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Food Self-Sufficiency Among Rice Farming Households And Its Determining Factors In Kota Utara Subdistrict, Gorontalo

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Abstract

The decline in the area of rice fields in the Kota Utara District in the last five years has the potential to stabilize food availability which can threaten the food independence of farmers' household. This study aims to determine the level of food independence (rice) and the factors that affect it in rice field farmer households in Kota Utara District. In contrast to previous research in general, this study adapts the self-sufficiency ratio (SSR) approach at the household level to look more spesifically at the ability of farmers' households to meet the food needs of their own farming products. The sample from this study consisted of 57 farmers obtained through disproportionate stratified sampling techniques. The analysis techniques used were self-sufficiency ratio analysis and multiple linear regression analysis. The results indicate that the farming households are food self-sufficient with an SSR value of 281%. Land area, rice consumption, and number of family members have a significant effect meanwhile expenditure on rice and rice production have a marginal significance at the level of significance of 10% in the level of household food independence and have a contribution of 84.5% to the variable level of food independence. These findings extend the application of SSR in assessing food self-sufficiency at the farm household level.

Keywords: Food Self-Sufficiency, Farmer Households, Kota Utara District

INTRODUCTION

Food is a basic need that must be met at all times to support the sustainability of human life. Based on the constitution of the Republic of Indonesia number 18 of 2012 concerning food,

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the state has an obligation to realize and ensure the availability and access to sufficient, safe, quality, and balanced nutritious food at the national, regional, and individual levels equally. This is in line with the second goal in the Sustainable Development Goals (SDGs), which is to alleviate hunger, realize food security, and improve nutrition and encourage sustainable agriculture. To support this goal, food independence is an important pillar in ensuring the sustainability of the national food system because it reflects a country's ability to meet food independently. Food independence is a strategic issue that is often discussed in the macro context, but in practice the ability to meet food needs independently begins and is highly determined by conditions at the household level. Food independence is an important aspect in creating sustainable family resilience where the family's ability to survive is stable and prosperous in the long term (Widiastuti, Adiba, Puspita, & Ika, 2024). In the context of farmer households, food independence reflects the ability of households to meet in their basic needs independently from their own production without any dependence from outside parties (Enriquez, 2020). In the development of food systems that are increasingly integrated with the market, households tend to depend on the food they buy. Therefore, food independence can function as an indicator of household resilience in the face of food insecurity and crisis (Pan, Min, & Waibel, 2024). Dependence on external food supply increases vulnerability to market shocks and price fluctuations (Szajner, Szczepaniak, & Lopaciuk, 2024).

As the main producer of rice, rice farmer households have an important role in supporting food independence, because they are producers as well as consumers at the household level. Considering that the food crop subsector has a strong contribution in supporting food self-sufficiency (Leovita & Martadona, 2021). However, farmers, especially in urban areas, have converted their agricultural land because agricultural land is considered to have a lower rental value when compared to land used for non agricultural activities (Prasada & Masyhuri, 2019), in addition, the high demand for land which is an implication of population growth and urban industrial development is the cause of changes in the function of agricultural land (Syukri & Arifin, 2021).

Kota Utara District is one of the sub-districts in Gorontalo City which until now still has the potential for a large agricultural subsector of food crops, namely paddy rice with an area of 725 hectares. However, based on data from the Gorontalo City Marine, Fisheries, and Agriculture Office, in the last five years Kota Utara District has shown the largest decrease in rice field area, which is 41 Ha. The problem of land conversion in Kota Utara District can affect the stability of rice production, especially the availability of food in farmer's households which will have an impact on

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household food independence. There are several factors that cause households to not be food independent, one of which is the limited land (Refina, Husaini, & Yanti, 2020) because food independence can be achieved by prioritizing the availability of rice fields as the main capital in rice production (Supriadi, 2021). This condition can be worrisome, especially since the level of rice consumption in Gorontalo City is still quite high because the majority of the population still chooses rice as their staple food (Asih, Halid, & Imran, 2021).

