



Contribution of Food Self-Sufficiency Variables Towards Food Adequacy and its Impact on Food Poverty in Indonesia for the Period 2018-2023

Anita Ria^{1*}, Tulus Widjajanto², Vinandri Hapsari³

^{1,3} Program studi Pendidikan Ekonomi Universitas Indraprasta PGRI,

² Program Studi Teknik Industri Universitas Indraprasta PGRI

¹ Student Doktoral Ekonomi Universitas Borobudur

Corresponding Author: anitarianita@gmail.com

ARTICLE INFO

Keywords: Food Self-Sufficiency, Food Adequacy, Food Poverty

Received : 23 September

Revised : 24 October

Accepted: 25 November

©2024 Ria, Widjajanto, Hapsari: This is an open-access article distributed under the terms of the [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

This research is about the contribution of food self-sufficiency variables to food sufficiency and its impact on food poverty in Indonesia, this research uses Eviews in data processing, using panel data from 2018 to 2023 as many as 34 provinces, while the results of the agricultural sector have a very significant contribution to the achievement of the Sustainable Development Goals (SDG's) program goals and also the second largest contributor to Gross Domestic Product (GDP). Aceh's agricultural sector excels in various commodities such as rice, corn, soybeans, and chili. One of the main commodities in Aceh's agricultural sector is rice. Rice is a staple food commodity for the Indonesian people whose needs continue to increase as the population increases and also as a source of income for the farming community in fulfilling their needs.

INTRODUCTION

Policies taken by the government to realize national development goals include improving economic life through agricultural development (Hernanto, 2003). The agricultural sector is also a mainstay in developing rural economic activities through the development of agriculture-based businesses. With the rapid growth of Indonesia's population, advanced agricultural businesses need to be realized throughout Indonesia's agricultural areas. The agricultural sector has a role in providing food so that agricultural progress is needed to ensure that the provision of food for the population can be guaranteed. Sumbawa Regency is one of the regencies based on the agricultural sector. Agricultural products support the economy and are a measure of the success of economic development.

The production process in the agricultural sector needs to be supported by several inputs, such as labor, land, technology and capital, these inputs will help in producing outputs, namely rice or corn and others. The production process can run smoothly if the required production factors are met. The four components of production factors consist of land, capital, technology and labor, which have different functions and influence each other. Farmer productivity that can affect farmer income is land area, as one of the production factors in the agricultural sector, when farmers have large areas of land, agricultural yields are also increasing, and vice versa, when farmers have narrow land can have an impact on low productivity levels.

Some factors that can cause a decrease in land area can be caused by limited capital, production facilities and infrastructure that are less supportive and tend to be unavailable, the existence of land conversion from agricultural land to residential or industrial, as well as environmental conditions that are less supportive, especially the availability of water, both sourced from irrigation and rainfall.

Salikin (2003) explains that agricultural land area is the area of rice fields that will be planted with rice in a certain season. Agricultural land is the determinant of the influence of production factors on agricultural commodities. The size of agricultural land will affect the scale of business and will ultimately affect whether or not an agricultural business is efficient. Land as one of the factors of production that has a significant contribution to the farming business. Land area as a factory of agricultural products that has a major contribution to increasing farmers' income. The size of farm production is influenced by the size of the farmer's land area, while production per hectare is influenced by changes in prices and changes in planting area. Nicholson (2012) explains that rice production is obtained through a fairly long and risky process, the length of time required is not the same, depending on the type of commodity being cultivated, not only time, the adequacy of production factors is also a determinant of achieving production.

LITERATURE REVIEW

Food needs are a basic and main need for the community in the economic field in the form of fulfilling food for daily life, this need can be met

independently by the community through the use of available resources sourced from nature and humans so that the community can build independent food self-sufficiency from within the country through several agricultural activities, providing land, providing seeds, providing fertilizers etc., this is so that farmers can produce food independently so that domestic agricultural products will be able to meet the needs of the national community independently.

In order to realize food self-sufficiency, the government must certainly collaborate with domestic farmers to increase agricultural productivity, this agrees with Bihun. N At.al (2023) That independence must be built together and requires internal & external factors contained in the environment to achieve it. Based on research by Erokhin, Vasilii. (2017). In Russia, it states that food security is a step to reduce the government's imports of good and healthy food for its people, so that they can live more prosperously and independently to fulfill food self-sufficiency in their country. Enriquez J,P (2020). Stating that the level of food self-sufficiency in a country will be able to grow and increase if there is government support to encourage it and limit the entry of food products from abroad.

The opinion of González C.C, Barriga M.F.D (2019) states that to intervene in food and nutrition security and the welfare of the people in Mexico the government promotes its people to consume various types of domestically produced food in order to improve people's welfare and food security in Mexico. Because self-sufficiency, which the government uses as a strategy to achieve food security, is a good alternative for areas experiencing food shortages Salvador, L. M. (2016).

Food poverty is the inability to meet one's daily food consumption needs properly. This is the impact of low community income to meet the needs of daily life, Laborde.D At.al (2019) states that the low level of food consumption in the world is due to the high increase in food prices and the low (tends not to rise) income of the community, this affects the value of consumption, Kostas G. (2004) in Vilar-Compte, M. et al. (2021) states that low-income people find it difficult to obtain diverse food sources such as fruits, fresh vegetables, tubers, nuts, but they have more access to foods that contain lots of sugar, fat and processed foods in excess.

Vilar-Compte, M. et al. (2021). stated that food poverty in the community can also be caused by low/no access to proper food so that the difficulty of access to food has an impact on the uneven distribution of food in every place.

