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The Impact of Agricultural Sector on Food Security

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Abstract

This study aims to determine the effect of workers in agricultural sector, income, access to clean water, and regional spending on food security in East Nusa Tenggara Province. This study uses panel data which is a combination of cross-section data from 22 districts/cities in East Nusa Tenggara Province and time series data from 2018-2021 which is then analyzed using multiple regression. The results show that the best estimation model is the Fixed Effect Model with the Generalized Least Squares (GLS) method. Based on the estimation result, it shows that the adjusted R2 is 0.91461. Assuming ceteris paribus, partially income and access to clean water has a significant positive effect on food security. Meanwhile, workers the agricultural sector has a significant negative effect on food security and local government expenditure has a non-significant positive effect on food security.

Keywords: Food Security, Income, Workers in Agricultural Sector, Local Government Expenditure

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INTRODUCTION

Food is a basic human need that must be fulfilled and cannot be delayed. According to the hierarchy of needs initiated by Abraham Maslow, food is a basic physiological need that must be met before non-primary needs are met (Sumarwan, 1997). The United Nations has made the fulfillment of nutritious food one of the sustainable development goals, namely eradicating hunger, achieving food security, improving nutrition, and promoting sustainable agriculture. Given the high importance of food, the need for food is a human right. But the irony

is that there are still many people who have not been able to fulfill this essential need of life.

Research from the Food and Agriculture Organization (2021) reported that globally the number of people suffering from hunger in the period 2018 to 2020 tends to increase. A total of 768 million people in the world in 2020 are still hungry or equivalent to 9.91 percent of the world's population. Based on the value of the Global Hunger Index (2021), in Southeast Asia, Indonesia's hunger rate ranks 3rd after Timor Leste and Laos. Indonesia's hunger level is classified as moderate with a score of 18 points. The score is still above the global average of 17.9 points. Furthermore, the condition of Indonesia's food security is still low. The Economist Intelligence (2021), noted in Global Food Security Index (GFSI) of Indonesia's food security index is 59.2 from the range 0-100. This puts Indonesia in 69th position out of 113 countries evaluated.

Table 1. Food Security Index in Nusa Tenggara Islands 2018-2021

Province	FSI			
	2018	2019	2020	2021
Bali	81.61	85.15	84.54	83.82
West Nusa Tenggara	72.20	62.43	75.60	75.67
East Nusa Tenggara	61.02	50.70	66.90	67.4
National Average	67.45	66.48	72.11	72.43

Source: Food Security Agency, 2022

The food security index in Indonesia measured based on three aspects which include aspects of food availability, affordability, and utilization. Based on the publication of the Badan Ketahanan Pangan, the score of the food security index (FSI) of the Nusa Tenggara Islands is 75.61. This places the Nusa Tenggara Islands as the area with the highest FSI after Java (79.01) and Sulawesi (77.92). The FSI scores of the provinces in the Java and Sulawesi islands are above the national average of 72.43. Meanwhile, in the Nusa Tenggara Islands, which consist of the provinces of Bali, West Nusa Tenggara, and East Nusa Tenggara, there is one province whose food security index achievement is always below the national average, namely the province of East Nusa Tenggara.

Table 1 shows the FSI score of East Nusa Tenggara Province during 2018-2021 which fluctuated but tends to increase and is classified as food secure provinces. Even though it tends to increase, the FSI of East Nusa Tenggara Province is still below the Nusa Tenggara Islands average of 75.61 and below the national average of 72.43. In addition, East Nusa Tenggara is the province with the lowest FSI score compared to the other 2 provinces in the Nusa Tenggara Islands.

Furthermore, based on the Food Security and Vulnerability Atlas (2021) , it is known that 13 regencies out of 22 regencies/cities in East Nusa Tenggara Province are categorized in priority areas 2 to 4. This figure is an increase compared to the previous period of 10 districts. In detail, in 2021 as many as 1 district is classified as priority 2 (vulnerable), 2 districts are classified as priority 3 (somewhat vulnerable), and 10 districts are classified as priority 4 (somewhat resistant).

The dominance of the region in East Nusa Tenggara Province that is not yet food secure indicates that the Province of East Nusa Tenggara is still far from the sustainable development goals of alleviating hunger, achieving food security, and improving nutrition so that food security development programs are still needed.

The issue of food has been a concern for a long time. In the 18th century, Thomas Robert Malthus argued that if preventive measures were not taken, the rate of population growth would increase according to a geometric progression,

while food production would grow arithmetically. Therefore, according to Malthus' perspective, future generations will be faced with problems regarding food availability (Winsdel, Pieris and Airlangga, 2015).

