Factors affecting the food security and community welfare of farmer households in Sumatera, Indonesia

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Abstract

Purpose – The purpose of this paper is to examine and analyze the factors of availability, access, and absorption affecting the level of food security and its impact on the community welfare.
Design/methodology/approach – This study focuses on food security and community welfare in all provinces in Sumatra. Available data are obtained from sustainable development goals (SDGs) data in 2015 (Badan Pusat Statistik, 2016), with the district/city in Sumatra as unit analysis, with the number of samples 152 districts/cities. The causal relations between variables (the relationship between availability (X1), accessibility (X2), and absorption (X3) and effect of food security (Y1), and the relationship between food security (Y1) and community welfare (Y2)) were examined using covariance-based structural equation modeling using WarpPLS.
Findings – The conclusion of this study shows that the availability, accessibility, and absorption statistically influence the food security. On the other hand, the food security statistically influences the community welfare.
Originality/value – Until now there is no previous research that brings food security factors integrated with the community welfare, and no one has studied the full modeling on the Sumatra, Indonesia, and the use of SDGs data intact considering the new data of 2015 SDGs collected replacing the millennium development goals data.

Keywords Availability, Accessibility, Food security, Absorption, Community welfare
Paper type Research paper

1. Introduction

Food security is different from food availability. Sufficient food availability means adequate food, not only in terms of rice but also food derived from plants, poultry, and fish (Suryana, 2003). Food security is not about food self-sufficiency as well. Self-sufficiency of food is generally an achievement of increasing food availability within the territory of a nation, while food security prioritizes the access of individuals to obtain nutritious food for health and productivity (Hanani, 2009). Law No. 7 of 1996 stipulates that food security is a condition where there is an adequate availability of safe, equitable, and affordable food (both in terms of quality and quantity). Based on this definition, food security must: consider the time dimension that food is available and accessible at any time; emphasize access of households and individuals to food, either physical, economical, or social one; and be oriented to the fulfillment of nutrition. In doing so, the achievement of food security of a region is not only determined by the factor of food availability, but also by other factors.

Based on the National Food Insecurity Atlas for Indonesia 2015, from 265 districts in Indonesia in 2013, food insecurity was identified in 100 districts as the variables that indicate food insecurity in these regencies had high scores, either for availability, accessibility, or absorption of food. As a result, it is imperative that those regencies need to get priority in attempts to deal with food insecurity. However, it should be noted that of the 100 districts indicated to suffer from food insecurity, food surplus was indicated in 47 districts only (DKP, 2015).

Based on the publication of the Food Security and Vulnerability Atlas in 2009, 346 districts in Indonesia in 2007 could be classified into six priority groups in relation to the attempt to cope with food insecurity. This classification was based on variables causing vulnerability of

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food insecurity in those areas. In the first three priority groups (groups susceptible to food insecurity), variables food availability, access to food, and food absorption became the dominant variables affecting food insecurity in those areas (DKP, 2009).

In regencies coming first and second in order of priority, the main variables indicating food insecurity were a high level of poverty and limited access to electricity, road vehicles, and clean water. As for the regencies that ranked third in order of priority, the main variables indicating food insecurity were high poverty, limited access to clean water, a high gap between food needs and production (cerealia), and limited access to electricity. Based on those findings, it is revealed that in regencies coming first and second in order of priority, the main variables indicating food insecurity are not those that constitute factors determining food availability. As for the regencies that ranked third in order of priority, the factor of food availability is one of the factors to note among variables included in the factors of access to food and food absorption, because variables including food availability (a high gap between food needs and production) become one of the major variables that indicate food insecurity in the area. These results indicate that the factors of access to food and food absorption are more dominant in influencing food insecurity in an area than food availability.

The benchmark to indicate whether a region manages to achieve food security or not is not only seen from the factor of food availability, but also by access to food and food absorption in that area. This is consistent with the concept of food security from various institutions in the world (Hanani, 2009) such as: USAID: conditions where everyone at all times has physical and economic access to their consumption needs for healthy and productive living. FAO: situation where all households have access both physically and economically to obtain food for all members of their family. Mercy Corps: a state where everyone at all times has physical, social, and economic access to food sufficiency, which is safe and nutritious for nutritional needs according to their taste for productive and healthy living.

