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DETERMINANTS OF FOOD SECURITY AMONG INDONESIAN FARMING HOUSEHOLDS

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Abstrak

The Global Food Security Index (GFSI) shows an increase in Indonesia's food security from 2021 to 2022. However, this increase does not yet indicate better Indonesian food security because this increase is still lower than the global average and the Asia Pacific average. The food security conditions of farming households could be a solution considering the importance of farming household food security which can deliver an impact in maintaining economic stability and reducing dependence on the market. This research aims to analyze the factors that influence the food security of farming households. The model used is Robust Regression since the Normality and Heteroscedasticity assumptions were failed. Data were taken from IFLS wave 5. Based on the results, it shows that the variables of age, gender, home ownership status, cooking fuels, electricity use and house location influence the food security of farming households. While, the variables of head of household's education, availability of toilets and water sources have no effect on the food security of farming households

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Keywords: IFLS, Food Security, Household

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INTRODUCTION

Food security is considered a global challenge and significant issue since it is highly related to economic growth and the quality of human resources in one's country (Tambe et al., 2023). Strong food security provides the basis for sustainable economic growth. With sufficient and nutritious food, society can function optimally, which impacts overall productivity and economic development. Countries with good food security tend to be more stable and able to avoid vulnerabilities caused by food crises, which can disrupt economic activity and investment (Djangmah, 2016).

To overcome this challenge, governments, civil society, and the private sector must work together to develop policies and programs that support food security. These efforts will not only increase access to food but also strengthen the foundation for sustainable economic growth and improve the quality of life of society as a whole.

A study reported that the proportion of food-insecure individuals in low and middle-income countries in 2015 was 13.4% and was projected to increase to 15.1% by 2025 (Sutyawan et al., 2019). Food security plays an essential role in ensuring the availability of sufficient and nutritious food for household members, which promotes their health and growth. Moreover, food security upsurges household economic stability by lessening dependence on food aid and market price fluctuations. Thus, good food security allows households to invest in education and health, which contributes to long-term social and economic development (Gregory & Coleman-Jensen, 2013).

Food security has become a top priority on the global policy agenda following overcoming the global food price crisis (Swinnen and Squicciarini, 2012). Most households in developing countries are net food buyers because they tend not to produce enough food to meet consumption needs. As food buyers, they must buy food from the market to meet their household needs. Therefore, price shocks such as sudden price increases to staple foods can seriously endanger household food security, especially for low-income groups.

Small farmers dominate the agricultural sector in many developing countries and can often only produce a small portion of their total food needs. The rest of their food needs are met through purchases at the market. Many developing countries have significant dependence on imported staple foods, such as wheat or rice. This dependence on imports makes domestic food prices more vulnerable to international price fluctuations (Naylor & Falcon, 2010).

Rising food prices can directly worsen the poverty situation for low-income households. In developing countries, poor households allocate most of their income to purchasing food, especially staple foods such

as rice, wheat and corn. Staple food price shocks directly impact household food security, which is defined as food availability, access, and stability. When prices soar, poor households lose access to adequate food.

It can also be seen from the member countries of the Association of Southeast Asian Nations (ASEAN), the majority of which have quite extensive agricultural land and are a source of world food. However, Singapore was ranked at the top position in terms of food security in the Southeast Asia region (corteva agriscience, 2022). Singapore does not have significant agricultural land, but it is able to secure food security by importing more than 90% of its food needs. Singapore has developed a highly diversified food import network, importing from more than 170 different countries. This makes it less vulnerable to supply disruptions from one particular country or region. This diversification of food sources helps Singapore reduce the risk of food crises due to dependence on one source and keeps supplies stable. This output is based on the 2022 GFSI food security index, which is measured using four indicators, namely affordability, supply availability, quality and safety, and sustainability and adaptation.