Based on the above description of the problem, this study aims to (1) analyze the level of staple food (rice) independence in paddy rice farmer households and (2) analyze the factors that affect the level of staple food (rice) independence in paddy rice farmer households in Kota Utara District. Previous research conducted by Gassi, Gültekin, and Ateş (2025) using the self-sufficiency ratio (SSR) approach to analyze rice food independence at the macro level combined with forecasting analysis. This approach provides an aggregate picture of a country's ability to meet food needs but does not yet describe food independence at the household level as a major actor in the food system. While research by Lusiana, Rauf, and Indriani (2021) in Gorontalo City, it has studied the food independence of farmer households using the balance of production and consumption as an indicator of food independence, but has not studied several factors that affect food independence simultaneously. Therefore, this study adapts the self-sufficiency ratio (SSR) approach in the analysis conducted at the household level of rice field farmers by considering the production, purchase, and sale of rice in one indicator of food independence to provide a more comprehensive measure in the picture of households' ability to meet food needs from their own production.

RESEARCH METHOD

This research is located in Kota Utara District, Gorontalo City, Gorontalo Province and was carried out for 6 months, from January to July 2025. This research is a type of quantitative research with a survey method. The data in this study uses two types of data, namely primary data obtained directly by farmers as respondents and secondary data obtained from related agencies, namely the Gorontalo City Marine, Fisheries, and Agriculture Service and Kota Utara Sub-district Office. The sample in this study was taken using the probability sampling technique, namely disproportionate stratified random sampling which is a non-proportional stratified random sampling where each stratum has no similarity in its population representation (Iliyasu & Etikan, 2021). The strata taken are based on the strata of the village. Based on the total population of 356 people, it was calculated using the Isaac & Michael sample withdrawal formula (Sugiyono, 2023).

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$$S = \frac{\lambda^2.N.P.Q}{d^2(N-1)+\lambda^2.P.Q}$$

$$S = \frac{2.706 \times 356 \times 0.5 \times 0.5}{0.01 \times (356-1) + 2.706 \times 0.5 \times 0.5}$$

$$S = \frac{240.834}{4.2265}$$

S = 57

Where the number of population (N) = 356, chi squared (λ^2) obtained from an error rate of 10% = 2.706, the difference in the average population and sample (d) = 0.01, the chance of right (P) and the chance of error (Q) = 0.5 so that a sample of 57 people was obtained.

This study uses self-sufficiency ratio (SSR) analysis to determine the level of food independence of rice field farmers households. Self-sufficiency ratio (SSR) analysis is a statistical measurement to measure a country's ability to produce its own food (FAO, 2015). In this study, the analysis of self-sufficiency ratio (SSR) was adapted on the household scale with the following equations :

$$SSR = \frac{Household\ rice\ production\ (kg)}{(Household\ rice\ production\ (kg) + Purchased\ rice(kg) - Rice\ sold(kg))} \times 100$$

This self-sufficiency ratio (SSR) approach does not directly include rice consumption in the comparison because total availability is assumed to be an intermediary of household consumption potential. Where the measurement criteria are : if SSR < 100% then food production is not enough, if SSR = 100% then food production is sufficient, and if SSR > 100% the food production is more than enough.

Futhermore, this study uses multiple linear regression analysis to determine the factors that affect the level of food independence of paddy rice farmers households. Multiple linear regression analysis allows researches to examine the influence of several independent variables on dependent variables (Aflah, Risnawati, and Hamdani, 2025). The multiple linear regression equations used are as follows :

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X_5 + \varepsilon$$

Description :

Y	= Household food independence
β_0	= Constant
$\beta_1, \beta_2, \ldots. \beta_5$	= Regression coefficient
X1	= Land area (Ha)
X2	= Expenditure on rice (Rp)

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X3 = Rice consumption (Kg)
X4 = Rice production (Kg)
X5 = Number of family members (People)
ε = Error or error

Multiple linear regression analysis in this study begins with a classical assumption test consisting of a normality test, a multicollinearity test, and a heterokedasticity test to see if the regression model meets the basic assumptions of regression so that the interpretation results obtained are valid in decision-making. After going through the classical assumption test, multiple linear regression measurements were carried out, namely the determination coefficient test (R^2), the simultaneous test (F test), and the partial test (T test) using a significance level of 10% (0.10).