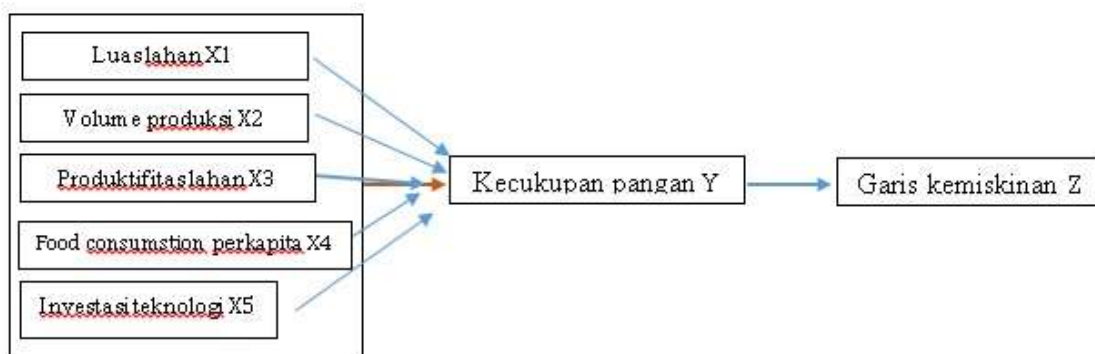


Figure 1. Conceptual Framework

Table 1. Research Hypothesis

H1	Variable X1, X2, X3, X4 and X5 simultaneously affect variable Y
H2	Variable X1 partially affects variable Y
H3	Variable X2 partially affects variable Y
H4	Variable X3 partially affects variable Y
H5	Variable X4 partially affects variable Y
H6	Variable X5 partially affects variable Y
H7	Variable Y partially affects variable Z

Table 2. Diskripsi Variable

SYMBOL	VARIABEL	DESCRIPTION
X1	Land area	Agricultural land area is the area of paddy fields that will be planted with rice in a certain season.
X2	Production volume	Is the volume produced by agricultural land
X3	Land productivity	Percentage of the yield of planted land
X4	Per capita food consumption	Is the per capita consumption of people for food
X5	Technology investment	Investment to support increased productivity of agricultural land
Y	Food sufficiency	Prevalence of food consumption inadequacy (Percent)
Z	Poverty line	Food Poverty Line (IDR/capita/month)

METHODOLOGY

This study uses quantitative methods with multiple linear regression analysis data. The variables in this study consist of variables of land area (X1), production volume (X2) land productivity (X3) per capita food consumption (X4), technology investment (X5) as independent variables while food sufficiency (Y) and poverty line (Z) This research data was taken during the period 2018 - 2023 with saturated sample technique (census method) in which all members of the population were sampled within a period of 6 years which included time series research data. The data source comes from the Indonesian Central Bureau of Statistics (BPS), secondary data collection, namely research data obtained indirectly from official institutions or agencies that are generally known, the data analysis tool used in this study uses Eviews.

RESEARCH RESULT

Table 3. Uji statistic deskriptif

	Y	X1	X2	X3	X4	X5
Mean	2.197206	11.42858	12.91975	3.793382	14.71902	8.775490
Median	2.230000	11.62000	13.18000	3.830000	14.72000	8.775000
Maximum	3.650000	14.42000	16.17000	4.290000	15.21000	11.46000
Minimum	0.360000	4.750000	5.780000	3.280000	12.52000	3.930000
Std. Dev.	0.704567	2.005142	2.108712	0.202121	0.229551	1.321648
Skewness	-0.185956	-1.079623	-0.985107	-0.511667	-4.207880	-0.373895
Kurtosis	3.083064	4.377225	4.231146	2.542210	42.41845	3.539633
Jarque-Bera	1.234349	55.75229	45.87842	10.68265	13809.44	7.228347
Probability	0.539466	0.000000	0.000000	0.004790	0.000000	0.026939
Sum	448.2300	2331.430	2635.630	773.8500	3002.680	1790.200
Sum Sq. Dev.	100.7723	816.1803	902.6729	8.293166	10.69680	354.5911
Observations	204	204	204	204	204	204

Food Sufficiency Variable (Y)

The food sufficiency variable has a minimum value of 0.360000 and a maximum value of 3.650000 with a mean value of 2.197206 and a standard deviation (the level of data distribution) of 0.704567. The mean value of food sufficiency is greater than the Standard Deviation. This indicates low data variability for the food sufficiency variable in the sample or it can be said to have a small deviation and indicates good data distribution.

Land Area Variable (X1)

The X1 variable has a minimum value of 4.750000 and a maximum value of 14.42000 with a mean value of 11.42858 and a standard deviation (the level of data distribution) of 2.005142. The mean value of land area is greater than the Standard Deviation. This indicates low data variability for the land area variable in the sample or it can be said to have a small deviation and indicates good data distribution.

Production Volume Variable (X2)

The X2 variable has a minimum value of 5.780000 and a maximum value of 16.17000 with a mean value of 11.42858 and a standard deviation (the level of data distribution) of 2.108712. The mean value of production volume is greater than the Standard Deviation. This indicates low data variability for the production volume variable in the sample or it can be said to have a small deviation and indicates good data distribution.

Land Productivity Variable (X3)

The X3 variable has a minimum value of 3.280000 and a maximum value of 4.290000 with a mean value of 3.793382 and a standard deviation (the level of data distribution) of 0.202121. The mean value of land productivity is greater than the Standard Deviation. This indicates low data variability for the land

productivity variable in the sample or it can be said to have a small deviation and indicates good data distribution.