The Global Food Security Index (GFSI) revealed that Indonesia's food security in 2021 is lower than Singapore's. GFSI recorded that Indonesia's food security index score in 2021 was reckoned at level 59.2, while Singapore was listed at 77.4 and was the highest in Southeast Asia. In 2022, Indonesia's food security index was strengthened and managed to be counted at the level of 60.2, or an increase of 1.7% compared to 2021. Still, Indonesia's food security in 2022 counted lower than the global average, with a minimum index of 62.2, even below the Asia Pacific average, with an index of 63.4. Indonesia is ranked 63rd out of 113 countries. Even though Indonesia has great potential in the agricultural sector, various challenges related to food availability, access, utilization and stability still need to be overcome. Focusing on sustainable policies, infrastructure improvements, and support for farmers will be critical to improving Indonesia's food security and achieving better indices in the future.

The quality of Indonesian food consumption is still less diverse and nutritionally imbalanced. So, consumption choices are still highly referred to the consumption of grains, oils, and fats and less in the consumption of vegetables and fruit, animal foods, and tubers.

The impact of the quality of food consumption that needs to be more diverse and nutritionally balanced among the Indonesian population is very significant on public health, labour productivity, economic burden and the quality of human resources. Efforts to increase food diversity and nutritional balance are significant to

overcome the problem of malnutrition and nutrition-related diseases, as well as to build a healthier and more productive society. The role of education, government intervention, and appropriate food policies are urgently needed to increase public awareness of the importance of a nutritious and balanced diet.

Based on the 2021 provincial Food Security Index, there is still a gap in Food Security Index between provinces, with eastern Indonesia generally having a lower Food Security Index than the western area of Indonesia. Data reveal that there are 74 districts/cities with details of 70 districts (16.83%) out of 416 districts and four cities (4%) out of 98 cities in the category of low Food Security Index. This condition also reveals a low Food Security Index, which is shown by the food deficit and the still high percentage of poor people. Good food security conditions should be able to help reduce poverty in rural areas. Agricultural households with enough food to meet their needs only need to spend a little money on food. Additionally, if they are able to produce a surplus of food, they can sell it and earn additional income. Access to stable food also allows households to focus on other economic developments, such as increasing agricultural productivity, education, and investment in non-agricultural sectors.

Damanik (2016) revealed no causal relationship between food security and poverty. It means that food security does not cause poverty, and poverty also does not cause the weakening of food security.

Food security for farming households is crucial since it ensures farmers' families have sufficient access to nutritious food for their health and well-being. This is related to contributing to economic stability so the farmers can reduce dependence on markets and increase their self-income through production surpluses. Food security for farmers' families refers to their ability to produce, access, and utilize sufficient and nutritious food to meet their nutritional needs (Kalkuhl et al., 2016).

Moreover, firm food security at the farmers' household level can increase community resilience to food crises and climate change (Djangmah, 2016). The conditions of farming households are often challenged by limited access to resources, lack of agricultural technology, and inadequate infrastructure. Many farmers depend on agricultural yields for household consumption and income but repeatedly deal with problems, such as low productivity, lack of post-harvest storage, and price fluctuations.

Demand theory is part of microeconomics and explains that demand for goods or services is influenced by price, income, tastes, and other factors. In the context of agricultural household food security, demand theory can be used to analyze how agricultural households determine their consumption patterns for

food and other commodities related to food security.

Furthermore, socio-economic factors such as education, household size, and access to credit also influence their food security and well-being. Farming households frequently experience food insecurity, with variations in access to resources and income. Farmers who engage in non-agricultural activities usually have higher incomes and better security. Likewise, ownership of agricultural equipment and access to credit significantly affect the productivity and welfare of farming households.

Proper farmers' food security has a positive impact on the health and welfare of their families, lessening malnutrition risk and improving the quality of life. In addition, robust food security allows farmers to have a production surplus, which can be marketed to increase income and investment in agriculture. Other impacts include increased local economic stability and reduced dependence on external food aid, supporting sustainable development.

Food security is closely related to household economic stability. Agricultural households with good food security tend to be more stable in income because they are not entirely dependent on purchasing food from the market.

The socio-economic model of farming households includes numerous factors that influence welfare and food security, such as education, household size, and access to resources. In this model, certain variables such as regular income, land ownership, and involvement in non-agricultural activities play an essential role in determining food security status. Moreover, the collaboration between social, economic, and environmental factors is also acknowledged as key to understanding the dynamics of farmers' lives and their adaptation strategies to deal with challenges. It also helps design effective adaptation strategies and policies supporting food security. With a comprehensive approach, farming households can be more resilient to the various challenges they face and, in turn, contribute to broader food security (Tambe et al., 2023).

