



# Independence of the Agricultural Sector in the Province of Central Java

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**Abstract.** The primary source of carbohydrates is corn, which serves as both a local staple meal and a national staple food. The demand for corn will keep rising year after year, necessitating attempts to boost production. The production of maize can be influenced by the availability of land, the availability of labor and other resources, the potential yield, and technology. This study intends to ascertain the direction and size of the influence of labor, land area, district minimum wage, and regional original income on corn output in 32 cities/districts in Central Java province during the 2018–2019 period. The panel regression model with the chosen panel regression estimation model, which is the fixed effect model, is the research methodology used. The study's findings demonstrate that the simultaneous effects of labor, land area, district minimum wage, and regional original income on corn production. In Central Java province, only land area has a significant impact on corn production, whereas labor, district minimum wages, and regional original income have no bearing.

**Keywords:** Agricultural Sector Independence · Production of Corn · Panel

## 1 Introduction

Indonesia is an archipelago with a lot of natural potential. Because of its plentiful natural resources, Indonesia is known as an agricultural nation. The agricultural sector plays a crucial role in developing a nation's economy, especially when it comes to increasing domestic food self-sufficiency. Food independence is an absolute requirement for national security [1]. The Gross Regional Domestic Product (GRDP), which is helpful in planning development, reflects economic progress and is classified into nine economic sectors, one of which is the agriculture sector, which makes a significant contribution to development [2]. According to the traditional Kuznets theory, the agricultural sector is crucial to the development of a nation's economy [2]. The Central Java Statistics Agency (BPS) reports that the agricultural sector's contribution to the gross domestic product (GRDP) was Rp. 40.171.161,35 million in 2018 and Rp. 38.385.233,60 in 2019.

One of the fundamental needs that every person has is food. The agricultural commodity that is often used by the Indonesian people to fulfil food is rice. People make rice their daily staple food, therefore the demand for rice in Indonesia is quite high, according to

the Central Java Statistics Agency (BPS) in 2018 rice production reached 10.499.588,23 tons and in 2019 it was 9.655.653,98 tons. Indonesian people consume more rice than needed, to improve the hopeful food pattern it is recommended that approximately 50% of food comes from grains, and the rest is tubers [3]. In Indonesia, there are many types of agricultural commodities that can replace rice as a staple food, one of which is corn. The main alternative staple food after rice is corn food crops [4].

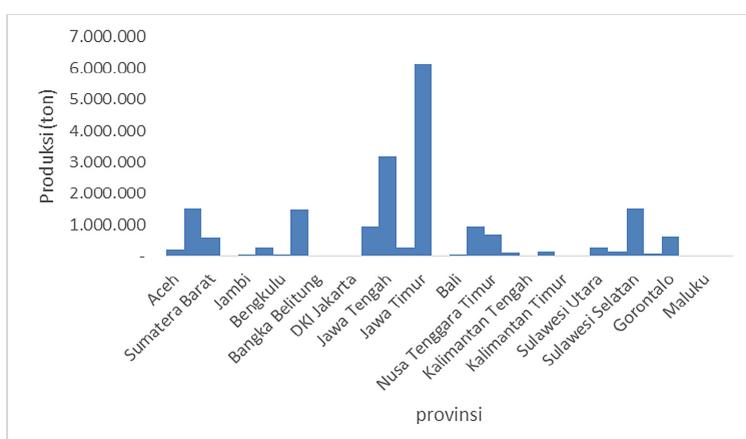
Corn is an agricultural food commodity that can be used as a substitute for rice as a staple food for most Indonesian people. Corn serves as a national staple food as well as a local staple, making it the main source of carbohydrates [5]. Along with the increase in people's economic living standards and the development of animal feed businesses, there will be an increase in demand for corn. Therefore, efforts need to be made to increase output by using human and natural resources, land availability, prospective results, and technology [6]. To increase the production of food crops, especially maize, the quality of agriculture must be improved.

Production is the relationship between inputs, or the things that go into making something, and output, or the finished product [4]. In the agricultural industry, there are several production related variables, such as land acreage, fertilizer, seeds, and labor [6]. The yield per hectare and harvested area are essentially the two factors that determine production [4].

