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Comparative Analysis of Household Food Security at Three Agro-Ecosystems Based on Farming Scale in South Sulawesi

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ABSTRACT

Regulation No 18 year 2012 on food security states that food security is a condition to fulfill adequate food from country up to individual. It is reflected in the availability of adequate food, both in quantity and quality, safe, diverse, nutritious, equitable and affordable in accordance with beliefs and culture people being able to live health, active and productive with sustainable basis. The research objective is to identify the socio-economic characteristics of farmers at all scales of field agro-ecosystem, coastal agro-ecosystem and mountain agro-ecosystem and analyzing the degree of household food security at farming scale based on coastal agro-ecosystem type, field agro-ecosystem and mountain rice field agro-ecosystem in South Sulawesi. The household food security level from food supply components is within rather resistant to food (ATP) category based on all farming scale and agro-ecosystem at all types except the field agro-ecosystem is in secure to food (TP) category. The household food security level from food access component is in rather insecure category in all types and farming scale. The household food security level of food utilization components is secure to food (TP) category for all agro-ecosystem types and farming scales. The household food security level based on households nutritional status components is in category of rather secure to food (ATP) in all agro-ecosystem types and farming scale.

INTRODUCTION

The agricultural sector will continue to play an important role for economic development as a whole and provide food security for community (Teki Surayya, 2010). Rural-based development is aimed to achieve food security in a region that has the infrastructure integration, ranging from the availability to the food consumption to meet and realize household food security (A, Henri-Ukoha, 2011). Regulation No 18 year 2012 on food security states that food security is a condition to fulfill adequate food from country up to individual. It is reflected in the availability of adequate food, both in quantity and quality, safe, diverse, nutritious, equitable and affordable in accordance with beliefs and culture people being able to live healthy, active and productive with sustainable basis. (Agriculture Department, 2012). www.Deptan.go.id.

Food security conditions in South Sulawesi province shows a growth in food production for vegetable sources, except cassava decline 7.86 percent, peanuts decline 9.80 percent, green beans decline 14.88 percent and fruits decline 0.99 percent. Adversely, rice increase 9.11 percent, maize increase 20.00 percent, sweet potato increase 7.94 percent, soybean increase 47.62 percent and vegetables increase 16.08 percent. Meanwhile, food animal sources with high enough increase are fish by 51.59 per cent, eggs by 24.44 percent and poultry meat by 24.44 percent. While the ruminant meat decrease by 10.69 percent (South Sulawesi Food Security Agency, 2012).

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Rice availability has surplus. The rate of consumption is 111.88 kg / capita / year or 878 267 tons, it can achieves surplus of 1,552,708 tons, reaching 6.47 percent when compared to 2008 of 1,452,264 tons.

Average energy availability in South Sulawesi's population reached 5,123 kcal / capita / day or 232.86 per cent above the level of supply of 2200 kcal / capita / day and protein availability has reached 154.90 grams / capita / day or 271, 75 percent above the provision of 57 grams / capita / day. However, there are some areas of energy supply that sub-standard, especially isolated areas in coastal and mountainous agro-ecosystem.

Energy availability is above the standard ideal, but the diversity of food (the balance between food groups) is still unequal. Grains food groups ideally only accounts for about 50 percent of total energy. In fact, the contribution is quite high of 83.43 per cent, while the other food groups still lower than expectation. On other hand, PPH score achieves new levels availability of 86.31, or about 86 percent of PPH ideal score of 100. The food groups with ideal score are grains, tubers, nuts and sugar, while the food groups with not ideal PPH score are animal food, oils and fats, fruit / oily seeds as well as fruits and vegetables.

Theoretical Basis:

Food security generally consists of of four subsystems, namely: food availability, food access, food utilization and food stability. The nutritional status is the outcome of food security (Gross, 2000 and Weingartner, 2004, in Nuhfil Hanani, 2012) .The relation between food security subsystem can be seen in Figure 1.

Mais Ilsan (2007) research with title of "Indicators Development of Food Insecure Mapping in Takalar District" investigates nine subdistricts and 77 villages. Galesong Subdistrict showed very low food availability, medium food access and food utilization in high category. Based on these three aspects, Galesong Subdistrict is categorized in insecure food category.

Mais Ilsan (2014) Productive age that followed by an adequate education level would support the farmer households to manage household food. Employment is economic variables that determine access and absorption of food as part of household food security component. Higher work diversity in farm household affects to improve household food security. Food security indicators in three agroecosystem types show different levels. AEPES type is within rather crisis food insecurity, AEPER and AEPEG type is in rather secure food category. Food availability and access to food in all three agroecosystem types are in rather crisis Food category. Food absorption in coastal Agroecosystems type is in rather crisis food category, field agroecosystem types is in secure food category and in mountains agroecosystem type are in rate secure food category. Household nutritional status of coastal and filed agroecosystem is in rather secure food category, whereas mountain agroecosystem type is in secure food category.