Food Consumption Per Capita Variable (X4)

The X4 variable has a minimum value of 12.52000 and a maximum value of 15.21000 with a mean value of 14.71902 and a standard deviation (the level of data distribution) of 0.229551. The mean value of per capita food consumption is greater than the Standard Deviation. This indicates low data variability for the per capita food consumption variable in the sample or it can be said to have a small deviation and indicates good data distribution.

Technology Investment Variable (X5)

The X5 variable has a minimum value of 3.930000 and a maximum value of 11.46000 with an average value of 8.775490 and a standard deviation (the level of data distribution) of 1.321648. The mean value of technology investment is greater than the Standard Deviation. This shows low data variability for the technology investment variable in the sample or it can be said that it has a small deviation and shows good data distribution.

Table 4. Stationary Test

No.	Variables	Level Test	
		ADF	Phillips-Perron
1	Food sufficiency (Y)	0.0000	0.0000
2	Land area (X1)	0.0000	0.0000
3	Production volume (X2)	0.0000	0.0000
4	Land productivity (X3)	0.0000	0.0000
5	Food consumption per capita (X4)	0.0000	0.0000
6	Technology investment (X5)	0.0000	0.0000

Dari hasil analisis diatas menunjukkan hasil uji statistik ADF pada level test yang menunjukkan bahwa hipotesis nol diterima, dengan nilai probabilitas lebih kecil dari 0,05, artinya semua variabel tersebut sudah tidak mengandung masalah akar unit dan mempunyai kondisi data stasioner pada tingkat level test.

Tabel. 5. Uji regresi model - 1

a. Selection of Regression Models

Chow test

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	30.374480	(33,165)	0.0000
Cross-section Chi-square	399.136761	33	0.0000

Hausmant test

Correlated Random Effects - Hausman Test
 Equation: Untitled
 Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.430496	5	0.0000

Based on the chow and hausman tests, the probability value is <0.05, so it is concluded that the panel data regression model is to use the Fixed Effect Models (FEM).

Table 6. Regresi Fixed Effect

Dependent Variable: Y
 Method: Panel Least Squares
 Date: 10/18/24 Time: 13:43
 Sample: 2018 2023
 Periods included: 6
 Cross-sections included: 34
 Total panel (balanced) observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.041131	8.444579	0.360128	0.0192
X1	2.255060	3.653298	0.617267	0.0379
X2	-2.349786	3.653941	-0.643083	0.0211
X3	2.390019	3.659912	0.653026	0.0146
X4	0.030854	0.101602	0.303674	0.0518
X5	0.034695	0.031176	1.112873	0.0274

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.910991	Mean dependent var	2.197206
Adjusted R-squared	0.890493	S.D. dependent var	0.704567
S.E. of regression	0.233155	Akaike info criterion	0.095950
Sum squared resid	8.969595	Schwarz criterion	0.730297
Log likelihood	29.21305	Hannan-Quinn criter.	0.352555
F-statistic	44.44092	Durbin-Watson stat	1.870370
Prob(F-statistic)	0.000000		

From the output results above, the following is the interpretation of panel data regression with a fixed effect model used to estimate the effect of land area, production volume, land productivity, food consumption and technology investment on food sufficiency, namely the following equation:

$$Y = -\beta_0 + \beta_1 y X_{1it} - \beta_2 y \ln X_{2it} + \beta_3 y \ln X_{3it} + \beta_4 y \ln X_{4it} + \beta_5 y \ln X_{5it} + \varepsilon_{it}$$

From the results of the eviews output, the form of the panel data multiple regression equation is obtained as follows: $\ln Y = 3.041131 + 2.255060 \ln X_1 - 2.349786 \ln X_2 + 2.390019 \ln X_3 + 0.030854 \ln X_4 + 0.034695 \ln X_5 + \epsilon_{it}$

The above model can be interpreted as follows:

The constant value of 3.041131 means that if all variables of land area, production volume, productivity, food consumption per capita and technology investment are constant, then food sufficiency will be worth 3.041131 units.

- The value of the regression coefficient β_1 is 2.255060, which means that the elasticity of land area to food sufficiency is $E = 3.653298$. Since $E > 1$, an increase in land area is elastic to an increase in food sufficiency.
- The value of regression coefficient β_2 is -2.349786, which means that the elasticity of production volume towards food sufficiency is $E = 0.643083$. Since $E < 1$, an increase in production volume is inelastic to an increase in food sufficiency.
- The value of regression coefficient β_3 is 2.390019, which means that the elasticity of productivity towards food sufficiency is $E = 0.653026$. Since $E < 1$, an increase in productivity is inelastic to an increase in food sufficiency.
- The value of regression coefficient β_4 is 2.390019, which means that the elasticity of food per capita consumption towards food sufficiency is $E = 0.303674$. Since $E < 1$, an increase in food per capita consumption is inelastic to an increase in food sufficiency.
- The value of regression coefficient β_5 is 0.034695, which means that the value of food technology investment on food sufficiency is $E = 1.112873$. Since $E > 1$, an increase in technology investment is elastic to an increase in food sufficiency.