Food security is not realized simply by achieving food availability. Rather, it will be achieved in the presence of proper access to adequate food and proper food absorption. Unfortunately, such conditions have not been achieved in many regencies in Indonesia, where the availability of adequate food even excessive one is not accompanied by adequate access to food. This results in less optimal absorption of food and consequently there are many regencies in Indonesia that still fail to achieve food security despite food surplus. In the present research, the phenomenon of food surplus in regencies where food insecurity is identified is limited to the assessment of food surplus in districts. This research analyzes conditions occurring in areas with food surplus. However, information about the food insecurity status of various regions was updated in 2016. Therefore, the research period is limited to year 2016.

Based on the above explanation, this research examines and analyzes the factors of availability, accessibility, and absorption affecting the level of food security and their impact on community welfare. This research focuses on all provinces in Sumatera. Srinita (2015) states that Aceh is a province that shows sustainable food security. Agriculture is the backbone of its economy, which serves as the key to maintaining food security. This means that the availability of food is sufficient both in terms of quantity and quality and it is distributed at an affordable price and accessible by society in order that they can do their daily activities throughout the day safely. Based on the foregoing, food security will suffice not only for the global, national, or regional levels but also for the level of households, especially farmer households.

Several previous studies have found a partial relationship between variables as follows: food availability and food security by Wojciechowska-Solis and Soroka (2017), Coppola *et al.* (2017), Camilleri and Neuhofer (2017), Agolla and Lill (2017), Pesantes and Documet (2017), and Savelli *et al.* (2017); access to food and food security by Koutsothanassi *et al.* (2017), Khare and Pandey (2017), Callado and Jack (2017), Rafay *et al.* (2017), and Sharabi (2017); food

absorption and food security by Sharabi (2017), Hu *et al.* (2017), Mody *et al.* (2017), Novak *et al.* (2017), Singh and Singh (2017), Jalles and Andresen (2017), Wang *et al.* (2017), Aluko and Knight (2017), Lin *et al.* (2017), and Andrews (2017); and food security and community welfare by Laine and Vinnari (2017), Coppola *et al.* (2017), Passarini *et al.* (2017), Kumar (2017), Danquah and Ohemeng (2017), Ram *et al.* (2017), Arruda and Krutkowski (2017), Aluko and Knight (2017), Cheung *et al.* (2017), and Fakos and Merino (2017). None of those previous studies had comprehensively investigated the relationship between food availability, accessibility, and absorption and food security and their effect on community welfare, especially in Indonesia.

2. The literature review

Food security is an integrated food economy system consisting of various subsystems (Suryana, 2003). The Food Security Council (DKP) in conjunction with the World Food Program has formulated food security indicators that are grouped into three factors, namely, food availability, accessibility, and utilization (DKP, 2009). Therefore, it can be said that the system of food security consists of three main subsystems, namely, food availability, accessibility, and absorption (Hanani, 2009). Food availability should be sufficient to define the number of calories needed for an active and healthy life (Suryana, 2003), while access to food is defined as the ability of all households and individuals with the resources they have to obtain enough food to meet their nutritional needs. It includes economic, physical, and social access. Economic access depends on income, employment, and price. Physical access involves the level of regional isolation (distribution facilities and infrastructure). Finally, social access concerns food preferences. The absorption of food refers to the consumption of food for the needs of a healthy life that includes energy and nutritional needs, water, and environmental health. The effectiveness of food absorption depends on a household's/an individual's knowledge, sanitation and water availability, health facilities and services, as well as nutritional and toddler counseling (Hanani, 2009). Food absorption refers to food consumption among households and the ability of individuals to absorb and metabolize nutrients (DKP, 2009).