Mais Ilsan (2014) Factors with positive effect on household farmer food availability farmers are planting area, productive workforce, agro-ecosystem type, household income. Factors with negative effect on household food availability are self-production food and poverty level, Factors with positive effect on household food access are a farmer's self-production food, work performance of household head, wife work performance, work performance of household members, wage labor, household head income, family members who work, while the negative effect is road access, Factors with positive effect on food absorption of farmers household are household income, agro-ecosystem type , food diversification , wife education, while negative effect is number dependents, Factors with positive effect on nutritional status are energy adequacy level and food diversification.

Waspodo (2003) examines the use of coastal and marine resources for household food security of fishermen in West Lombok regency, given the level of production, household income, food consumption, food prices, food science and nutrition in household of fishermen.

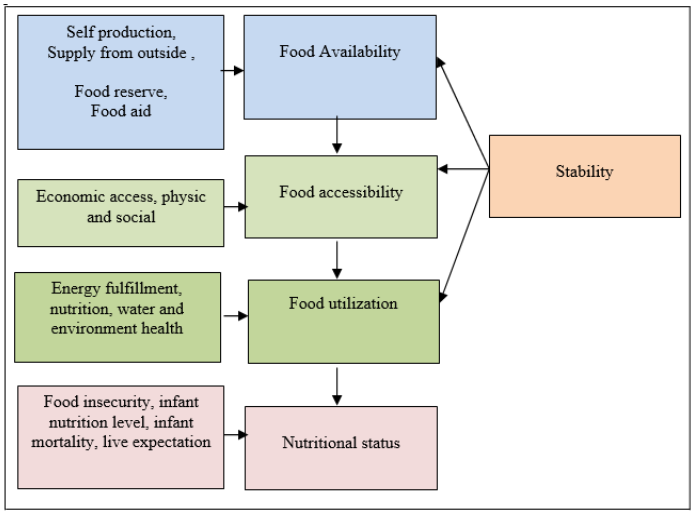

Fig. 1: Food Security Subsystem (Source: Hanani Nuhfil, 2012)

Research Chart:

Research Chart for household food security at three agro-ecosystems types based on farming scale in South Sulawesi is presented in figure 2. It explains the household food security based on 4 four aspects, namely food availability, food access, food utilization and food insecurity. These areas simultaneously may affect on level of household resilience.