The fixed effect model assumes that the intercept/constant is different for each province but the slope coefficient of all provinces is the same. The following is the cross section fixed effect model for each province, namely:

Tabel 7. Data Tabel Konstanta

Province	Effect	Province	Effect	Province	Effect
Aceh	0.106758	JaTeng	0.483135	SulUt	-0.628666
SumUt	-0.197151	DIY	0.114036	SulTeng	0.111684
SumBar	-0.255253	JaTim	0.132107	SulSel	0.136422
Riau	0.074729	Banten	-1.206142	SulTengg	0.198197
Jambi	0.115572	Bali	-0.715591	Gorontalo	0.333939
SumSel	0.038603	NTB	-1.098530	SulBar	0.041200
Bengkulu	-0.054767	NTT	0.500200	Maluku	1.245306
Lampung	0.387619	KalBar	0.813758	MalUt	1.092181
BaBel	0.055776	KalTeng	0.125994	Papua	0.776693
KepRi	-0.847564	KalSel	-0.947029	PapBar	1.348696
DKI	-2.043871	KalTim	0.039393		
JaBar	-0.497771	KalTara	0.220341		

Based on the data above, it can be interpreted as follows:

Aceh has an intercept/constant value of 3.147889 (3.041131 + 0.106758), so that the form of the fixed effect equation for the province is

a. Aceh is: $Y = 3.147889 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

b. SumUt has an intercept/constant value of 2.84398 (3.041131 - 0.197151), so the fixed effect equation form for SumUt province is: $Y = 2.84398 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

c. SumBar has an intercept/constant value of 2.785878 (3.041131 - 0.255253), so the fixed effect equation form for SumBar province is: $Y = 2.785878 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
Riau has an intercept/constant value of 3.11586 (3.041131 + 0.074729), so the fixed effect equation form for Riau province is: $Y = 3.11586 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

d. Jambi has an intercept/constant value of 3.156703 (3.041131 + 0.115572), so the form of the fixed effect equation for Jambi province is: $Y = 3.156703 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

e. SumSel has an intercept/constant value of 3.079734 (3.041131 + 0.038603), so the fixed effect equation form for SumSel province is: $Y = 3.079734 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

f. Bengkulu has an intercept/constant value of 2.986364 (3.041131 - 0.054767), so the fixed effect equation for Bengkulu province is: $Y = 2.986364 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

g. Lampung has an intercept/constant value of 3.42875 (3.041131 + 0.387619), so the form of the fixed effect equation for Lampung province is: $Y = 3.42875 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

h. BaBel has an intercept/constant value of 3.598891 (3.041131 + 0.055776), so the fixed effect equation form for BaBel province is: $Y = 3.598891 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

i. KepRi has an intercept/constant value of 2.193567 (3.041131 - 0.847564), so the fixed effect equation form for KepRi province is: $Y = 2.193567 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

From the results of the analysis above, it can be seen that the cross section in the provinces on the island of Sumatra, if the value of each independent variable is constant, is as follows:

Table 8. Cross Section

Province	Y Value
Aceh	5.508722
SumUt	5.204825
SumBar	5.147723
Riau	5.476702
Jambi	5.517545
SumSel	5.440576
Bengkulu	5.347206
Lampung	5.789592
BaBel	5.959733
KepRi	4.554512

From the above data it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in the province of Babylon, considering the cross section of the calculation results of 5.959733, while for the lowest influence on the province of Riau Islands with a cross section value of 4.554512.

- DKI has an intercept/constant value of 0.99726 (3.041131 - 2.043871), so the fixed effect equation for DKI province is: $Y = 0.99726 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- JaBar has an intercept/constant value of 2.54336 (3.041131 - 0.497771), so the fixed effect equation form for JaBar province is: $Y = 2.54336 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- JaTeng has an intercept/constant value of 3.524266 (3.041131 + 0.483135), so the fixed effect equation form for JaTeng province is: $Y = 3.524266 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- DIY has an intercept/constant value of 3.155167 (3.041131 + 0.114036), so the form of the fixed effect equation for DIY province is: $Y = 3.155167 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- JaTim has an intercept/constant value of 3.173238 (3.041131 + 0.132107), so the fixed effect equation form for JaTim province is: $Y = 3.173238 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- Banten has an intercept/constant value of 1.834989 (3.041131 - 1.206142), so the form of the fixed effect equation for Banten province is: $Y = 1.834989 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$

From the results of the above analysis, it can be seen that the cross section of provinces on the island of Java, if the value of each independent variable is constant, is as follows:

Table 9. Cross Section

Province	Y Value
DKI	3.353642
JaBar	4.899742
JaTeng	5.880648
DIY	5.511549
JaTim	5.52962
Banten	4.191371

From the above data it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in the province of Central Java, considering the cross section of the calculation results of 5.880648, while for the lowest influence on the province of DKI with a cross section value of 3.353642.

- a. Bali has an intercept/constant value of 2.32554 (3.041131 - 0.715591), so the fixed effect equation form for Bali province is: $Y = 2.32554 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- b. NTB has an intercept/constant value of 1.942601 (3.041131 - 1.098530), so the fixed effect equation form for NTB province is: $Y = 1.942601 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$
- c. NTT has an intercept/constant value of 3.541331 (3.041131 + 0.500200), so the form of the fixed effect equation for NTT province is: $Y = 3.541331 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.

From the results of the analysis above, it can be seen that the cross section in the provinces on the island of Bali-NTB-NTT, if the value of each independent variable is constant as follows:

Table 10. Cross Section

Province	Y Value
Bali	4.686382
NTB	4.303443
NTT	5.902173

From the data above, it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in the province of NTT, considering the cross section of the calculation results of 5.902173, while for the lowest influence on the province of NTB with a cross section value of 4.303443.

