

Factors Affecting the Area of Paddy Field on the Island of Sumatra 2015-2022

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ARTICLE INFO

Keywords: Number of Industries, Total Population, GRDP, Paddy Field Area

Received : 14, September

Revised : 18, October

Accepted: 24, November

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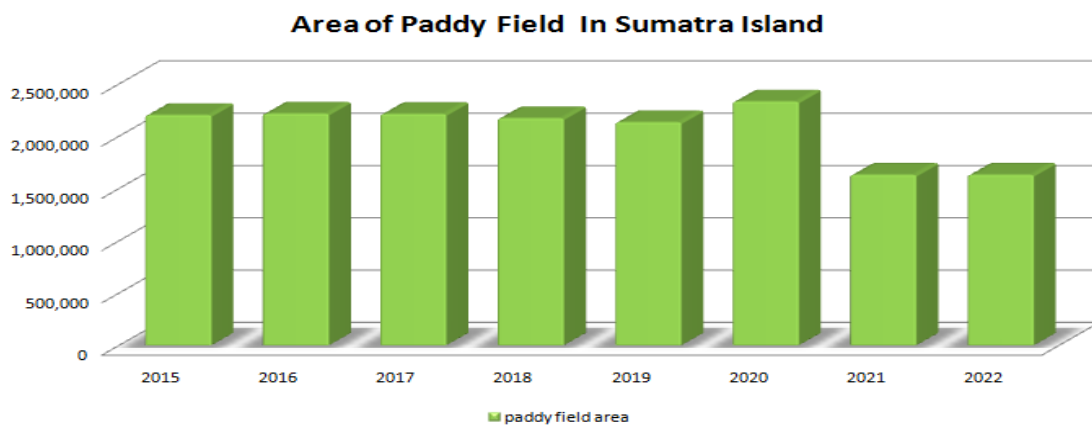
ABSTRACT

This study aims to identify the factors of the number of industries (X1), population (X2) and gross regional domestic product (GRDP) (X3) that affect the area of paddy fields (Y) on the island of Sumatra. The scope of this survey includes 10 provinces on the island of Sumatra. The data used is secondary data derived from BPS and uses panel data type. The analysis method used in this study uses multiple linear regression analysis with SPSS 25 analysis tool. The results of the study indicate that there is a positive relationship between the variables of the number of industries and the number of population with the area of paddy fields, while GRDP has a significant negative effect on the area of paddy fields. These results indicate that an increase in population and industry makes the need for paddy fields also increase while an increase in GRDP will make a decrease in the area of paddy fields.

INTRODUCTION

Paddy fields are one of the important assets in agriculture that has a vital role in meeting food needs in Indonesia. The area of available paddy fields has a direct impact on the production of rice, the main food crop that is the main source of carbohydrates for the Indonesian population (I Wayan & Gede 2017). The area of paddy fields is influenced by the development of community activities that require land as a place that is growing rapidly along with population growth and economic growth (Merisa & Putu 2014).

The provinces on the island of Sumatra are the largest rice producers in Indonesia, especially 5 provinces, namely Lampung, South Sumatra, North Sumatra, Aceh and West Sumatra provinces. Sumatra Island as the largest rice producer in Indonesia has a very high need for rice fields. Economic growth on the island of Sumatra causes competition in the use of space for various sectors which causes the need for land to be higher, resulting in many conversion of agricultural land into non-agricultural land (Dudan 2023)



Source: <https://bps.go.id> (processed data 2023)

