

## Internet Use and Agricultural Household Food Insecurity in Indonesia

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### Abstract

Food is an essential aspect of human life, but there are still households that experienced food insecurity. It caused a major challenge for policymakers to reduce food insecurity, especially at a household level. This study aims to analyze the association between internet use and food insecurity of agricultural households in Indonesia. This study uses the National Socio Economic Survey or Survei Sosial Ekonomi Nasional (Susenas) 2018 data. The food insecurity variable is measured by using the food insecurity experience scale (FIES) and internet use is a binary variable. Estimation of the impact of internet use on food insecurity uses Ordinary Least Square (OLS) regression. The result of this study indicates that internet use has a negative effect on agricultural household food insecurity. It means that internet use can reduce food insecurity in agricultural households. The policy implication directed to the government can improve the quality of internet infrastructure and improve content as positive information for the user, especially in the agricultural sector.

**Keywords:** Agricultural households; Food insecurity; internet; OLS model

**JEL classification:** D1, D6, Q1

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### 1. Introduction

Having enough food is an essential aspect of human right but food insecurity still exist and can be experienced by individual or household. Food insecurity has negative consequences on physical and mental health of the populations, such as malnutrition, chronic disease, obesity, and depression (Sulaiman, Yeatman, Russell, & Law, 2021). Household food insecurity can impede the development of education, health, employment, and household income (FAO, 2021).

Food insecurity is a multidimensional problem for all countries. The State of Food Security and Nutrition in The World 2021 projected that between 720.4 and 811 million people faced hunger (FAO, IFAD, UNICEF, WFP, & WHO, 2021). Existing food insecurity globally could

hinder the world development agenda listed in the second Sustainable Development Goals (SDGs), namely zero hunger by 2030. The prevalence of insufficient food consumption in Indonesia reached 8.34 percent in 2020 (BPS). Based on the Global Hunger Index (GHI), Indonesia's hunger index has decreased since 2006. However, in 2020 Indonesia is still ranked 70th from 107 other countries. Although the hunger index in Indonesia has declined, when compared to other countries such as Thailand, Vietnam, Malaysia, and the Philippines, Indonesia's hunger score is still higher. This shows that Indonesia's efforts to reduce food insecurity are still lagging behind.

Previous studies show that many factors influence food security at the agricultural household level, such as socio-demographic

factors (Abdullah, et al., 2019) and access to credit (Sisha, 2020). Recent studies have found that the internet is another factor that can affect household welfare such as Ma, et al. (2019), Leng, et al. (2020), Siaw, et al. (2020), and increased food security such as Xue, et al. (2021) and Twumasi, et al. (2021). Internet use in low-income countries has crucial implications for economic well-being, income diversification, agricultural productivity, and household food and nutrition security (Ma, et al., 2019; Leng et al., 2020; Twumasi et al., 2021). An Internet connection allows households to take advantage of technological innovations such as smartphones, computers, and other communication tools in various economic activities. Ma, et al. (2019) found that internet use contributes in supporting the household economy, which in turn affects well-being. Twumasi, et al. (2021) also found that internet use can improve smallholder farmers find food. Internet users especially agricultural households have a series of incentives such as obtaining information about additional employment and information on marketing and selling agricultural products or others to earn additional income which ultimately increases food security (Twumasi, et al., 2021). That statement is inline with the asymmetric information theory by Akerlof (1970), namely the ease of access to information helps reduce transaction costs and facilitate cooperation. In line with this theory, the difficulty of accessing information in agricultural sector can affect how to make decisions in agricultural methods, controlling pests, preservation, processing, managing finances and marketing products (Ezeoha, Obi, Igwe, & Ezeruigbo, 2019).

In the era of digitalization, the internet is growing rapidly. Based on BPS data, internet use in Indonesia alone has increased from 21.98 percent in 2015 to 47.69 percent in 2019. This high internet penetration is in line with the expansion of broadband internet providers. The active mobile broadband and fixed broadband subscribers tend to increase to 92.02 and 3.51 per 100 people. The high use of the internet indicates the existence of information disclosure and technological developments as well as changes towards an information society (BPS, 2019). This

condition will grow rapidly and consequently increase the need for internet use.