Food diversification refers to any capability of farmers in Aceh Province to produce some food varieties. Based on data collected using questionnaires, it can be observed that most of the food varieties produced are various grains. Hence, the majority of farmers in this area plant various grains in paddy fields as well as fruits and vegetables. The better food diversification is, the higher food security among farmer households in Aceh Province is. Agriculture is the backbone of its economy, which serves as the key to maintaining food security. This means that the availability of food is sufficient both in terms of quantity and quality and it is distributed at an affordable price and accessible by society in order that they can do their daily activities throughout the day safely. Based on the foregoing, food security will suffice not only for the global, national, or regional levels, but also for the level of households, especially farmer households. Food security may be influenced by some factors, which among other things are food diversification, the food pattern expectation, policies, and institutional and local potential. Those factors may influence food security in Aceh Province which still faces the issue of food insecurity, especially at the level of households.

3. Research method

This research focuses on food security and community welfare in all provinces in Sumatera. Data were obtained from the sustainable development goals data in 2015 (Badan Pusat Statistik, 2016), with a total sample of 152 districts/cities located in Sumatera as the unit of analysis. The causal relations between variables (the relationship between availability (X1), accessibility (X2), and absorption (X3) and food security (Y1), and the relationship between food

security (Y1) and community welfare (Y2)) were examined using covariance-based structural equation modeling using WarpPLS. The conceptual framework of the research is presented in Figure 1. Theories and previous research for each relationship are described as follows:

H1. There is a relationship between food availability and food security, which is consistent with Wojciechowska-Solis and Soroka (2017), Coppola *et al.* (2017), Camilleri and Neuhofer (2017), Agolla and Lill (2017), Pesantes and Documet (2017), and Savelli *et al.* (2017).

H2. There is a relationship between accessibility and food security, which is consistent with Koutsothanassi *et al.* (2017), Khare and Pandey (2017), Callado and Jack (2017), Rafay *et al.* (2017), and Sharabi, M. (2017).

H3. There is a relationship between absorption and food security, which is consistent with Sharabi (2017), Hu *et al.* (2017), Mody *et al.* (2017), Novak *et al.* (2017), Singh and Singh (2017), Jalles and Andresen (2017), Wang *et al.* (2017), Aluko and Knight (2017), Lin *et al.* (2017), and Andrews (2017).

H4. There is a relationship between food security and community welfare, which is consistent with Laine and Vinnari (2017), Coppola *et al.* (2017), Passarini *et al.* (2017), Kumar (2017), Danquah and Ohemeng (2017), Ram *et al.* (2017), Arruda and Krutkowski (2017), Aluko and Knight (2017), Cheung *et al.* (2017), and Fakos and Merino (2017).

In this research, all of its variables are unobservable and were formed using formative indicators (as an observable variable) using the principal component analysis (the same as the outer weight in WarpPLS). The variable availability (X1) was measured based on the proportion of the population living in households with access to utilities, total official flows to the agricultural sector, subsidies for exports in the agricultural sector, the proportion of the population using water safely, and the proportion of the population using managed sanitation services. The variable accessibility (X2) was measured based on the volume of production per labor unit by farm class, the proportion of the agricultural area underproductive and sustainable agriculture, the number of plant and animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities, coverage of essential health services, the rate of participation of the youth and adults in formal education, and the proportion of the population with access to electricity. The variable absorption (X3) was measured based on the prevalence of stunting, life expectancy, and the proportion of moderate underweight children under five years of age. The variable food security (Y1) was measured based on the indicators of food price

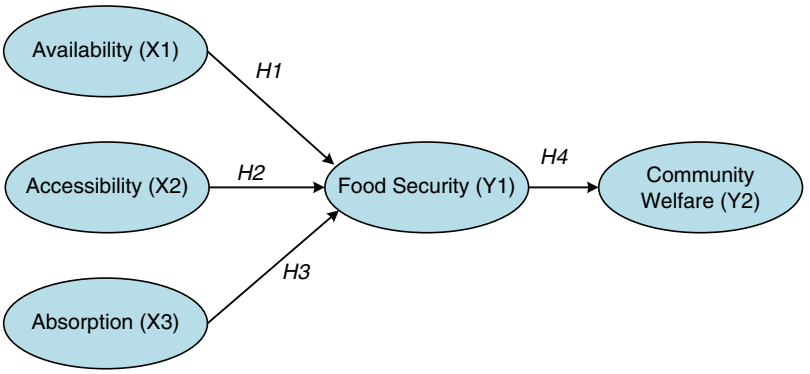

Figure 1.
Conceptual framework

anomalies, the mortality ratio, the global food loss index, the prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition. The variable community welfare (Y2) was measured based on the agricultural orientation index for government expenditures, the average income of small-scale food manufacturers, the annual growth rate of actual GDP, the rate of unemployment, and the poverty gap ratio.