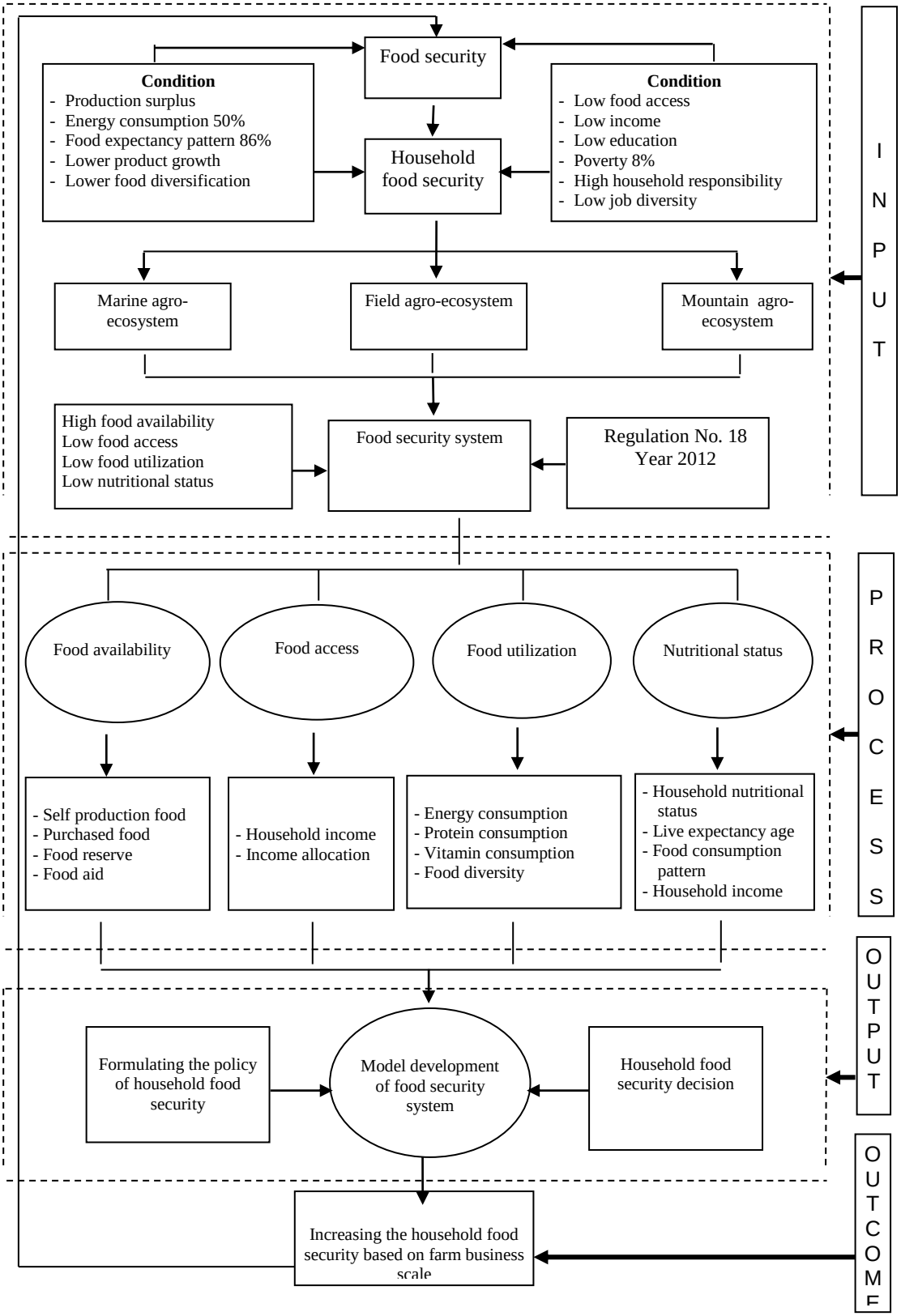

Fig. 2: Research Conceptual Framework of Household Food Security.

Indicators of household food security for food security are amount of household food production, food purchased and food aid. Factors of food availability will have positive effect if the index value increases the household food security and negative when the index value decreases the household food security.

Household food security indicators for food access are income of household head, income wife, and income of household members, income allocation for food consumption and income allocation for non-food consumption. Factors of food access will have positive effect for higher index value of household food security and negative for lower index value of household food security. Indicators of household food security for food utilization are energy sufficiency index, protein adequacy index, index adequacy vitamin, and food diversification.

Food utilization factors will have positive effect for higher index value of household food security and negative for lower the index value of household food security.

Nutritional status is the fourth component to measure household food security. It consists of household nutritional status, infant mortality, live expectancy, food consumption patterns and household knowledge pattern. All these aspects will determine the nutritional status as the components to asses household food security.

Research sites:

The study was conducted in South Sulawesi Province, with consideration that South Sulawesi is one barn in eastern region Indonesia. The study location object is determined by Multistage Sampling. The selected area is Takalar District for coastal agro-ecosystem, Luwu District for fields agro-ecosystem and Enrekang District for mountain agro-ecosystem.

Research respondents:

Data is collected at three levels of land ownership, namely (1) farmer ownership <0.5 hectares, (2) farmer ownership > 0.5 hectares to 1.00 hectares, and (3) farmer ownership > 1.00 hectares. The result show that agro-ecosystem are 90 respondents with details of 22 respondents for land area > 1 hectare, 47 respondents with land area 0.5 to 1.0 hectare and 21 respondents with land area <0.5 hectare. The field agro-ecosystem has 111 respondents with detail of 25 respondents for land area > 1 hectare, 65 respondents for land area 0.5 to 1 hectare and 22 respondents for land area <0.5 hectares. Mountain agro-ecosystem has 87 respondents with details of 22 respondent for land area > 1 hectare, 64 respondents for land area 0.5 to 1 hectare and 21 respondents for land area <0.5 hectares.

Data analysis method:

The analytical method used in this study is presented in accordance with research purpose.

1. Descriptive Analysis:

Descriptive analysis is used to answer the first goal namely to describe socio-economic variables in relation with household food security. It consists of age, education level, number of dependents, work performance, income.

2. Analysis of Household Food Security Degrees:

Food security at household level was analyzed using quantitative descriptive analysis by calculating and comparing the composite scores and weights of individual components of food security, namely food availability, food access, food utilization and Nutritional Status based on type of agro-ecosystem. This analysis is used to answer the second objective to measure each component of food security as presented in appendix.

Research Result:

Socioeconomic Characteristics of Farmers for Three Agro-ecosystem Types:

Socioeconomic characteristics analyzed were age, education, number of dependents, a second job of household heads, work performance of wife and family member. The study results (Figure 1) shows that household head age are classified in productive age with 41 41 years old for coastal agro-ecosystem (AEPES), 49 years old for fields agro-ecosystem (AEPER) and 42 years old mountain agro-ecosystem (AEPEG).