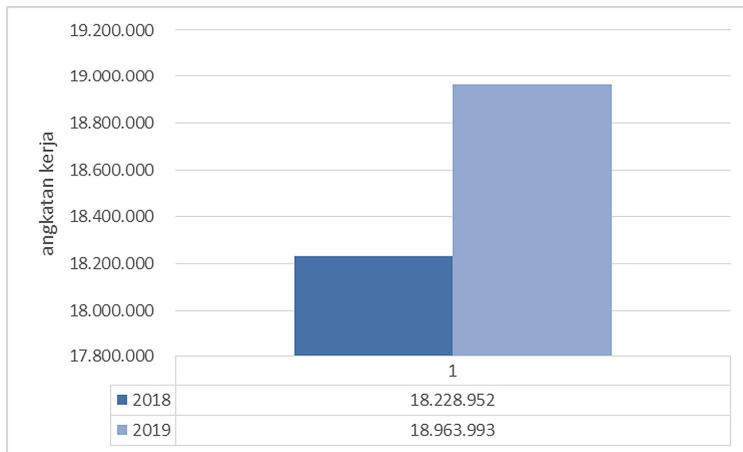
After East Java, Central Java is one of the Indonesian provinces with the highest amount of corn production. According to earlier studies, it was found that the development of national corn production from 1993–2015 fluctuated but showed a significant increasing trend, and provinces that had high corn production were East Java, Central Java, and Lampung [7].

According to Fig. 1, Central Java, which produced 3.212.392 tons of corn, had the second highest corn production rate behind East Java.

Based on Fig. 2 shows that the level of the labor force in Central Java province has increased quite a lot, in 2018 the number of the workforce in Central Java was 18.228.952



**Fig. 1.** National Corn Production by Province.



**Fig. 2.** Level of the Central Java Province Workforce 2018–2019.

people and in 2019 it was 18.963.993 people, this means that in the period one year the workforce in Central Java has increased by 735.041 people. It is anticipated that an increase in the labor force will be able to stimulate an increase in agricultural output, particularly corn production in Central Java as a potential food crop.

Central Java province has potential and problems related to agricultural development, according to the given background. In essence, the need for food will continue to grow from year to year for various reasons. In order to understand the elements that lead to agricultural development, it is important to assess the level of self-reliance of the agricultural sector in Central Java. Therefore, this study was conducted to determine the factors that influence corn production as a reflection of food independence. Corn food crop production was used in this study as the dependent variable.

## 2 Theoretical Review

### 2.1 Production Theory

Production is the transformation of at least two inputs into at least one output (product) [8]. The production function in a production process refers to the association between the production elements and the output [9]. Using the production function, one may directly assess the link between production factors and output [8]. The survival of the community cannot be separated from economic activities, one of which is production activities. The importance of carrying out production activities because it is a link in the chain of economic activities that are important for the survival of the community.

In carrying out the production process requires production factors, namely tools or means to carry out the production process [10]. These factors include humans, in this case the amount of labor, capital in the form of money or it can also be in the form of tools/machines and natural resources in the form of land. These factors have different roles and functions but are interrelated with each other.

## 2.2 Production of Corn

One of the agricultural products with significant relevance for food self-sufficiency is corn [11]. In addition to being a source of raw materials for the production of sustainable bio energy, corn offers several advantages as a substitute for rice as a staple diet. In Indonesia, corn as a food ingredient is the second source of carbohydrates after rice, from the many types of corn food, including a superior commodity [12].

## 2.3 Labor's Impact on Corn Production

The population of working age, defined as those between the ages of 10 and 64, is known as labor [9]. Increased labor force numbers will be able to produce higher production yields [9].

An earlier study that using multiple linear analysis discovered that seeds in Lau Baleng village, Karo district, had an impact on corn output, with a regression coefficient of 0.651 and an empirical significance of  $2.163 > 2.06$ . Land area, labor, and fertilizer, with empirical t significance values of  $1.824 (>0.05)$ ,  $0.117 (>0.05)$ , and  $1.283 (>0.05)$ , respectively, have no impact. It uses a linear relationship pattern [13].

Using multiple linear analysis, it was discovered that capital, land area, and fertilizer all have an impact on the amount of maize produced in Tanah Toa Village, with regression coefficients of 2.141, 6.099, and 2.086 and empirical significance values of  $0.038 (<0.05)$ ,  $0.000 (<0.05)$ , and  $0.043 (<0.05)$ , respectively. These three variables have a linear-linear relationship with corn production. With a significance of  $0.103 (> 0.05)$ , labor has a detrimental but minor impact on corn production [14].