RESULT & DISCUSSION

Characteristics of Respondents

The characteristics of paddy farmers include the identity obtained from the results of the interviews, which are as follows :

Tabel 1. Responden Characteristics

No	Characteristics	Number (People)	Percentage (%)
1	Age		
	25 – 34	5	8,77
	35 – 44	7	12,28
	45 – 54	25	43,86
	55 – 64	14	24,56
	65 – 74	6	10,53
2	Education		
	Elementary School (SD)	27	47,37
	Junior High School (SMP)	16	28,07
	High School (SMA)	11	19,30
	Bachelor (S1)	2	3,51
	Master (S2)	1	1,75
3	Number of Family Members		

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No	Characteristics	Number (People)	Percentage (%)
	1 – 3	25	43,86
	4 – 6	25	43,86
	7 – 9	7	12,28
4	Land Area		
	< 1	40	70,18
	1	6	10,53
	> 1	11	19,30
5	Farming Experience		
	1 – 10	18	31,58
	11 – 20	7	12,28
	21 – 30	12	21,05
	31 – 40	17	29,82
	41 – 50	2	3,51
	> 50	1	1,75
6	Land Ownership Status		
	Own Property	16	28,07
	Work	41	71,93

Source : Primary Data Analysis, 2026

The table above shows that most of the paddy farmers in Kota Utara District are in the age range of 45-54 years which is still at a relatively productive age. Farmers who are at productive age will generally work more optimally (Gusti, Gayatri, and Prasetyo, 2021) so that is has the potential to increase rice production which can support food independence. Generally, farmers complete their education up to the elementary school level, this shows that the majority of rice field farmers in Kota Utara District have a low level of education. The level of education is one of the factors that causes farmer's ability to run their agricultural business (Pinem, 2021), this can affect the productivity of farming which ultimately has an impact on food independence. In one household, rice farmers in Kota Utara Distrit generally consist of 1-6 members. The number of family member is related to the level of fulfillment of the amount of food in a household (Yanti & Murtala, 2019). Most of them have a paddy field area of less than 1 hectare, this shows that rice farmers in Kota Utara District have relatively narrow rice fields. The limited land area has

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implications for low rice production capacity so that it can limit the ability of households to meet their food needs, even though generally rice farmers in Kota Utara District have a long enough experience in farming so that it becomes an important capital fo farmers in running their farming optimally. The majority of rice farmers in Kota Utara District are only cultivators, this condition shows limitations in the control of production assets which can affect food independence due to the limited amount of production obtained to meet household needs.

Levels of Household Staple Food Independence of Rice Field Farmers

This research focuses on one type of food, namely rice. To see the food (rice) independence of farmer households in Kota Utara District, it is calculated based on the self-sufficiency ratio (SSR) approach.

Tabel 2. Results of Self-Sufficiency Ratio Analysis

Household Rice Production (kg)	Purchased Rice (Kg)	Rice Sold (Kg)	SSR	Description
1.962	29	1.336	281	Food production is more than enough

Source : Primary Data Analysis (2026)

The table above shows the ratio of food independence based on the results of the SSR analysis, which is 281, if referring to the requirements of self-sufficiency ratio (SSR) is classified as more than sufficient in the category of food production. A high SSR value indicates a low dependence on external food supply while a low SSR value indicates a high dependence on external food supply (Lin, Yu, Wen, & Liu, 2022). These results show that rice field farmer households in Kota Utara District are able to meet food from their own production and have a small dependence on buying rice from outside. If the amount of production produced exceeds the demand for food, then the household is in a state of food independence (Lusiana, Rauf, and Indriani., 2021). Based on the conditions in the field, rice farmers in Kota Utara District use a crop management pattern that does not fully focus on sales. Rice field farmers in Kota Utara District usually set aside part of their rice harvest to be stored as a supply for household consumption needs for one planting season, this is done to anticipate crop failure or uncertain crop yields in the next season. Therefore, even though the majority of farmers in Kota Utara District have

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relatively narrow land, the value of SSR is still relatively high. Based on the survey results, they usually buy rice or borrow rice only when the stored rice stock has completely run out. This shows that most of its rice needs are met from its own production. Farmer households whose rice needs are mostly met from their own production tend not to experience a food deficit (Saidi & Bakari, 2025).

Kota Utara District consists of 6 villages, therefore an analysis of the level of food independence of rice paddy farmers households in each sub-district in Kota Utara District was also carried out.