Formal education of household heads for all types agro-ecosystem still relatively low, at AEPES and AEPER are primary schools and average formal education level of AEPEG are secondary school. Family dependents are moderate for AEPES and AEPEG namely 5 people and AEPER are four people.

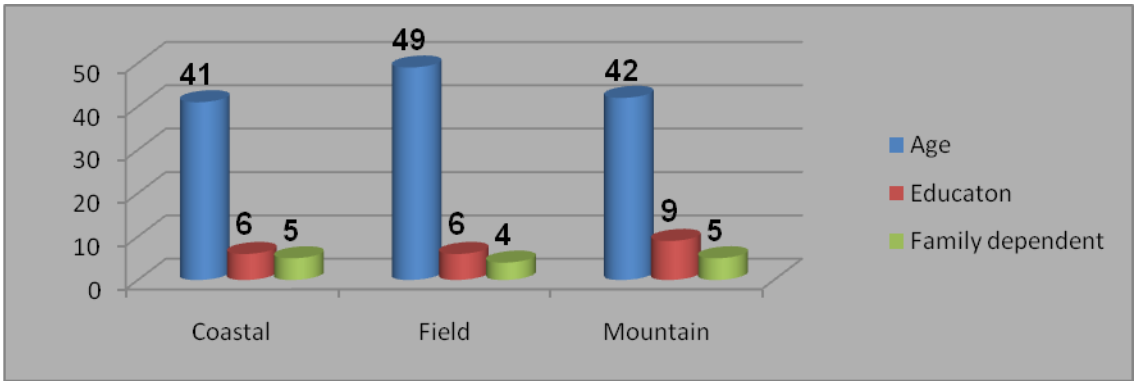

Fig. 1: Average Age, Formal Education and Number Dependents Farmer Household Head for Three Agro-ecosystem types in South Sulawesi

Second job for farmer households (graph 2) on three agro-ecosystem types is very diverse, but the percentage of households without second job is still very high. Household heads without second job for AEPER are 68%, AEPEG are 43.14% and AEPES are 4.55%. Second job for AEPES predominantly are fishermen of 39.77%, making the red rocks of 20.45% and self-employed of 14.77%. Second job for AEPER are construction worker of 13%, self-employed traders of 12% and motorcycle taxis of 3%. Second job for AEPEG are entrepreneur of 17.91%, farmers of 13.43% and construction workers of 5.97%.

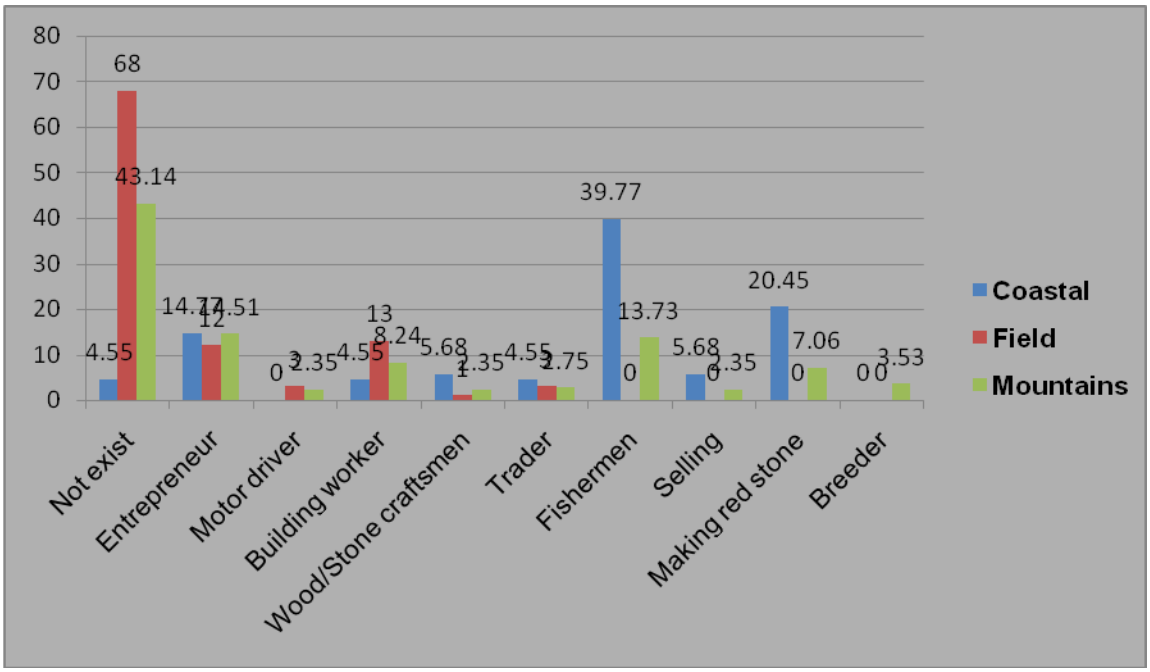

Fig. 2: Employment Conditions of Farmers Household Head for Three Agro-ecosystems in South Sulawesi.