- a. KalBar has an intercept/constant value of 3.854889 (3.041131 + 0.813758), so the form of the fixed effect equation for KalBar province is: $Y =$

$$3.854889 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$$

- b. Central Kalimantan has an intercept/constant value of 3.167125 (3.041131 + 0.125994), so the form of the fixed effect equation for Central Kalimantan province is: $Y = 3.167125 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- c. KalSel has an intercept/constant value of 2.094102 (3.041131 - 0.947029), so the fixed effect equation form for KalSel province is: $Y = 2.094102 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- d. KalTim has an intercept/constant value of 3.080524 (3.041131 + 0.039393), so the form of the fixed effect equation for KalTim province is: $Y = 3.080524 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- e. KalTara has an intercept/constant value of 3.261472 (3.041131 + 0.220341), so the form of the fixed effect equation for KalTara Province is: $Y = 3.261472 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.

From the results of the analysis above, it can be seen that the cross section in the provinces on the island of Kalimantan, if the value of each independent variable is constant, is as follows:

Table 11. Cross Section

Province	Y Value
KalBar	6.215731
KalTeng	5.527967
KalSel	4.454944
KalTim	5.441366
KalTara	5.622314

From the above data it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in the province of KalBar, considering the cross section of the calculation results of 6.215731, while for the lowest influence on the province of South Kalimantan with a cross section value of 4.454944.

- a. SulUt has an intercept/constant value of 2.412471 (3.041131 - 0.628666), so the form of fixed effect equation for SulUt province is: $Y = 2.412471 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- b. Central Sulawesi has an intercept/constant value of 3.152815 (3.041131 + 0.111684), so the fixed effect equation form for Central Sulawesi province is: $Y = 3.152815 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- c. South Sulawesi has an intercept/constant value of 3.177553 (3.041131 + 0.136422), so the fixed effect equation form for South Sulawesi province

is: $Y = 3.177553 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.

- d. SulTengg has an intercept/constant value of 3.239328 (3.041131 + 0.198197), so the fixed effect equation for SulTengg province is: $Y = 3.239328 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- e. Gorontalo has an intercept/constant value of 3.37507 (3.041131 + 0.333939), so the fixed effect equation form for Gorontalo province is: $Y = 3.37507 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.

From the results of the analysis above, it can be seen that the cross section in the provinces on the island of Sulawesi, if the value of each independent variable is constant, is as follows:

Table 12. Cross Section

Province	Y Value
SulUt	4.773313
SulTeng	5.513657
SulSel	5.538395
SulTengg	5.600170
Gorontalo	5.735912

From the data above, it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in Gorontalo province, considering the cross section of the calculation results of 5.735912, while for the lowest influence in North Sulawesi province with a cross section value of 4.773313.

- a. Maluku has an intercept/constant value of 4.286437 (3.041131 + 1.245306), so the form of the fixed effect equation for Maluku province is: $Y = 4.286437 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- b. MalUt has an intercept/constant value of 4.133312 (3.041131 + 1.092181), so the fixed effect equation form for MalUt province is: $Y = 4.133312 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- c. Papua has an intercept/constant value of 3.817824 (3.041131 + 0.776693), so the fixed effect equation form for Papua province is: $Y = 3.817824 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.
- d. PapBar has an intercept/constant value of 4.389827 (3.041131 + 1.348696), so the fixed effect equation form for PapBar province is: $Y = 4.389827 + 2.255060\ln X_1 - 2.349786\ln X_2 + 2.390019\ln X_3 + 0.030854\ln X_4 + 0.034695\ln X_5 + \epsilon_{it}$.

From the results of the analysis above, it can be seen that the cross section in the provinces on the Maluku-Papua island, if the value of each independent variable is constant, is as follows:

Table 13. Cross Section

Province	Y Value
Maluku	6.647279
MalUt	6.494154
Papua	6.178666
PapBar	6.750669

From the above data it is obtained that the contribution of land area, production volume, productivity, food per capita consumption and technology investment is very influential in the province of PapBar, considering the cross section of the calculation results of 6.750669, while for the lowest influence on the province of Papua with a cross section value of 6.178666.

Based on the results of the analysis per island in Indonesia, it can be described the contribution of land area, production volume, productivity, food per capita consumption and technology investment affecting food sufficiency is as follows:

Tabel 14. Cross Section

NO	PULAU	PROVINCE	CS
1	Sumatera	BaBel	5.959733
2	Jawa	JaTeng	5.880648
3	Kalimantan	KalBar	6.215731
4	Sulawesi	Gorontalo	5.735912
5	Bali dan Nusa Tenggara	NTT	5.902173
6	Papua dan Maluku	PapBar	6.750669

From the results of the above analysis, it is known that food sufficiency that needs attention in the variables of land area, production volume, productivity, per capita consumption and technology investment in Indonesia based on the largest cross section value is as follows:

Tabel 15. Cross Section

NO	PROVINCE	CS Value
1	PapBar	6.750669
2	KalBar	6.215731
3	BaBel	5.959733
4	NTT	5.902173
5	Jateng	5.880648
6	Gorontalo	5.735912

c. Hypothesis Test

To determine the effect of land area, production volume, productivity, food per capita consumption and technology investment simultaneously or together on food sufficiency in Indonesia, it can be seen from the results of the F test shown in the table below:

Table 16. Hypothesis Test

Influence	R-Squared	Adjusted R-Squared	F count	<i>p-value</i>	Decision
Simultaneous	0.910991	0.890493	44.44092	0.00000	Significant effect (Ha1 accepted)

Based on the table above, the *p-value* is smaller than the significance value of 0.05. Thus it can be concluded that H01 is rejected and Ha1 is accepted which states that land area, production volume, productivity, food per capita consumption and technology investment have a significant effect simultaneously or together on food sufficiency in Indonesia. From the model above, the R-squared value is 0.910991 and the Adjusted R-squared value is 0.890493, from which it is found that land area, production volume, productivity, food per capita consumption and technology investment simultaneously or jointly contribute to food sufficiency in Indonesia by 91.09% while the remaining 8.10% is the contribution of other variables besides the independent variables studied.