The internet has been widely used to carry out social interactions through various applications such as *Facebook*, *WhatsApp*, *WeChat*, and others between individuals from various backgrounds, races, genders, and ages (Siaw, Jiang, Twumasi, & Agbenyo, 2020). The pattern of internet use in Indonesia based on data from the Survey of the Indonesian Internet Service Providers Association (APJII) in 2018 showed that the main reasons for using the internet are communication through messages (24.7 percent), social media (18.9 percent), and looking for work-related information (11.5 percent). However, besides productive activities, there are also non-productive activities of using the internet such as playing online games (5.7 percent) and watching movies and videos (5 percent). Utama & Waruwu (2019) shows that there are positive benefits of using the internet for households. Internet access is dominantly used to find sources of knowledge such as media for communicating and obtaining information, media for exchanging data, transacting, and buying or selling products. Meanwhile, very few internet users in Indonesia use the internet in negative ways such as accessing adult content, violence, online gambling, and committing crimes (Utama & Waruwu, 2019). Adeniji (2010) argued that internet technology can be used as a two-way communication tool. The internet is used to exchange product information between the government and farmers as well as communication between farmers and other farmers which in turn can reduce food insecurity. The emergence of various applications such as *Fishfinder* used by fishermen in Pelabuhan Ratu to find fish in the sea and *Tanihub*, *Sayurbox*, *Agripedia*, etc. to help farmers access markets and increase production. Thus, it is necessary to know how the role of internet use for agricultural households.

In Indonesia, studies on internet use on household food insecurity still need attention because they only focused on welfare, such as Ariansyah (2018), Rahayu & Riyanto (2020), and Gurning & Khaliqi (2021). Ariansyah (2018) concluded that internet use has a positive impact

on household monthly income so that the influence of the internet not only benefits households in developed countries but also developing countries. Rahayu & Riyanto (2020) examined the impact of internet use on non-agricultural household income. The results showed that the use of the internet by non-agricultural households has a significant effect on their household income. Meanwhile, Gurning & Khaliqi (2021) examined the impact of internet use on household spending and showed that internet use has a significant impact to spent 29 percent more than those without internet. Therefore, it is important to conduct a study related to the relationship between internet use and household food insecurity.

Based on the facts that have been mentioned previously, this study aims to empirically examine the impact of internet use on the food insecurity of agricultural households in Indonesia. The hypothesis proposed in this study is agricultural households with internet use would decrease food insecurity.

This study offers some novelty. First, related studies in Indonesia, still only focused on household welfare (income and expenditure) such as studied by Ariansyah (2018), Rahayu & Riyanto (2020), and Gurning & Khaliqi (2021). Therefore, this study fills the gap by focusing on the impact of internet use on food insecurity of agricultural households. This study is expected to contribute in providing empirical evidence and can complement the existing literature. Second, this study used subsample data from Susenas 2018 conducted by BPS which consisted of 128.915 agricultural households spread across 34 provinces in Indonesia. In this case, the agricultural sector is very important because food insecurity reflects the situation of poverty and health in the agricultural sector in various countries (Oluwatayo & Ojo, 2019). Issahaku & Abdulai (2019) also argue that the agricultural sector, especially in developing countries, is a major contributor to ensure food security. Therefore, agricultural households are more representative and are expected to be a basis for policymakers to reduce food insecurity. Third, another novelty of this study is using the Food Insecurity Experience Scale (FIES) as a household food insecurity measurement. This

study use FIES because that is a new global standard for food insecurity measurement so it can be compared amongst countries (FAO, 2013).