## 2.4 Land Area's Impact on Corn Production

The low area of agricultural land causes low agricultural production, so the need for imported agricultural goods into the country will be even greater, then dependence on imports will affect social, economic and political stability [15].

Land use properly can be a solution in increasing food production in order to maintain food security. The impetus for the conversion of land to non-agricultural land is thought to have a role in the availability of community food [16].

Rice production and maize area in Indonesia between 2006 and 2011 had a substantial impact on maize production, according to panel data regression analysis using the Fixed Effect Model (FEM), with regression coefficients of 0.128571 and 3.28, respectively, and significance levels of  $0.000 (<0.05)$ . With an empirical significance of  $0.0520 (>0.05)$ , GRDP is not significant and has no direct impact on maize yield. The variables of rice production, corn area, and GRDP with corn production are realized by a linear relationship pattern [4].

## 2.5 Wages' Impact on Corn Production

The level of wages received by a person can affect productivity. A high wage level will increase productivity or work motivation which will have an effect on increasing production and vice versa, so it is concluded that wages and production have a positive relationship [17]. In conventional economic theory, it is explained that the provincial minimum

wage can increase labor productivity and reduce the consequences of unemployment [18].

It was discovered that maize production is lucrative in some regions of Bangladesh using a multistage stratified random sampling. The cost-benefit ratio is greater than 2, and the average net yield per hectare is 32392 bdt. A profit inefficiency of 29% is shown by the profit efficiency score of 0.71. According to this study, the primary causes of profit inefficiency are age, education level, extension experience, and non-farm income [19].

## 2.6 Regional Original Income (PAD) Impact on Corn Production

Revenue from the region that results from separate regional wealth management and other legal regional original income is referred to as regional original income (PAD) [20]. The existence of regional original revenue serves as a means of decentralization by enabling local governments to finance the implementation of regional autonomy in accordance with regional capacity.

In order to improve the quality of agriculture, it is necessary to involve the government in the form of spending in the form of agricultural financing and Regional Original Income (PAD) can be one source of government expenditure. Regional Original Revenue can increase the allocation of government spending to the community by making expenditures [20]. Government spending is spending by local, state, and federal governments [20].

Capital expenditures have an impact on government spending due to regional Original Revenue (PAD). Using t test, coefficient of determination analysis, and simple linear regression analysis, it was discovered that PAD significantly affected capital spending in Langsa city from 2006 to 2015, having a 40.6% impact [21].

Using the panel data approach, a two-stage least squares model, and the chosen Random Effect Model (REM), it was discovered that government expenditure on improving road quality, subsidizing fertilizer, and purchasing agricultural equipment and tools had an impact on raising agricultural production. While agricultural output has no impact on lowering rural poverty, agricultural productivity, income, and farmer exchange rates can significantly do so [22].

In Sumatra, it was discovered through panel data regression using the Fixed Effect Model (FEM) method that whereas irrigation had a significant beneficial impact on the agricultural sector, road infrastructure had a positive but non-significant impact [23].

## 3 Method

In this study the data used are secondary data sourced from the Central Statistics Agency (BPS) and the Department of Agriculture and Plantations (DISTANBUN). The secondary data is presented in the form of *time series* and *cross section*. The data analysis method used in this research is using panel data regression analysis. Panel data regression analysis is a regression analysis based on panel data to observe the relationship between one dependent variable (dependent) and one or more independent variables (independent) [24].

The objects in this study include corn production as the dependent variable, labor, land area, district minimum wage, and local revenue as an independent variable. The unit of analysis in this study is 32 cities/districts in Central Java province except for Surakarta, Pekalongan, and Tegal (the three cities do not have agricultural land).

The panel data used in this study will be analyzed using reviews 9, with the following econometric model:

$$PJ_{it} = \beta_0 + \beta_1 TK_{it} + \beta_2 LL_{it} + \beta_3 UMK_{it} + \beta_4 PAD_{it} + \varepsilon_{it}$$

Description:

$PJ$  = corn production (tons)

$TK$  = Labor (soul)

$LL$  = Harvested Area (ha)

$UMK$  = District Minimum Wage (rupiah)

$PAD$  = Regional Original Income (billion rupiah)

$\beta_0$  = constant

$\beta_1 \dots \beta_4$  = independent variable regression coefficient

$\varepsilon$  = error term

$i$  = Regency/City to i

$t$  = year t

Common effects, fixed effects, and random effects were used to analyze the model selection. The Chow test, Hausman test, and Lagrange multiplier test are used to choose the best model [25].