Work performance of respondent wife's is high on research area. This is shown in chart 3 with total 68.24% of wife has productive jobs, and 31.76% are not working. Number wife who had a productive job are 79.54% for AEPES, 74.63% for AEPER and 68.24%. for AEPEG, While the wives of respondents who did not work on AEPES is 20.45%, AEPER is 46% and AEPEG is 31.76% Figure 3 shows the wife performance wife of in South Sulawesi to work productive at 68.24%. This distribution is 79.54% for AEPES, 54%, for AEPER and 74.63% for AEPEG type. Work performance of household members in Figure 4 shows that 37.75% of household members are not working, 55.69% of household members work to one person 1 and 6.6% work to more than one person. For AEPER type is 53.41% work to 1, AEPER 53%, and 55.69% on type AEPEG.

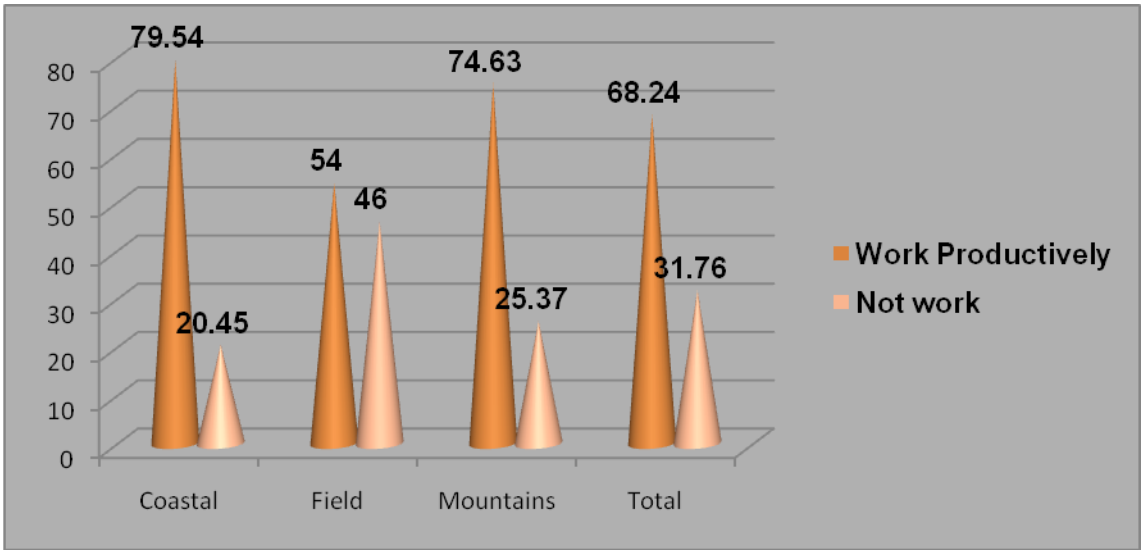

Fig. 3: Wife Work Performance for Three Agro-ecosystem types in South Sulawesi.