The conversion of agricultural paddy fields can have an impact in the form of reduced agricultural land, decreased national food production, threatening the balance of the ecosystem. agricultural land, decreasing national food production, threatening the balance of the ecosystem, agricultural infrastructure becomes unused, farm labourers lose their jobs, food prices increase, and urbanisation rates increase. food prices become more expensive, and urbanisation rates become high. The impact of the conversion of agricultural land The impact of agricultural land conversion is inseparable from several factors, namely rapid population growth, increase in people's needs for housing, the high cost of organising agriculture, the declining selling price of agricultural products, the lack of interest of the younger generation to manage agricultural land, the turn to manage agricultural land, shifting to sectors that are considered more promising, and weak regulations to control land conversion. weak regulations to control land conversion. The conversion of paddy fields can make it difficult for the Government, both central and regional, to realise self-reliance, resilience and sovereignty. realising food independence, security and sovereignty. Food is the basic needs of every community so it absolutely must be fulfilled. Food is included in the sector that

can affect the social, economic, and politics of a country. is intended so that the availability of food agricultural land can be maintained so that the needs of the Indonesian people related to the right to food can be fulfilled. the needs of the Indonesian people related to the right to food can be fulfilled (Benny & Kusuma 2018).

Rice fields are a pressing issue in agriculture and environmental sustainability. Paddy fields are a valuable asset in the effort to fulfill global food needs. However, the conversion of paddy fields to other land uses, such as urban, industrial, or infrastructure, has become a serious challenge (Ayu, Lala 2018). The conversion of paddy fields has significant economic, ecological, and social impacts, which need to be well understood.

Based on these observations, this study was conducted to understand the factors that drive changes in the area of paddy fields, which is an important step in designing sustainable economic policies and ensuring future food security.

THEORETICAL REVIEW

Farm Land

Land is the main production factor in agriculture, Paddy fields are a plot of agricultural land used specifically for growing rice or other grain crops (Gessan & Nur, 2020). Paddy fields have special characteristics, such as the presence of water that can be controlled, usually by an irrigation system, to maintain soil moisture needed for rice plant growth. The size of paddy fields is an important parameter in agriculture, especially in food security and rice production.

Industries

Land-based Industrial Development is an approach in economics that emphasizes the important role of geographic location or land in the development of a region's industrial sector. This theory recognizes that factors such as accessibility, environmental sustainability, and land availability have a significant impact on industrial development (Christaller & Losch, 2010).

The transformation of the economic structure from agriculture to industry is inevitable given the condition of Bogor Regency as one of the buffers for the rapid economic growth of the metropolitan city. The increasing number of industrial sectors also has an impact on the increasing number of land conversion. The land that has changed function is agricultural land, so that with the many changes in function due to the industrial sector, the amount of land for the agricultural sector is decreasing (Jean, 2021),

Population

Population is a term that refers to the number of individuals or people living within a certain geographical area, such as a country, city, village, or region at any given time. Population is a key element in demographic studies, which includes analyzing and understanding the structure and characteristics of a region's population, including aspects such as age, gender, nationality, occupation, education level, and more.

Grdp

GRDP is one of the economic indicators used to measure the total value of production of goods and services in a particular region, such as a state, province, or other administrative area. GRDP reflects the large amount of goods and services produced by the economic sector in the region during a certain period of time, (Junaidi, 2017). A continuous increase in growth will facilitate the process of economic development. Regions that are in a developing stage really need physical development such as roads, offices, hotels and restaurants as well as other public facilities (Erastus, 2021).

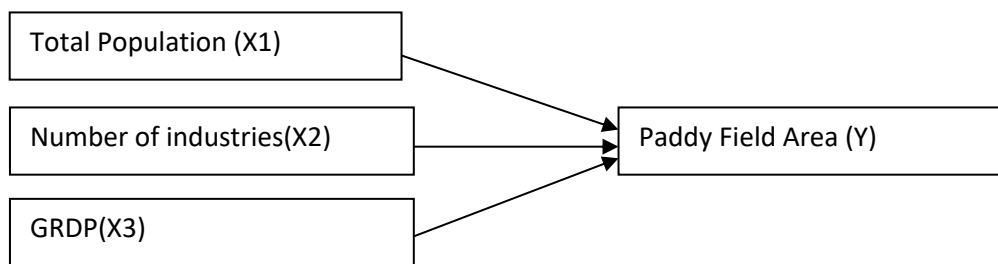


Figure 1. Conceptual Framework

METHODOLOGY

Time and Place of Research

This research was conducted in 10 provinces on the island of Sumatra. This location was chosen because on the island of Sumatra there is currently a decrease in the area of rice fields and there are indications of changes in the function of agricultural land into non-agricultural land. This research was conducted from 2015 to 2022.