## 2. Research Method

This study uses data from Survei Sosial Ekonomi Nasional (Susenas) 2018 with 128.915 samples of agricultural households. Household food insecurity becomes the dependent variable in this study. The food insecurity variable is measured by using a raw score and a Rasch score based on the Food Insecurity Experience Scale (FIES) question item from Susenas. In the raw score, each question is considered to have the same weight so it does not consider the level of severity. The minimum raw score is 0 and the maximum score is 8. However, the questions in FIES have different levels of severity, so there must be a weighting in each response. The Rasch score gives different weights to each question item based on severity. Food insecurity based on FIES can be analyzed as something that is latent or cannot be observed directly using the Item Response Theory (IRT) method, namely the Rasch Model. The higher the raw score and Rasch score, the higher level of food insecurity. In addition, Anwar & Nasrudin (2021) and Ronalia (2021) used raw scores and Rasch scores to estimate household food insecurity.

The main independent variable in this study is internet use. Based on Ma, et al. (2019), the variable used is a dichotomous variable that has the value of 1 if the household uses the internet and 0 otherwise. Agricultural households are said to use the internet so that they can use or enjoy internet facilities. Internet use is not only used to obtain information but also communicate including *Facebook*, *Twitter*, *BBM*, *Whatsapp*, and *others*. In using the internet, it can be done by mobile or wifi from various devices such as smartphones, computers, or laptops.

This study also uses several variables as a control for internet use status and household food insecurity. These control variables that affected households' food insecurity have been confirmed statistically significant to avoid bias. The control variables in this study consist of a status area of residence, the gender of the

household head, the age of household head, the education of the household head, the number of household members, access to credit, cooperative membership, the presence of the elderly in the household, access to electricity and the last is spatial location variable based on the island of residence.

In terms of residence status, adopted from Twumasi, et al. (2021), urban and rural areas have an important role to make households' status of food insecurity. This variable has a code of 0 for rural and 1 for urban. The gender of the household head (Gender) was adopted from Abdullah, et al. (2019). The operational definition of gender variables is 0 if the household head is female and 1 for male. The age of the households head (Age) was adopted from Abdullah, et al. (2019). The age variable is a ratio scale (units of years). The number of household members (Members of household) adopted from Abdullah, et al. (2019) and Twumasi, et al. (2021). The number of household members is the number of people in the household (units of people). The numbers of members in a household indicate how much food the household needs. This means that the more the household members are, the more the need for food in that household. The next control variable is the presence of the elderly in the household (Elderly). This variable is adopted from the model by Twumasi et al. (2021). The agricultural household is given 0 if there are no elderly or ages greater than 60 years old and 1 otherwise. Access to household electricity (Electricity) is variable that was adopted from Asghar & Muhammad (2013). The definition of an electricity variable is code 0 for a household that does not have access to electricity and 1 that has access to electricity. Education of the household head (Education) was adopted from Issahaku & Abdulai (2019) and Twumasi, et al. (2021). Education variable of household head obtained from the last education owned by the household's head. Code 0 for household heads who didn't have school or have elementary school level and code 1 for household heads who have a junior high school level or above. Access to credit (Credit) is another control variable that measures the accessibility of agricultural households to credit. it is adapted

from the model by Twumasi, et al. (2021). Credit access is a dichotomous variable that has a value of 0 if the household has no credit access and 1 otherwise. The cooperative members variable (Cooperatives) is another control variable that measures the accessibility of agricultural households to cooperatives. It is adapted from the model by Twumasi, et al. (2021). The cooperatives variable is also a dichotomous variable that has a value of 0 for the household that does not have any members in the cooperatives and 1 otherwise. The last control variable is the island of residence (Island). This variable is divided into 5 categories according to the largest islands in Indonesia. This variable is used to accommodate the diversity of infrastructure conditions amongst islands that may lead to the diversity of access to the internet and also food security.