4. Results

In this research, the model was considered fit if it was supported by empirical data. It is known that the structural model goodness of fit in the WarpPLS analysis in the form of the value of predictive relevance (Q2) is computed based on the R^2 value of each endogenous variable. From the R^2 value for each endogenous variable, it can be seen that the value of predictive relevance (Q2) is equal to 0.7601 or 76.01 percent, meaning that the model can explain the variables food security and community welfare by 76.01 percent and the remaining 23.99 percent is explained by other variables not included in the model. This suggests that the value of Q2 by less than 75 percent indicates that the model is fit and suitable for further analysis.

The first part of the analysis results is the measurement model (outer model), which indicates results of measurement for each variable, defined by several indicators. Those indicators are deemed statistically significant if they have a p-value < 0.05.

Based on Table I, the variable availability is significantly measured by four indicators, namely, the proportion of the population living in households with access to utilities,

Variable	Indicators	Outer weight	p-value
Availability	Proportion of population living in household with access to utilities	0.551	0.028*
	Total official flows to the agricultural sector	0.470	0.060
	Subsidies for exports in the agricultural sector	0.740	0.003*
	Proportion of the population using water safely	0.794	0.001*
	Proportion of the population using managed sanitation services	0.543	0.030*
Accessibility	Volume of production per labor unit by farm class	0.416	0.096
	Proportion of the agricultural area underproductive and sustainable agriculture	0.400	0.109
	Number of plant and animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities	0.401	0.108
	Coverage of essential health services	0.592	0.018*
	Rate of participation of the youth and adults	0.508	0.042*
	Proportion of the population with access to electricity	0.438	0.080
Absorption	Prevalence of stunting	−0.450	0.072
	Life expectancy	0.670	0.007*
	Proportion of moderate underweight children under five years of age	−0.781	0.002*
Food security	Indicators of food price anomalies	−0.472	0.059
	Mortality ratio	−0.447	0.074
	Global food loss index	−0.634	0.011*
	Prevalence of undernourishment	−0.690	0.006*
	Prevalence of moderate or severe food insecurity	−0.713	0.004*
	Prevalence of malnutrition	−0.596	0.017*
Community welfare	Agricultural orientation index for government expenditures	0.529	0.034*
	Average income of small-scale food manufacturers	0.503	0.044*
	Annual growth rate of actual GDP	0.469	0.061
	Rate of unemployment	−0.681	0.006*
	Poverty gap ratio	−0.771	0.002*

Table I.
Measurement model

Note: *Statistically significant (p-value < 0.05)

subsidies for exports in the agricultural sector, the proportion of the population using water safely, and the proportion of the population using managed sanitation services. The variable accessibility is significantly measured by two indicators, namely, coverage of essential health services and the rate of participation of the youth and adults in formal education. The variable absorption is significantly measured by two indicators, namely, life expectancy and the proportion of moderate underweight children under five years of age. The variable food security is significantly measured by four indicators, namely, the global food loss index, the prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition. The variable community welfare is significantly measured by four indicators, namely, the agricultural orientation index for government expenditures, the average income of small-scale food manufacturers, the rate of unemployment, and the poverty gap ratio.

The second part of the analysis results is the structural model (inner model), which indicates the relationship between variables. In this research, each hypothesis was tested using the PLS analysis and a *t*-test was performed on each direct path of effect partially (Table II) (Figure 2).