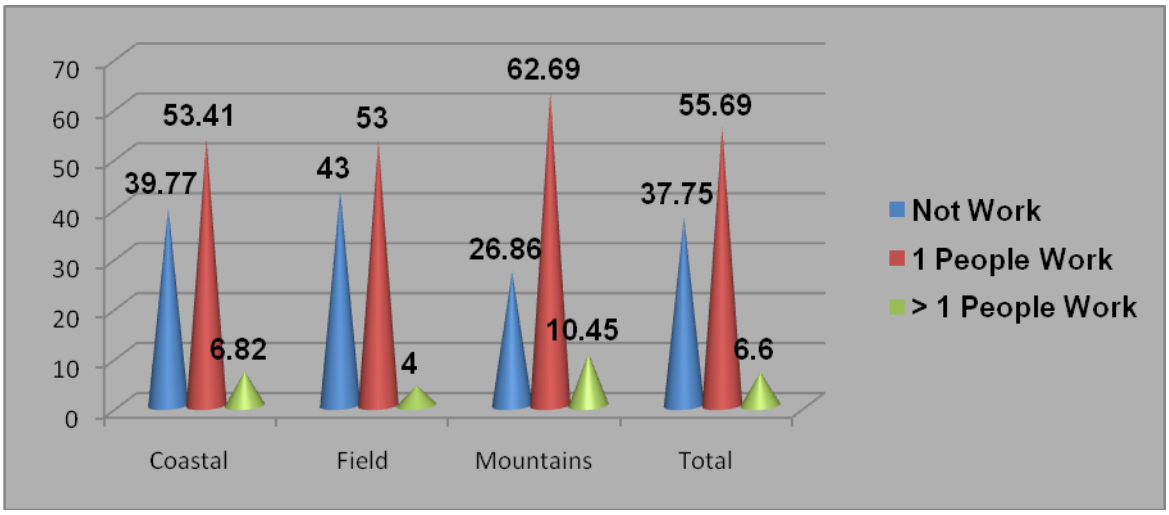

Fig. 4: Performance of Farmers Family Members Work on Three Agro-ecosystem types in South Sulawesi.

Food Availability:

Household food availability is composed of four indicators namely, self production food (X1), purchased food (X2), food aid (X3) and food supplies (X4). Composite value of household food security levels in three agro-ecosystem types based on farming scale are presented in Table 1.

Table 1: Composite Value of Farmers Household Food Security Level Based Food Availability in South Sulawesi.

Indicator of food availability	Household food security level at all type of agro-ecosystem		
	Coastal	Field	Mountain
Farm business > 1,00 hectare			
Self production food (X1)	2,67(ARP)	3,00(ARP)	2,95(ARP)
Purchased food (X2)	5,19(TP)	5,80(STP)	5,55(STP)
Food aid (X3)	3,90(ATP)	5,64(STP)	6,00(STP)
Food reserve (X4)	2,38(ARP)	4,92(TP)	4,55(TP)
Average	3,54(ATP)	4,84(TP)	4,76(TP)
Medium farm business scale (0,50 – 1,00 hectare)			
Self production food (X1)	3,32(ARP)	3,50(TP)	3,27(ARP)
Purchased food (X2)	5,53(STP)	5,94(STP)	5,55(STP)
Food aid (X3)	4,21(ATP)	4,44(ATP)	4,18(ATP)
Food reserve (X4)	2,64(ARP)	2,12(RP)	2,64(ARP)
Average	3,93(ATP)	4,00(ATP)	3,91(ATP)
Small farm business (< 0,50 hectare)			
Self production food (X1)	2,67(ARP)	3,18(ARP)	2,67(ARP)
Purchased food (X2)	5,19(TP)	5,73(STP)	5,19(TP)

Food aid (X3)	3,90(ATP)	4,32(ATP)	3,90(ATP)
Food reserve (X4)	2,38(RP)	2,59(ARP)	2,38(RP)
Average	3,54(ATP)	3,96(ATP)	3,54(ATP)

Source: Primary Data 2015

Description:

Number in parentheses is a composite score to indicate the household food security level with following criteria:

<1.50 is categorized as High Insecure to Food (SRP)
1.50 to 2.49 are categorized as Insecure to Food (RP)
2.50 to 3.49 are categorized as Rather Insecure to Food (ARP)
3.50 to 4.49 are categorized as Rather Secure to Food (ATP)
4.50 to 5.49 are categorized as Secure to Food (TP)
5.50 to 6.00 are categorized as High secure to Food (STP)

The analysis showed that households food supply indicators in coastal agro-ecosystem is categorized in little secure to food (ATP), whereas rice and mountain agro-ecosystem are categorized as secure to food (TP). However, for small and medium farming scale, indicators of households food security are categorized as rather secure to food (ATP). The results of this analysis is consistent with Mais Ilsan (2015) that there are differences in household food security level for three agro-ecosystem types. The Household food availability of fields agro-ecosystem is still higher than coastal and mountainous agro-ecosystem types.

Food access:

Farmer household food access consists of five indicators, namely, household head income (X5), wife income (X6), other members income (X7), income allocation for food (X8) and income allocation for non-food (X9). The composite value of farmer household food access is presented in Table 2.

Table 2: Composite Value of Farmer Household Food Security based on Food Access Component Based in South Sulawesi.

