Weight*Rating)	Total
Opportunities				
Rice Demand as a Staple Food Continues to Increase	0.22	4	0.85	**3.61**
Availability of Assistance or Subsidies Such as Fertilizers. Seeds. and Equipment from the Government	0.20	3	0.68	
The Role of Agricultural Extension Officers in Helping Farmers Improve Rice Cultivation	0.20	4	0.75	
Availability of Rental Services for Harvesting Machines. Plows. Threshers. and other Machinery that are Easily Accessible	0.19	3	0.67	
There are Local Government Policies that Support Increasing Paddy Field Production	0.19	3	0.66	
Threats				
Frequent Attacks of Plant Pests and Diseases	0.37	4	1.34	**3.51**
Unstable Paddy Prices	0.31	3	0.99	
Increasing Prices of Agricultural Inputs (Fertilizers. Pesticides. Labor)	0.32	4	1.18	

Source: Processed Primary Data. 2026.

The total opportunity score is 3.61. driven by increasing rice demand. government assistance and subsidies. the role of agricultural extension workers. availability of agricultural machinery rental services. and supportive local government policies. These offer strong opportunities to sustain paddy farming. The total threat score is 3.51. with key threats including pest and disease attacks. unstable grain prices. and rising agricultural input costs. The difference between opportunities and threats is +0.10. indicating opportunities slightly outweigh threats. though external pressure on paddy sustainability remains high.

3.3.3 *SWOT Quadrant Diagram Analysis*

The results of the SWOT analysis were obtained from the difference between the internal and external factor values. as presented in the following Table 8. below:

Table 8. SWOT Analysis Results

No	Item	Weighted Value	Difference	Value
1	Strengths	3.02	**1.36**	+
2	Weaknesses	1.66		
3	Opportunities	3.61	**0.10**	+
4	Threats	3.51		

Source: Processed Primary Data. 2026.

These results place the position of controlling the conversion of paddy fields in Quadrant I (S–O) of the SWOT strategy quadrant diagram. The SWOT quadrant diagram results can be seen in detail in Figure 1 below:

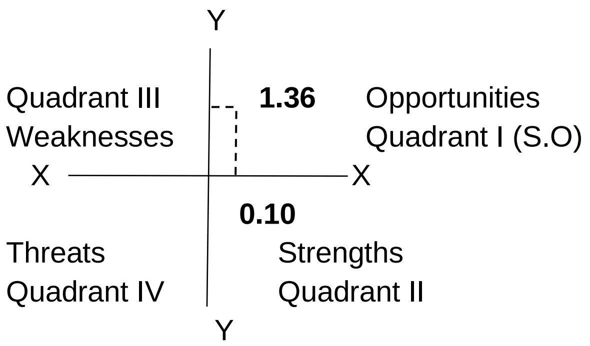

Figure 1. Quadrant Diagram Results of Control in the SWOT Analysis

In the SWOT diagram above. the X-axis (horizontal) is obtained from the difference between the strength (S) and weakness (W) values included in internal factors. while the Y-axis (vertical) is calculated from the difference between opportunity (O) and threat (T) values included in external factors. With this calculation. the most appropriate strategic position for managing land-use conversion can be determined. In the diagram presented. strengths have a weighted value of 3.02 with a difference of +1.36. while weaknesses have a value of 1.66. Opportunities have a weighted value of 3.61 (+0.10). and threats have a value of 3.51. These results place the combination of internal and external factors in Quadrant I. namely the Strength–Opportunity (S–O) strategy or aggressive strategy. This position indicates a relatively favorable condition. in which both internal strengths and external opportunities are positive. Therefore. the recommended strategy is an aggressive (growth-oriented) approach that leverages existing strengths to seize available opportunities in order to maintain and strengthen the sustainability of paddy fields.

3.3.4 SWOT Strategy Formulation

The S–O strategy is formulated by leveraging the internal strengths of paddy rice farmers to capitalize on available external opportunities. The main strengths include relatively high paddy productivity. suitability of land and climate for rice cultivation. active participation of farmers in farmer groups. stable income from rice farming. and the availability of irrigation water supply. Meanwhile. supporting external opportunities include the increasing demand for rice as a staple food. the availability of government assistance and subsidies for agricultural inputs. the role of agricultural extension officers. the availability of rental services for agricultural tools and machinery. and local government policies that support increasing paddy field production.