The results of the test show that the inner weight of the relationship between the variables availability and food security is equal to 0.654 (positive), the value of *t*-statistic is equal to $3.270 > 1.96$, and the *p*-value is equal to $0.001 < 0.05$, meaning that the variables availability and food security have a statistically significant and positive relationship. The higher the value of the variable availability is (as shown in the values of the proportion of the population living in households with access to utilities, subsidies for exports in the agricultural sector, the proportion of the population using water safely, and the proportion of the population using managed sanitation services which are higher because the coefficient of the outer weight is positive), the higher its resulting effect on the variable food security (as shown in the values of the global food loss index, the

Relationship	Inner weight	*t*-statistic	*p*-value
The relationship between availability and food security	0.654	3.270	0.001*
The relationship between accessibility and food security	0.592	2.960	0.018*
The relationship between absorption and food security	0.620	3.099	0.013*
The relationship between food security and community welfare	0.699	3.494	0.005*

Note: *Statistically significant (*t*-stat > 1.96 and *p*-value < 0.05)

Table II.
Structural model

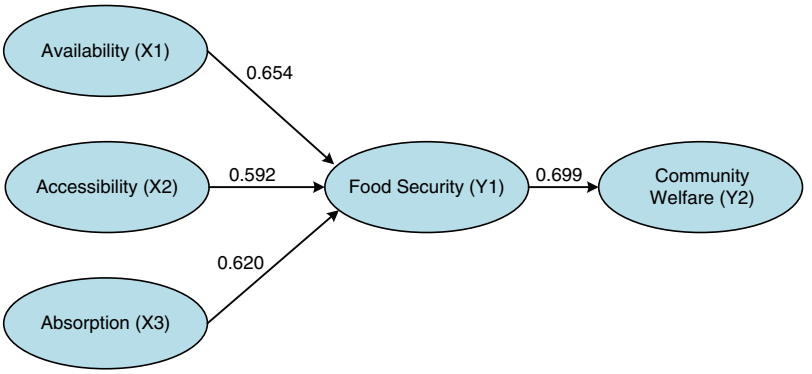

Figure 2.
Structural model

prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition which are lower because the coefficient of the outer weight is negative).

The results of the test show that the inner weight of the relationship between the variables accessibility and food security is equal to 0.592 (positive), the value of *t*-statistic is equal to $2.960 > 1.96$, and the *p*-value is equal to $0.018 < 0.05$, meaning that the variables accessibility and food security have a statistically significant and positive relationship. The higher the value of the variable accessibility is (as shown in the values of coverage of essential health services and the rate of participation of the youth and adults in formal education which are higher because the coefficient of the outer weight is positive), the higher its resulting effect on the variable food security (as shown in the values of the global food loss index, the prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition which are lower because the coefficient of the outer weight is negative).

The results of the test show that the inner weight of the relationship between the variables absorption and food security is equal to 0.620 (positive), the value of *t*-statistic is equal to $3.099 > 1.96$, and the *p*-value is equal to $0.013 < 0.05$, meaning that the variables absorption and food security have a statistically significant and positive relationship. The higher the value of the variable absorption is (as shown in the values of life expectancy and the proportion of moderate underweight children under five years of age which are higher because the coefficient of the outer weight is positive), the higher its resulting effect on the variable food security (as shown in the values of the global food loss index, the prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition which are lower because the coefficient of the outer weight is negative).

The results of the test show that the inner weight of the relationship between the variables food security and community welfare is equal to 0.699 (positive), the value of *t*-statistic is equal to $3.494 > 1.96$, and the *p*-value is equal to $0.005 < 0.05$, meaning that the variables food security and community welfare have a statistically significant and positive relationship. The higher the value of the variable food security (as shown in the values of the global food loss index, the prevalence of undernourishment, the prevalence of moderate or severe food insecurity, and the prevalence of malnutrition which are lower because the coefficient of the outer weight is negative), the higher its resulting effect on the variable community welfare (as shown in the values of the agricultural orientation index for government expenditures and the average income of small-scale food manufacturers which are higher (negative coefficient) as well as the rate of unemployment and the poverty gap ratio which are lower (positive coefficient)).

5. Discussions

Research findings suggest that the variables availability, accessibility, and absorption statistically affect food security, in which the higher the availability, accessibility, and absorption are, the more significant their effect on food security. Moreover, food security statistically influences community welfare, where the higher the level of food security is, the higher the resulting effect on community welfare.

Conditions of food availability, accessibility, and absorption affect the resulting food security. It can be seen that based on those variables, the group of regencies with food security generates a higher value of food security than the group of regencies with food insecurity. This indicates that the superiority of a region with regard to the factor of food availability will determine the resulting food security in that region.

