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Livelihood Strategies and Household Food Security Analysis in the Context of Rural Development. Case Study: North Sumatra, Indonesia.

Doctoral Thesis

Author: Ing. Libuše Valešová
Supervisor: prof. Ing. David Herák, Ph.D.
Consultant: Ing. Jana Mazancová, Ph.D.

Prague, June, 2017

Declaration of Authorship

I, Libuše Valešová, hereby declare that this thesis entitled "Livelihood Strategies and Household Food Security Analysis in the Context of Rural Development. Case Study: North Sumatra, Indonesia" submitted in partial fulfillment of the requirements for the degree of Ph.D., in the Faculty of Tropical AgriSciences of the Czech University of Life Sciences Prague, and the work presented in it is entirely my own work. Information derived from the published or unpublished work has been acknowledged in the text and in a list of references is given.

Prague, June 2017

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Ing. Libuše Valešová

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List of Abbreviations

Abbreviation	Description
ANOVA	Analysis of Variance
BPS	Badan Pusat Statistik (The Indonesian Central Bureau of Statistics)
BULOG	Badan Urusan Logistin (The National Food Logistic Agency)
CARE	International Network of Relief and Development Organizations
CDI	Calorie Deprivation Indicator
CFSVA	Comprehensive Food Security and Vulnerability Analysis Surveys
CRED	Centre for Research on the Epidemiology of Disasters
CSI	Coping Strategies Index
CSPI	Centre of Science in Public Interest
CULS	Czech University of Life Sciences Prague
CWIQ	Core Welfare Indicators Surveys
DDI	Dietary Diversity Indicators
DDS	Dietary Diversity Score
DFID	Department for International Development
DHS	Demographic and Health Surveys
EI	Euromonitor International
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization of the United Nations Statistics
FCS	Food Consumption Score
FIA	Food Insecurity Access
FFS	Food Frequency Score
FSC	Food Security Council
FSVA	Food Security and Vulnerability Atlas
FVS	Food Variety Score
GDP	Gross Domestic Product
GFSI	Global Food Security Index
GHDX	Global Health Data Exchange
HBS	Household Budget Surveys
HDDS	Household Dietary Diversity Score
HEA	Household Economy Approach
HFIA	Household Food Insecurity Access
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
HH	Household
HIES	Household Income and Expenditure Survey
IDC	International Development Comittee
IDR	Indonesian Rupiah
IES	Income and Expenditure Surveys
IFPRI	International Food Policy Research Institute

IFRC	International Federation of Red Cross and Red Crescent Societies
LSMS	Living Standards Measurement Study
MAHFP	Months of Adequate Household Food Provisioning
MICS	Multiple Indicators Cluster Surveys
NGO	Non-Governmental Organization
PCA	Principal Component Analysis
RPJMN	National Medium-Term Development Plan
SDA	Samosir Dalam Angka (The Statistics of Samosir Regency)
SD	Standard Deviation
SDG	Sustainable Development Goals
SLF	Sustainable Livelihood Framework
SUDA	Sumatera Utara Dalam Angka (The Statistics of North Sumatra)
TSDA	Tobasa Dalam Angka (The Statistics of Tobasa Regency)
UN	The United Nations
UNDP	The United Nations Develoment Programme
UNICEF	United Nations Children's Fund
USAID	The United States Agency for International Development
USD	The United States Dollar
USDA	The United States Department of Agriculture
WB	World Bank
WFP	World Food Programme
WHO	World Health Organization
WMS	Welfare Monitoring Surveys
24HNS	24-Hour Nutrition Surveys

Abstract

North Sumatra (*Sumatera Utara*) is one of the ten provincial territories of Indonesia, including Tobasa and Samosir regencies, selected for the study. From the agricultural point of view, it is an exceptionally rich region with high numbers in production of rubber, coconut, palm oil, candle nut and coffee. Consequently, the district is considered as one of the most developed provincial territories of the country. Despite of the relatively high socioeconomic status of North Sumatra province, households in rural areas have to tackle with food insecurity, particularly to poor dietary diversity and low intake of protein.

The study investigates correlation and regression analyses designed to assess the respective relationships between the Household Food Insecurity Access Scale/ Prevalence (HFIAS/ HFIAP) as a measure of food access, the Household Dietary Diversity Score, as a measure of the dietary diversity and the Months of Adequate Household Food Provisioning (MAHFP) as a measure of food stability and possible determinants of food insecurity. Primary data collection was conducted in two time periods in 2013 and 2014, and included 192 households with 892 individuals. The purpose of the study is to (1) assess the food security status of rural households in both regencies, (2) identify the influence of selected factors on household food security condition and (3) deliver outcomes which might play an important role in establishing appropriate policies and intervention strategy to prevent and reduce food insecurity in North Sumatra.

Due to the proven applicability in many studies, USAID's Food and Nutrition Technical Assistance method is implemented for the comprehensive household food security analysis. The relations between the food security indicators and selected variables were statistically analysed with use of ANOVA, Chi-square tests, PCA, regression analysis and two-sample tests. The study reveals that there are significant differences between the regencies, given their divergent natural and social conditions. The overall results demonstrate that both regions suffer from low levels of household food security: av. HFIAS=6.11 (SD 6.59) and av. HDDS=5.30 (SD 2.57) and that 51.60 % of households are classified as moderately or severely food insecure. Further analysis investigates the relations among the all domains of household food insecurity and its possible determinants.

Keywords: Indonesia, Food access, Dietary diversity, HFIAS, Vulnerability

Preface

The research idea which focused on household food security was born during my participation and coordination of the summer school organized by CULS and Institut Teknologi Del in North Sumatra, Indonesia. After the completion of my master thesis study on palm oil production in Indonesia, I decided to explore more on my key area of interest - food and nutrition.

At the beginning of the data collection, I had to face several challenges related to language barriers, as most rural people do not understand English which motivated me to learn Indonesian language (*Bahasa Indonesia*). Subsequently, I was able to communicate on common-user level and conduct the data collection in the *Bahasa*. This was advantageous and allowed a possibility to penetrate in the daily routine of households and perceived all the nuances and customs related to food consumption, pattern and its preparation. Obviously, this helped me to understand that the severity of food insecurity in North Sumatra is not only determined by agriculture production, household assets or livelihood diversification but also by a very strong tradition and food patterns ingrained deeply in culture of Batak people.

Thorough knowledge of the region and the research outcomes enabled me to suggest feasible intervention strategies that are tailored to the conditions of North Sumatra. Thus, the dissertation should be of interest to high-level decision makers, government bodies, particularly in the Indonesian Ministry of Agriculture, and also of NGOs.

1 Introduction

Despite global economic crises, Indonesia has witnessed economic growth in recent years, making the list of lower middle income countries in 2009 (Gillespie and Van Den Bold, 2015; WB, 2014). However, poverty, food insecurity and malnutrition have been still serious topics and remain with large disparities between provinces and districts (Campbell et al., 2011; Sibhatu et al., 2015). Yusuf and Sumner (2015) point out that between September 2014 and March 2015 the share of the Indonesian population in poverty increased even though economic growth was close to 5 %. In addition, Global Hunger Index identified Indonesia as one out of 52 countries in the world where hunger remains at serious or alarming levels (IFPRI, 2015).

Agricultural sector is very important for the Indonesia; it currently employs 35 % of the workforce and contributes around 14.4 % to national GDP (WB, 2014). This situation denotes a relatively low level of labor productivity compared to other sectors, particularly to manufacturing sector. The position also reflects the reality that more than 60 % of poor Indonesians live in the rural areas where they mostly rely on agriculture for their livelihood (FAO, 2015). Unfortunately, food insecurity affects especially smallholder farmers, farm workers and fishermen who are financially and materially unable to use the opportunities provided by national economic growth (Gillespie and Van Den Bold, 2015; IFPRI, 2015). Therefore with the collaboration of the UN, the Indonesian government adopted new Medium-Term Development Plan (RPJMN) 2010-2014 with the vision "development for all", with no groups left behind. The RPJMN is an inclusive development strategy targeted on several outcomes including sustainable livelihoods where food security is an important priority for the UN. The goals of the strategy are linked to the Sustainable Development Goals (SDGs), particularly to SDG 2 ("end hunger, achieve food security and improved nutrition, and promote sustainable agriculture") (FSVA, 2009; UN, 2016). Besides RPJMN's targets, the National Food Security Council (FSC) in collaboration with the United Nations World Food Programme (WFP) produced and launched the first Food Insecurity Atlas (FIA) in 2005.

The publication identified 100 priority districts as food insecure requiring an urgent attention of policy makers. Based on results of the FIA, The Government of Indonesia allocated 32 million USD to the most vulnerable districts. The first FIA 2005 and its updated version titled as Food Security and Vulnerability Atlas 2009 (FSVA)

confirmed that despite Indonesia's economic and food security achievements, attaining food security for all remains to be a major challenge (FAO, 2015; USDA, 2012a). In addition to that, food insecurity is considered as a serious social and public health problem in rural Indonesia as a whole. The geographic patterning of food insecurity such as the alarming rates in North Sumatra province, as well as the variation in rates that is found among districts, suggest that reducing the prevalence of food insecurity requires attention and action by all levels in government (FSVA, 2009; FSVA, 2015).

This study aims to investigate the food insecurity in North Sumatra province at micro level and to assess the relationship between the household characteristics and their food security condition. Despite the alarming food security situation in Indonesia, there is very poor empirical evidence focused on causes of household food insecurity. FSVA and other national reports give a comprehensive overview about food security situation on macro level. However, the scientific evidence oriented solely on household level remains neglected. Therefore, the data in this study provide an impetus for discussion that is critical to the development of programs and policies by all sectors aimed at tackling food insecurity in rural Indonesia.

2 Literature Review

2.1 Food security situation in Indonesia

"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food" (The Universal Declaration of Human Rights, Article 25, UN 1948).

The roots of concern about food security are found in the Universal Declaration of Human Rights by UN in 1948. Despite technological development and improvements to boost global food energy per person, regional differences in in distribution and productivity mean that some areas have a surplus of food, others are lacking (Welch and Graham, 2000). Indonesia which is the world's fourth most populous country has been on economic growth recent years, despite economic crises in the world. Nowadays, Indonesia is ranked among countries with status of "lower middle income" and also among countries which significantly reduced their overall poverty from 17 % in 2004 to 13 % in early 2010 (WB, 2014). According to the New Food Law issued in October 2012 in Indonesia, food security has been defined as a situation when individual at all times has social, economic and physical access to sufficient, diversified, safe and nutritious food that meets all dietary needs, food preferences and religious believes for an active and healthy life (USDA, 2012a).

Generally, the most frequent causes of food insecurity are following; (i) economic setting of the current system, (ii) political causes and (iii) global environmental problems. Economic problems include liberalization of international trade, rising food prices, global food system, investment policy and energy targets of developed countries. The second cause take into account wars, political instabilities and internal conflicts and environmental troubles are represented by climatic changes and wasteful use of natural resources (Gopalan, 2001). The law strongly stated that food security condition should be developed based on primarily domestic production and the ability to define own food preference (food sovereignty) based on local specific needs and resources. Moreover, the Government is expected to establish policies and regulations governing food imports which must not have a negative impact on the sustainability of the agri-business, food production growth,

or the welfare of farmers, fishermen, fish cultivators, or micro and small food entrepreneurs (FSVA, 2009).

There is a basic problem in a confusion among terms "food security" and "food safety" Both terms are interrelated concepts with a profound impact on quality of human life, and there are many external factors that affect both of these areas. While food safety is the protection of food products against unintentional contamination, food security is a condition related to the ongoing availability, access, utilization and stability of food. Sometime there is also one problem in the confusion in terms „food security, food-sufficiency and also food sovereignty (Gopalan, 2001).

Indonesia's self-sufficiency in rice is a matter of national prestige. Nowadays, food security is also a politicized problem. Government can rise or fall, depending upon how policy makers handle this issue. That is interesting that a country can be successful in terms of agricultural production but achieving food security can be still difficult. The reason is that the food which is produced can be too expensive for poor households who are vulnerable (Dawe, 2008). Poor people tend to be vulnerable to price fluctuations and the majority of the Indonesian people are net food buyers, even in rural areas. According to WB (2014), 46 % of Indonesians live on less than 2 USD a day and 70 % of the poor people come from rural areas. For this vulnerable groups can be the food and fuel prices fluctuations very serious problem. However, rates of undernourished people has been decreasing, nearly 20 million Indonesians of total 240 million are still malnourished (FSVA, 2009).

Despite the dominant position of agriculture, Indonesia is not self-sufficient in rice production. Because rice production is a highly debated issue, the Indonesian president Joko Widodo (called "Jokowi" by the Indonesians) outlined plans to push through with self-sufficiency in key commodities including rice by 2018. Jokowi has also announced plans to revive import controls which could affect the movement of rice, rubber, coffee, corn, soybeans and palm oil into Indonesia (Sambodo, 2014). Agricultural output is growing at a high rate (during 2004–2007 about 3.5 % per year) and reached 4.8 % in 2008. Rice and maize production increased while production of sweet potatoes and cassava was relatively stable and groundnuts and soybean production was reduced (FAO, 2014b).

According to Food Security and Vulnerability Atlas of Indonesia (FSVA) in 2007, the average energy daily intake was 2020 kcal and the protein intake was 56.25 grams in 2007 (FSVA, 2009). Both indicators surpassed the national Recommended Daily

Allowance (RDA) which is daily intake of 2,000 kcal and 50 grams of protein. However, the daily intake of the lowest three expenditure classes was only 1,817 kcal/ capita/ day or less and their diet remained very imbalanced (FSVA, 2009). WFP confirms that families depending on subsistence farming and landless workers are included between the most insecure classes. Paradoxically, in the rice lands, the owners of small plots of land may be still food insecure because they still cannot produce enough rice from their small land to sell and eat (IDC, 2008).