## 4 Discussion and Results

### 4.1 Result

The econometric estimation results that have been carried out using the Pooled Least Square (PLS) approach, Fixed Effect Model (FEM), Random Effect Model (REM) along with the results of the model selection test are summarized in Table 1.

The Fixed Effect Model (FEM) was determined to be the best estimated model according to the results of the Chow and Hausman tests, as evidenced by the probability or empirical significance of the  $F$  and the  $\chi^2$  statistics, each of which was worth 0.0000 ( $<0.01$ ) in value. Tables 2 and 3 display the total estimation outcomes of the FEM estimated model.

Table 2 shows that the FEM has a very good predictive capability with a probability or empirical statistical significance F of 0.0000 ( $<0.01$ ) and a coefficient of determination ( $R^2$ ) of 0.9979. The land area variable (LL), which is one of the four variables in the econometric model, has an effect on corn production with a probability or empirical statistical significance  $t$  of 0, 0434 ( $<0.10$ ), therefore its predictive capability must be taken seriously.

The land area variable has a linear-linear relationship and a regression coefficient value of 1.251811. In other words, the production of maize will grow by 125.18 quintals if the land area increases by 1 hectare. On the other hand, the yield of corn will drop by 125.18 quintals if the land area drops by 1 hectare.

**Table 1.** Econometrics estimation result.

Variable	Regression Coefficient		
	PLS	FEM	REM
C	-41711,67	67204,21	-56954,12
TK	0,028713	-0,027245	0,037069
LL	6,106514	1,251811	5,807941
UMK	0,018071	0,031342	0,029220
PAD	-12,22645	-54,23534	-21,75366
R <sup>2</sup>	0,975891	0,997943	0,925779
Adjusted. R <sup>2</sup>	0,974256	0,995372	0,920748
Statistic F	597,0435	388,1770	183,9820
Prob. Statistik F	0,000000	0,000000	0,000000
Model selectin test			
Chow			
Cross-Section F (31,28) = 9,684858; Prob. F (31,28) = 0,0000			
Hausman			
Cross-Section random $\chi^2$ (4) = 66,669449; prob. $\chi^2$ (4) = 0,000			

Primary Data Processed

**Table 2.** Fixed Effect Model (FEM) Estimation.

$\widehat{PJ}_{it} = 67204,21 - 0,027245TK_{it} + 1,251811LL_{it} + 0,031342UMK_{it} - 54,23534PAD_{it}$				
(0,3959)	(0,8533)	(0,0434) ***	(0,1771)	(0,3417)
$R^2 = 0,9979$ ; DW-Stat = 3,8787; F-Stat = 388,177; Prob. F-stat = 0,000				

Source: Statistics Agency (BPS), processed. **Note:** \* significant at  $\alpha = 0,01$ ; \*\* significant at  $\alpha = 0,05$ ; \*\*\* significant at  $\alpha = 0,10$ ; the number in brackets is the probability value of t statistic

Table 3 shows that the Grobogan district has the highest constant value, which is 594355.81. Cities and districts in Central Java Province typically produce more corn than other districts in the province due to the influence of the factors labor, land area, regency minimum wage, and original regional revenue. The two regencies with the largest constants after Grobogan Regency are Blora Regency and Wonogiri Regency.

Salatiga, with a constant value of -41507.99, is the city with the lowest value. In other words, Salatiga often produces less corn than other districts or cities in Central Java Province due to the influence of the factors Manpower, Land Area, District Minimum Wage, and Regional Own Revenue. The two districts with the lowest constants, after the city of Salatiga, are Magelang and Pekalongan.