It is necessary to pay attention to the distribution of regencies with food security status by the factor of food availability. For most districts in this group, the resulting score for the

variable food availability is below average. However, when viewed from the factor of food accessibility, the resulting score of most regencies is above average. Then, in relation to the factor of food absorption, the distribution of this regency group is not different from that of regencies with food insecurity status, where most regencies still need to pay attention to the percentage of household users and increase the knowledge of household heads so that food absorption can be improved. The provision of access to food coupled with adequate food absorption makes most of the regencies in this group have an above-average score for the variables that indicate the outcome of food security.

Food diversification is an important issue in attempts to achieve food security. Food diversification means consuming food and/or beverages from some food resources. Food resources are divided into two categories, i.e., resources derived from animals and resources derived from plants. From those resources, a substance called nutrition can be obtained and used for the process of metabolism in the human body. Then, in order that the human body/organs can function properly, the intake of nutrition from food should be adjusted to the metabolism need to support all physiologic and body functions. Basically, the nutrition required by the human body cannot be obtained from a single source of food only; thus, to meet the nutritional need requires a variety of food. However, food diversification is necessary to get rid of dependency on any food variety. This may be manifested in local food utilization and development. Traditional or local food is the type of food usually consumed by the community based on their respective ethnic group and area/region processed based on a well-recognized prescription handed down through generations. Generally, local food is made from local materials such as all kinds of tubers (corn and rice) and legumes. Local food may be made as a product in order to achieve food diversification such as: *papeda*, *ledok*, *beras aruk*, *jeppa*, *eloi*, *baalo binthe*, *basang*, *kapurung*, *talipok*, *embal*, *tiwul*, *tinotuan*, *ampok* rice, and *hanjeli porridge*. Maneh Ro (a kind of rice) is the staple food of the people of Aceh. It is delicious. Currently, farmer households in Aceh Province are implementing food diversification. In addition to rice, they also eat food derived from all kinds of tubers.

Findings of the research by Mardhiyyah and Wijaya (2012) also discovered that development of potential local food may support food diversification. Potentially, local food contains high nutrition that can be improved as functional food. Food diversification is not only defined as the alternative to basic food but it also includes protein and fat diversification. In order to reduce consumption of rice/cerealia, improvement needs to be made with regard to consumption of other sources of food such as food derived from animals, legumes, vegetables, fruits, and so on while still maintaining the balanced diet. Diversified food is vital as an individual's nutritional needs cannot be met by a single source of food. Then, through the consumption of diversified food, one can get particular nutrition that has not been obtained from particular food. Findings of the research by Muthoni (2011) concluded that diversification strongly affects household food security. It contributed to the household food security status of about 47 percent of small-scale sugar cane farmers who maintained food and diversification positively.

The food pattern expectation refers to a variety of food based on the amount of energy it provided (absolute or relative) from any availability pattern and food consumption. The food pattern expectation of the people of Aceh Province is equal to 2,075.79, which is slightly higher than the recommended energy adequacy, i.e. 2,000 kcal. However, the food pattern expectation of farmer households is relatively ideal, although consumption of various grains is still highly dominant; however, most of those farmer households also combined it with all kinds of tubers and food such as vegetables, fruits, legumes, various fishes, and many more.

A balanced and qualified consumption pattern of nutritional food can improve the well-being of the human body/organs and household food security. Findings of the

present research corroborate those of the research by Pawirosono that consuming various food that contain carbohydrate, protein, or fat may increase the biological value of the food consumed during the metabolism process, and simultaneously, it contributes to the well-being of the body/organs and is vital for national food security, whereas findings of the research by Capone *et al.* (2014) suggested a strong correlation between food security and nutrition. Change in food consumption and food production is important for ensuring a sustainable food system and achieving food security and nutrition in Mediterranean. The research by Holmes (2008) described the relationship between food security, food consumption, and nutritional intake based on social and environmental factors.