Unfortunately, Indonesia is one of the world's most vulnerable countries to natural disasters. It is included into top five of the countries prone to natural disasters, together with United States, China, India and Philippines (WB, 2012). This fact influences food security temporarily or for an extended period. This kind of food security called "transient food security" may cause inability to meet food needs for a temporary period and can affect all dimensions of food security; food access, food availability, food utilization or food stability. Besides natural disasters, there are rainfall fluctuations which are significantly affecting transient food security, particularly in terms of food distribution and food availability (FAO, 2002). Another phenomenon strongly influencing food security is climate change. Evaporation, surface water run-off, altering precipitation and soil moisture levels have impacts on agriculture and thus food security. To prevent the decrease of food security caused by climate changes the Indonesian government proposed some strategies in 2009, e.g. to promote plantation of crop varieties that need less water for growth, to cultivate crops suitable for the specific conditions of a location etc. (FAO 2002; Levinsohn and McMillan, 2005).

The Indonesian minister of agriculture assured that food security in the country is one of the government priorities. Through agriculture, forestry and fishery revitalization, the government has been consistently increasing food availability. The result was that Indonesia was able to escape from global food crisis and to regain self-sufficiency in 2008 (FSVA, 2009). The government is also improving basic infrastructure to smooth and expedite food distribution, improvement of people access to basic health facilities which resulted in improvement of health and nutrition indicators. As the president of the Republic of Indonesia said, food is human basic necessity. Therefore its fulfillment is not only to satisfy basic human rights or moral obligation of the Indonesian people, also become economic as well as social investment to have better generation in the future (FAO, 2010).

2.1.1 Basic concept of food and nutrition security

According to FAO (2003a) "*Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".* If this concept is applied to the family level, with individuals within households as the focus of concern, we call it „household food security". Generally, food security is based on four pillars:

• **Physical availability of food**: means that there is a consistent and reliable source of quality food.

• **Economic and physical access to food**: may be defined as an assured ability to acquire acceptable foods in socially acceptable way (without using any coping strategies, e.g. stealing, resorting to emergency food supplies and other acceptable ways).

• **Adequate food utilization**: includes the access to adequate health care, sanitation and water and also appropriate use based on knowledge of basic nutrition (FAO, 2003a).

• **Stability of the other three dimensions over time**: households and individuals must have access to adequate food at all times to be food secure. They may not risk losing food access as a reaction of sudden shocks, e.g. natural disasters, economic crises or cyclical events, e.g. seasonal food insecurity. Therefore the concept of food stability refers to both dimensions of food security; food availability and food access (FAO, 2003a; FSVA, 2009). Food insecurity is defined as uncertain or limited availability of safe and adequate food and also limited ability to get acceptable food in acceptable ways without using any unacceptable coping strategies (USDA, 2012b).

Figure 1 illustrates the relationship among the elements within the conceptual framework of food security. There are two factors which are influencing the framework; a temporal which refers to stability and affects all three physical elements; Availability → Accessibility → Use and utilization. The determinant of *availability* refers to the physical existence of food coming from markets or own production. At macro level food availability presents a combination of commercial food imports, domestic food production and food stock, food aid. Food *Access* is secured when all individuals and households have sufficient resources to meet their dietary needs and food preference (Riley and Moock, 1995).

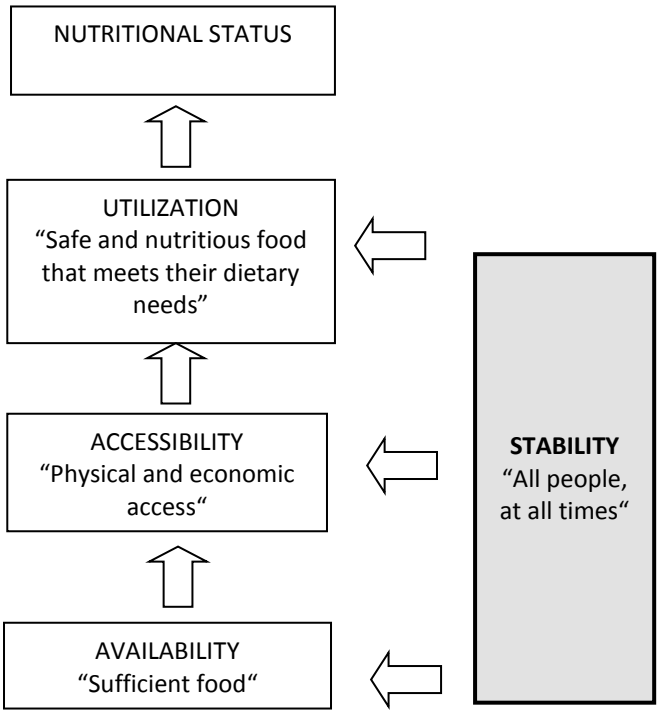

Figure 1 Food security and nutrition framework (Klennert, 2005)

2.1.2 Vulnerability and coping strategies of households

Vulnerability says something about the level of risk for households or communities concerning threats to their lives and livelihood. Vulnerability at the household level is determined by the ability of a subject to cope with shocks and risks such as flooding, drought, conflicts, government policies or other crisis. The duration and magnitude, the time and duration of the shock are very important factors (Klennert, 2005). Households have to use coping strategies to avoid the most severe impacts of shocks in order to ensure adequate food access. We should distinguish "vulnerability" and "poverty", although underlying poverty contributes to increased vulnerability in most emergencies. Vulnerability to food insecurity of households is the combined effect of the following three factors:

- The external hazards affecting the community over which they have small chance to control them, e.g. floods, drought or political upheaval.
- Underlying community vulnerabilities; cannot be changed by the individuals and relates to factors including poverty and climate.

- The internal capacity of the household to cope with food insecurity situation; it is related to household´s skills, resources and networks that help them to overcome a difficult situation of food insecurity. The internal capacity is found in all subjects (Klennert, 2005; Kurosaki, 2011). Some households are able to overcome the situation better than others. Some of them can be exposed to hazards or face long-lasting disease in the family which can be the reason for losing their capacity to cope (IFRC, 2006). Coping strategies are considered as activities that household members use or choose as ways of living through difficult times brought on by some sort of shock to their standard or normal ways of living.

There is a long anthropological tradition of considering coping strategies in the face of insufficient access to food (Davies, 1993; Klennert, 2005). Household should distinguish different stages of coping, early coping strategies are not necessarily abnormal and the do not cause lasting damage. These strategies may include selling non-essential assets, collecting wild foods or sending household members to work elsewhere. More radical strategies may permanently deflate future food security, e.g. distress migration of whole families, sale of land or deforestation. Shocks can be classified as asset shocks or income shocks. The first type include floods, storms may cause a decline in a physical assets and could decrease income as well. It may slightly influence wealthy households but tends to influence poor households for a long time period (Carter et al., 2007; Kurosaki, 2011). Experience with using of the CSI shows that food insecure households use four basic types of consumption coping strategies;

- Change their diet. It means they rather switch food consumption from preferred to cheaper (less preferred) foods.
- Increase their food supplies. They use short-term strategies which are not sustainable over a long period, e.g. borrowing or purchasing on credit or even begging and consuming immature crops or seed stocks.
- Reduce the number of people that they have to feed by sending some of them elsewhere, e.g. sending the children to grandparents or to neighbors).
- Manage the food shortfall, e.g. cutting portion or the number of meals, or skipping whole days without eating) (Maxwell and Caldwell, 2008).

2.1.3 Macro and micro dimension of food security

The most important factors of the food security system at the macro level is economic growth and its distribution, macroeconomic stability, governance, public spending and quality of institutions. External and internal balance of Indonesia may be included between the main indicators for macroeconomic stability. The fiscal balance and the related ability of Indonesia to borrow money on the international market is also the important matter for food security at macro level (Diao et al. 2007). Food security may be improved due to economic growth through generating tax revenues and foreign exchange earnings through exports and resulting increases in beneficial investments and public spending. Besides trade and sport, health and education, agriculture has its important role in food security. It may significantly improve food access by providing food, supplying services and assets essential for food insecurity prevention and by generating household incomes. Generally, growth of agriculture has mostly strong linkage effects driving overall growth and contributing to lower food prices (Christiaensen and Subbarao, 2005; Diao et al. 2007). Agriculture is very important for achieving of food security at national level because it supplies food and generates household's incomes. Moreover, exports in agriculture help providing of substantial earnings, generating revenues for public spending, food imports and investments.

Generally, households are food secure when their members may live healthy and active lives during all year. In practice, it means that households are able to produce and/ or purchase the food which is needed by all family members to meet their food preference, dietary requirements and also able to have access to the services and assets necessary to achieve an adequate nutritional status. (FAO, 2002). FAO (2010) recognizes that healthy and well-nourished people are bot the outcome of successful economic and social development and constitute a basic input into the development process. In 1997-1998 Indonesia was rocked by many crises; of political and monetary character, ethnic strife and drought cause by El Niño combined with forest fires. As a result, food prices increased dramatically and the household food security of an ever larger portion of the population was being significantly threatened. Then the World Bank estimated that up to 50 million of the Indonesian inhabitants face problems with adequate caloric intake in the future months (Wirakesuma, 2013). The urban poor people were hit by this crisis the hardest. Rural poor were able to cope with the food insecurity due to their agricultural production (Levinsohn

and McMillan, 2005). Despite this fact, small farmers and people employed in agriculture are still considered as the most vulnerable groups to food insecurity (Gillespie and Van Den Bold, 2015). According to the World Bank (2014), the number of people living below poverty line raised from 11.3 % in 1996 to 17.9 % in 1998. The households hit by the crises tried to cope by boosting the proportion of their income spend on staples, e.g. oil and rice and by reducing the allocations on food such as vegetables and meet and also on education, health care, housing and recreation (Soekirman, 2001).

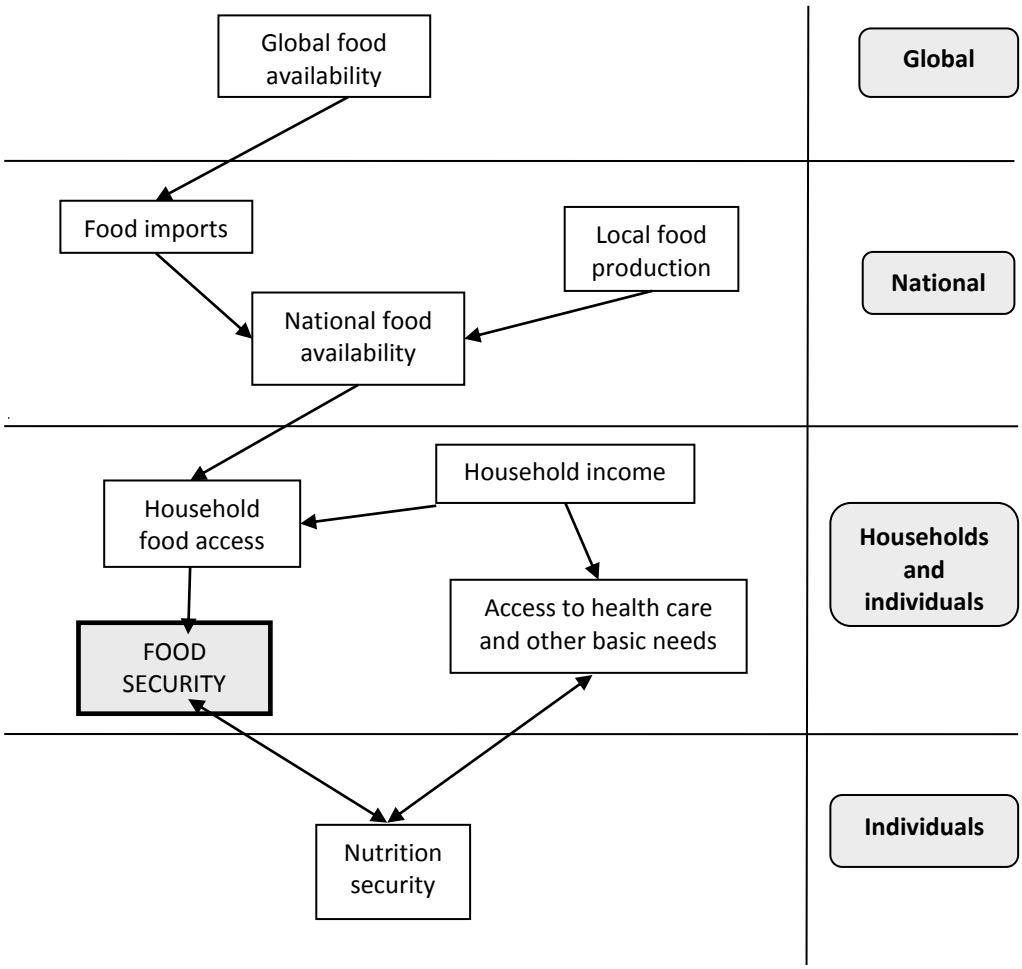

Figure 2 Food security concept at different levels (FAO, 2002)

2.1.4 Duration and severity of food insecurity

It is obvious that not all households suffer incomplete food consumption for the same period of time. It may vary from a short-term problem to a lifelong experience. Therefore, there were defined two types of food insecurity; (i) chronic and (ii) transitory

food insecurity (FAO, 2008). Chronic food insecurity is long-term or persistent and occurs when people are not able to achieve their minimal food requirements over the endless period of time. This type of insecurity may be overcome with long-term development measures, e.g. access to productive or financial resources, such as credits or access to education. In the contrast, transitory food insecurity is short-term and temporary matter and occurs when there is an acute drop in the capacity to access or produce enough food to meet a good nutritional status. It results from short-term fluctuations in food availability and food access, including year-to-year variations in food prices, household incomes and domestic food production, and from short-term shocks (Klennert, 2005; Soekirman, 2001). his type of food insecurity is difficult to predict and can emerge suddenly which makes planning more problematic. It requires different types of interventions, e.g. safety net programs[1] or early warning capacity (FAO, 2008; Stamoulis and Zezza, 2003).