Data Collection Methods

The data used in this research is secondary data. Secondary data is data obtained from relevant agencies such as the Provincial Statistics Agency and the agriculture office of 10 provinces on the island of Sumatra. Secondary data collected are the number of industries, population, GRDP per capita, and rice field area with panel data (time series and cross section).

Data Analysis Method

Multiple Linear Analysis

The data analysis method in this study is to measure the intensity of the relationship between two or more variables. This method uses quantitative tools in the form of SPSS computer software in processing the data. To be able to find out whether the regression model used has met the requirements or criteria, a normality test, autokorelasi test, multicollinearity test, and heteroscedasticity test will be carried out first in this study to analyse or see the influence between population, GRDP per capita, and the number of industries on the area of agricultural land in North Minahasa Regency. The method used is multiple regression analysis method:

$$Y_{it} = B_0 + B_1X_{1it} + B_2X_{2it} + B_3X_{3it} + e_{it}$$

Ket:

Y= Rice field area

B=Intercept coefficient

Yit= rice field area

X1 = Number of Industries

X2 = Total Population

X3 =GRDP

i = 10 provinces in Sumatera island

t = Unittime series from 2015-2021

Eit = Errorterms

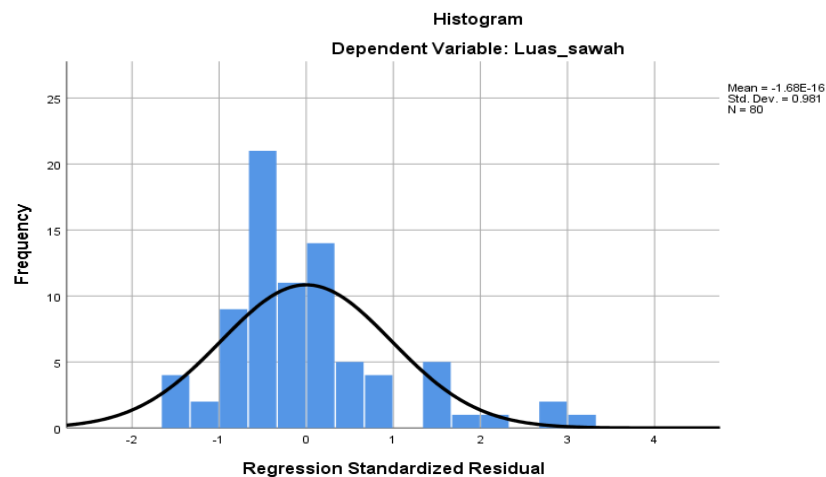
RESULTS

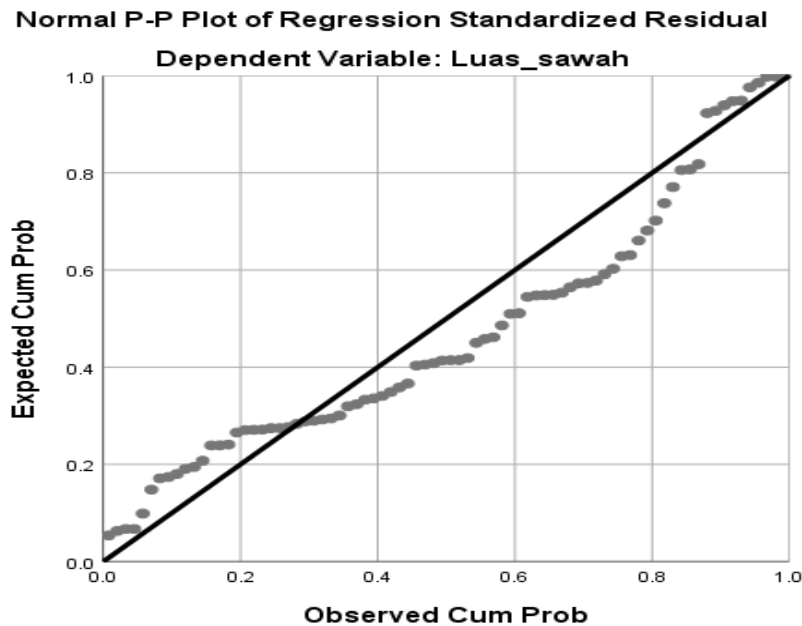
Classical Assumption Test

To ensure that the model obtained is the right model, a classic assumption test will be carried out first, which consists of, among others:

1) Normality Test

To find out whether the variables are normally distributed or not, in this study using histograms and normal p plots, so that the normality test is obtained as follows:





Based on the results of the histogram normality test and p plot, the model is declared not to experience symptoms of normality because the data is spread following the line in the classical assumption test above.

2).Heterodoxy Test

To find out whether the variables have heterodoxy symptoms or not, this study use the Glejser test, so that the test is obtained as follows:

Table 3.1

Variabel	Sig
Number of Industries	0,6227
Total Population	0.70
GRDP	0.62