Furthermore, to determine the effect that land area, production volume, productivity, food per capita consumption and technology investment partially on food sufficiency in Indonesia, it can be seen from the following t test results:

Table 17. Test T

Partial Effect	β	t-statistic / t count	<i>p-value</i>	Decision
Land area (X1)	2.255060	0.617267	0.0379	Significantly influenced (Ha2 accepted)
Production volume (X2)	-2.349786	-0.643083	0.0211	Significantly influenced (Ha3 accepted)
Productivity (X3)	2.390019	0.653026	0.0146	Significantly influenced (Ha4 accepted)
Per capita food consumption (X4)	0.030854	0.303674	0.0518	Significantly influenced (Ha5 accepted)
Technology investment (X5)	0.034695	1.112873	0.0274	Significantly influenced (Ha6 accepted)

Based on the data above, the following is an interpretation of the effect of land area, production volume, productivity, food per capita consumption and technology investment partially on food sufficiency in Indonesia, namely:

1. The effect of land area on food sufficiency in Indonesia is as follows: Based on the table above, the statistical t value of land area is 0.617267 with a probability value of 0.0379. The statistical t value of land area is 0.617267 and is positive, indicating a positive effect of land area on food sufficiency. The probability value (Prob.) of land area of 0.0379 is smaller than the significance value of 0.05, then Ha2 is accepted so it can be concluded that land area significantly has a positive effect on food sufficiency in Indonesia.

2. The effect of production volume on food sufficiency in Indonesia is as follows: Based on the table above, the statistical t value of production volume is -0.643083 with a probability value of 0.0211. The statistical t-value of production volume is -0.643083 and is negative, indicating a negative effect of production volume on food sufficiency. The probability value (Prob.) of production volume of 0.0211 is smaller than the significance value of 0.05, then H_{a2} is accepted so it can be concluded that the production volume significantly negatively affects food sufficiency in Indonesia.
3. The effect of productivity on food sufficiency in Indonesia is as follows: Based on the table above, the statistical t value of productivity is 0.653026 with a probability value of 0.0146. The statistical t value of productivity is 0.653026 and is positive, indicating a positive effect of productivity on food sufficiency. The probability value (Prob.) of productivity of 0.0146 is smaller than the significance value of 0.05, then H_{a2} is accepted so it can be concluded that productivity significantly has a positive effect on food sufficiency in Indonesia.
4. The effect of productivity on food sufficiency in Indonesia is as follows: Based on the table above, the statistical t value of productivity is 0.653026 with a probability value of 0.0146. The t-statistic value of productivity is 0.653026 and is positive, indicating a positive effect of productivity on food sufficiency. The probability value (Prob.) of productivity of 0.0146 is smaller than the significance value of 0.05, then H_{a2} is accepted so it can be concluded that productivity significantly has a positive effect on food sufficiency in Indonesia.
5. The effect of food per capita consumption on food sufficiency in Indonesia is as follows: Based on the table above, the statistical t value of food per capita consumption is 0.303674 with a probability value of 0.0518. The t-statistic value of food per capita consumption is 0.303674 and is positive, indicating a positive effect of food per capita consumption on food sufficiency. The probability value (Prob.) of food per capita consumption of 0.0518 is smaller than the significance value of 0.05, then H_{a2} is accepted so it can be concluded that food per capita consumption significantly has a positive effect on food sufficiency in Indonesia.
6. The effect of technology investment on food sufficiency in Indonesia is as follows: Based on the table above, the t-statistic value of technology investment is 1.112873 with a probability value of 0.0274. The t-statistic value of technological investment is 1.112873 and is positive, indicating a positive effect of technological investment on food sufficiency. The probability value (Prob.) of technological investment of 0.0274 is smaller than the significance value of 0.05, then H_{a2} is accepted so it can be concluded that technological investment significantly has a positive effect on food sufficiency in Indonesia.

- **Regression test model - 2**
- a. Regression model selection

Table 18. Chow test

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	18.274216	(33,169)	0.0000
Cross-section Chi-square	309.906488	33	0.0000

Table 19. Hausman test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.460364	1	0.0021

Based on the chow and hausman tests, the probability value is <0.05 , so it is concluded that the panel data regression model is to use the Fixed Effect Models (FEM).