In this study, answering the research objective to see the relationship between internet use and food insecurity in agricultural households, an empirical model is formed, namely a linear regression model. The model that is used in this study is in form of Ordinary Least Square. (OLS). This method is a type of linear squares method for estimating the unknown parameters in a linear regression model. This model was chosen because it has the ability to examine the association between the dependent variable which is in this case is agricultural household food insecurity score and scale with more than one independent variable. In this study, two approaches will be used, namely the simple sum of raw score and the rasch score. Rasch score for food insecurity was obtained using the IRT method, namely the rasch model. The rasch score is a method for correcting the raw score because the rasch model can eliminate latent traits among households so that they are more comparable (Anwar & Nasrudin, 2021).

The research model used in this study is formulated as follow :

$$Y_{1i} = \alpha_0 + \alpha_1 internet_i + \alpha_2 G_i + \alpha_3 age_i + \alpha_4 edu_i + \alpha_5 urban_i + \alpha_6 member_i + \alpha_7 credit_i + \alpha_8 coop_i + \alpha_9 elder_i + \alpha_{10} elect_i + \alpha_{11} island_i + v_i \quad (1)$$

$$Y2_i = \beta_0 + \beta_1 internet_i + \beta_2 G_i + \beta_3 age_i + \beta_4 edu_i + \beta_5 urban_i + \beta_6 member_i + \beta_7 credit_i + \beta_8 coop_i + \beta_9 elder_i + \beta_{10} elect_i + \beta_{11} island_i + e_i \quad (2)$$

Where  $i$  indicates the  $i$ -th agricultural household.  $Y2_i$  is agricultural household's food insecurity score (Raw score),  $G_i$  is agricultural household's food insecurity score (Rasch score),  $internet$  is whether a household is using the internet or not,  $G_i$  is the gender of the head of the household -  $i$ ,  $age_i$  is the age of the head of the household -  $i$ ,  $edu_i$  is the education of the head of the household -  $i$ ,  $urban$  is classification of the status of the household (urban or rural),  $member_i$  is the number of household members,  $credit$  is access to credit,  $coop$  is cooperative membership,  $elder$  is the presence of the elderly in the household,  $elect$  is access to electricity and  $island$  is the variable island of residence (island).  $e_i$  and  $e_i$  denote random error terms, and  $\beta_0$  indicate the parameters to be estimated.

### 3. Results and Discussion

Maitra & Rao (2017) and Anwar & Nasrudin (2021) classify food insecurity status using cut-offs based on raw scores of 3, 5, and 7. Based on this, food insecurity status is divided into 4 groups, namely High food secure ( $0 \leq$  raw score  $< 3$ ), Marginally food secure ( $3 \leq$  raw score  $< 5$ ), Moderately food insecure ( $5 \leq$  raw score  $< 7$ ), and Severely food insecurity ( $7 \leq$  raw score  $< 8$ ). Classification of food insecurity by island can be seen in Table 1. Table 1 shows the variation in the agricultural households' food insecurity status by island. Java Island has the highest proportion of food secure households compared to other islands. Meanwhile, severe food insecurity is common in the eastern region, especially for Maluku and Papua islands. Samim, et al. (2021) stated that the differences in severity of food insecurity between regions may be due to low efficiency and agricultural production, as well as the lack of adequate infrastructure and still a social conflict like war.

**Table 1. Percentage of Agricultural Households by Food Insecurity Classification and Island (%)**

Food insecurity status	Island (percentage)					
	Jawa	Sumatera	Kalimantan	Sulawesi	Balnusra	Mapa
High food secure	91.56	88.32	89.32	85.58	74.94	77.70
Marginally food secure	5.70	8.14	7.15	9.71	18.63	13.21
Moderately food insecure	1.73	2.15	1.99	2.81	4.60	4.65
Severely food insecurity	1.01	1.39	1.54	1.90	1.83	4.44
Summary	100	100	100	100	100	100

Source : Processed Susenas 2018  
 Balnusra : Bali & Nusa Tenggara Island  
 Mapa : Maluku & Papua Island