However, this view of Malthus has been criticized because Malthus did not take into account the impact of technological advances where with technological advances the production or output could be more (Todaro and Smith, 2006). Furthermore, Ester Boserup in 1981 argued that population growth can affect technological change. This is because population growth will encourage the arrival of new technologies that can trigger increased food production (Singgih, 2001).

Todaro and Smith (2006) also views that population growth is not a problem. For the majority of developing countries, population growth is actually a necessary thing because it can create a labor supply which in turn can have an impact on increasing output. Therefore, as the population increases, the number of workers will also increase. In particular, if the workforce in the agricultural sector increases, this will have a good impact on food security.

Labor in the agricultural sector is a necessary resource to produce agricultural output. According to the production function, the amount of production is directly proportional to the number of workers. This means that in this case, along with the increase in labor in the agricultural sector, the food production produced will also increase. Thus, labor can affect food security in terms of availability.

The labor structure in East Nusa Tenggara Province throughout 2018 to 2021 is dominated by agricultural sector workers who account for more than 50 percent of the total working population. During the study period, the majority of districts/cities of East Nusa Tenggara Province tended to experience an increase in the workforce in the agricultural sector.

Food security is not just about food supply. Amartya Sen, a Nobel laureate in economics in the 1980s, brought a paradigm shift in the literature that shifted the focus of food security from availability to access to food (Islam and Berkes, 2016). Food security in Sen's perspective is defined as a food supply problem which refers to the importance of access and rights (Maxwell, 1996). Furthermore, the concept of food security according to FAO is also in line with Sen's opinion. FAO defines food security as a condition when all people have physical and economic access to sufficient, safe and nutritious food for a healthy life.

Hanafie (2010) and Prakoso (2021) states that the main determinant of food security is purchasing power or adequate income to meet the cost of living. Wages are rewards for workers in the form of money or goods received from the company/employer. Wages are a source of labor income used to meet the living needs of workers and their families such as clothing, food, shelter and other needs (Maipita, 2018). Income can reflect people's purchasing power to meet their needs, including in obtaining food (Meidiana and Marhaeni, 2019).

Based on data obtained from the BPS of East Nusa Tenggara Province (2022), the wages/net income of district/city workers of East Nusa Tenggara Province in 2019 experienced an increase in net income, while in 2020 and 2021 there was a decrease. The decrease in net wages was caused by a decrease in labor productivity. When viewed from the data published by the BPS of East Nusa Tenggara Province (2020) workers who work less than 35 hours as much as 37 percent of the total workforce. This figure will

increase by 1.5 percent in 2021 to 38.5 percent. In this study, the income variable is only limited to the income of workers.

In realizing food security, access to clean water has an equally important role. According to Vilakazi, Nyirenda and Vellemu, (2019) water is an important part of national food security. Food security can be maintained by having access to clean water (Khalifa and Bidaisee, 2018). Clean water is a prerequisite for a healthy, active and productive life. Unclean water can increase the risk of disease. In addition, it can also reduce the ability of the body's organs to absorb food which in turn has an impact on a person's nutritional status (Nugroho and Rini Mutisari, 2015).

Furthermore, FAO (2015) according to scarce water, poor water quality and inadequate sanitation affect poor food security, nutrition and educational and economic opportunities for poor families. Therefore, the more households that can access clean water, the food security condition of a region will also improve.

Efforts to achieve food security cannot be separated from the role of the government. The Indonesian government through UU 18 of 2012 has mandated to realize food security. With the implementation of regional autonomy, the appropriate management pattern for the development of food security in the region is the pattern of decentralization, so that in this case the role of local governments is one of the keys in developing household and regional food security (Saliem and Ariani, 2002).

Regional spending is an instrument of local government fiscal policy that is used to finance government priority sectors in achieving development. Regional expenditures in various fields such as in the agricultural, infrastructure, education and health sectors are expected to increase food security in terms of availability, access and utilization. This study aims to analyze the factors that influence food security in the province of East Nusa Tenggara.

RESEARCH METHODS

This type of research is research with a quantitative approach which is a research approach method with the data used in the form of numbers and in the analysis using statistics. The purpose of this study is to find out what factors can affect the food security index in East Nusa Tenggara Province in the 2018-2021 period. The variables used in this study are food security as the dependent variable, then workers in agricultural sector, income, access to clean water and local government expenditure as independent variables.