Table 20. Regression Fixed Effect

Dependent Variable: Z
Method: Panel Least Squares
Date: 10/23/24 Time: 12:37
Sample: 2018 2023
Periods included: 6
Cross-sections included: 34
Total panel (balanced) observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.33848	0.074738	165.0895	0.0000
Y	-0.229861	0.033856	-6.789455	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.793706	Mean dependent var	12.84353
Adjusted R-squared	0.752203	S.D. dependent var	0.207370
S.E. of regression	0.103227	Akaike info criterion	-1.548855
Sum squared resid	1.800835	Schwarz criterion	-0.979570
Log likelihood	192.9832	Hannan-Quinn criter.	-1.318569
F-statistic	19.12410	Durbin-Watson stat	1.810375
Prob(F-statistic)	0.000000		

From the output results in the table above, the following is the interpretation of panel data regression with a fixed effect model used to estimate the effect of food sufficiency on the poverty line in Indonesia, namely model 2 equation below:

$$Z = \beta_0 - \beta_1 \hat{Y}_{it} + \epsilon_{it}$$

The calculation results in the table above can be explained as follows:

$$Z = 12.33848 - 0.229861 \hat{Y}_{it} + \epsilon_{it}$$

From the form of the regression equation above, it can be interpreted as follows:

1. The constant value of 12.33848 means that in statistical calculations if all *ceteris paribus* variables have a constant value, then the number of poor people is 12.33848 units.
2. The value of the regression coefficient β_1 is -0.229861, meaning that the elasticity of GRDP on the number of poor people is $E = -0.229861$. Because $E < 1$, an increase in food sufficiency is inelastic to a decrease in the poverty line.

b. Hypothesis testing

To determine the effect of food sufficiency on the poverty line in Indonesia, it can be seen from the results of the F test displayed in the table below:

Table 21. F Test

Influence	R-Squared	Adjusted R-Squared	F count	p-value	Decision
Parsial	0.793706	0.752203	19.12410	0.00000	Significant influence

Based on the table above, the t-statistic value of food sufficiency is -6.789455 with a probability value (p-value) of 0.0000. The t-value of the GRDP statistic is -6.789455 and has a negative value, indicating that food sufficiency has a negative effect on the poverty line. The probability value (p-value) of 0.0000 is less than the significance value of 0.05, it can be concluded that H_0 is rejected, and H_a is accepted, which means that food sufficiency has a negative and significant effect on the poverty line in Indonesia.

The magnitude of the effect of food sufficiency on the poverty line is indicated by the R-squared value of 0.793706, which means that food sufficiency affects the poverty line by 79.37% and the remaining 20.63% is influenced by other factors outside the model studied.

- **Model feasibility test**

A good research model is required to meet the characteristics set out in an econometric model (the goodness of an econometric model). In accordance with Wirasmita (2008, p.124), the model feasibility test results show that the research model has met the goodness of an econometric model.

1) Theoretical Plausibility

This research model test shows whether the test results are in accordance with the expectations of the economic theory on which they are based.

Table 22. Model Feasibility Test

Relationship between Variables	Pra Estimation	Pasca Estimation	Conformity
Area (X1)	X1 : positif	X1 : positif	Appropriate
Production volume (X2)	X2 : negatif	X2 : negatif	Appropriate
Productivity (X3)	X3 : positif	X3 : positif	Appropriate
Per capita food consumption (X4)	X4 : positif	X4 : positif	Appropriate
Technology investment (X5)	X3 : positif	X3 : positif	Appropriate

In the table above, it can be explained that the theoretical plausibility test shows that the model before estimation and after estimation is in accordance with expectations.

1) Accuracy of the estimates of the parameters

The research model produces an accurate feasibility test for future estimation purposes if each variable has a p-value $< \alpha = 0.05$.

Table 23. Accuracy of the Estimates of the Parameter

Variabel Independent	ρ - value	Information
Model - 1		
Area (X1)	0.0379 < 0.05	Accurate
Production volume (X2)	0.0211 < 0.05	Accurate
Productivity (X3)	0.0146 < 0.05	Accurate
Per capita food consumption (X4)	0.0518 < 0.05	Accurate
Technology investment (X5)	0.0274 < 0.05	Accurate
Model - 2		
Food Adequacy	0.0000 < 0.05	Accurate

In the table above, it can be explained that the Accuracy of the Estimates of the Parameters test shows that the model shows an accurate feasibility test for future estimation purposes because each variable has a p-value $< \alpha = 0.05$.

1) Explanatory ability

The research model has a high ability to explain the relationship between the economic phenomena studied. The standard error of estimates (SE) is high, where variance error of estimates = $SE^2 < \text{mean square of regression}$ in the Anova table as can be seen in the table below:

Table 24. Explanatory Ability

Partial Effect	Koefisien Regresi	Standard Error (SE)	1/2 Beta	Test Results
Model 1				
Area (X1)	2.255060	3.653298	1.12753	SE > ½ Regression Coefficient
Production volume (X2)	2.349786	3.653942	1.174893	SE > ½ Regression Coefficient
Productivity (X3)	2.390019	3.659912	1.1950095	SE > ½ Regression Coefficient
Per capita food consumption (X4)	0.030854	0.101602	0.015927	SE > ½ Regression Coefficient
Technology investment (X5)	0.034695	0.031176	0.017347	SE > ½ Regression Coefficient
Model - 2				
Food sufficiency (Y)	0.0229861	0.033856	0.01149305	SE > ½ Regression Coefficient

The calculation recapitulation above explains that the explanatory ability test shows that the entire model shows a standard error greater than ½ β. This means that each variable has a low capacity to explain the relationship between the variables studied.

2) Forecasting ability

Testing whether this research model will have a high predictive ability for the behavior of the dependent variable which is indicated by the high coefficient of determination as follows:

Table 24. Forecasting Ability

Variabel	Coefficient of Determination Adjusted R-Squared / R-Squared	Information
Model 1		
Effect of area, production volume, productivity, per capita food consumption and technology investment on food sufficiency	91.09% > 50 %	Appropriate
Model 2		
Effect of food sufficiency on the poverty line	79.37% > 50 %	Appropriate

In the table above, it can be explained that the forecasting ability test on all models shows the adjusted R Squared / R-squared value above 50% so that it has a high predictive ability for the behavior of the dependent variable. Thus, from all model feasibility tests, all models from this study have met the research feasibility standards.