2.1.5 Food and nutrition security in the context of conflicts, crises and natural disasters

Unfortunately, Indonesia is one of the world's most vulnerable countries to natural disasters, particularly of hydrological and geophysical character[2]. Based on information recorded by the CRED (2012), there are five countries in the world which were hit by natural disasters in 2012 the most; China, the United States, the Philippines, Indonesia[3] and Afghanistan. Together they accounted for 38.1 % of total disaster occurrence in 2012 (CRED, 2012). According to Food Security and Vulnerability Atlas (FSVA, 2009), there are some important strategies in terms of natural disasters which should be adopted by the farmers and policy makers to assure food security. The following strategies and practices are helpful to achieve sustainable food security:

• Disaster preparedness and contingency planning.
• Watershed development: Particularly in Java, NTB and NTT.
• Early warning and surveillance system.

[1] Safety Nets include income transfers for chronically unable to work and for people affected by natural disasters or economic recession. Options include; targeted direct feeding programmes, tood-for-work programmes and income-transfer programmes (Stamoulis and Zezza, 2003).
[2] *Geophysical* disasters are defined as events originating from solid earth, e.g. earthquake, Volcano Mass Movement (dry) and *hydrological* disasters include events cause by deviations in the normal water cycle and/ or owerflow of bodies of water cause by wind set-up, e.g. flood, Mass Movement (wet) (CRED, 2012).
[3] In 2012 Indonesia suffered from nine hydrological, four geophysical and two meteorological disasters (CRED, 2012).

• Reforestation and reducing of deforestation: Particularly in Sumatera and Kalimantan islands.

• Mainstreaming climate change issues in all projects and policies.

• Setting up of regional remote sensing agencies.

Conflicts are also one of the most common causes of transient food insecurity. Most of the countries where undernourishment is prevalent had to face to conflict in past times (FAO, 2002). Food security and conflicts are closely related and interrelated. Violent conflicts are not significant source of poverty and food insecurity. The relationships between all factors are described in Figure 3 (CRED, 2012; Klennert, 2005).

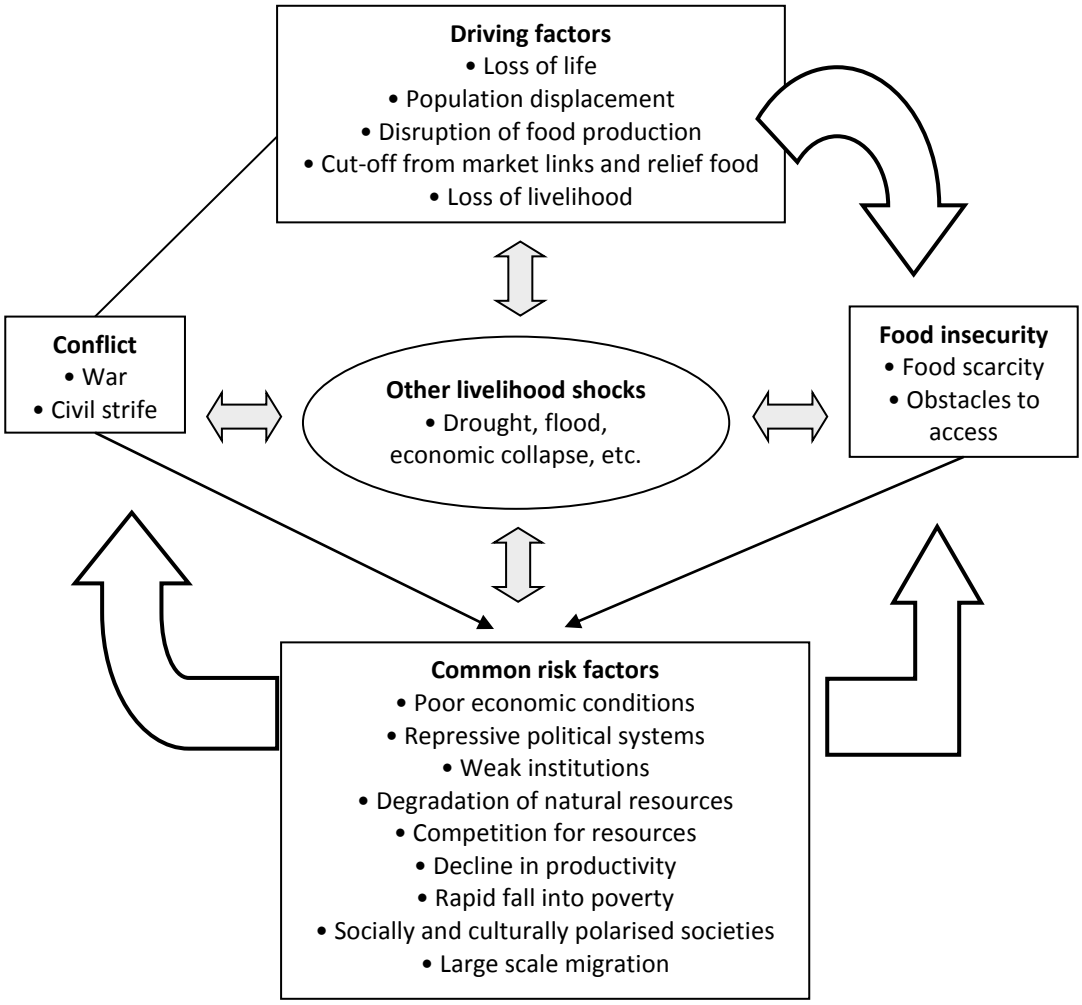

Figure 3 Food security framework in the context of conflicts and natural disasters (FAO, 2002)

2.2 Sustainable rural livelihoods and household livelihood strategies

The way how households cope with shocks depends on the options available, e.g. assets, capabilities and activities that are household livelihood strategy (Dercon and Krishan, 1996). Households from different socioeconomic groups have various strategies which ensure various levels of resilience to food insecurity. Hence, these different households (e.g. farm household and household whose main income comes from public sector) need different interventions. Then, national food security strategies should be tailored to various groups and households according to their needs and household livelihoods. The forceful factors of each livelihood strategy are therefore decisive for improving the response mechanism related to food security of the households (Dercon and Krishan, 1996; Ellis and Freeman, 2007). There is a definition of a sustainable rural livelihood which is applied most commonly at household level: *"A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation: and which contributes net benefits to other livelihoods at the local and global levels in the long and short term"*(Chambers and Conway, 1992).

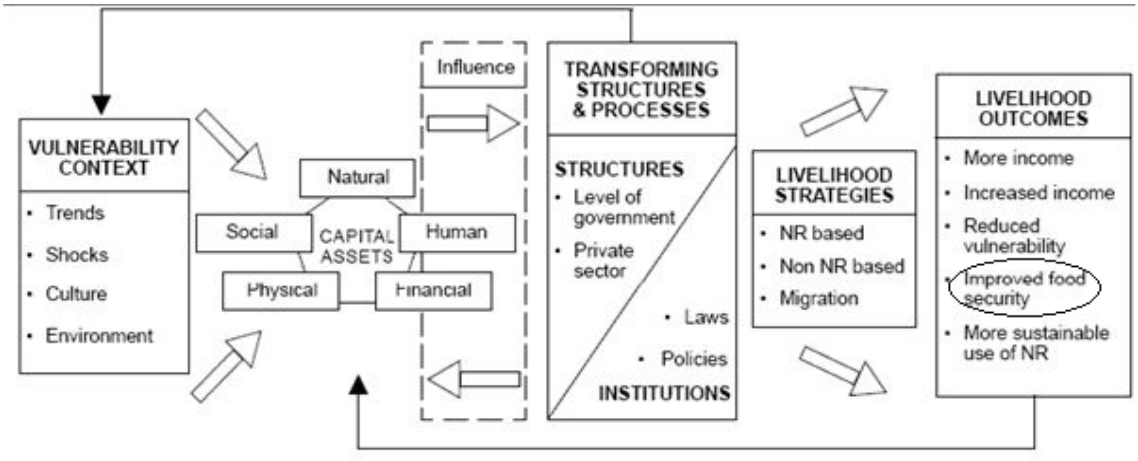

Figure 4 Sustainable livelihood framework (SLF) (DFID, 1999)

Table 1 Sustainable livelihood framework: six key elements (DFID, 1999)

Assets	What people have.
Strategies	What people do with what they have.
Outcomes	What people get from what they do, which builds what they have.
Rules	The things that regulate which people are allowed to do what.
Risks	Threats that reduce what one has.
Influence	To power to change rules.

The definition of a livelihood may be applied to different levels but Chambers and Conway (1992) emphasized that it is used most commonly at the household level. The Sustainable Livelihood Framework (SLF) is a way how to improve understanding of livelihoods of poor people (Figure 4 and Table 1). There are the main factors in the framework which affect poor peoples' livelihoods and highlight the classic relationships between these factors. The SLF (Figure 4) describes the various aspects of poor peoples' vulnerability while pointing the economic, social and political processes and structures which influence vulnerability. Other factors have an effect on people's ability to struggle a sustainable choice of livelihood. Institutions and policies operating at different levels from international to local may either support people in making a living. Certain household assets are required to make a living. These assets may be divided into five main groups;

- *Financial* – sources of income, assets which may be sold or traded, savings, financial services or objects/ resources/ activities that may generate cash.
- *Natural* – water, forest, soil, environmental assets, natural resources such as land used to produce crops or grazing.
- *Physical* – houses, schools, roads, clinics, physical structures such as buildings including shops and markets.
- *Human* – health, skills, education, knowledge and motivation.
- *Social* – family links, support network, leadership, conflicts, the family structure (DFID, 1999; Ellis and Freeman, 2007).

2.2.1 Policy makers creating a food secure future of Indonesia

Food security has always been a highly politicized issue. The government may rise or fall, depending upon how policy makers handle this problem. Suharto, the second president of Indonesia, was aware of this and made his best achievements to improve national self-sufficiency in rice production. The topic of Indonesia's self-sufficiency in rice

is a matter of national importance and prestige (Dawe, 2008; Soekirman, 2001). Rice is the most politically charged commodity. Unfortunately, Indonesia remains a leading rice buyer, many worry that the country depends too much on international rice markets. Achieving food security may be difficult while Indonesia may be successful in terms of producing its own food. The food produced is too costly, leaving poor households vulnerable. The majority of households in rural areas of Indonesia are today net food buyers. Therefore, these groups are very vulnerable to price fluctuations, e.g. when national rice production falls and global prices increase, the poor households may be hit (Dave, 2008; McCarthy and Zohari, 2013). According to The State of Food Insecurity in the World, a 10 % increase in the price of rice leads to a 1.3 % increase in the poverty rate (FAO, 2014c). To avoid this situation, the government of Indonesia may use The National Food Logistic Agency or BULOG (Badan Urusan Logistik). The BULOG managed food security, buffer stock operations and domestic food price stabilization, particularly rice prices stabilization (Yonekura, 2004). If the Indonesian government uses the BULOG to buy up rice in advance from farmers or import, it enables the country to enhance stocks and protect it from unstable world prices and low production. The agency may also collect the rice from farmers to keep prices at levels. Later, as in Indonesia happens often, the agency had to face a scandal because it changed from a non-profit institution into a profit seeking state company (McCarthy and Zohari, 2013).

Later, with the collaboration of the UN, the Indonesian government adopted the new Medium-Term Development Plan (RPJMN) 2010-2014 whose vision is “development for all”, with no groups left behind. The RPJMN is an inclusive development strategy targeted on several outcomes including Sustainable livelihoods where food security is an important priority for the UN. The National Medium-Term Development Plan 2010-2014 enunciated Indonesia’s approach to development and poverty reduction, with the government focusing on increasing food security, particularly in rural areas. The goals of the strategy are linked to the Millennium Development Goals (MDGs), particularly to SDG 2 (FAO, 2014; FSVA, 2009). Besides RPJMN's targets, the National Food Security Council (FSC) in collaboration with the United Nations World Food Programme (WFP) produced and launched the first Food Insecurity Atlas (FIA) in 2005. The publication identified 100 priority districts as food insecure requiring an urgent attention of policy makers. Based on these findings, The Government of Indonesia allocated 32 million USD to the most vulnerable districts. The first FIA 2005 and its updated version titled as Food

Security and Vulnerability Atlas 2009 (FSVA) confirmed that despite Indonesia's economic and food security achievements, attaining food security for all remains to be a major challenge (WFP, 2010). Based on FSVA (2009), the majority of the Indonesian territory is food self-sufficient in cereal production and food availability at the national level is adequate.

Probably, the oldest survey organized by the Indonesian government is SUSENAS (National Socio-economic Survey) which has been held since 1963. In the two last decades, up to 2010, the survey was conducted every year by Central Bureau of Statistics (Badan Pusat Statistics) which is the important source of this research´s secondary data collection. The SUSENAS provides information particularly about the welfare of households, consumption patterns and about household expenditures. (BPS, 2014). According to McCarthy and Zohari (2013), a WFP researcher analysing SUSENAS from 1998 to 2002 data pointed out that household food security is also a matter of personal choice. He found out that once households shifted from being poor (below poverty line) to transition poverty (poverty line + 20 %), they consummation of fish increased significantly but also the consummation of tobacco products. Based on his personal observation held in Nusa Tengara Timur province, many households do not consume the fruit growing in their fields; a woman who never gave a papaya fruit to her children, reported "takut masuk angin" which means "fear from cold". Therefore, also education should have a significant role in reducing food security in Indonesia but unfortunately we may not rely on the Indonesian Ministry of Education to deliver applicable education modules (McCarthy and Zohari, 2013).