This study uses secondary data from various sources which include: Badan Ketahanan Pangan, Central Statistics Agency and Ministry of Finance. The type of data used is panel data which is a combination of time series data and cross-section. The number of observations is 88 data consisting of time series data which is annual data from 2018 to 2021 as well as data between individuals as many as 22 regencies/cities in East Nusa Tenggara Province. The equation of the model in this study is as follows.

$$IKP_{it}=\beta_o+\beta_1 TKP_{it}+\beta_2 Pend_{it}+\beta_3 AB_{it}+\beta_4 BD_{it}+\varepsilon_{it}$$

There are differences in units and quantities in the research variables, then the data is transformed into logarithmic form. Several variables in this study were converted into logarithmic form, so that the new form of the model equation is presented in equation 2 below.

$$IKP_{it}=\beta_o+\beta_1 LogTKP_{it}+\beta_2 LogPend_{it}+\beta_3 AB_{it}+\beta_4 LogBD_{it}+\varepsilon_{it}$$

Where Log is logarithm, IKP is food security index (points), TKP is workers in agricultural sector (people), Pend is worker's income (rupiah), AB is access to clean water (percent), BD is local government expenditure (IDR Billion), i is cross section data, t is time series data, β_0 is contanta, β_1, β_2, β_3, β_4 is coefficient of independent variable, ε_{it} is error panel data.

This study uses panel data regression which is analyzed with three approaches, namely Common Effect, Fixed Effect, and Random Effect. Determination of the best approach model is done by using the Chow test and Hausman test. After the best model has been found, the next step is to test the classical assumptions to ensure that the model is free from symptoms of normality, autocorrelation, multicollinearity and heteroscedasticity. After the model is confirmed to be free from the symptoms of classical assumptions, then proceed to perform statistical tests. The statistical test consists of the adjusted value of the coefficient of determination or adjusted R-squared, F test, and t test.

RESULTS AND DISCUSSION

The purpose of the Chow test is to choose the best model between the Common Effect Model (CEM) and the Fixed Effect Model (FEM).

Table 2. Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	7.53351	(21,62)	0.0000
Cross-section Chi-square	111.53285	21	0.0000

Source: Data Processed, 2022

The results of the Chow test in table 2 show that the cross - section value of F is 7.533510 with a probability value of 0.0000 and a significant level of significance of 5 percent. Thus it can be concluded that Ho (Common Effect Model) is rejected and H1 (Fixed Effect Model) is accepted, which means that the best model chosen is fixed effects.

The purpose of the Hausman test is to compare the best model between Random Effect Models and Fixed Effects models. Based on the Hausman test results presented in table 3, it is known that the random cross-section value is 12.597060 with a probability value of 0.0134 . The probability value is less than the 5 percent significance level (0.05). Thus it can be concluded that Ho (Random Effect Model) is rejected and H1 (Fixed Effect Model) is accepted, which means that the best model chosen is fixed effects.

Table 3. Hausman Test

Test Summary	Chi-Sq. Statistics	Chi-Sq. df	Prob.
Cross-section random	12.59706	4	0.0134

Source: Data Processed, 2022

Based on the results of the Chow test and Hausman test, a decision was made to analyze the effect of agricultural labor, income, access to clean water and regional spending on food security in East Nusa Tenggara in 2018-2021 by using the Fixed Effect Model.

Based on the regression results presented in table 4, it is known that the adjusted R2 value is 0.914614. This figure means that the independent variables used in the model, namely agricultural labor, income, access to clean water and regional expenditures together can explain the variation of the dependent variable, namely food security by 91.46 percent, while the remaining 8.54 percent explained by other variables outside the research model.

Table 4. The Results of the Estimation of the Fixed Effect Model using the GLS Method

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26.52146	50.10872	0.529278	0.5985
Log (TKP)	-8.099567	1.931418	-4.193586	0.0001
Log (PEND)	6.532868	2.885015	2.264414	0.0271
AB	0.248061	0.022093	11.22797	0.0000
Log (BD)	2.243922	2.284901	0.982065	0.3299
R-squared				0.93915
Adjusted R-squared				0.91461
S.E. of regression				2.84551
Durbin-Watson stat				2.48612
F-statistic				38.27624
Prob(F-statistic)				0.00000

Source: Data Processed, 2022

Based on the results of the t test, the agricultural sector workforce partially has a significant negative effect on food security with a coefficient value of -8.099567. The variables of income and access to clean water have a significant positive effect on food security with each coefficient of 6.532868 and 0.248061. Meanwhile, regional spending has no significant positive effect on food security.

Based on table 4, it is known that partially the labor variable in the agricultural sector has a significant negative effect on food security with a coefficient value of -8.099567. Thus, it means that an increase in agricultural labor by 1 percent can reduce food security by 8.09 percent, assuming other variables are constant.