Table 9. Results of SWOT Strategy Formulation

Internal Factors / External Factor	Strengths 1. High paddy productivity 2. Suitability of land (soil and climate) for rice cultivation 3. Active participation in farmer groups 4. Stable income from rice farming 5. Availability of irrigation water supply	Weaknesses 1. The type of land owned is peatland 2. Simultaneous planting process 3. Limited infrastructure/access of irrigation water to farmland
Opportunities 1. Increasing demand for rice as a staple food 2. Availability of government assistance/subsidies for agricultural inputs such as fertilizers. seeds. and tractors 3. The role of extension officers in developing appropriate cultivation techniques 4. Availability of rental services for harvesting machines. threshers. and plows 5. Local government policies supporting increased paddy field production	1. Maintain and increase paddy field productivity by utilizing land suitability. irrigation water supply. and support from local government policies (S1. S2. S5 – O1. O5) 2. Optimize the role of farmer groups and agricultural extension officers in implementing efficient and sustainable rice cultivation technologies (S3 – O3) 3. Utilize government assistance and input subsidies as well as rental services for agricultural tools and machinery to reduce production costs and increase farmers' income (S4 – O2. O4)	1. Improve the quality of irrigation infrastructure on peatland through support from government programs and agricultural institutions (W1. W3 – O2. O5) 2. Strengthen the capacity of farmer groups to manage more flexible and adaptive cropping patterns through extension assistance (W2 – O3)
Threats 1. Attacks of plant pests and diseases 2. Unstable paddy prices 3. Increasing agricultural input prices	1. Strengthen coordination between farmer groups and extension officers in controlling pests and diseases to reduce the risk of crop failure (S1. S3 – T1) 2. Improve the efficiency of rice farming through the use of technology and cost management to cope with unstable paddy prices and rising agricultural input costs (S4. S5 – T2. T3)	1. Adjust commodities and cultivation systems on peatland that is less suitable for rice to minimize the risk of losses (W1 – T1. T3) 2. Improve irrigation governance and cropping pattern arrangements to reduce the impact of external threats on paddy field productivity (W2. W3 – T2)

The S–O strategy becomes the primary priority because it aligns with the SWOT quadrant analysis results and is oriented toward strengthening the sustainability of paddy fields. In the table above. the formulated S–O strategies are:

1. Maintain and increase paddy field productivity by leveraging land suitability. irrigation water availability and support from local government policies to meet the continuously increasing demand for rice.
2. Optimize the roles of farmer groups and agricultural extension officers in implementing efficient. sustainable rice cultivation technologies. so that productivity and farming efficiency can continue to improve.
3. Utilize government assistance and agricultural input subsidies. as well as rental services for agricultural tools and machinery. to reduce production costs and increase farmers' income. ensuring that rice farming remains more attractive than converting land to oil palm plantations.

The results of the SWOT strategy formulation indicate that the S–O strategy is the most appropriate and prioritized approach for controlling the conversion of paddy fields into oil palm plantations in the study area. This strategy emphasizes strengthening farmers' internal advantages and optimizing external support. so that the sustainability of paddy fields can be maintained and the pressure for land conversion can be sustainably minimized

4. Conclusion

Based on the research conducted. the following conclusions can be drawn:

1. The pattern of converting paddy fields into oil palm plantations involves several stages. including identifying the condition of the land and rice farming. considering economic and social factors. making decisions. implementing the conversion. and adapting to oil palm farming. The main factor driving conversion is economic consideration. particularly regarding income and yield stability between rice and oil palm. Farmers perceive that oil palm provides more stable and sustainable income. making it more profitable in the long term compared to paddy rice.
2. The binary logistic regression analysis shows that farm income is the only variable that significantly influences farmers' decisions to convert paddy fields into oil palm plantations ($p = 0.025$; Odds Ratio = 0.497). This result indicates that higher income from paddy farming reduces the probability of land conversion to oil palm plantations. In contrast. other variables. including land area. farmers' age. number of household members. education level. and knowledge of land-use regulations. do not show a statistically significant influence on land conversion decisions. These results suggest that land conversion decisions are primarily driven by economic incentives rather than by demographic characteristics or regulatory awareness.
3. The SWOT analysis indicates that the strategy for controlling the conversion of paddy fields in the study area is positioned in Quadrant I (Strength–Opportunity). which reflects a relatively favorable strategic condition. Internal strengths such as high paddy productivity. suitable soil and climate conditions. active farmer group participation. relatively stable rice farming income. and the availability of irrigation water can be utilized to take advantage of external opportunities. These opportunities include increasing demand for rice as a staple food. government support through agricultural assistance and subsidies. the role of agricultural extension officers. the availability of agricultural machinery rental services. and local government policies supporting paddy production. Based on this position. an S–O (aggressive) strategy is recommended. focusing on strengthening paddy farming productivity. optimizing farmer group roles and extension services. and improving farmers' income through government support programs. These

strategies are expected to increase the economic attractiveness of paddy farming and reduce the pressure for land conversion to oil palm plantations.

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