Indonesia has made significant progress in establishing mechanism and institutions that improve food security governance. However, there are still challenges in ensuring that these systems have adequate institutional and financial support to work effectively. The Food Law (No. 18/2012) provides steady framework for food security by declaring food a human right; it contains provisions under 12 headings that range from food planning to food investigation. It also provides a platform for the Government of Indonesia to institutionalize self-sufficiency in food production and food sovereignty as overarching food security policies (USDA, 2012a). The overall success of this reformed food security policy will depend on how effectively will be the new law applied, particularly at the local level (FAO, 2014).

2.3 Frequently used food security measurement

In the previous chapters, food security is defined as multidimensional concept that is found at different levels ranging from the national to household an individual level. This makes it a difficult concept to measure and that is why measuring food insecurity may be sometimes very challenging issue for researchers. The chapter briefly reviews the conceptual and methodological literature on food insecurity measurement, describes a particular methods for measuring, particularly on the household level.

2.3.1 Calorie deprivation indicators (CDI)

One of the oldest indicators of food insecurity is calorie availability or deprivation. The method was used by FAO, mostly at the country level – on national food balance sheets, but it can be also used at the household level. The original FAO indicator of calorie deprivation is measured solely at the national level. However, household survey data of food consumption can be used to measure the proportion of people with insufficient calorie consumption. Unfortunately, as calorie indicators are not easily measured at the micro level, their nutritional relevance is limited (FAO, 2003b). Many case studies showed weak correlation or even no correlation between calorie deprivation and anthropometric indicators of malnutrition (Deaton and Dréze, 2009; Pelletier et al., 1995). In addition, Jensen and Miller (2010), noted that calorie availability is a poor indicator of trends in food security because of own demand elasticity of staple foods and low income. According to their study, when poor people suffer a loss of income, they change their diet form high-value caloric sources (e.g. meat) to low-value calorie sources (e.g. rice). It means that total food expenditure may decrease significantly, calorie consumption may not. The financial crisis in Indonesia in 1998 led to a nearly 200 % increase in prices of rice but rice consumption was maintained or even increased slightly (Skoufias, 2003). In contrast, according to most surveys, the consumption of high-value food decreased. There are also some suggestions that households in rural areas were able to cope with the food crisis better due to a higher share of food from their own agriculture production (Block et al, 2004; Hartini et al. 2003b). It is interesting that FAO data show no decline in food availability at the aggregate level in Indonesia over the crisis (FAO, 2003b). The

conclusion is that calorie availability is a very poor indicator of the impacts of shocks, except in situations of the most severe food shortages (Headey et al., 2012).

2.3.2 Coping strategies index (CSI)

The Coping Strategies Index (CSI) is a tool developed on a collaborative research project in Africa, implemented by WFP and CARE. The CSI measures behavior; what individuals/ households do when they have limited access to food or if they cannot access enough food. Generally, coping strategies are activities that people choose as ways of living through difficult times brought on by some sort of shock to their normal livelihoods (IFRC, 2006; Maxwell and Caldwell, 2008). The basic logic of the CSI is "What do you do when you do not have enough food, and do not have enough money to buy food?" These coping strategies are not difficult to observe. Hence, the CSI is an appropriate tool for time limited research and for the situations when other methods are not practical. The index is also suitable tool for food aid programs, particularly for monitoring long-term trends in food insecurity. The set of different coping behaviors based on these categories is given in Table 2.

Table 2 List of coping strategies according to the CSI index (Maxwell and Caldwell, 2008)

1.	**Dietary Change**
	a. Rely on less preferred and less expensive foods
2.	**Increase short-term household food availability**
	b. Purchase food on credit
	c. Borrow food from relatives or friends
	d. Consume seed stock held for next season
	e. Harvest immature crops, or gather wild food, hunt
3.	**Decrease numbers of people that household have to feed**
	f. Send household members to beg
	g. Send children to eat with neighbors or with relatives
4.	**Rationing strategies**
	h. Restrict consumption by adults in order for small children to eat
	i. Limit portion size at mealtimes
	j. Reduce number of meals eaten in a day
	k. Feed working household members at the expense of non-working members
	l. Skip entire days without eating

Corbett (1988) and Devereux (1993) noted that as food insecurity is increasing, households are more likely to adapt strategies which are less reversible, and therefore

represent a more severe type of coping and lower food security. The CSI captures this logic to reflect household insecurity. Coping strategies fall into four basic categories;

(i.) Dietary change.

(ii.) Short-term measures to increase household food availability.

(iii.) Short-term measures to decrease numbers of people to feed and rationing.

(iv.) Managing the food shortfall.

2.3.3 Dietary diversity indicators (DDI)

Dietary diversity indicators are considered as very effective food and nutrition security indicators. There are two basic reasons for these claims; first, dietary diversity capture consumption of both macro and micronutrients. Second, economic theories of demand suggest that individuals will diversify into higher-value micronutrient-rich food (e.g. fish, meat, milk products, fruits and vegetables) only when they satisfied their basic caloric needs (Jensen and Miller, 2010). For these important reasons, dietary diversity indicators became popular and many organizations found them useful, e.g. in the WFP's Emergency Food Security Assessments. Mostly, these indicators consist of answers to recall questions about the consumption of food groups or items over a recent period (usually from 24 hours to 2 weeks).

The most used indicators are the Food Variety Score (FVS), the Dietary Diversity Score (DDS), and the Food Frequency Score (FFS). The indicators provide a count of the number of different food groups or items, usually between 7 and 15 food groups (Headey et al., 2012). Another dietary diversity indicator is WFP's Food Consumption Score (FCS) that is calculated from a seven day household food consumption recall. The FCS and the HDDS share a common emphasis – they are both focused on food access. They differ in the number and definition of food groups, recall period and in the weighting of food groups (Kennedy et al., 2010). The highest weights are connected to meat, fish, and milk, followed by pulses, cereals, vegetables and fruits, and sugar and oil (Headey et al., 2012). The DDI are used for various measurements, not just for food security at household level but also for measurement of nutrient adequacy at the individual level. Hatløy et al. (1998) defined two types of the DDI against nutrient adequacy. His study found a significant association between these two DDI indicators and nutrient adequacy. With regards to household food security, Hoddinott and Yohannes (2002) who conducted an analysis of ten countries

identified a strong relationship between dietary diversity at the household level and consumption and energy availability per capita.

2.3.4 Household income and expenditure survey (HIES)

The HIES obtain information on a variety of specific experience, behaviors and information defining the severity of the condition (FAO, 2002). The set of special questions (Table 4) measures the degree of severity of household food insecurity when the level of magnitude depends on number of affirmative answers (Smith, 2002). Creti (2010) mentioned that the main gap for analysis of income is "how to capture the diversity of earnings existing within the same type of activities without causing mushrooming of the number of sub-groups and making the analysis unmanageable?" Other approaches, e.g. Household Economy Approach (HEA) face the same problems. Therefore, HEA confirms that analysis of household expenditures is more suitable and stable tool for measuring household indicator. The higher the share of total expenditure on food, the stronger is the likelihood that a household has poor access to food (Creti, 2010). The household food energy deficiency relates to people who do not consume sufficient dietary energy to meet the minimal food requirements established by FAO (1996). Household members who do not meet these requirements are in a high risk of food energy deficiency (FAO, 1996). According to Smith (2002) and FAO (2002), Household Income and Expenditure Surveys (HIES) are a source of policy relevant measures allowing targeting and monitoring of regional food insecurity prevalence. However, they also noted that the data collection costs are high, not just financially but also in terms of time.

2.4 Alternative survey instruments for food security measurement

According to Carletto (2012), there is currently a wide variety of survey instruments collecting information on diverse dimensions of food insecurity, with large variation across surveys in the quality, content and quantity of collected information. Frequently used survey instruments are summarized below:

(i) **Household Budget Surveys (HBS) and Income and Expenditure Surveys (IES)** are implemented at varying periodicity by national statistics offices in most countries with the principal purpose of collecting expenditure shares

information to update the weights of the basket for calculating consumer price index (Carletto, 2012).

(ii) **Living Standards Measurement Study (LSMS) and other Multi-Purpose and Integrated Household Surveys (IHS):** the key objective of the LSAMS surveys is to capture determinants of outcomes and linkages among assets, livelihood sources, characteristics of household and government interventions (Mathiassen, 2012).

(iii) **Demographic and Health Surveys (DHS)** are designed to collect data on health and basic demographic and socioeconomic variable for women in reproductive age and children. Due to lack of information on food consumption patterns, expenditures on food an food frequency, the DHS are recommended to combine with other consumption-based surveys (USAID, 2016).

(iv) **Multiple Indicators Cluster Surveys (MICS)** were originally implemented to monitor progress on the goals established by World Summit for Children. Principal dimensions that are covered include nutrition, child health and mortality, housing, water and sanitations, reproductive health and contraceptive use, child protection, literacy, labor and domestic violence (UNICEF, 2012).

(v) **Comprehensive Food Security and Vulnerability Analysis Surveys (CFSVA)** do not collect information on food consumption and food expenditures; however they give results on various aspects of food security including food frequency, dietary diversity and in some instances anthropometric data (WFP, 2003).

(vi) **Welfare Monitoring Surveys (WMS)** monitor welfare conditions on a frequent basis through collection of a minimum amount of information necessary for classification and identification of vulnerable groups of households. WMS provide community and household level information for policy formulation and evaluation (Carletto, 2012).

(vii) **Core Welfare Indicators Surveys (CWIQ)** surveys were created by the United Nations and World Bank to monitor socioeconomic indicators on a large-scale. The surveys contain information related water and sanitation, housing conditions, health care, education, income and household assets (GHDX, 2014).

(viii) 24-Hour Nutrition Surveys (24HNS) generally include a 24-hour dietary recall, anthropometric measurements and health questionnaires, blood tests and information about feeding practices and household environment (Carletto, 2012).

2.5 Overview of the agricultural and socioeconomic situation in North Sumatra province

North Sumatra (Sumatera Utara) is one out of ten provincial territories of the Republic of Indonesia and it consists of 25 regencies including Tobasa Regency and Samosir regency, selected for the study. By 2009, the population of North Sumatra province was 13.25 million inhabitants, or 5.7 % of Indonesia's total population (BPSU, 2014). There were 3,027,500 households with average size of 4.38 members per household. The dependency ratio was 99.1 in 2009. Based on statistics of North Sumatra Province, 54 % of total population live in rural areas and 31 % is younger 15 years. Despite Indonesia is considered as lower middle income country (WB, 2014) and North Sumatra as one of the more developed provinces, percentage of people under poverty line is still 11.51 %. Surprisingly, difference between poverty lines in rural (11.56 %) and urban (11.45 %) areas of North Sumatra is not significant (SUDA,2010).

The first target area Tobasa regency with the value of 10.07 % of people under poverty line can be ranked among the most developed regencies of North Sumatra. Despite the second target area Samosir Regency is considered as the region with the higher percentage of people under poverty line with the value of 17.55 %. Agriculture sector employs 46.7 % of population (>15 years old). 20 % of population is employed in restaurants and hotel industry. The percentage of people working in agriculture sector in target areas; Tobasa Regency (74.5 %) and Samosir Regency (80.1 %) is significantly higher (SUDA, 2010).

2.5.1 Household food and non-food expenditures

National Socioeconomic Survey of North Sumatra (SUDA, 2010) province provides valuable information on how consumers in urban and rural areas spend their money on food and non-food goods (Table 3). According to Pangaribowo (2011), the

poorest households' dominant expenditure is staple food and the households are less likely to consume dairy products. Study also confirmed that the richest group spend larger share of their budget on better diet such as meat, vegetables, fish and dietary products. Based on SUDA (2010), average household member in rural areas of North Sumatra province spend 21.5 USD per month on food. It is necessary to note that tobacco and betel products were included in the survey and create nearly 13 % of the month average expenditure (Table 3). For the Indonesians in rural areas, the using of tobacco and betel products is very important part of their daily life and despite of the new regulation on tobacco in 2012, the impact on the tobacco consumption has been very low (EI, 2014). Rice is a major share of expenditures of the poor in Indonesia (Dawe and Timmer, 2012) and in North Sumatra province the situation is not different. Table 3 refers to monthly average expenditure for food and non-food items per capita spend by households.

Table 3 Monthly average expenditure for food and non-food items per capita in North Sumatra (USD)

Expenditure item	Urban area	Rural area	Expenditure item	Urban area	Rural area
A. Food			**B. Non-food**		
Cereals	3.82	5.66	Household facility	10.64	4.31
Tubers	0.17	0.26	Goods and services	10.83	4.66
Fish	3.12	2.74	Clothing and footwear	2.04	1.29
Meat	0.76	0.40	Durable goods	2.20	1.61
Eggs and milk products	1.93	0.96	Taxes and insurance	0.89	0.28
Vegetables	1.91	2.19	Ceremony events	0.33	0.37
Legumes	0.35	0.34			
Fruit	1.22	0.68			
Oils and fats	1.04	1.03			
Beverages	0.80	0.86			
Spices	0.36	0.35			
Miscellaneous	0.34	0.34			
Prepared food and beverages	6.48	3.00			
Tobacco, betel	2.97	2.68			
Total	25.26	21.49	Total	26.94	12.51
Total expenditure (USD)				**52.20**	**34.00**

The item cereals represented by rice in particular, presents nearly 27 % of the monthly average household food expenditure per capita. Following items of the budget are prepared food and beverages (14 %), Fish (13 %) and Tobacco and betel products (nearly 13 %). The most significant differences between average monthly expenditures per capita

in urban and rural areas are in the case of prepared food and beverages (6.5 USD in urban areas and 3 USD in rural areas) and cereals (3.8 USD in urban areas and 5.7 USD in rural areas) (SUDA, 2010). The difference between expenses for food in rural and urban areas is not as significant as in the case of non-food items. In rural areas, household member spend on food (including tobacco and betel products) in average 21.5 USD per month compared to urban areas – 25.3 USD per month. However, differences between expenses for non-food items are significantly higher. Urban households spend in average 27 USD per capita on non-food items. The most significant differences are concerning items household facility, goods and services and taxes and insurances, exceeding difference 50 %. In total, rural households spend monthly in average 34 USD per capita compared to household members in urban areas where they spend 52 USD per month both for food and noon-food items (Dawe and Timmer, 2012, SUDA, 2010).