According to Susilowati (2016) agricultural workers are included in the young age category, namely 39 years of age or younger. Furthermore, the Ministry of Agriculture (2019) states that millennial farmers are farmers aged 19-39 years or those who are adaptive to technology. Thus, it means that young agricultural workers are the labor force absorbed by agricultural sector jobs which are included in the age range of 19 years to 39 years.

Based on data obtained from the Central Statistics Agency, the workforce in the agricultural sector in East Nusa Tenggara Province in 2018-2021 is dominated by workers aged over 39 years with an average of 54.10 percent. In general, workers who are no longer young have low productivity. Low productivity will result in low production output.

The study of Guo, Wen and Zhu (2015) found evidence that older farmers have a negative impact on agricultural yields. The experience of older farmers is not sufficient to compensate for the ill effects of their old age. In addition, the old age of agricultural workers will reduce their physical strength which can limit production yields (Li et al., 2018). The study results of Liu et al., (2019) also proves that the old age of tea farmers is technically less efficient in producing output. The same study also shows that better access to new agricultural technologies will contribute to increased technical efficiency in tea production.

Based on data obtained from the Ministry of Agriculture, it is known that food production

in 2018-2021 tends to decrease. According to Puspita Kristiana (2015) excessive use of agricultural labor production factors can have an impact on decreasing agricultural output. Utilization of labor in the agricultural sector of East Nusa Tenggara Province is considered to be inefficient because it is dominated by older workers. An aging agricultural workforce requires technology to compensate for physical deficiencies. Therefore, it is necessary to increase the use of modern technology to ensure a high level of food security.

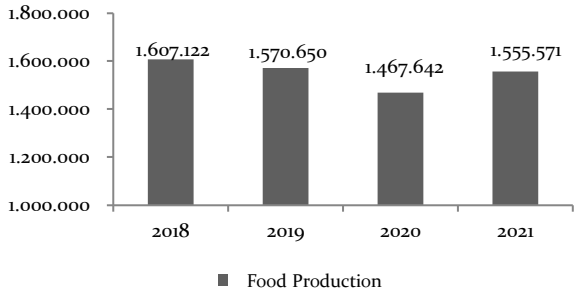

Figure 1. Food Production of East Nusa Tenggara Province in 2018-2021
Source: Ministry of Agriculture, 2021

The results of this study also support the findings of Poernomo and Winarto (2020) that the agricultural sector workforce has a significant negative effect on food security in Banyumas. This is because the number of workers in the agricultural sector has reached the maximum point so that if the number increases it can reduce production capacity.

Furthermore, an average of 40.5 percent of the workforce in the agricultural sector of East Nusa Tenggara Province were family workers or unpaid workers. This means that there are still many agricultural sector workers who do not get wages or salaries as compensation for what they have done. This is also a trigger for low labor productivity which in turn has an impact on low output. According to efficiency wage theory, high wages will ultimately have an impact on worker productivity.

Furthermore, in this case agricultural sector workers who are classified as family workers do not have their own income so they have to depend on other parties or family members who have income to meet their needs. An increase in family members who have no income if it is not accompanied by an increase in food production will reduce the availability of food for everyone in the household so that it will have an impact on low food security (Ndirangu, Mbogoh and Mbatia, 2017).

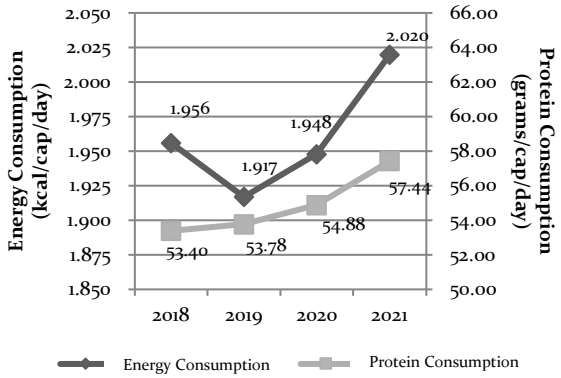

Figure 2. Energy Production of East Nusa Tenggara Province in 2018-2021
Source: BPS East Nusa Tenggara Province, 2021

In addition to the decline in food production, the population's food consumption tends to increase. In Figure 2, it is known that the food consumption of the population in this case is no exception for workers in the agricultural sector, which is converted into energy and protein units tends to increase. Increased food consumption should be followed by increased food production, so that food production can meet the population's need for food. If

consumption increases but is not accompanied by an increase in production, it will have an impact on food insecurity.

Assuming other variables are fixed, income has a significant positive effect on food security with a coefficient value of 6.532868. If there is an increase in income of 1 percent, it can increase food security by 6.53 percent, with the assumption of ceteris paribus.