Before conducting an empirical analysis to determine the relationship between internet use on food insecurity of agricultural households, data exploration is carried out first to find out a general description of the characteristics of the household. The summary statistics of variables used in this study are shown in Table 2. As shown in Table 2, from 128,915 samples of agricultural households, there is about 30.35 percent of households or there are 39,120 agricultural households that use the

internet. There are 88.45 percent of the household head is male. The average age of household head is 49 to 50 years old, which indicates that the agricultural sector is less attractive to young people. On average, 15.40 percent of agricultural households live in urban areas and the rest live in rural areas. The urban agricultural household is more active to use the internet than the household that lived in the rural area. It shows that the infrastructure in urban areas is easier

to be accessed by households than in rural areas. 22.53 percent of agricultural households have access to credit and 24.06 percent of households are members of cooperatives. The average number of household members is 4 people. The education of the agricultural household head in this sample is dominated by the household head who only has an elementary school which reached 70.48 percent. The education level of households that use the internet is higher than the households that don't.

Difference between the raw score and Rasch score between internet users and non-internet users. Food insecurity is seen to be clear and still exists even though they have been divided by geographic areas (in this study divided by islands). This can be seen in Figure 1 and Figure 2. The difference in the average value of the raw score between 2 large sub-samples occurred in

almost all regions, especially in Bali and Nusa Tenggara. The average raw score of internet users in the region is 0.99 and for non-internet users, it is 1.56. Meanwhile, The difference in the average Rasch score between the 2 sub-samples is greatest on the island Maluku and Papua where the Rasch score of internet users is 0.82 while non-internet users are 1.02. This indicates that it is necessary to further analysis to see if there are differences in the impact of internet use on food insecurity of agricultural households in Indonesia, due to the findings in Figure 1 and 2 without taking into account other factors such as demographic factors such as type of gender, education, age, household size, and other factors are both observable or not, which factors are likely to have a simultaneous effect on agricultural household decisions in using the internet and also food insecurity.

**Table 2. Internet users and non-internet users mean differences of key variable**

Variable	All samples		Non-internet users		Internet users		Mean differences
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
Raw Score	0.887	1.623	1.005	1.719	0.616	1.337	-0.388***
Rasch Score	0.993	0.739	1.034	0.764	0.897	0.666	-0.137***
Internet	0.304	0.460					
Gender	0.885	0.320	0.881	0.324	0.893	0.309	0.012***
Age	49.597	13.082	48.935	13.860	51.117	10.939	2.182***
Education	0.295	0.456	0.268	0.443	0.357	0.479	0.089***
Elders	0.299	0.458	0.303	0.460	0.288	0.453	-0.015***
Credit	0.225	0.418	0.196	0.397	0.292	0.455	0.096***
Cooperation	0.241	0.428	0.204	0.403	0.325	0.468	0.121***
Household size	3.997	1.782	3.967	1.932	4.067	1.374	0.100***
Urban	0.154	0.361	0.124	0.330	0.222	0.415	0.097***
Electricity access	0.923	0.267	0.896	0.305	0.985	0.121	0.089***
D u m m y Jawa	0.227	0.419	0.205	0.404	0.276	0.447	0.071***
D u m m y Sumatera	0.329	0.470	0.313	0.464	0.368	0.482	0.056***
D u m m y Kalimantan	0.103	0.304	0.101	0.301	0.107	0.309	0.006***
D u m m y Sulawesi	0.146	0.353	0.145	0.352	0.149	0.356	0.004***

Variable	All samples		Non-internet users		Internet users		Mean differences
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
D u m m y Balnusra	0.091	0.288	0.103	0.303	0.065	0.246	-0.038***
D u m m y Mapa	0.104	0.305	0.134	0.340	0.035	0.184	-0.098***
Observaton	128,915		89,795		39,120		