2.5.2 Household nutrition security

WHO considers ensuring household food and nutrition security as a basic human right. Unfortunately, the levels of malnutrition remain persistently high in Indonesia, despite considerable increase in GDP per capita. From 1990 to 2012 GDP increased 106 % while undernourishment declined 59 % in the same time period. Fortunately, under-five mortality reduced 63 %. However, the progress has stagnated in recent years and the achievement of the SDG target may be at risk. Poor dietary diversity, low intake of protein and high intake of carbohydrates (particularly rice), is considered as one of the key problems of nutrition security in Indonesia (FAO, 2014). However, also overweight and obesity occurs here. It is observed that there are situations where overnutrition coexists with undernutrition at the household level, implying that these conversely affected individuals share the same household (Doak et al., 2005; Khor, 2008). There are aspects within households that contribute to food and nutritional inequality which is in the line with survey on intra-household resource allocation (Alderman et al., 1995).

Table 4 Daily average calorie consumption of households in North Sumatra in 2009 - kcal[4]/ per capita (SUDA, 2010)

Expenditure item	Urban area	Rural area
Cereals	845.3	1155.8
Tubers	17.20	42.6
Fish	62.4	70.1
Meat	35.3	16.70
Eggs and milk products	65.4	35.8
Vegetables	35.8	45.4
Legumes	31.6	27.10
Fruit	41.6	45.1
Oils and fats	273.8	274.2
Beverages	104.4	103.0
Spices	11.50	10.60
Miscellaneous	36.4	35.9
Prepared food and beverages	259.1	146.8
Total	1,819.6	2,009.1

According to Doak et al. (2005), overweight and dual burden households (meaning that household have both overweight and underweight members) are found to have considerably higher incomes than the rest households in Indonesia. Around 16 % of the Indonesian households are classified as dual burden; mostly children are underweight while adults are overweight. Nowadays, the highest prevalence of dual burden households is found in the lowest expenditure quintile. Most households that escaped the dual burden class shifted to the overweight category (Roemling et al., 2013). According to SUDA (2010) in Table 4, cereals, represented particularly by rice, create a half dose of people's daily caloric intake; in urban area it is exactly 46.5 %. In rural areas the share of cereal consumption is slightly higher – 57.5 %. There are some differences seen in food consumption in urban and rural areas; already mentioned cereal consumption and very significant differences in consumption of (i) tubers, (ii) meat, (iii) eggs and milk products and (iv) prepared food and beverages. These four food groups are characterized by a double consumption in urban areas. The proportion of daily caloric intake in other food groups is very similar.

[4] Specifically, a calorie is the amount of energy, or heat, it takes to raise the temperature of 1 gram of water 1 degree Celsius (1.8 degrees Fahrenheit). One calorie is equal to 4.184 joules, a common unit of energy (Cutnell and Johnson, 2012).

2.6 Development of agricultural production

Rice is the stable food in the Indonesian diet providing more than half of daily caloric intake (FAOSTAT, 2014; SUDA, 2010). Indonesia ranks among the biggest world's rice producers but also among the world's rice importers (USDA, 2012a). Rice production in North Sumatra has been increasing 0.5 % annually. However, the rice production in mountainous areas has been decreasing 0.68 % annually (SUDA, 2010). Corn became important crop for the province because its production increased 6.15 % recently, the same with sweet potato production which experienced nearly 23 % growth in 2009 compared to 2008. Cassava production is also on the massive rise with the growth of 37 % (270,513 t) in 2009 compared to the previous year. The peanut production has been decreasing due to reducing of harvested area; 16.7 t in 2009 which is 2,559 t less than in 2008. In the contrast, soy bean production experienced the significant increase 22 % in 2008 compared to 2009 (SDA, 2013; SUDA, 2010; TSDA, 2013). Table 5 shows agricultural production of small farmers in North Sumatra province in 2009. In terms of volume, the most important was production of rubber (254.6 t), coconut (93.0 t) and palm oil (45.5 t). North Sumatra is well known area for its large plantations, especially plantations of oil palms, rubber, coffee, tobacco and cocoa. Rubber industry experienced an average growth 3.8 % per annum in 2006–2009 (SUDA, 2010).

However, palm oil production is the dominant industry in the area, particularly in Labuhan Batu Utara regency. 16 % of total palm oil production of North Sumatra can be found in the regency.

Table 5 Crop production of smallholders (SUDA, 2010)

Smallholder production	**North Sumatra**	
	Area (ha)	Production (t)
Rubber	376,076	254,650
Palm oil	57,142	45,483
Coconut	110,758	93,088
Cocoa	66,091	38,249
Clove	2,928	289
Incense	23,245	4,662
Cinnamon	5,937	3,686
Candlenut	11,300	12,359
Palm sugar	4,706	2,115
Areca nut	4,989	3,939

Given the growth in production and the paralleled employment opportunity Indonesia has experienced over the past decades, palm oil as Indonesia's currently second most successful agricultural product is already estimated to have shifted over 6 million lives upside of the poverty line (FAOSTAT, 2014; SUDA, 2010). Unfortunately, besides economic and social development, the industry has contributed to a line of ecological problems such as deforestation, habitat destruction, biodiversity decline, water, soil and air pollution and chemical contamination (Teoh, 2010). North Sumatra is also famous for its coffee production. Local coffee offers peculiar flavor profile, low acidity, thick body, and rustic flavors that can be described as earthy. The most productive regencies of North Sumatra are Dairi and Tapanuli Utara which is located next to Tobasa regency. There are three main coffee plantations in North Sumatra and hundreds of private coffee plantations owned by smallholders. In relation to world total coffee production, Indonesia is the third largest coffee producer in 2012-2013 (FAOSTAT, 2014; Nugroho, 2013).

Table 6 gives an overview of the crop production in the area, separately in North Sumatra, Tobasa regency and Samosir regency. The dominant crop production of the province is conclusively wetland paddy with nearly 3.4 million t produced covering 719 ha of harvested area in 2009. Wetland paddy is followed by corn with production of nearly 1.2 million t and 245 ha of harvested area in the same year. Although the size of the two regencies are almost the same (2,235 km^2 in Tobasa regency and 2,43 km^2 in Samosir regency), the agricultural production in Samosir regency is lower. The most striking differences in volume production are seen particularly in production of wetland paddy and corn where Tobasa regency clearly leads.

Table 6 Overview of the crop production in North Sumatra province (SUDA, 2010)

Crop	North Sumatra		Tobasa regency		Samosir regency	
	Harvested Area (ha)	Production (t)	Harvested Area (ha)	Production (t)	Harvested Area (ha)	Production (t)
Wetland paddy	718,583	3,382,066	19,704	90,634	7,129	32,509
Dryland paddy	49,824	145,833	356	1,004	12	34
Corn	247,782	1,166,548	6,558	30,646	1,226	5,701
Peanut	14,317	16,771	126	147	676	785
Mungbean	4,124	4,426	3	3	23	24
Cassava	38,611	1,007,284	406	10,560	622	16,163
Sweet potato	12,359	140,138	212	2,401	619	7,012

However, Samosir regency has multiple production of peanut, mungbean and sweet potato, as well as the cassava production is much higher than in Tobasa regency. The livestock population of the province consists of cattle, horses and buffaloes which are used instead of agricultural mechanization by local farmers. Due to the prevailing number of Christian unity, rural people breed pigs but it is not often as any other kind of livestock (SUDA, 2010).

2.7 Political influence on development of North Sumatra province and Lake Toba

Since North Sumatra is strategically positioned in international shipping line, the President Joko Widodo instructed his ministers to prepare the region to become an international hub in 2017. Geographically, North Sumatra has a beneficial position in the Malacca Strait shipping line which is located near Singapore, Malaysia and Thailand. The national strategic project in North Sumatra includes construction of a toll road connecting Tebing Tinggi, Pematangsiantar, Parapat, Tarutung and Sibolga (The Jakarta Post, 2016; Jakarta Globe, 2017). Besides this, Jokowi's administration intends to boost tourism in Lake Toba region. Lake Toba is one of 10 new tourism destination identified by the Indonesian government to undergo acceleration of infrastructure development. The revitalization of Lake Toba includes particularly improving road access and expansion of Silangit airport. The President has demanded faster progress on the construction of infrastructure at Lake Toba to turn North Sumatra into a world-class destination. BPS recorded 41.6 % decline in foreign tourist that entered through Kualanamu Airport[5] between January 2015 and January 2016. Thus, the Government emphasizes the importance of boosting the brand of Lake Toba, as the main touristic attraction in the province, through promotion and better services to meet international standards (The Jakarta Post, 2016).

The project on development of Lake Toba intends not to harm the local Batak culture and will instead strengthen its unique character. The Indonesian President also affirmed that implementation of the project will positively influence household livelihoods and support their welfare (CNN Indonesia, 2016; The Jakarta Post, 2016).

[5] Kualanamu Airport is an international airiport in Medan, capital city of North Sumatra province, opened in 2013.

2.8 Cultural context: Batak tribe

2.8.1 Traditions and customs

Batak Toba people are the most numerous of the Batak people in North Sumatra province. In daily life, Batak Toba people speak in Batak language and they are concentrated around Lake Toba and Samosir Island within the lake (Bangkaru, 2001). They may be found particularly in following regencies: Tobasa, Samosir, Humbang Hasundutan, North Tapanuli, Dairi, Central Tapanuli and Sibolga (SUDA, 2010). Batak people are familiar with ancient system of mutual assistance in farming and usually use simple tools for crop production such as hoes, plow or single stick. Although Indonesia is the largest Muslim country in the world, majority of Batak people are Christians. Batak tribe is one of the tribes in Indonesia who maintain their culture and strictly hold their customs and tradition (Tobing, 1956). Since starting the birth of child, growing up, getting married, having children until death, Batak people have to follow the customary rituals (Poerwandari, 2005).

Bangkaru (2001) claims that historical isolation of Bataks has kept their culture more intact and forms of their social interaction are different compared to other parts in Indonesia. Unlike Balinese with several different traditional group affiliation at once or Javanese affiliated with their neighborhood or village, the Bataks orient themselves traditionally to *marga*, a patrilineal descent group (Poerwandari, 2005). Batak people are not allow to marry with someone from their own *marga* since they believe the person may be their brother or sister. Generally, in social manners Batak people concern with the way they set the tradition very strictly (Bangkaru, 2001; Tobing, 1956).

Position of women in Batak society seems to be advantageous compared to women in other parts of Indonesia. Batak women are well-known as hard workers, they are used to working in the field, carry out most home food processing and have primary responsibility for raising children (Tobing, 1956). However, in the patrilineal system, Batak men and women have different responsibilities and rights towards their clans. Men have been socialized since their childhood to be knowledgeable about their customs and history. The Toba Batak conceptualization of children refers to men culturally while women are not included. As a result, women are never taken into account in terms of inheritance, only men have rights to inherit land. Nevertheless, Batak women may ask their

fathers or brothers for a plot of rice paddy *pauseang* as a present but only if the man is willing to grant it to them (Bangkaru, 2001; Poerwandari, 2005). The Batak culture defines its three principal goals in life: *hagabeon* (having many male descendants), *hamoraon* (prosperity) and *hasangapon* (honor). Nowadays, majority of Batak people still strictly adheres to the original conceptualization of the three goals. Nevertheless, for some families, the concept of *hagabeon* no longer means to have male descendants only but to have successful and highly educated children, both male and female. The concept of *hasangapon* and *hamoraon* is in view in terms of ownership and access to labor and capital, as well as non-material goods such as education and information (Poerwandari, 2005, Tobing 1956).

2.8.2 Food patterns of Batak people

Given the historical isolation of the Bataks and vast majority of Christians within the community, Batak cuisine and food patterns are more indigenously preserved and different compared to other parts in Indonesia (Tobing, 1956). For many centuries Batak tribes has led a relatively isolated way of life and maintained their ancestral belief systems which results in preservation of their traditions (Bangkaru, 2001). Batak people are not restricted to Islamic halal dietary law[6], unlike neighboring Muslim majority ethnic groups such as Aceh and Minang. Batak cuisine holds its indigenous Austronesian cooking traditions such as cooking meats (pork in particular) along with its blood. Nevertheless, since many tribes of the archipelago have converted to Islam, some non-halal meals have been abandoned. Many of the local Batak meals are made of pork as well as foods made from unusual ingredients: blood or dog meat (Bangkaru, 2001; Tobing 1956).