Much research has been carried out on food security because this issue is very important and relevant throughout the world (Korir et al., 2020; Ouoba & Sawadogo, 2022; Wang, 2010), However, there is still little research using a socio-economic approach, this is because this approach often requires data that is complex and difficult to obtain, such as data on income, employment and social conditions of the community.

Therefore, this study aims to analyze the factors that influence the food security of farming households in Indonesia, particularly socio-economic factors, using the data derived from the Indonesian Family Life Survey 5 (IFLS5). By using IFLS5 data at the household level, it is expected that the results can be

considerations based on national data for food security policy-makers since previous similar studies occasionally employed surveyed data with limited locations (Tajerin et al. 2017; Zani, Saediman, Abdullah, Daud & Yunus, 2019). By considering household characteristics, demand analysis can inform more effective policy strategies to improve food security.

RESEARCH METHOD

The descriptive method with a quantitative approach is applied as the method in this research, in which the research results are then managed and evaluated to conclude. The study emphasizes the analysis results on numerical data (numbers). By employing this research method, significant relationships between the variables will be identified, resulting in conclusions that will clarify the picture of the object under study. According to Sugiyono (2014), the descriptive analysis method is statistics that are expended to analyze data by describing or illustrating the data that have been collected as they are, without the purpose of making general conclusions or generalizations. Based on considerations of data availability in IFLS, the model in this research will then be analyzed using multiple linear regression as follows:

$$FCS = a + b1SDM + b2FK + b3Lok + e$$

In which,

FCS = Food Consumption Score (FCS)

SDM = Human Resources characteristic in Household

FK = Qualitative Factors

Lok = Location Variable

Ɛ = Error Term

Food security is defined as a condition that all people, at all times, have physical, social, and economic access to sufficient, secure, and nutritious food to meet their dietary needs. This research considers food security as an indicator of the World Food Program, namely the Food Consumption Score (FCS) which is linked to the food security indicator, which is considered the most appropriate and simplest in measuring household food consumption (Tiwari, Skoufias & Sherpa, 2013; Cafiero et al., 2014; INDDEX Project, 2018).

Preferences for certain types of food will influence demand. In agricultural households, this preference is often influenced by the availability of home-grown food. When the availability of food from agricultural products varies, household consumption patterns tend to be more varied than those of non-agricultural households.

The FCS score is calculated using data of the diversity and frequency of food groups consumed by households for the past seven days. Later, this data is weighted based on the relative nutritional value of the food classification consumed.

Table 1. Food Classification and Weighting Based on FCS

Food Classification	Weight
Staples	2
Nuts (pulses)	3
Vegetables	1

Fruits	1
Meat/Fish	4
Dairy Products (milk)	4
Sugar	0.5
Oil	0.5

Source: INDDEX Project, 2018

The independent socio-economic variable is an adjustment from the results of prior research. These results were then separated into human resource factors and qualitative factors (Maharjan & Joshi, 2011). Related to human resources, it will then be expanded into age (hhhead_age), sex (gender) (hhhead_gender), marital status (house_status), and educational level of the household head (hhhead_edu) (Grobler, 2016; Mutisya, Ngware, Kabiru, & Kandala, 2016). The education of the head of the family plays a vital role in improving family welfare because a higher level of education often correlates with the ability to get a better job and higher income. Educated family heads tend to be better able to make better decisions regarding resource management, health, and children's education, all of which contribute to the overall well-being of the family (Djangmah, 2016).

In terms of the availability of data in IFLS, the income owned by households is later arranged. This means that the economic variables development will be positioned in the areas of main cooking fuel in house (stove), owned house status (house_status), sanitary location (toilet_loc) and household electricity (elect) as the independent qualitative factor variable (Ahmed et al., 2017; Mustapha, Kamaruddin & Dewi, 2018; Abdullah et al., 2019). This indicator is associated with the concept that agricultural households that will influence the food security.