Source : Processed Susenas 2018

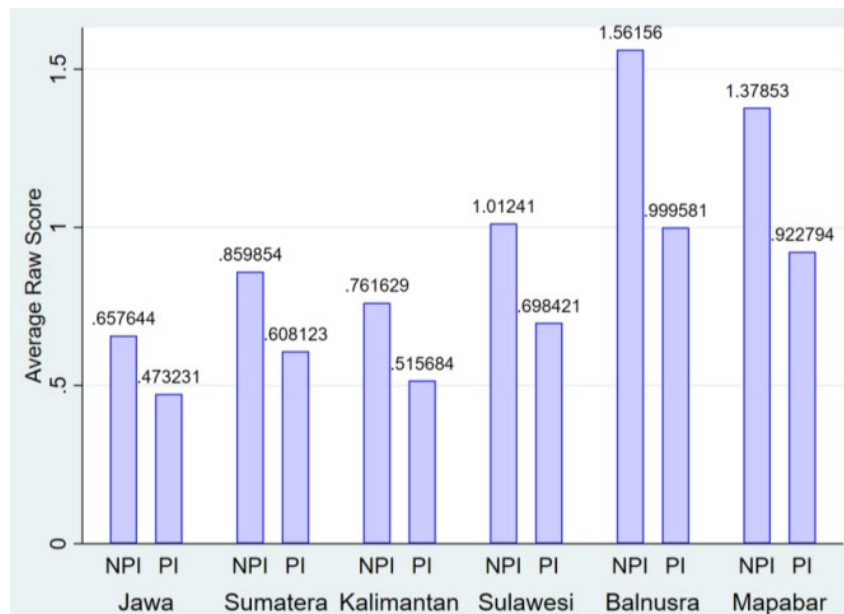


Figure 1. Internet Use and Average Rasch Score of Agricultural Households By Region

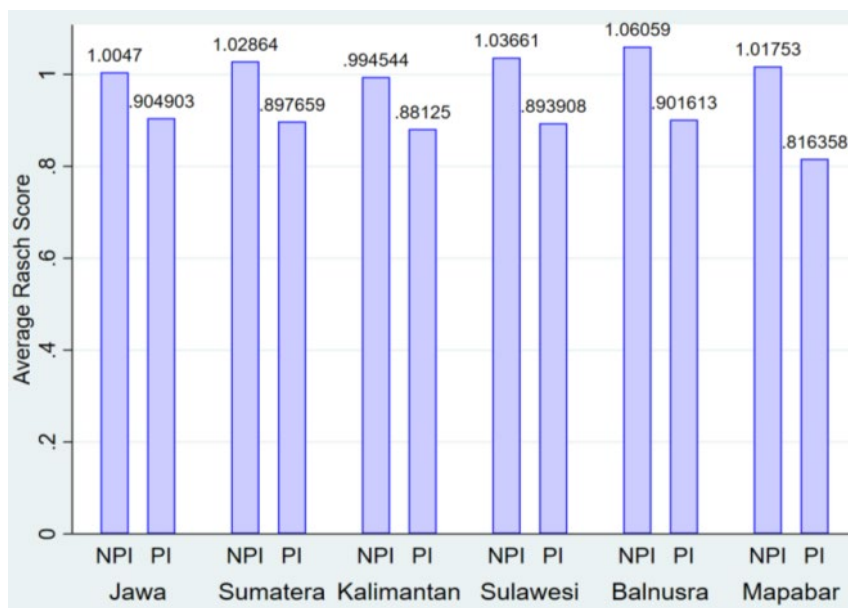


Figure 2. Internet Use and Average Rasch Score of Agricultural Households By Region

The regression result of internet use on agricultural households' food insecurity is presented in Table 3. Estimated results using both measurements with or without control variables show the same direction. Internet use can reduce food insecurity of agricultural households in Indonesia. The estimation results in Table 3 show that internet use has a negative and significant effect on food insecurity of agricultural households with a significance level of 1 percent. Assuming other variables are constant, internet use can reduce the raw score of food insecurity by 0.205 points and a Rasch score food insecurity of 0.090 points if the household uses the internet. The role of internet use is relatively large for reducing food insecurity of agricultural households, which is 0.231 relative to the average raw score of all observations, as well as food insecurity Rasch score of 0.09 relative to the average Rasch score of all observations. The results of this study further strengthen the evidence of empirical study results previously that the use of the internet can reduce food insecurity of agricultural households. Research by Twumasi, et al. (2021) found that the use of the internet can reduce the food insecurity of agricultural households in Ghana. Internet use lowers agricultural household food insecurity access scores of 0.061 points (Twumasi, et al., 2021).