Tabel 3. Results of Self Sufficiency Ratio Analysis of Each Village

Village	Production	Purchased Rice	Rice Sold	SSR	Description
Dulomo Utara	1.731	35	1.208	285	Food production is more than enough
Dulomo Selatan	2.100	44	1.289	237	Food production is more than enough
Dembe II	2.130	36	1.483	286	Food production is more than enough
Dembe Jaya	1.491	0	900	267	Food production is more than enough
Wongkaditi Timur	2.742	8	2.008	338	Food production is more than enough
Wongkaditi Barat	1.865	35	1.330	285	Food production is more than enough

Source : Primary Data Analysis (2026)

Table 3 above shows the level of food independence of rice paddy farmers in Kota Utara District when viewed in detail at the village level. The results of the analysis show that farmer households in the six villages in Kota Utara District are in a state of food independence, this is seen from each village has a food independence ratio value above 100 which in the sense that farmer households in each village are able to meet the food needs of rice from their own production. Although each village is in a state of food independence, most farmers in Kota Utara District have less than 1 ha of paddy fields and 71.93% of them are cultivators so this condition has the potential for crop failure due to climate change. In accordance with the problems that are not uncommon

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encountered by rice field farmers, Kota Utara District in several villages often experience floods and ultimately have an impact on the quality and quantity of rice obtained. The impacts of climate change such as floods and droughts are a direct threat to the production of staple food crops (Mamassi, Muneret, Guilpart, and Accatino, 2026). In addition, the increase in land rents and land conversion are also problems that usually occur in paddy fields in urban areas. This also happens in paddy fields in Kota Utara District, which has been recorded in the last five years showing fluctuations and even tends to decrease due to land conversion. However, in fact, it has not fully affected the level of food independence of farmers' households, this is one of which is supported by the existence of the sustainable food agricultural land (LP2B) policy which stipulates around 250 hectares of paddy fields in Gorontalo City as an area that can no longer be converted. Agricultural land protection policies can help in maintaining the availability of agricultural land as a key factor to achieve food security and ensure agricultural sustainability (Octavianti & Nurikah, 2021).

Factors Affecting the Level of Food (Rice) Independence of Rice Farmers in Kota Utara District

1. Classic Assumption Test

The normality test is carried out with the aim of seeing whether the data that has been collected is in accordance with normal assumptions. If the data is not distributed normally, then the assumptions underlying the analysis method will be violated so that it can produced incorrect conclusions (Isnaini, Afgani, Haqqi, and Azhari, 2025).

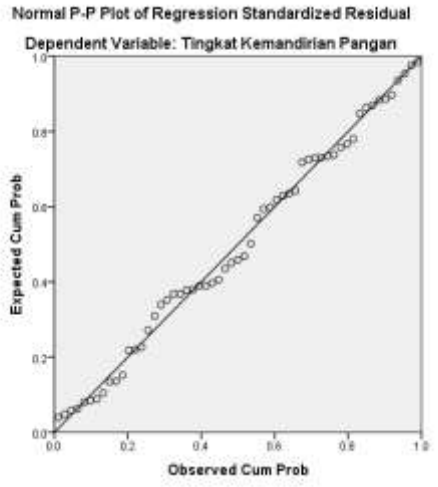


Figure 1. Normality Test Results

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Based on figure 1 above, it can be seen that the residual points are spread around the diagonal line and follow the direction of the line. Therefore, the residual of the independent variables in this study is normally distributed.

After that, the multicollinearity test is carried out with the aim of seeing if each independent variable has a correlation, a good regression model is that there is no correlation between independent variables so that the explanation of each independent variable does not overlap (Effiyaldi *et al.*, 2022).

Table 4. Multicollinearity Test Results

No	Variable	Tolerance	VIF Value
1	Land Area	0.495 > 0.1	2,021 < 10
2	Production for Rice	0.921 > 0.1	1,085 < 10
3	Consumption	0.254 > 0.1	3,933 < 10
4	Production	0.490 > 0.1	2,040 < 10
5	Number of Family Members	0.256 > 0.1	3,906 < 10

Source : Primary Data Analysis (2026)

Based on table 4 of the results of the multicollinearity test above, it is observed that the five independent variables have a VIF value of < 10 and a tolerance of > 0.1, which means that the five independent variables do not experience symptoms of multicollinearity.