Component Indicators of Food Access	Food Security Level of Household Farmer at Three Agro-Ecosystem Type		
	Coastal	Field	Mountain
Wide Farm Business Scale (> 1,00 hectare)			
Household head income (X5)	5,41(TP)	5,48(TP)	5,41(TP)
Wife income (X6)	1,86(RP)	1,40(SRP)	1,86(RP)
Other household members income (X7)	1,95(RP)	1,64(RP)	1,95(RP)
Income allocation for food (X8)	4,59(TP)	5,04(TP)	4,59(TP)
Income allocation for non food (X9)	2,14(RP)	2,48(RP)	2,14(RP)
Average	3,19(ARP)	3,21(ARP)	3,19(ARP)
Medium Farm Business Scale (> 1,00 hectare)			
Household head income (X5)	4,04(ATP)	4,44(ATP)	4,00(ATP)
Wife income (X6)	1,87(RP)	1,20(SRP)	1,91(RP)
Other household members income (X7)	2,72(ARP)	2,31(RP)	2,75(ARP)
Income allocation for food (X8)	2,74(ARP)	3,30(ARP)	2,70(ARP)
Income allocation for non food (X9)	2,45(RP)	2,72(ARP)	2,45(RP)
Average	2,76(ARP)	2,79(ARP)	2,76(ARP)
Small Farm Business Scale (> 1,00 hectare)			
Household head income (X5)	4,00(ATP)	4,59(TP)	4,00(ATP)
Wife income (X6)	1,86(RP)	1,32(SRP)	1,86(RP)
Other household members income (X7)	2,38(RP)	2,14(RP)	2,38(RP)
Income allocation for food (X8)	1,90(RP)	1,68(RP)	1,90(RP)
Income allocation for non food (X9)	3,33(ARP)	3,68(ATP)	3,33(ARP)
Average	2,69(ARP)	2,68(ARP)	2,69(ARP)

Source: Primary Data 2015

Description:

Number in parentheses is a composite score to indicate the household food security level with following criteria:

<1.50 is categorized as High Insecure to Food (SRP)
1.50 to 2.49 are categorized as Insecure to Food (RP)
2.50 to 3.49 are categorized as Rather Insecure to Food (ARP)
3.50 to 4.49 are categorized as Rather Secure to Food (ATP)
4.50 to 5.49 are categorized as Secure to Food (TP)
5.50 to 6.00 are categorized as High secure to Food (STP)

The analysis showed that households food supply indicators in coastal agro-ecosystem are categorized in rather insecure to food (ARP). From five indicators of household food access, only household head income

indicator is categorized as secure food (TP) and rather secure food (ATP). These conditions must be anticipated as early as possible because if the household head does not provide income to the household, household will be threatened with food shortages because other components that support food access is categorized as insecure to food (RP) and rather insecure to food (ARP). The research results are consistent with Mais Ilsan (2015), namely household food access of farmers in South Sulawesi should be increased because household food security level of three agro-ecosystem types are rather insecure to food (ARP).

Food Utilization:

Food utilization of farmer household consists of four indicators namely, energy sufficiency level (X10), nutritional sufficiency level (X11), Vitamin A sufficiency level (X12) and food diversification (X13). The level of food utilization for farmer households in three agro-ecosystem types in South Sulawesi is presented in Table 3.

Table 3: Composite Value of Farmer Household Food Security Based on Food Utilization Component in South Sulawesi.

Component Indicators of Food Access	Food Security Level of Household Farmer at Three Agro-Ecosystem Type		
	Coastal	Field	Mountain
Wide Farm Business Scale (> 1,00 hectare)			
Energy sufficiency level (X10)	5,59(STP)	5,96(STP)	5,59(STP)
Nutritional sufficiency level (X11)	5,73(STP)	6,00(STP)	5,73(STP)
Vitamin A sufficiency level (X12)	5,59(STP)	5,88(STP)	5,59(STP)
Food diversification (X13).	3,55(ATP)	3,32(ARP)	3,55(ATP)
Average	5,12(TP)	5,29(TP)	5,12(TP)
Medium Farm Business Scale (> 1,00 hectare)			
Energy sufficiency level (X10)	5.53(STP)	5,97(STP)	5,52(STP)
Nutritional sufficiency level (X11)	5,83(STP)	6,00(STP)	5,84(STP)
Vitamin A sufficiency level (X12)	5,81(STP)	5,84(STP)	5,80(STP)
Food diversification (X13).	3,28(ARP)	3,50(ATP)	3,25(ARP)
Average	5,11(TP)	5,33(TP)	5,10(TP)
Small Farm Business Scale (> 1,00 hectare)			
Energy sufficiency level (X10)	5,29(TP)	5,59(STP)	5,29(TP)
Nutritional sufficiency level (X11)	5,38(TP)	6,00(STP)	5,38(TP)
Vitamin A sufficiency level (X12)	5,24(TP)	5,55(STP)	5,24(TP)
Food diversification (X13).	3,62(ATP)	3,77(ATP)	3,62(ATP)
Average	4,88(TP)	5,23(TP)	4,88(TP)

Source: Primary Data 2015

Number in parentheses is a composite score to indicate the household food security level with following criteria:

<1.50 is categorized as High Insecure to Food (SRP)
1.50 to 2.49 are categorized as Insecure to Food (RP)
2.50 to 3.49 are categorized as Rather Insecure to Food (ARP)
3.50 to 4.49 are categorized as Rather Secure to Food (ATP)
4.50 to 5.49 are categorized as Secure to Food (TP)
5.50 to 6.00 are categorized as High secure to Food (STP)

Table 3 shows that food utilization level of farmer household for three agro-ecosystem types and all the farming scale that are categorized in secure to food (TP). However, there are some indicators that still need to be improved as food diversification. On wide farming level, fields agro-ecosystem is categorized as rather insecure to food (ARP), and rest are categorized as rather secure to food. The results are consistent with Mais Ilsan (2015) which states that higher food utilization leads farmers in South Sulawesi need to increase the food diversification to corn, cassava and sweet potatoes to create household food security. This is consistent with government policy through the Ministry of Agriculture to anticipate the rice import. Food diversification program is needed in order farmer households have alternative food sources to fulfill food utilization in household scale.

Nutritional Status:

The nutritional status of farmer households as one component of household food security comprises five indicators, namely infant nutritional status (X14), infant mortality under five years (X15), life expectancy (X16), food consumption pattern (X17) and housewife knowledge (X18). The nutritional status of farmer household as one component of farmers household food security is presented in Table 4.

Table 4: Composite Value of Farmer Household Food Security Based on Nutritional Component in South Sulawesi.

Component Indicators of Food Access	Food Security Level of Household Farmer at Three Agro-Ecosystem Type		
	Coastal	Field	Mountain
Wide Farm Business Scale (> 1,00 hectare)			
Infant nutritional status (X14)	5,27(TP)	5,04(TP)	5,27(TP)
Infant mortality under five years (X15)	4,73(TP)	4,56(TP)	4,73(TP)
Life expectancy (X16)	4,64(TP)	4,76(TP)	4,64(ATP)
Food consumption pattern (X17)	3,41(ARP)	3,60(ATP)	3,41(ARP)
Housewife knowledge (X18)	3,23(ARP)	2,88(ARP)	3,23(ARP)
Average	4,27(ATP)	4,17(ATP)	4,27(ATP)
Medium Farm Business Scale (> 1,00 hectare)			
Infant nutritional status (X14)	4,98(TP)	5,08(TP)	4,95(TP)
Infant mortality under five years (X15)	4,64(TP)	4,59(TP)	4,59(TP)
Life expectancy (X16)	3,87(ATP)	4,14(ATP)	3,82(ATP)
Food consumption pattern (X17)	3,55(ATP)	3,56(ATP)	3,55(ATP)
Housewife knowledge (X18)	2,94(ARP)	2,81(ARP)	2,86(ARP)
Average	4,00(ATP)	4,04(ATP)	3,95(ATP)
Small Farm Business Scale (> 1,00 hectare)			
Infant nutritional status (X14)	5,00(TP)	5,09(TP)	5,00(TP)
Infant mortality under five years (X15)	4,19(ATP)	4,55(TP)	4,19(ATP)
Life expectancy (X16)	4,14(ATP)	4,45(ATP)	4,14(ATP)
Food consumption pattern (X17)	3,86(ATP)	3,45(ARP)	3,86(ATP)
Housewife knowledge (X18)	3,57(ATP)	3,14(ARP)	3,57(ATP)
Average	4,15(ATP)	4,14(ATP)	4,15(ATP)

Number in parentheses is a composite score to indicate the household food security level with following criteria:

<1.50 is categorized as High Insecure to Food (SRP)
1.50 to 2.49 are categorized as Insecure to Food (RP)
2.50 to 3.49 are categorized as Rather Insecure to Food (ARP)
3.50 to 4.49 are categorized as Rather Secure to Food (ATP)
4.50 to 5.49 are categorized as Secure to Food (TP)
5.50 to 6.00 are categorized as High secure to Food (STP)

Conclusion:

Based on discussion, the conclusion of results of this study are below.

1. Social and economic factors to determine the farmers household food security level in three agro-ecosystem types are age, education, second jobs, job diversification for head household, wife and other family members.
2. The household food security level generally differs based on type of agro-ecosystem. Food supply components for wide-scale farming show difference between the agro-ecosystem types. Coastal agro-ecosystem is categorized as rather secure to food, field and mountain agro-ecosystem types is categorized as secure to food. While medium and small scale agro-ecosystem types are categorized in rather secure to food.
3. The household food security level of food access component for all farming scales and agro-ecosystem type is categorized in rather insecure to food.
4. The household food security level for food utilization at all scales of agro-ecosystem types are categorized in secure to food.
5. The household food security level of nutritional status at all scales of farming and and agro-ecosystem type is categorized in rather secure to food

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