In addition, based on a study by Xue, et al. (2021), rural China gives the same result, namely the use of the internet has an impact to increase the household consumption of protein, fat, and daily energy nutrients. User the internet has a series of incentives such as obtaining additional information about employment or information regarding the marketing and sales of agricultural products or others to get additional income which ultimately increases food security (Twumasi, et al., 2021). So that it can be said to reduce food insecurity, households should use the internet. The results of this study are also in line with the research by Namubiru (2018), which found that the use of ICT tools such as cell phones, radio,

and computers as tools to search for agricultural information and market information can increase the chances of households being more food secure in Uganda by 33.4 percent. The utilization of the internet can improve communication between agricultural households and also improve access to information related to inputs and techniques as well as new technology. In addition, the internet can also make it easier to access information such as estimates whether to reduce unpredictable weather and ensure product prices agriculture, increase agricultural products.

The control variables which had a positive and significant association with agricultural households' food insecurity are urban status, household size, and access to credit, the other variables like gender, age, education, and cooperation status have a negative association and are significant to agricultural household's food insecurity. In addition, the elders variable has a non-significant association with household food insecurity.

This study also shows that the education of the head of the household is negatively and significantly related to food insecurity in agricultural households. This means that household food insecurity is less experienced by households whose head of household has a junior high school education or above. The head of the household who has a junior high school or above can reduce food insecurity, both raw score and Rasch score by 0.237 points and 0.120 points. This is because when compared to the less educated household, educated people have more knowledge and skills to increase agricultural production and obtain off-farm jobs to increase household income and spending patterns. The increasing income of the agricultural household would reduce their food insecurity. The results of this study are also in line with the research of Issahaku & Abdulai (2019) and Twumasi, et al. (2021) in China which shows that education can significantly improve household food security. So education plays an important role in achieving household welfare.



**Table 3. The Regression Result Of Internet Use On Household's Food Insecurity**

Variables	Raw Score		Rasch Score	
	Food Insecurity	Food Insecurity	Food Insecurity	Food Insecurity
	(1)	(2)	(3)	(4)
Internet	-0.388*** (0.010)	-0.205*** (0.010)	-0.137*** (0.004)	-0.090*** (0.004)
Gender		-0.304*** (0.142)		-0.140*** (0.006)
Age		-0.004*** (0.000)		-0.002*** (0.000)
Education		-0.237*** (0.104)		-0.120*** (0.005)
Urban		0.068*** (0.012)		0.025*** (0.005)
Household size		0.054*** (0.002)		0.023*** (0.002)
Elders		-0.006 (0.012)		0.002 (0.006)
Cooperation		-0.322*** (0.011)		-0.182*** (0.005)
Credit		0.002 (0.011)		0.017*** (0.005)
Electricity access		-0.513*** (0.018)		-0.198*** (0.008)
Constant	1.004*** (0.005)	2.134*** (0.031)	1.034*** (0.002)	2.134*** (0.031)
Dummy island	No	Yes	No	Yes
Observations	128,915	128,915	128,915	128,915

Source : Processed Susenas 2018

Furthermore, households with access to credit have experienced greater food insecurity than those who are not. It means that households with debt can increase food insecurity. This result is inversely proportional to the results of research conducted by Twumasi, et al. (2021). In this case, credit has benefits for households to increase agricultural production and maximize profits, and can also create employment which in turn can increase household income to improve food security. However, in Indonesia, the finding has the opposite association. The result shows

that better access to credit will increase the chances of agricultural households experiencing vulnerability which may be because the credit obtained is used for unproductive activities so that households cannot afford to pay for them. Furthermore, other household characteristics such as the number of family members as well increase the food insecurity of agricultural households. That matter indicates that the more members of the household owned, the more food insecure assuming the other variables are constant. That is because the demand for food

quality will decrease due to expenditure which increases with the number of household members (Twumasi, et al., 2021). The other factor that can affect household food insecurity is living status. Households living in urban areas can increase raw score and Rasch score for food insecurity are 0.068 units and 0.025 units, respectively assuming the other variables are constant. More agricultural households are found in rural areas indicating that access to food is greater.