After that, the heterokedasticity test is carried out with the aim of seeing whether or not there is a bias in a regression model, seen on the scatterplot graph if there is a certain pattern and the spread is above or below the zero number of the y-axis, then heterokedasticity does not occur. A good regression model is that heterokedasticity does not occur (Widana & Muliani, 2020).

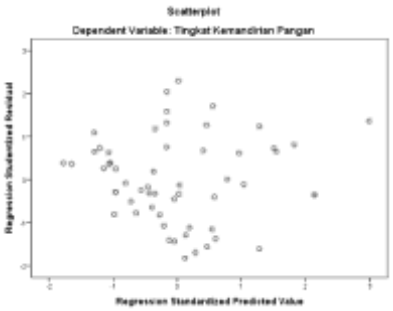


Figure 2. Heterokedasticity Test Results

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Based on figure 2 above, it can be seen that the dots are randomly spread above and below the zero number of the y-axis and do not form a specific pattern (fan, funnel, arc). This shows that the regression model does not show any symptoms of heterokedasticity, thus meeting the classical assumption test and linear regression.

2. Hypothesis Test

Hypothesis tests on multiple linear regression were carried out to examine the influence and relationship of several independent variables on dependent variables. The mathematical model of multiple linear regression in this study is $Y = 261.765 + 1.898X_1 – 0.036X_2 – 0.316X_3 + 0.064X_4 – 16.221X_5 + \varepsilon$. The following is the interpretation of the multiple linear regression equation.

Table 5. Results of Multiple Linear Regression Analysis

No	Variable	Regression Coefficients	Calculated T-Value	Sig	Desc
1	Constant	261.765	8.834	0.000	
2	Land Area (X1)	1.898	9.110	0.000	***
3	Production for Rice (X2)	- 0.036	- 1.781	0.081	*
4	Rice Consumption (X3)	- 0.316	- 2.073	0.043	**
5	Rice Production (X4)	0.064	1.963	0.055	*
6	Number of Family Members (X5)	- 16.221	- 2.088	0.042	**
7	R-Squared (R2)	0.845			
8	Durbin-Watson (D-W)	2.216			
9	Adjusted R2	0.830			
10	Calculation	55.757			
11	F Sig	0.000			

Source : Primary Data Analysis (2026)

Based on the results of multiple linear regression analysis, the test value of the determination coefficient (R^2) by 0.845 or 84.5%. The determination coefficient test is performed to see how much independent variables affect dependent variables (Paramita, Rizal, and Sulistyan, 2021). This shows that 84.5% of the variables of the level of food independence can be explained

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by the variables of land area, expenditure on rice, rice consumption, rice production, and number of family members. The remaining 15.5% was influenced by other factors that were not studied in this study.

Based on the results of multiple linear regression analysis, an F value of 55.757 was obtained with a significance value of 0.000. Because the value is smaller than the significance limit of 10% (0.10), H_1 is accepted and H_0 is rejected, thus the variables of land area, expenditure on rice, rice consumption, rice production, and the number of family members together have a significant influence on the level of food independence of rice paddy farmer households.

Based on table 5 above, the value of the constant (a) of the multiple linear regression equation is 261.765 which is the constant result of the dependent variable if there is no influence from the independent variable.

Land area (X1) has a regression coefficient value of 1,898 and has a positive relationship (+) meaning that for every 1 hectare increase in land area, the level of food independence will increase by 1,898 percent. Research (Yani & Restiatun, 2022) stated that the main factor that is very important in efforts to realize food independence is the availability of agricultural land for rice plants. Research conducted by (Noviwiyanah & Yudhistira, 2024) shows that a significant increase in the area of rice fields can increase rice production on the land of dilling. Findings in the field show that paddy farmers who have a larger area of rice fields tend to get more rice production. This in in line with the statement (Sembiring, 2025) which explains that if the area of land cultivated by a farmer is higher, it will increase the surplus of household rice in one planting season.