Symptoms of heteroscedasticity are indicated by the regression coefficient of each independent variable on the absolute value of the residual $|e|$. If the probability value is greater than the alpha value ($\text{sig} > \alpha$), it is certain that the model does not contain symptoms of heteroscedasticity or it is said that there is no heteroscedasticity if $t \text{ count} < t \text{ table}$. Based on the output above, it is known that the regression model does not occur symptoms of heteroscedasticity. This is because the sig variable of the absolute residual number of industries is $0.627 > 0.05$, the sig variable of the total population against the absolute residual is $0.70 > 0.05$, and the sig variable of the total population against the absolute residual is $0.62 > 0.05$, so the data does not have symptoms of heterodoxy.

3.) Multicollinearity test

Multicollinearity approach can be seen through variance inflation factors (VIF). to see whether there is multicollinearity or not can be seen through Variance inflation Factors (VIF).

Table 3.2

Variabel	VIF	1/VI
Number of Industry	1.411	0,708
Total population	1.349	0.741
GRDP	1.056	0.946

If the VIF value is <10 and $1/VIF > 0.1$, it can be said that the model is free from multicollinearity symptoms. From the above tests, it can be seen that the number of industries <10 (1,411), total population <10 (1,349), and GRDP <10 (1,056), so it can be concluded that the model is free from multicollinearity symptoms.

Regression Analysis Test

The table below shows the results of multiple linear testing with SPSS.

DPK	Coefficient	Standar error	T	Sig.
Total population	.277	5565.274	4.118	.001
Number of Industries	15.893	3.877641	3.714	.000
GRDP	-2.004	1544.494	-4.337	.000
C	145559.861	41295.432	3.525	.001
Number of obs = 80				
R-squared = 0.562				
Adj R-squared = 0.749				

The regression model obtained from the research results can be written in the form of an equation

$$Y = 145559.861 + 15.893X_1 + .277X_2 + -2.004X_3 + \text{eit}$$

Based on the results of the above calculations show that the constant of 145559.861 means that if the number of industries, population and GRDP is fixed or worth 0, then the area of paddy fields increases by 14559.861%.

a. Test Coefficient of Determination (R-squared) Based on the results of data processing, the coefficient of determination (R-Squared) is 0.562. This shows that the independent variables, namely the number of industries (X1), population (X2) and GRDP (X3) can explain the dependent variable, namely the conversion of paddy fields (Y) by 72.30%, while the remaining 43.80% is explained by other variables outside the model.