This study is also in accordance with the efficiency wage theory which explains that the higher the wages received by workers, the more they will be able to meet their minimum life needs. This income or wages is needed to purchase food to increase food security (Adebayo et al., 2018). In addition, the results of this study are in line with Sen's view that food security is based on the importance of access to food.

Furthermore, the results of this study support the study of Shebanina et al., (2018) and Monirul Alam, Alam and Mushtaq, (2018) who find evidence that income has a positive effect on food security. With increasing income, people's purchasing power of food will also increase. In addition, higher income will increase access to a better variety of foods.

The study of Dodd and Nyabvudzi, (2014) shows that there is an influence between unemployment and living wages on food security. Unemployment is a condition when someone who is included in the labor force does not have a job. In the condition of not having a job, it means that the opportunity to generate income is getting smaller. The higher the unemployment rate, the greater the possibility of becoming food insecure. The study also shows that income from grants and remittances can support increased food security.

The variable of access to clean water partially has a significant effect on food security. Based on the results of panel data regression, it shows that the coefficient value of the variable access to clean water is 0.248061. Thus, it means that increasing access to clean water has a significant positive effect on food security, assuming other variables are constant. Increasing access to clean water by 1 percent can increase food security by 0.24 percent with the assumption that other variables are constant.

The results of this study are in line with those of Cai et al., (2020) which shows that food security is positively influenced by access to clean water. Water participates in all processes of human metabolism, and is also used during food preparation and cooking. Therefore, clean water is the foundation of nutrition, while nutrition is the core of food security. At the global level, health and sanitation as represented by clean drinking water is one of the main factors affecting food security.

Food security cannot be achieved without addressing the water problem because the lack of clean water supports food insecurity. Therefore, to achieve food security, there must be a quantity and quality of water that can be utilized for health, livelihoods, ecosystems, and production.

The results of this study support the study of Vilakazi, Nyirenda and Vellem (2019) which explains that clean water has a positive effect on food security. This is because clean water plays an important role in food processing. Poor water quality when used in food processing can cause foodborne illnesses such as diarrhea and other diseases that contribute to malnutrition. So that public access to clean water is important to achieve food security.

Based on table 4, it is known that the probability value of the regional expenditure variable is 0.3299 which is greater than the real level of 5 percent (0.05). This means that the

regional expenditure variable partially has a positive and insignificant effect on food security.

One of the reasons why regional spending does not affect food security is because in 2020-2021 the realization of regional expenditures in the districts/cities of East Nusa Tenggara Province tends to decrease. The existence of a pandemic has caused district/city local governments to not be optimal in carrying out budget absorption so that this has an impact on the low realization of regional expenditures.

In 2021 the realization of regional spending will only be 78.75 percent, down by 8.19 percent compared to the previous year. The not yet optimal absorption of the budget can have an impact on the provision of public facilities in various fields such as agriculture, infrastructure and education which can have an impact on food security.

The results of this study also support the study of Nurfitriani and Rindayati (2012) which found that government spending had no effect on food security in East Nusa Tenggara Province. This is because the budget is used more for personnel expenditures than capital expenditures that are directly beneficial to the community. This condition also occurs in the province of East Nusa Tenggara. In 2021, the realization of personnel expenditure is 23.22 percent higher than capital expenditure. In detail, the realization of capital expenditures was only 3,635.12 billion rupiah or only 63 percent of the set budget.

This means that capital expenditure has not been absorbed optimally, so it does not have an impact on public facilities such as agricultural infrastructure, irrigation, roads and machinery that can support food security. The results of this study are also in line with Kanu (2017) which found that government spending has no effect on agricultural production in Nigeria. This is caused by funds that are not channeled properly to the agricultural sector, as a result the increase in funds does not lead to an increase in the amount of food produced.

CONCLUSION

With the assumption of ceteris paribus, partially income variables and access to clean water have a significant positive effect on food security. Meanwhile, labor in the agricultural sector has a significant negative effect on food security and regional expenditures have a positive and no effect on food security. Based on the estimation results, it is known that the adjusted coefficient of determination is 0.91461, which means that the independent variables used in the model, namely agricultural labor, income, access to clean water and regional expenditures together can explain the variation of the dependent variable, namely food security of 91.46 percent, while the remaining 8.54 percent is explained by other variables outside the research model.

In this study, the income variable is only limited to the income of workers, so that future researchers are advised to use a better proxy for the income variable. In addition, this study also examines regional food security. Regional food security is a mandatory requirement, but not a requirement for adequacy of household food security. Therefore, for further research, it is recommended to study food security at the household level.

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