Expenditure on rice (X2) has a regression coefficient value of -0.036 and has a negative relationship (-), meaning that every increase in expenditure on rice of 1 rupiah will decrease the level of food independence by 0.036 percent. This is as explained by (Yunus, Abubakar, Mulyadi, and Huzaimah, 2022) where farmers' household income determines their ability to reach rice, especially during the famine season or outside the harvest season, so that the amount of expenditure allocation for food, especially rice in a household is a measure of whether the household is fully able to meet food needs from its own production or not. Finding in the field show that a small number of paddy farmers in Kota Utara District still buy rice from outside due to insufficient harvests and additional needs such as celebrations, weddings, and family gatherings. Therefore, the higher household expenditure on rice will reduce the level of household staple food independence. This is in line with research (Sholeha, Prasmatiwi, and Lestari, 2021) which explains that households that are able to achieve food independence tend to have lower

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household expenditures, especially grains. The increase in rice prices will affect spending on other types of food, showing that they do not have strong food security because they are still dependent on market mechanisms (Maku, Bakari, and Lusiana, 2025).

Rice consumption (X3) has a regression coefficient value of -0.316 and has a negative relationship (-), meaning that for every 1 kg increase in rice consumption, the level of food independence will decrease by 0.316 percent. Research conducted by (Lusiana, Rauf, and Indriani, 2021) explained that rice consumption is one of the influencing factors that affect food adequacy in rice paddy farming households in Gorontalo City. Findings in the field show that most rice farmer households in Kota Utara District still depend on rice as a daily staple. This condition affects the level of household food independence, where if the amount of rice consumption is higher, it can cause the rice production produced to be unable to meet the needs of household rice consumption so that the level of food independence is lower and vice versa. This is in line with research (Darsono, 2016) which explains that rice consumption is one of the factors that determine household food balance, so that if the amount of rice consumption is greater than the production, then households are in a condition of food deficit, as well as research (Clapp, 2017) which states that if the consumption level increases without being followed by an increase in production, households will experience food shortages so they have to buy food sources from outside.

Rice production (X4) has a regression coefficient value of 0.064 and has a positive relationship (+) meaning that every 1 kg increase in rice production will increase the level of food independence by 0.064 percent. Research conducted by (Clapp, 2017) explaining that the food production is a determining factor in the level of food independence, food independence is achieved if food production is able to meet food consumption in a balanced way or exceed the amount of food consumption. Findings in the field show that rice farming households that obtain large quantities of rice production generally have sufficient rice stocks until the next harvest. On the other hand, those who obtain small quantities of rice production often run out of rice stocks so they have to buy at the market or borrow from their bosses and close relatives. This shows that rice production is one of the important factors that affect the level of food independence of rice paddy farmers households in Kota Utara District. This is in line with research conducted by (Darsono, 2016) which explains that rice production is the main factor that has the most influence on food independence at the level of farmer households in Solo Raya.

The number of family members (X5) has a regression coefficient value of -16.221 and has a negative relationship (-) meaning that for every increase of 1 household member, the level of

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food independence will decrease by 16,221 percent. In line with the explanation (Sihite & Tanziha, 2021) in his reseaech, the increase in the number of family members in a household wil increase food needs. Findings in the field show that farmer households with more than five family family members often complain that the rice harvest produced is often insufficient to meet their food needs until the next harvest season so they need to obtain rice from outside. This shows that large family members can accelerate the depletion of harvested rice stocks and increase dependence on external rice sources. This is in line with research (Darsono, 2016) which explains that the increasing number of family members will affect food reserves in households which is at risk of decreasing the level of food independence if not balanced with increasing production and efficient crop management. Often in the instance of imitating, a kind of social learning behavior is researched in both cognitive and social psychology, there is very little cross-pollination between both the two fields.

CONCLUSION

The results of the study show that rice field farmer households in Kota Utara District are in a state of food independence with a food independence ratio value of 281 which shows that the farmers households is able to meet the needs of rice from their own production. The level of household food independence is influenced by land area, expenditure on rice, rice consumption, rice production, and the number of family members. These findings indicate the importance of maintaining the implementation of the sustainable food agricultural land (LP2B) policy, in addition to food diversification can be a policy implication to support household food independence. This study has limitations in the use of a 10% significance level and data that only covers one planting season, so the next study is expected to use time series data and consider other more exogenous variables.

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