b. F test Based on the results of data processing, the significance value is 0.000. The significance value is $< \alpha = 0.05$. This means that all independent variables included in the model, namely the number of industries (X1), population (X2) and GRDP (X3) together have a real effect on the dependent variable, namely the area of paddy fields (Y).

c. Based on the results of data processing, it can be seen that all independent variables included in the model, namely the number of industries (X1), population (X2) and GRDP (X3) significantly affect the size of paddy fields (Y). The regression estimation model of factors affecting the conversion of paddy fields at the regional level are:

1) Influence of the number of industries on the size of paddy fields

Based on the results of the partial testing of the number of population on rice field area, the probability value of 0.001 was obtained. Because the probability value of $0.001 < 0.05$, it can be stated that the number of industries partially has a significant effect on the size of paddy fields.

2) Effect of Population on the size of paddy fields

Based on the partial test results of the exchange rate on third party funds, the probability value is 0.000. Because the probability value of $0.000 < 0.05$, it can be stated that the number of population partially has a significant effect on the size of paddy fields.

3) Effect of GRDP on the size of paddy fields

Based on the results of partial testing of GRDP on the size of paddy fields, the probability value is 0.000. Because the probability value of $0.000 < 0.05$, it can be stated that GRDP partially has a significant effect on the size of paddy fields.

DISCUSSION

The Analysis of Each Variable is as Follows.

a. Variable Number of Industries

The province on the island of Sumatra has many industries that continue to innovate through businesses in the form of goods and services. The results of the research with the analysis obtained the value of the parameter coefficient of 15.893, meaning that every time there is an increase in the number of industries by one unit, there will be an increase in agricultural land area of 15.893 ha, which means that the increasing industry makes the area of rice fields also increase.

b. Total Population Variable

The size of the coefficient value of the population parameter is 0.277, this means that every time there is an increase in the population of one person, there will be an increase in agricultural land area of 0.277 ha. This shows that population has a significant effect on the area of agricultural land and because population growth in Sumatra Island Province continues to increase every year so that the demand for rice as the main source of carbohydrates also increases.

c. GRDP Variable

The results of the research with the analysis obtained the magnitude of the parameter coefficient value of the population size of -2.004, this means that

every time there is an increase in GRDP by one unit, there will be a decrease in the area of agricultural land by 2.004 ha. This shows that GRDP has a significant effect on the area of agricultural land and due to the increasing GRDP in the Province of Sumatra Island will make a decrease in the area of rice fields.

CONCLUSIONS AND RECOMMENDATIONS

The results showed an analysis of the factors affecting the area of paddy fields in the province of Sumatra Island in 2015 - 2022, namely the number of industries, population and GRDP had a significant influence on the area of paddy fields. The increase in the number of industries and population makes the land area also increase. The increasing population shows that the need for food in the form of rice also increases in line with the growth of paddy fields. The increase in industry also makes paddy fields also increase because the agricultural industry is also progressing and developing while with the increase in GRDP, people tend to change their consumption patterns, such as increasing demand for processed food products and non-agricultural products. This can lead to a reduction in demand for rice farming, which affects the decrease in the area of paddy fields.

The government needs to always provide assistance both technology and knowledge to farmers to help farmers be more active in farming. The government must also limit the rules and permits for the conversion of agricultural land to non-agricultural land. Policies implemented should also reflect local conditions and needs and incorporate participation and input from stakeholders, including farmers and local communities in order to maintain food security.

FURTHER STUDY

This article needs to be further researched in order to get better results regarding the relationship between variables and can add other variables that can be included in the study so that it can help the government in making policies in Indonesia.

ACKNOWLEDGMENT

Thank you to previous researchers whose writings have been used as guidelines for making my article, so that it can become an international journal.

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