However, the most common foods are dishes made of fish from Lake Toba, particularly Gold fish and fish called *Ikan Batak.* Fish consumption has always had a deep tradition around Lake Toba and it is the most important part of Batak diet. Another common foods consumed by the Bataks are buffalo meat, beef and chicken. The most traditional Batak dishes are following: *arsik*: a gold fish boiled in water with candlenut and chili, *ikan tombur* or *natinombur*: a fish grilled with spicy sauce of candlenut and pepper, *Naniura*: a sour raw fish with spices without any cooking, *susu kerbau*: a buffalo milk

[6] Islamic jurisprudence specifies which foods are halal ("lawful"). According to the Quran (the holy book of Islam), foods explicitly forbidden are meat from animals that die of themselves, the meat of swine (pigs, porcine animals), blood and animals dedicated to other than God (Tieman, 2015).

boiled with water, *gota*: a sauce made of blood with meat, *lomok-lomok* and *sangsang*: pork meat chopped in small pieces and cooked in its bloodand spices, *babi panggang*: grilled pork served with spiced blood as dipping sauce and dog meat boiled with spices and dog meat (Bangkaru, 2001).

3 Hypotheses

The study is based on the overall hypotheses that (i) households in rural areas of North Sumatra, specifically in Tobasa and Samosir regency are food insecure; (ii) given the various natural and social conditions of the two regions, there are differences in the household food security. This is to be proved by using frequently used food security indicators, specifically by Household Food Insecurity Access Scale (HFIAS), Household Food Insecurity Access Prevalence (HFIAP), Household Dietary Diversity Score (HDDS) and the Months of Adequate Household Food Provisioning (MAHFP), as tools for measuring food access, dietary diversity and food stability. The specific hypotheses of the study are listed in Table 7.

Table 7 Study hypotheses

Hypothesis number	Summary
H1	Female-headed households are more vulnerable to food security and tend to be more food insecure by comparison with male-headed households.
H2	Higher education levels of the head of household positively correlate with the lower levels of household food insecurity.
H3	Household income has an important role in the food security condition of the households; low-income households are difficult to access the food.
H4	The type of livelihood strategy adopted by the households is associated with its food security status.

4 Objectives

4.1 General objective

The overall objective of the study is to provide data and outcomes contributing to the development of relevant strategy for the Government of Indonesia (more specifically, for the Ministry of Agriculture) oriented on tackling the household food insecurity in rural areas. As a result, identification of the appropriate interventions could complement a coping mechanism of the rural households and develop their livelihood in both short and long term. Concerning the regional level, targeted food security programs might be implemented in the particular provinces and municipalities with regard to their specific characteristics and conditions.

4.2 Specific objectives

a) Assess the food security status of households, with the focus on food access, by utilization the following frequently used food security indicators:
   (i) The Household Food Insecurity Access Scale (HFIAS) and the Household Food Insecurity Access Prevalence (HFIAP), as a measure of food access;
   (ii) The Household Dietary Diversity Score (HDDS); as a measure of food diversity;
   (iii) The Months of Adequate Household Food Provisioning (MAHFP), as a measure of food access stability.
b) Identify the relationship between the food security indicators and the selected household characteristics; household heads' gender and education level, household income and adopted agricultural strategy.
c) Deliver outcomes which might play an important role in establishing appropriate policies and intervention strategy aimed at reduction and prevention food insecurity in rural areas.

5 Methodology

The cross-sectional study was conducted in two regencies of North Sumatra province, located around Lake Toba. The study proceeded through following phases: a thorough review of statistics documents (secondary data collection), qualitative studies at community, household and individual levels, pilot testing of semi-structured questionnaire, primary data collection and data entry and its analyses. Data analysis included three main stages: (i) calculation of food security indicators, (ii) analysing differences in the regional context and (iii) analysing correlations between food security indicators and selected household assets and livelihood strategies. The outcomes of the analyses are given and discussed in Chapter 6 and specific suggestions for interventions are found in Chapter 6.7.

5.1 Study area description: Tobasa and Samosir Regency

North Sumatra (*Sumatera Utara*) is one of the ten provincial territories of Indonesia and it is consisted of 25 regencies including Tobasa and Samosir regency, selected for the study. Both regencies are located around Lake Toba which is the largest lake in Indonesia and also the largest volcanic lake in the world (Figure 5). The area is a home of ethnic tribe called Batak who are mostly Christians. Due to its historical isolation the Batak people have different culture, traditions and food patterns compared to other ethnics in Indonesia, as described in Chapter 2.8.

Tobasa regency is surrounded by five regencies, including Simalungun, Labuhan Batu, Asahan Regency, North Tapanuli and Samosir regency. The regency is located on upland, with attitude between 900 – 2,200 m above sea level, with various type of topography and gradients of land. Structure of land is labile and located in tectonic and volcanic shaking area[7]. Tobasa regency consists of 16 sub-regencies with 231 villages in total, including Sigumpar and Lagubuti that participate in the research. The largest sub-regency is Balige with 35 villages, followed by Laguboti and Silaen. Population of Tobasa Regency reached 173,129 inhabitants and the number of households is 42,501 (TSDA,

[7] Sumatra is at the boundary between two tectonic plates which causes the vulnerability to natural disasters, particularly to earthquakes. Based on information recorded by the CRED, there are five countries in the world which were hit by natural disasters in 2012 the most; China, the United States, the Philippines, Indonesia[7] and Afghanistan. Together they accounted for 38.1% of total disaster occurrence in 2012 (CRED, 2013).

2013). Tobasa is one of the most developed regencies of North Sumatra Province. However, the percentage of people under poverty line is 10.2 which is one of the five lowest values among 25 regencies of North Sumatra in 2009 (SUDA, 2010). Agriculture sector employs 46.7 % of population in the province of North Sumatra. Nevertheless, the share of people engaged in agriculture in Tobasa is above this and results in 74.5 %. Balige as the capital of Tobasa is trade and government center with the highest population. The sex ration in the region is 98.93 %; 86,101 males and 87,028 females. Based on calculation of demographic data in 2010, the dependency ratio is 62 % in Tobasa Regency. Number of people under poverty line has been decreasing significantly between 2004-2010, from 19.2 % to 10.2 % (SUDA, 2010; TSDA, 2013).

Figure 5 The Map of North Sumatra province (Bangkaru, 2001)

Samosir regency is located on large volcanic Samosir Island lying within Lake Toba. Samosir is the world's largest island within an island with its 630 square kilometers, slightly smaller than Singapore. It consists of nine sub-regencies, namely Pangururan, Ronggur Nihuta, Sianjur Mula Mula, Nainggolan, Onan Runggu, Palipi, Harian, Sitio-tio and Simanindo which is one of three sub-regencies included in the survey (Bangkaru, 2001). The district consists of 134 municipalities compared to 231 municipalities in Tobasa. Simanindo with 21 municipalities is the second largest sub-regency and it creates nearly 14 % of the total Samosir regency area. The population of Simanindo is 19,814 inhabitants: 16.3 % of the total regency population (SDA, 2013). There are 5,031 households in the sub-regency out of 29,775 households in Samosir. Agriculture sector employs 71 % of the working population (49,185 people) According to SUDA (2010), the largest group affected by unemployment are people with high school education attained when the group makes 63 % of total unemployed population of Tobasa. Smallholders in Samosir focus their agricultural production particularly on following crops: coffee (2,831 t), candlenut (262.2 t), cocoa (67.9 t), sugar palm (65.6 t), coconut (34.6 t), clove (16.6 t) and vanilla (13.6 t) in total (SDA, 2013; SUDA, 2010). Samosir is also a popular tourist destination[8] due to its exotic history, calm atmosphere and pleasant weather conditions. The island provides unique and fascinating Batak heritage in its clusters of traditional houses with roofs curving upwards like buffalo horns, white-washed churches and ancient stone tombs and monuments.

5.2 Sampling

The survey was conducted in two time-periods; in 2013 and 2014 in two regencies: Samosir and Tobasa, including eight municipalities (*desa*); Ambarita, Garoga, Martoba, Sigumpar Dangsina, Dolok Jior, Nauli, Pasar Laguboti and Gasaribu, listed in Table 8. Data were collected from 192 households in total, including 892 individuals. Statistics documents of North Sumatra province including maps and fact sheets served as source for sampling of the particular municipalities, considering their accessibility and similar population size (SDA, 2013; SUDA, 2010; TSDA, 2013).

[8] Tourists are mostly concentrated in Tuktuk area which is not selected for the study.

Table 8 Overview of the study sites (N=192, including 892 individuals)

Regency	Sub-regency	Municipality
Samosir (n=68)	Simanindo (n=68)	Ambarita (n=22)
		Garoga (n=27)
		Martoba (n=19)
Tobasa (n=124)	Sigumpar (n=79)	Sigumpar Dangsina (n=30)
		Dolok Jior (n=26)
		Nauli (n=23)
	Laguboti (n=45)	Pasar Laguboti (n=25)
		Gasaribu (n=20)

Random sampling was used to select households in each municipality, using the most recent household list available. According to Dickson (2009), random allocation happens as far as each household of the municipality has an equal chance of appearing in the sample. Therefore, printed households lists were obtained in the sub-regency local governments and used for the random sampling. However, total sample of 192 households cannot be statistically considered as a sample representing target area. Given the time-consuming character of the data collection and a strong need to approach each respondent individually, it resulted in lower number of total respondents than representative sample size requires. Nevertheless, according to study by Dickson (2009), homogenous populations do not present problems in sampling; a small random sample suffices as opposed to heterogeneous populations. Since (i) 100 % of the respondents are part of Batak ethnic group and (ii) 98.5 % are Muslims, the sample may be conclusively considered as homogenous. Thus, the kind of data collection and sample sizing are in accordance with the objectives and hypotheses of the study.

5.3 Data collection and questionnaire structure

The data collection was conducted at three main levels: national, provincial (secondary data collection) and municipal (primary data collection). The important sources for secondary data collection were particularly (i) The Indonesian Central Bureau of Statistics (Badan Pusat Statistik) and (ii) The Regional Development Planning Board of Samosir regency and Tobasa regency. Semi-structured questionnaire with close and open ended questions was translated into the Indonesian language and used for primary data collection.

The questionnaire was divided into the several sections: general household characteristics, land ownership, agricultural production, economic status including total household income, expenditures, access to credit and questions related to the calculation of food security indicators and to coping strategies assessment. Full questionnaire format may be seen in Annex 3 in English and in Annex 4 in Indonesian language. In order to ensure the accurate answers, the phase of pilot testing was included into the survey. Hence, focus group discussion was organized with 10 household representatives and pre-tested the questionnaire. Their hesitation, erasures and skipped questions were observed and discussed within the session. The following supportive questions were analysed:

- Does each question measure what it is supposed to measure?
- Are all the questions and used words understood?
- Do all respondents interpret the question in the same way?
- Do respondents correctly follow directions?
- Do questions motivate the people to respond?
- Does questionnaire collect the required information?

After pilot testing of the questionnaire among respondents, few questions were modified to ensure the accurate answers and relevant results. Despite of these adjustments, some limitations of the questionnaire occurred later, as described in Chapter 6.8. The vast majority of questionnaires were completed personally with enumerators to reduce misunderstandings and distortions. The main enumerator (the author of the study) collected approximately 85 % of the total number of questionnaires. Remaining data were collected by two bachelor students recruited at local university Institut Teknologi Del. These enumerators were instructed in detail and notified about all questionnaire requirements in order to avoid errors and incomprehension. As a secondary product of the data collection, informal conversational interviews were conducted. This provided complementary data required for better understanding the factors influencing the livelihoods as well as cultural context.

5.4 Data analysis

The collected data were analysed in three main stages: the first stage included calculating of the food security indicators related to each households, the second stage

consisted of analysing differences between the districts and in the last stage relations between household assets, livelihood strategies and food security condition of the households were investigated. The data were captured and analysed in the field using the SPSS Data Entry Builder™ and MS Excel. Later data were analysed in Statistica 12 and Gretl 1.9.14. For the first stage of data analysis frequently used food security indicators were computed based on data collected and assessed the food security status of the households. Quantitative data analysis was based on:

- Descriptive statistics including tables and histograms, mean and variance statistics
- Regression analysis
- Two-sample t-tests for means
- Two-sample t-tests for relative frequencies
- Analysis of variance (ANOVA) for more samples
- Chi-square test in contingency table.
- Principal Components Analysis (PCA)

5.5 Household food security analysis and calculation

The chapter is focused on description of (i) analytical tools used for measurement of household food security and (ii) its procedure resulting in obtaining the hard results. For the purposes of the study, the food security indicators and techniques developed by USAID's Food and Nutrition Technical Assistance (FANTA) were used. The explanation and justification on using this methodology approach is summarized in Chapter 6.6.

5.5.1 Measuring of household food access: Household Food Insecurity Access Scale (HFIAS)

In order to obtain results on household food access, the FANTA's HFIAS indicator is computed and used for further analysis. The indicator consists of nine questions representing apparently universal domains of the household food insecurity (access) experience and it is used to assign households and populations along a continuum of severity, from food secure to severely food insecure (Coates et al., 2007; FANTA, 2004). The set of questions (Table 9) examines whether the household experienced a form

of insufficient access to food in the past 30 days, and if the situation occurred, with what frequency.

Table 9 The set of the questions used for the HFIAS indicator

No.	Occurrence Questions
Q1	In the past four weeks, did you worry that your household would not have enough food?
Q2	In the past four weeks, were you or any household member not able to eat the kinds of food you preferred because of lack of resources?
Q3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?
Q4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because a lack of resources to obtain other types of food?
Q5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
Q6	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?
Q7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?
Q8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?
Q9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

The HFIAS occurrence questions relate to three different domains of food insecurity (access) (Table 10) found to be common to the cultures examined in a cross-country literature review (Coates, 2004; Coates et al., 2007). The HFIAS module provides information on food insecurity (access) at micro (household) level.

Table 10 Domains of food insecurity

Domain of Food Insecurity	Questions
Anxiety and uncertainty about the household food supply	1.
Insufficient quality (including variety and preference of the type of food)	2.,3.,4.
Insufficient food intake and its physical consequences	5.,6.,7.,8.,9.