Based on the results of the Model Feasibility Test, all research models produce research models that have met the goodness of an econometric model or characteristics that can be expected according to the reference. Thus the implication of the results of the model feasibility test shows that:

All hypotheses in all models proposed by the researcher before the research was carried out were in accordance with what was expected and the

theory and international journals that had been published were the basis for their rationale.

1. All research models were found to be accurate for future estimation purposes, so they can be used to predict GRDP and the number of poor people.
2. All research models show a standard error greater than $\frac{1}{2} \beta$. This means that each variable has a low capacity to explain the relationship between the variables studied, so it can be used as input for future researchers to examine other variables outside of this study.
3. All research models have a high predictive ability for the behavior of the dependent variable, which is indicated by the high coefficient of determination so that the selection of independent variables made by researchers shows accurate accuracy so that it has a dominant influence on the dependent variable compared to variables that are not studied with an average coefficient of determination above 50 (fifty) percent for each variable.

CONCLUSION

- a. This study was conducted to analyze the contribution of food self-sufficiency to food sufficiency and its impact on the poverty line in Indonesia. Productivity is expected to have a negative and significant effect on food sufficiency investment, while land area, production volume, per capita food consumption and technology investment have a positive and significant effect on food sufficiency, and food sufficiency has a negative and significant effect on the poverty line.
- b. There are 6 hypotheses proposed in this study with the following conclusions: Simultaneously, if the variables of land area, production volume, productivity, per capita food consumption and technology investment are constant, then food sufficiency will be met, while partially based on the data above, the relationship between the land area variable and the food sufficiency variable has a positive relationship, meaning that the land area significantly has a positive effect on food sufficiency in Indonesia, the production volume variable significantly has a negative effect on food sufficiency in Indonesia, The productivity variable significantly has a positive effect on food sufficiency in Indonesia, meaning that the higher the productivity of farmers in producing agricultural products, the food needs will be fulfilled The productivity variable significantly has a positive effect on food sufficiency in Indonesia, food per capita consumption significantly has a positive effect on food sufficiency in Indonesia, technology investment significantly has a positive effect on food sufficiency in Indonesia.

REFERENCES

- Bihun, N., Aliksieieva, I., Herasina, S., Yelchaninova, T., Meshko, O., Sobkova, S. (2023). Self-Sufficiency as a Factor in the Development of the System of Psychological al Self-Regulation of Personality. *Revista Românească pentru Educație Multidimensională*, 15(3), 15-30. <https://doi.org/10.18662/rrem/15.3/750>
- Enriquez J,P (2020). Food SelfSufficiency: Opportunities and Challenges for the Current Food System. *Biomed J Sci & Tech Res* 31(2). BJSTR. MS.ID.005061
- Erokhin, Vasilii. (2017). "Self-Sufficiency versus Security: How Trade Protectionism Challenges the Sustainability of the Food Supply in Russia" *Sustainability* 9, no. 11: 1939. <https://doi.org/10.3390/su9111939>.
- González C.C, Barriga M.F.D (2019) *Rev Esp Nutr Comunitaria La seguridad alimentaria y nutricional en una comunidad indígena de México.* https://www.renc.es/imagenes/auxiliar/files/RENC_2019_3_04_GC_Lopez_Seguridad_alimentaria_comunidad_indigena_de_Mexico.pdf
- Hernanto, F. 2003. Ilmu Usahatani. Penebar Swadaya. Jakarta
- Lexy J. Moleong. (2011). Metodologi Penelitian Kualitatif, Cetakan Ke-XXIX, Bandung: Remaja Rosdakarya.
- Laborde.D, Lakatos, C, Martin, W. (2019). Poverty Impact of Food Price Shocks and Policies, Macroeconomics, Trade and Investment Global Practice
- Murdiantoro, Bayu. (2011). Faktor-faktor yang Mempengaruhi Produksi Padi di Desa Pulorejo Kecamatan Winong Kabupaten Pati. Semarang: Universitas Negeri Semarang
- Nicholson, Walter. 2012. Mikroekonomi Intermediate dan Aplikasinya. Jakarta: Erlangga.
- Reksoprayitno. (2004). Sistem Ekonomi dan Demokrasi Ekonomi. Jakarta: Bina Grafika.
- Vilar-Compte, M., Burrola-Méndez, S., Lozano-Marrufo, A. *et al.* (2021). Urban poverty and nutrition challenges associated with accessibility to a healthy diet: a global systematic literature review. *Int J Equity Health* 20, 40 <https://doi.org/10.1186/s12939-020-01330-0>
- Kostas G. Stamoulis, Prabhu, Pingali and Prakash S. (2004). Emerging Challenges for Food and Nutrition Policy in Developing Countries. Agricultural and Development Economics Division Vol.1 No2 (ESA) FAO. <http://ageconsearch.umn.edu/record/12000/files/01020154.pdf>
- Salikin, A. 2003. Sistem Pertanian Berkelanjutan, Yogyakarta: Kanisius.
- Salvador, L. M. (2016). Seguridad alimentaria, autosuficiencia y disponibilidad del amaranto en México. *Problemas Del Desarrollo*, 47(186), 107-132. <https://www.jstor.org/stable/90012697>