**Table 3.** Region Effects and Constants

No.	Regency/City	Region Effect	Region Constants
1	Kab. Cilacap	-40121,73	27082,48
2	Kab. Benyumas	-36538,39	30665,82
3	Kab. Purbalingga	-58691,99	8512,22
4	Kab. Banjarnegara	-52258,38	14945,83
5	Kab. Purworejo	-73047,36	-5843,15
6	Kab. Kebumen	-50715,14	16489,07
7	Kab. Wonosobo	-55894,76	11309,45
8	Kab. Magelang	-56377,05	10827,16
9	Kab. Boyolali	35679,69	102883,9
10	Kab. Klaten	-4833,05	62371,16
11	Kab. Sukoharjo	-73416,72	-6212,51
12	Kab. Wonogiri	151382,3	218586,51
13	Kab. Karanganyar	-72542,17	-5337,96
14	Kab. Sragen	48165,8	115370,01
15	Kab. Grobogan	527151,6	594355,81
16	Kab. Blora	187301,9	254506,11
17	Kab. Rembang	-6524,295	60679,915
18	Kab. Pati	66743,35	133947,56
19	Kab. Kudus	-73605,19	-6400,98
20	Kab. Jepara	-34527,22	32676,99
21	Kab. Demak	9856,344	77060,554
22	Kab. Semarang	-42257,18	24947,03
23	Kab. Temanggung	-35872,71	31331,5
24	Kab. Kendal	69667,16	136871,37
25	Kab. Batang	-35301,76	31902,45
26	Kab. Pekalongan	-86933,41	-19729,2
27	Kab. Pemalang	-48016,94	19187,27
28	Kab. Tegal	26863,54	94067,75
29	Kab. Brebes	36070,92	103275,13
30	Kota Magelang	-102730,4	-35526,19
31	Kota Salatiga	-108712,2	-41507,99
32	Kota Semarang	-9964,576	57239,634

Primary Data Processed

## 4.2 Discussion

Land area is known to have a positive effect on corn output during the 2018–2019 in 32 district cities in Central Java. The production of maize will rise as land area increases. The findings of this study are consistent with earlier research carried out in Bangladesh, which discovered that land usage for non-agriculture caused a reduction in the amount of planting space available for agriculture, but that better irrigation led to an increase in cropping intensity [26]. Additionally, earlier studies from Indonesia shown that land area has a positive effect on maize productivity [4].

This positive influence shows that the land area is in accordance with the previous theory where the amount of land used in farming to produce production is able to affect the quantity of the production [27]. The conditions that occur in this study indicate that the independence of the agricultural sector in Central Java is quite strong because an increase in the available land area can increase corn production.

In this study, the amount of workers in Central Java had no impact on corn production. As more people are employed, less will be produced; this can be attributed to a variety of social reasons, including labor inefficiencies. According to the previous view, the number of workers not in accordance with the area of land that can be planted will cause a decrease in production due to labor inefficiency [14].

This research involves the government's role as a provider of financing capital for the sector. The financing is used as expenditure to facilitate the agricultural sector, the source of the financing is explained through the Regional Original Income (PAD). The results of the study indicate that Local Original Income does not have a significant effect but simultaneously has an effect on corn production. Previous research explained that regional income has a positive influence on district/city regional expenditures in East Java and this expenditure has an influence on regional growth. Regional expenditures need to be considered as well as possible so that allocations to sectors and projects can increase productivity [28].

According to the study's findings, each city and district in Central Java has different constants. This is because each region has different strengths and potentials. It is evident which locations have the potential to be explored in order to increase optimal maize output from the variations in these constants. Additionally, it is apparent that the region with the smallest constant produces relatively little corn. Further study on the potential of each region can be done based on these distinctions in order to enhance the agricultural and economic development of the cities and districts in the province of Central Java.

## 5 Conclusion

It is clear from the research and discussion's findings that land area is the only factor that matters. While the other three variables, namely labor, district minimum wages, and local revenue have no effect on corn production in cities/districts in Central Java.

Limited data is one of the obstacles in the observation considering the data used in the form of secondary data. However, this study presents something new from previous research, namely the use of variables related to the government to show the government's role in agricultural development through corn production.

In order to grow agriculture and foster independence, government and community cooperation is required. The government should be able to increase the current potential through established programs, particularly in the agriculture sector. One strategy to enhance corn production is through raising the standard of human resources and providing sufficient agricultural infrastructure, particularly in relation to land. Communities with their level of expertise should be able to enhance maize production by pursuing agricultural innovation.

It is anticipated that future study will be able to develop this research model using these additional variables and alternative approaches for model estimation, resulting in more diverse outcomes.

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**Authors' Contribution.** Identifying the elements that influence maize output as a measure of food security, with the independent variables being labor, land area, the regional minimum wage, and local revenue. Usually, the independent variable of municipal revenue was not used in earlier studies.

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