5.5.2 Household food insecurity access-related conditions and domains

This calculation derived from the HFIAS provides specific information about the perceptions and behaviors of the rural households and presents the share of households that responded affirmatively to each question, regardless of the frequency of the experience (Table 11). It measures the percentage of respondents experiencing the condition at any level of severity (Coates et al., 2007; Edward et al., 2004).

Table 11 Formula for assessment of the HFIA-related conditions

Household Food Insecurity Access-related Conditions	Percentage of households that responded "yes" to a specific occurrence question. For example: Percentage of households that ran out of food.
Households experiencing condition at any time during the recall period	Example: Number of households with response = 1 to Q1 _____ X 100 Total number of households responding to Q1
Households experiencing condition at a given frequency	Percentage of households that responded "often" to a specific frequency-of-occurrence question. For example: Percentage of households that ran out of food often. Example: Number of households with response = 3 to Q1a _____ X 100 Total number of households responding to Q1

Meanwhile, Table 12 shows a calculation on how information on the prevalence of households experiencing one or more behaviors in each of the three domains (Table 10) reflected in the HFIAS is obtained.

Table 12 Formula for assessment of the HFIA-related domains

Household Food Insecurity Access-related Domains	Percentage of households that responded "yes" to any of the conditions in a specific domain. For example: Percentage of households with poor access to food. Example: Number of households with response = 1 to Q2 or 1 to Q3 or 1 to Q4 _____X 100 Total number of households responding to Q2 or Q3 or Q4
Household experiencing any of the conditions at any level of severity in each domain	

The HFIAS score variable is computed for each household by summing the codes for each frequency-of-occurrence questions (Table 13). Before setting up the final score, the each answer has to be coded: never=0, rarely=1, sometimes=2, often=3. With together nine occurrence questions for respondents, the maximum score for household was 27. The higher the HFIAS score is, the greater the food insecurity (access) and the lower the score is, the less food insecurity (access) the household experienced (Coates et al., 2007; Radimer et al., 1990).

Table 13 Formula for assessment of the HFIAS score

HFIAS Score	Sum of the frequency-of-occurrence during the past four weeks for the nine food insecurity-related conditions
Minumum value = 0 Maximum value = 27	Sum frequency-of-occurrence question response code (Q1+Q2+Q3+Q4+Q4+Q5+Q6+Q7+Q8+Q9)
Average HFIAS Score	Sum of HFIAS Scores in the sample Number of HFIAS Scores (households) in the sample

5.5.3 Household Food Insecurity Access Prevalence (HFIAP)

In order to report household food insecurity (access) prevalence, the categorical indicator HFIAP is calculated. The indicator classifies the target groups into four grades of food insecurity: (i) food secure, (ii) mildly, (iii) moderately and (iv) severely food insecure (Table 14) as they respond affirmatively to more severe conditions and/or experience those conditions more frequently (Coates et al., 2003). Household classified as food secure experienced none of the food insecurity (access) conditions, or just experience worry, but rarely. HFIAP category variable is calculated for each household by assigning a code for the food insecurity (access) category in which it falls. First, each answer is coded; never=0, rarely=1, sometimes=2, often=3 (Table 14).

Table 14 The Calculations of the HFIAP Categories

HFIAP category	**Calculation of HFIA category for each HH**
1=Food Secure (FS)	HFIAP category = 1 if [(Q1=0 or Q=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
2=Mildly Food Insecure (MIFI)	HFIAP category = 2 if [(Q1=2 or Q1=3 or Q2=1 or Q2=2 or Q2=3 or Q3=1 or Q4=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
3=Moderately Food Insecure (MOFI)	HFIAP category = 3 if [(Q3=2 or Q3=3 or Q4=2 or Q4=3 or Q5=1 or Q5=2 or Q6=1 or Q6=2) and Q7=0 and Q8=0 and Q9=0]
4=Severely Food Insecure (SFI)	HFIAP category = 4 if [Q5=3 or Q6=3 or Q7=1 or Q7=2 or Q7=3 or Q8=1 or Q8=2 or Q8=3 or Q9=1 or Q9=2 or Q9=3]

And as the subsequent step, HFIA Prevalence is calculated (Table 15).

Table 15 The Calculation of the HFIA prevalence

HFIA Prevalence	Percentage of HH that fall in each HFIA category. For example: Percentage of moderately food secure (access) HHs (HFIA category = 3). Example: Number of HHs with HFIA category = 3 _____ X 100 Total number of HH with a HFIA category

5.5.4 Measuring of dietary diversity: Household Dietary Diversity Score (HDDS)

As the further step of the food security analysis, the HDDS indicator is calculated, as the measure of the household dietary diversity. The indicator mirrors number of different food groups consumed by households over a given reference period, specifically during yesterday and night. In order to better reflect a quality diet, the number of various food groups (Table 16) is calculated and analysed. Respondents are asked whether they or any other household member consumed any item from the particular food group, in given period of time. This has to be reported by a household member who is responsible for food preparation or at least by a person who was present and ate in the household on the previous day since the questions refers to the household as a whole. (Hoddinott et al., 2002). Respondents are instructed to exclude food consumed outside the home, not prepared in the household. The HDDS variable is calculated for each household when the value ranges from 0-15. Thereafter, the number of affirmative answers (=1) is summed which provides outcome on dietary diversity of the particular household. Table 17 shows a calculation of the HDDS and its average value in the sample.

Table 16 Overview of food groups used for the HDDS calculation (an expanded version)

	Food Groups Used for the HDDS Calculation
A	Rice, noodles, biscuits, cookies, any other foods from millet, sorgum, maize
B	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside
C	Potatoes, white yams, manioc, cassava, or any other foods made from roots or tubers
D	Dark, green, leafy vegetables such as cassava leaves, bean leaves, kale, spinach, pepper leaves, taro leaves, and amaranth leaves
E	Any other vegetables
F	Ripe mangoes, ripe papayas
G	Any other fruits
H	Beef, pork, lamp, goat, rabbit wild game, chicken, duck, or other birds, liver, kidney, or other kind of meat or organs
I	Eggs
J	Fresh or dried fish or shellfish
K	Foods made from beans, peas, or lentils
L	Cheese, yogurt, milk or other milk products
M	Foods made with oil, fat, or butter
N	Sugar or honey
O	Other foods, such as condiments, coffee, tea

Table 17 Calculation formula for the HDDS

HDDS	Total number of food groups consumed by HH members when values for A through L are either "0"or"1".
Maximum value = 12	
Minimum value = 0	Sum (A+B+C+D+E+F+G+H+I+J+K+L+M+N+O)
Average HDDS	Sum (HDDS) / Total number of HHs (N=192)

5.5.5 Measuring of food stability: Month of Adequate Household Food Provisioning (MAHFP)

Food stability assessment includes calculation of the MAHFP indicator which focuses on the desired outcome of improved food access – improved household food consumption. Data for the MAHFP are collected by first screening out households that were able to satisfy their food needs throughout the entire year. Households that are not able to meet their food supply (Question 1) were asked to skip to Question 2. Here, they are asked to identify in which months (during the past 12 months) they do not have access to sufficient food to satisfy their food needs. Therefore, the MAHFP indicator ranges between 0–12, the higher the score is, the greater the food insecurity access (Table 18). Similarly as in the HDDS calculation, these questions have to be reported by household member who was responsible for food preparation since the questions refer to the food needs of the household as a whole, not any single member of the household (Bilinsky and Swindale, 2010).

Table 18 Calculation formula for the MAHFP

MAHFP for each HH	Twelve months minus the total number of months out of the previous 12 months that the HH was not able to satisfy its food needs.
Maximum value = 12	Values for A through L are "0" or "1"
Minimum value = 0	When answer to Question 1 was "No.", then responses A-L Question 2 is "0".
	(12) – Sum (A+B+C+D+E+F+G+H+I+J+K+L)
Average MAHFP	Sum of the MAHFPs for all HHs in the sample / Total number of HHs (N=192)

6 Results and Discussion

Thesis outcomes should principally serve as an impetus for discussion and particularly as a guideline for governmental bodies on developing programs and strategies oriented at tackling food insecurity in rural areas of Indonesia. Regarding the scientific point of view, the research outcomes contribute to empirical evidence and complete data related to food security at micro level in North Sumatra Province. Therefore, this provides basis for further design of socio-economic models which might be applied in the rural areas of Indonesia within the government intervention strategies focused on combating household food insecurity.

6.1 Socioeconomic and agricultural characteristics of the households

The chapter is focused on elementary socio-economic analysis of rural households in two regencies of North Sumatra province to better understand the livelihood concept of the respondents. Major attention is given to the selected parts of the Sustainable Livelihood Framework (Figure 4) including education levels, gender, household income and basic types of livelihood strategies. These variables are used for further analysis, in accordance with the objectives of the dissertation. Total number of households represented by heads of the households was 192 including in total 892 individuals; 91.5 % male-headed households and 8.5 % female-headed households.

The area of North Sumatra is typical for Christian population, therefore 98.5 % of respondents are Christian Batak Toba people and 1.5 % of Muslims[9]. In average, there are 3.01 children per household which places the area slightly above national average with fertility rate 2.4 since 2010 (WB, 2014). Based on data, average number of people in household (including children) is 5.02. Vast majority of households live in house - 97.5 % and only 2.5 % of respondents live in a hut. 64.5 % live in their own house, 31 % rent a house and 4 % share a dwelling. Households, renting a house, pay in average 19.4 USD per month. 82.3 % of households are focused on-farm livelihoods; 20.3 % of respondent direct

[9] Despite there is a majority of Christian population in Tobasa and Samosir regency, Indonesia is the country with the world's largest Muslim population (205 milliion. Roughly 88 percent of Indonesia's population is Muslim, and the nation is home to about 13 percent of the world's Muslims (Pew Research Center's Forum on Religion and Public Life, 2011).

their livelihood just on crop production, 7.8 % on livestock production and 54.2 % of households have both crop and livestock production. 17.7 % of households have no farm and drive their livelihoods purely on off-farm activities. It is observed that 100 % of respondents attended schooling; the largest portion of respondents – 52. 3 % attained senior high school and 21.1 % junior high school (Figure 6). Figure 7 displays the age structure of the household heads (Figure 7). The largest part is created by age group between 34- 44 years and makes 34 % of total number of respondents while the smallest percentage is represented by the lowest age group between 18–24 years. The average age of the household heads is 45.43 years.

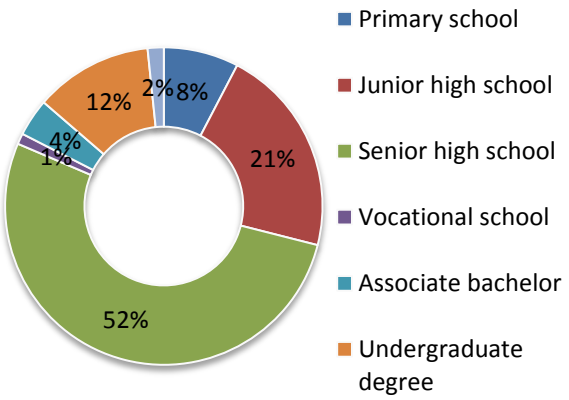

Figure 6 Structure of education level s (N=183)

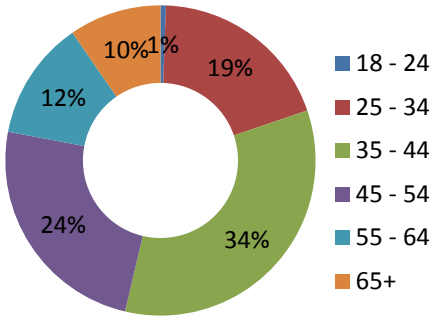

Figure 7 Age structure (N=177)

Household economy of the respondents reveals the following facts: total household expenditure is 172.1 USD per month while total household income is 193.3 per month which proves difficult conditions for households to reach any savings (Hes et al, 2017; SUDA 2010). Results differ in the two regions; the average total household expenditure in Tobasa regency is 201 USD per month and the average total household income is 224 USD per month. In the regional context, the results coming from Samosir regency are less favorable; the average total household expenditure is 157.5 USD per month and the average total household income is 189 USD per month. Figure 8 shows detailed structure of principal household expenditures when respondents were asked to specify the main source of their household's expenditures. Outcomes indicate that rural households spend particularly on (i) food (34.6 %), (ii) children education (25.0 %) and (iii) crop inputs (13.5 %). High share of households with covering of loan/credit (11.9 %) as the main source of their household expenditures should be also considered in the

development of the particular interventions. This encourages the creating an appropriate microfinance system in North Sumatra as proposed by Hes et al. (2017).