Any important steps in the formulation of food security need to be understood and agreements have been established through meetings of work groups, seminars/workshops, regency head/mayor/governor assembly, and conferences. In order to enhance the stability of food security, the government has issued policies which focuses on the interest of farmers related to improvement of production capacity especially through incentives and the use of purchasing price set by the government for quality of GKP (dried unhulled paddy separated from the stalks). Hence, it is expected that the price received by farmers accords with the amount of the government's purchase. Additionally, there are policies related to efforts to manifest food independence, among others: the positive impact of the policy in the short term, i.e. input subsidy and increased output price and food trade, including distribution intervention; the positive impact of the policy in the long term, i.e. change of technology, extensification, safety net of food security, investment in infrastructures, as well as macro-policies, education, and health; and policy driving growth of domestic production supply. Such food policies should take farmers' side and protect them as well as have a positive meaning for farmer empowerment and guidance for manifestation of food security among farmer households.

Food policies are harmonization of activities supporting availability, distribution, and consumption of food to help individuals to access food and manage their own consumption to meet their nutritional needs. Food policies implemented in Sumatera Island especially attempt to ensure the availability of rice. Because most of the households in this island grow rice, so the availability of rice here is very adequate to meet the needs of those farmer households. Any food policies ensure people's right to food (as food consumers) and give communities their right (as producers, farmers) to determine the food system in accordance with the potential of local resources. The better the food policy is, the higher the level of food security among farmer households in Sumatera Island is. This is consistent with the research by Suparyanto (2014) that implementation of food policies has a positive effect, where they influence food distribution coordination to manifest food security in regencies, whereas according to the findings of the research by Ilham *et al.* (2013), in order that the policy on food pricing can run effectively, it should be supported by other policies such as those on infrastructures, increased income of the community, and attempts to eradicate corruption, especially in relation to food-related programs.

The food institution set the rules of games for sustainability of interests in managing foods (Arifin, 2009). From the perspective of the institution, Law No. 18 of 2012 on food has instructed the establishment of a governmental institution to manage the food sector. This institution shall be responsible to the president and serves as a governmental instrument in managing food security and food stability in order to ensure sufficient availability and affordable basic foods. Presently, at the local level, provinces in Sumatera already have a Board of Local Food Security tasked with the management of food security in Sumatera Island. This institution is in charge of monitoring conditions and speed up food security supported by facilities, networks, and infrastructures. In provinces in Sumatera, food institutions exercise a dominant effect on food security of farmer households.

These food institutions are an organization regulating and managing food security. In provinces in Sumatera, food institutions are highly supported by agricultural activities, especially in terms of bargaining activities where the price of products generated by farmers will be set based on the bargaining process. Then, the better the food institutions are, the higher the level of food security among farmer households in provinces in Sumatera is. Food institutions which play their role effectively may enhance food security among farmer households.

Sumatera Island is rich in vegetation. This area's local potential can be utilized through identification of the suitable potential for development of food commodities to counterbalance the speed of paddy field conversion, intensification of the quality improvement of areal expansion, improvement of irrigation networks and agricultural infrastructures, provision of production facilities accessible by farmers, and acceleration of super seed/germ technology invention to enhance productivity. Presently, the sectors of production, trade, and food consumption are dominated by legumes (cerealia and leguminosa). However, food production should be increased by adding and utilizing local resource-based food biodiversification. Local potential also significantly influences food security in provinces in Sumatera. In these provinces, a number of natural resources still have not been cultivated optimally in several agricultural fields, food supplies from farmers cannot be exploited, and farmers' ability to breed livestock remains poor. Even in production, invention of technology or knowledge may not be utilized yet. In other words, it can be said that the provinces in Sumatera should continue implementing change to the environmental management. The better the local potential is, the higher the level of food security among farmer households in provinces in Sumatera is.

6. Conclusions and recommendations

This research concludes that the variables availability, accessibility, and absorption statistically affect food security, in which the higher the availability, accessibility, and absorption are, the more significant their effect on food security. Moreover, food security statistically influences community welfare, where the higher the level of food security is, the higher the resulting effect on community welfare is.

Based on the research conclusions, several policies can be implemented, namely, first, local governments whose regions have reached a condition of food surplus should strengthen access to and absorption of food to achieve real food security. Second, the Food Security Council (DKP) as an institution that plays a role in formulating national food security policies is expected to add variables used in this research as new variables in the analysis of national food security.

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