Food security is influenced by several factors, including income, education, family size, and access to resources such as land and water. Food insecurity can cause health problems, including malnutrition, and may harm people's social and economic development. Food security in agricultural households is critical because it ultimately includes economic, social, and health dimensions crucial for household members' welfare. Access to nutritious food is the basis of food security. When agricultural households consistently have access to healthy food, they can meet nutritional needs that support growth, health, and productivity. Long-term malnutrition can cause health problems such as stunting in children and decreased body resistance to disease. Households with good food security will be better able to maintain the health of all family members, especially children and pregnant women, who are more vulnerable to malnutrition.

Location factors are also included since household location (village, city, topographical conditions) is a determining factor for food insecurity (Maharjan & Joshi, 2011; Abu & Soom, 2016;).

A classic assumption test is initially conducted to assess the existing data. It is performed to build the data that fulfills the categorization of BLUE (Best, Linear, Unbiased, and Estimator). The hypotheses determination on independent variables' influences towards dependent variables is carried out aligned with previous research. Therefore, based on previous research, HR variables have a positive influence on food security, and the age variable is excluded. This age variable is assumed to have a positive influence based on experience in providing basic and appropriate food for the household, which will increase aligned with the age of the mother or the age of the head of the household (Sulemana et al., 2019). In contrast to Abu & Soom, 2016 and Grobler, (2016) the age variable will describe the condition when the age of the household's heads is higher (older), the less productive they will be and lead to the bigger chance for food insecurity. Qualitative Factor Variables and location variables are presumed to have a positive influence on food security. A summary of the variables used in this study is shown in Table 2.

Table. 2. Variable Description

Variabel name	Detail	Unit/measurement
FCS	Food Consumption Score	a composite score based on households' dietary diversity, food consumption frequency, and relative nutritional value of different food groups.
Demographics/charateristic		
hhhead_age	age of head of household	year
hhhead_gender	gender of head of household	dummy, 1 = male, 0 = female
hhhead_edu	highest level of education completed by the head of the household	years
Qualitative Variables		
house_status	home ownership status	dummy : 1 = own house, 0 = other
toilet_loc	toilet location	dummy : 1 = in the house/own property, 0 = other
stove	energy used for cooking	dummy : 1 = uses electricity/gas, 0 = others
elect	access to electricity	dummy : 1 = has access to electricity, 0 = does not exist
water_loc	water source location	dummy: 1 = water source is inside the house, 0 = water source is outside the house
Location Variable		
region	residence location	dummy: 1 = city, 0 = village

Source: Processed (2024)

RESULTS AND DISCUSSION

This section will discuss the research results followed by a discussion that begins by displaying descriptive statistics as shown in Table 3.

Table 3 Descriptive Startistics

Variable	Obs	Mean	Std. dev.	Min	Max
hhhead_age	483	46.849	13.986	19	92
hhhead_gen~r	483	0.801	0.399	0	1
hhhead_edu	483	0.636	0.482	0	1
house_status	483	0.822	0.383	0	1
toilet_loc	483	0.638	0.481	0	1
stove	483	0.487	0.500	0	1
elect	483	0.983	0.128	0	1
water_loc	483	0.551	0.498	0	1
region	483	0.302	0.460	0	1

Source: Processed (2024)

Table 4. Normalitas

Variable	Obs	z	Prob>z
residual	483	7.349	0

Source: Processed (2024)

Table 5. Heteroscedasticity

Test	Value
Chi2(1)	51.52
Prob>chi2	0.0000

Source: Processed (2024)

Based on the results of the classical assumptions, it is identified two assumptions that failed are normality and heteroscedasticity. Violations of assumptions that often occur in data are usually caused by outlier data. According to Soemartini (2007), outliers are observations that are far different from the data group, which may influence the regression coefficient extensively. Robust regression is an important tool for analyzing data contaminated by outliers. Robust regression is used to detect outliers and provides results that are resistant to the presence of outliers (Chen 2000). So, the utilization of robust regression is considered an appropriate method, considering that the distribution results of the residuals are not normal and potentially may affect the model. This method is an important tool for analyzing data that is influenced by outliers. Therefore, models that are robust or resistant to outliers can be generated. The results of linear regression can be described as follows:

Table 6. Linear Regression Table

Y = fcs	Coef.	Robust St.Err.	t-value	p-value
hhhead_age	0.679	0.232	2.93	0.004
hhhead_gender	33.297	6.534	5.10	0.000
hhhead_edu	-5.89	5.918	-1.00	0.32
house_status	13.335	7.444	1.79	0.074
toilet_loc	9.125	5.623	1.62	0.105
stove	16.678	5.794	2.88	0.004
elect	33.954	8.425	4.03	0.000
water_loc	-.118	5.662	-0.02	0.983
region	11.935	6.559	1.82	0.069
Constant	-11.313	15.946	-0.71	0.478

Source: Processed (2024)

Referring to the above table, the age and gender variables of the household's head influence the food security of farming households. The age of household members influences their ability to participate in agricultural activities and resource management. Older members tend to have better experience and knowledge in agricultural practices, which can increase production yields. However, older members may also have physical limitations, affecting household productivity and food security.

Gender influences roles and responsibilities in food production. Men are often more involved in agricultural activities, while women are often responsible for managing consumption and nutrition. Women have an important role in making decisions regarding household expenses and food choices, which impact food security.

According to research conducted by Abu and Soom (2016), age plays a big role in influencing decision-making regarding household needs. This condition indicates the impact of decision-making on the food security of farming households.

Farming households that utilize electricity and gas for cooking have a positive influence on their household's food security.

Electricity and gas are usually more efficient than firewood or other traditional fuels. With faster cooking times, farmers can save time and energy to carry out other activities that support food security, such as farming or managing their agricultural business. Using electricity and

gas allows farmers to cook food more hygienically and healthily. This contributes to improving the quality of food consumed, thereby helping to ensure that families receive adequate and balanced nutrition

Households located in urban areas have a positive tendency towards increasing food security. Cities have a positive trend towards increasing food security due to various factors supporting better food access and stability in the food supply. In urban areas, residents generally have easier access to markets, supermarkets and food distribution centres. This allows them to obtain food from a variety of local and imported sources, which helps reduce the risk of becoming dependent on one particular type of food or region. The diversity of food sources in urban areas also provides opportunities for people to consume more diverse and nutritious foods, supporting household food security. Maharjan and Joshi (2011) suggested that households located in rural areas have lower conditions that have a positive influence on the food security of farming households.

Meanwhile, the variables education, toilet location, and water source location show no positive relationship with farming households. In one type of food or specific region. The diversity of food sources in urban areas also provides opportunities for people to consume more diverse and nutritious foods, supporting household food security.

Maharjan and Joshi (2011) show that households in rural areas have lower conditions. Meanwhile, household location conditions positively influence the food security of farming households. Meanwhile, the variables education (hhhead_edu) , toilet location (toilet_loc), water loc (water source location) do not have a positive relationship with farming households. Education conditions show a negative and significant influence on food security, so it can be seen that the head of the household will spend more time on education than farming. Heads of households with primary formal education are more likely to have food security than those without education. Although education can increase knowledge, time spent on education can reduce focus on agricultural activities, which has a negative impact on food security (Djangmah, 2016).

Ownership of toilets and clean water is expected to have a positive impact, resulting in maintenance costs

that reduce the benefits. There is no significant difference in food security between households that have and those that do not. Lestari and Sarana (2018) also concluded that the location of toilets and water sources does not influence a household's food security.

CONCLUSION

Increasing food access is very important to strengthen the food security of farming households from a social and economic perspective. Even though they are involved in food production, farming households often still experience food insecurity due to various factors such as limited access to markets, price fluctuations, and limited income. Therefore, overcoming food access problems can help farming households achieve better socio-economic prosperity.

Farmers are the primary food providers in many countries. By increasing their food security, local economic stability will also be maintained, reducing overall food insecurity in the community. Farmers' strong food security contributes to social empowerment and improved quality of life. This helps reduce poverty and improve their access to education and health services.

Farmers with good food security can better withstand economic shocks, climate change, and natural disasters. This is important to ensure the sustainability of food production and meet community needs. Farmers play an essential role in maintaining the sustainability of the food system. Policies that support them can help create more environmentally friendly agricultural practices. With increasing reliance on food imports, strengthening farmers' food security will help reduce global food price fluctuations and supply disruption risks.

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