Agricultural households that have access to electricity have a negative impact on agricultural households' food insecurity. In this case, agricultural households that have access to electricity can reduce food insecurity, both the raw score and Rasch score food insecurity

were 0.513 units and 0.198 units. This result is in line with research by Asghar & Muhammad, (2013) which found the fact that households who have access to electricity are less likely to be food insecure compared to households that do not have access to electricity. A household that has access to electricity was found to be 14 percent less likely to experience food insecurity. The quality of household infrastructure, one of which is the availability of electricity be an indicator of the standard of living or household welfare that can support productivity and work (Faridi & Wadood, 2010). In addition, access to electricity allows households to store food ingredients so that food will last longer for consumption (Faridi & Wadood, 2010).

**Table 4. The Regression Result Of Internet Use On Household's Food Insecurity by Gender**

Variables	Raw Score		Rasch Score	
	Male	Female	Male	Female
	(1)	(2)	(3)	(4)
Internet	-0.198*** (0.010)	-0.256*** (0.033)	-0.088** (0.004)	-0.106*** (0.015)
Household'head characteristics	Yes	Yes	Yes	Yes
H o u s e h o l d characteristics	Yes	Yes	Yes	Yes
Dummy island	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Observations	114,023	14,892	114,023	14,892

Source : Processed Susenas 2018

In this study, we will further analyze the impact of using the internet on food insecurity in agricultural households based on the gender of the head of the household. The result is presented in Table 4. Based on the results, the coefficient for both men and women shows the same direction, namely the use of the internet can reduce food insecurity in agricultural households. Compared to females, the use of the internet by male household heads has a smaller coefficient. This shows that female head households that use the internet have a greater impact on reducing household food insecurity for both the raw

score and the Rasch score. This finding is very interesting because it provides evidence that the activity of agriculture that has a positive impact on food security is mostly done by women. Female-headed households relatively use the internet productively. The female household heads will lower the food insecurity, having both raw score and Rasch score of 0.256 points and 0.106 points, while male household heads have raw score and Rasch score of 0.198 points and 0.088 points respectively. This result is in line with Ibnouf (2011) which shows that female household heads compared to men will have more

roles in improving food security. This relates to her responsibility in preparing, processing and preserving food for the family (Ibnouf, 2011).

#### 4. Conclusions

Based on the results, this study found evidence that there are differences in the level of food insecurity between agricultural households who use the internet and those who do not. Furthermore, the results of this study complement existing studies that in developing countries, there is a negative relationship between internet use and agricultural household food insecurity. It means that internet use can reduce food insecurity in agricultural households. This is related to the existence of information related to agriculture that can increase income which in turn reduces food insecurity.

Based on the results, several policy implications can be obtained in designing policies to improve food security. First, this study has proved that the use of the internet for agricultural households located in the mountains or hills is less than those located in the plains. So the government should focus more on increasing investment related to internet infrastructure in the region, such as supporting the provision of Base Transceiver Stations (BTS). Second, besides providing easy access to the internet, the government also needs to develop content and provide information that can be accessed using the internet to increase the productivity of agricultural households such as information for transacting, buying, and selling agricultural products online, price information, weather information, and agricultural technology information. This is because information related to agriculture obtained from the internet can support food security.

In this study, there are still some limitations, the use of cross-section data. Ideally, an analysis of the impact of internet use on agricultural household food insecurity is more interesting if using panel data so that changes can be seen between years. In addition, this research still uses the internet in general which is used to increase productivity, without considering internet usage based on the purpose of use. Therefore, further

research is expected to consider using panel data and using internet variables that are more detailed based on their intended use.

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