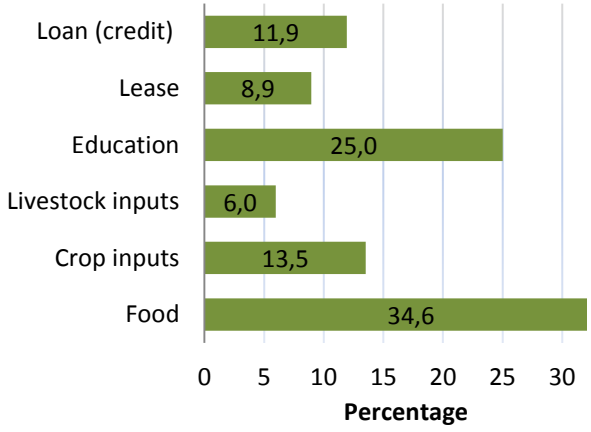

Figure 8 Major expenditure items of households (N=191)

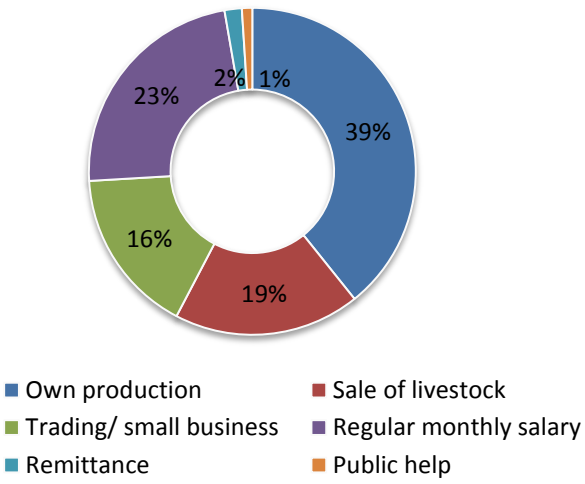

Figure 9 Households' access to food (N=189)

In order to introduce household food security situation in the regions, respondents were asked questions related to food consumption; on the (i) main sources to access the food (Figure 8) and (ii) the frequently consumed food groups, as one of the outputs for the HDDS calculation (Chapter 6.2.3.). Figure 9 shows that the households are enabled to access the food mainly due to their own agricultural production (39 %), monthly regular salary (23 %) and sale of livestock (19 %). Since the share of agricultural households (both with crop and livestock production) is 82.3 %, as stated above, the total share of households accessing food through their own agricultural production should be possibly increased. In order to demonstrate the specific share of household expenditure on food items, the head of households were asked how much they spend on food weekly. Rural household in Tobasa and Samosir regency spend in average 5.8 USD a week on food items which is comparable with the results in regional statistics documents of North Sumatra province (SUDA 2010).

Similarly, the respondents were asked to specify principal sources of their household income; the frequencies of affirmative and negative responses are shown in the Table 19. Results prove the importance of on-farm activities as the main contributors to household budgets but also administrative works highlight its relevance towards increasing in households' incomes. Since off-farm activities are generally perceived as factors positively influencing the livelihoods (McCarthy and Sun, 2009; Rose and Charlton, 2002),

Table 19 shows the overview of these activities adopted by the households. Obviously, the most frequent off-farm activities adopted by households are seasonal works, fishing and cooking in restaurant or warung[10]. The highest numbers of affirmative answers related to household source of income are found in selling crops, administrative works and selling animals. The correlation between the scope of off-farm activities, sources of income and the food security condition of the households are investigated in Chapter 6.4.4.

Table 19 Overview of off-farm activities and sources of income

Off-farm activity (N=182)	**Answers**			
Frequency	Yes	%	No	%
Renting of land	8	4.40	174	95.60
Cooking in restaurant or warung	17	9.34	165	90.66
Seasonal works	35	19.23	147	80.77
Guiding	1	0.55	181	99.45
Welding	1	0.55	181	99.45
Driving	2	1.,10	180	98.90
Trading	7	3.85	175	96.15
Teaching	1	0.55	181	99.45
Medication	1	0.55	181	99.45
Music	1	0.55	181	99.45
Fishing	32	17.58	150	82.42
Source of Income (N=186)				
Frequency	Yes	%	No	%
Selling crops	93	50.00	93	50.00
Selling animals	46	24.73	146	78.49
Fishing	29	15.59	157	84.41
Rural temporary works	27	14.52	159	85.48
Urban temporary works	6	3.23	180	96.77
Administrative works	58	31.18	128	68.82
Remittance	4	2.15	182	97.85
Trading	26	13.98	160	86.02
Laundry	1	0.54	185	99.46
Renting bikes and motorbikes	4	2.15	182	97.85
Crafts	12	6.45	174	93.55
Maintaining services	6	3.23	180	96.77
Restaurant	3	1.61	183	98.39
Driving	1	0.54	185	99.46
Playing music	1	0.54	185	99.46

[10] A warung (old spelling *waroeng*) is a type of small farmily-owned business. It is often a modest small restaurant, café or a causal shop in Indonesia.

6.2 Indicators for food security measurement

The chapter gives results on food security measurement by using FANTA's method delivering information on household food accessibility, dietary diversity and food stability. Thus, it provides key outcomes on the most important domains of household food security necessary for further analysis and investigations.

6.2.1 Summary statistics on the HFIAS, HFIAP, HDDS and the MAHFP indicators

A basic exploratory analysis in Table 20 shows means, standard deviations and maximum and minimum values of the HFIAS, HDDS and MAHFP, as measures of the (i) food access, (ii) food diversity and (iii) food stability. The average HFIAS score equals to 6.11 which falls into the first quarter of 0-27 possible range when the higher the score the more food insecure the household is. Average value of the HDDS is 5.3 which indicates that average household consumes only less than a third of the different food groups available to them. This confirms a statement of The Economist's Global Food Security Index identifying the five challenges for improving food security in Indonesia; (i) public expenditure on agricultural research and development, (ii) corruption, (iii) gross domestic product per capita, (iv) quality of proteins and (v) diet diversification (GFSI, 2015). According to Rah et al. (2010) low dietary diversity is a strong predictor of stunting among children aged 6-59 months and it also plays an important role for development of mental disorders (Poorrezaeian, 2015). For these reasons, an improved diet diversification should be one of the top priorities for interventions focused on tackling food insecurity in the province. The MAHFP indicates that households are able to provide for themselves with adequate food for 11.41 months per year in average.

Table 20 Summary statistics on the food security indicators (N=192)

Food Security Indicator	Mean	Sdev	Maximum value	Minimum value
Household Food Insecurity Access Scale (HFIAS)	6.11	6.59	27	0
Household Dietary Diversity Score (HDDS)	5.30	2.57	15	1
Months of Adequate Household Food Provisioning (MAHFP)	11.41	1.7	12	4

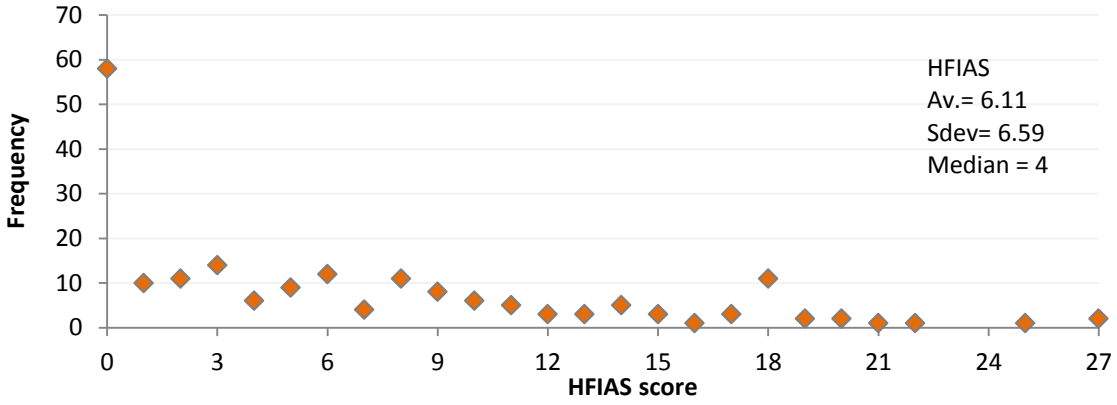

Figure 10 The HFIAS score distribution (N=192)

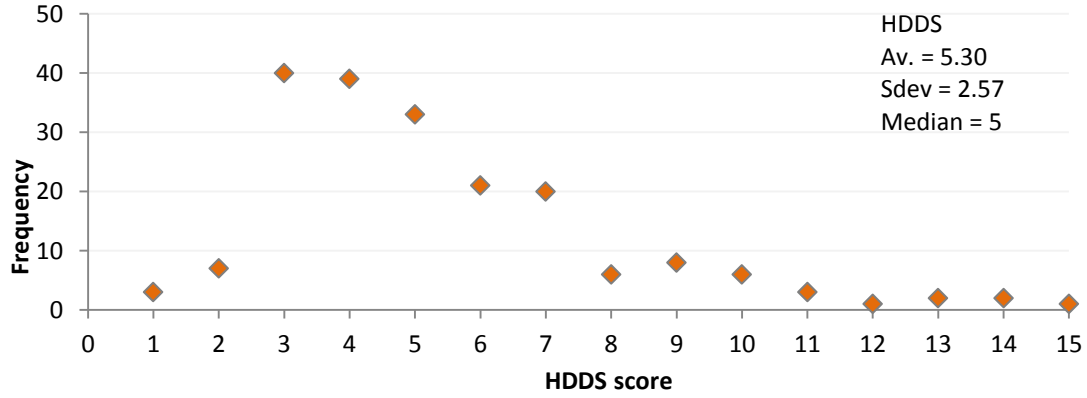

Figure 11 The HDDS score distribution (N=192)

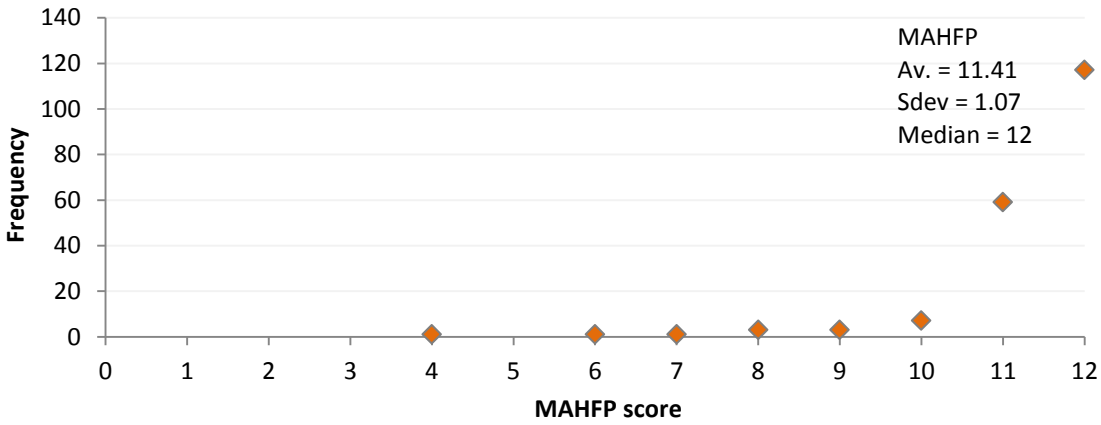

Figure 12 The MAHFP distribution (N=192)

Figure 10, 11 and 12 show frequency distribution of the food security indicators. Frequency distribution of the HFIAS and the MAHFP is unimodal while data distribution of the HDDS is right-skewed. Figure 10 displays the distribution of the HFIAS and shows relatively high proportion of households (*n=54*) with the HFIAS=0 proving their secure access to food. However, the overall results on food accessibility confirm the severe

conditions in the both regions (Table 22). The shape in Figure 11 indicates overall poor dietary diversity among households in both regencies. This adverse situation is discussed more in detail in Chapter 6.2.3. The distribution trend shown in Figure 12 demonstrates that households in Tobasa and Samosir have favorable food access stability since the average household is able to meet its dietary needs for 11.41 months a year. Figure 13 shows bimodal distribution and indicates that (i) there is similar number of households in both regencies who are considered as severely food insecure (*n=60*) and food secure (*n=57*) (ii) there is nearly the same number of moderately (*n=39*) and mildly food insecure households (*n=36*).

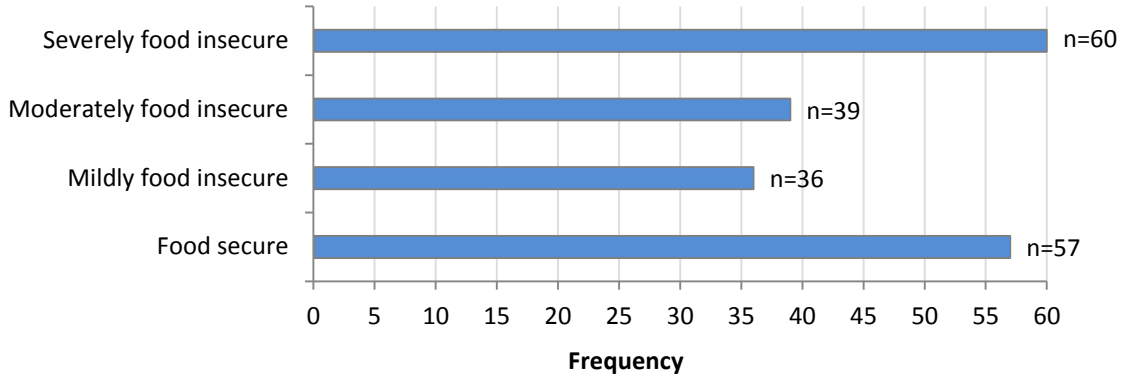

Figure 13 The HFIAP distribution (N=192)

6.2.2 The HFIAS domains of food insecurity

Detailed structure of the answers and domains related to the household food access are shown in Table 21. The HFIAS scores, as the measure of food access, range between 0-27 with a mean score of 6.11 (SD 6.59) and median score of 5.00 (Figure 10). Table 21 presents (i) findings for each of the nine items (Q1-Q9) in the HFIAS and (ii) Household Food Insecurity Access-related Domains:

Domain I (Q1): *Anxiety and uncertainty about the household food supply:* Even though 47.1 % of households responded affirmatively to severity item asking whether they are worried about household food supply, only 7.9 % respondents reported that they worried „often“. Then, 52.9 % of subjects reported a negative answer to all items in domain indicating that more than half of the households do not have to face any deficient food supply.

Table 21 (1) The occurrence frequency of the nine items on the HFIAS; (2) prevalence of the household food insecurity domains (N=189)

HFIAS Items: Domains of Food Insecurity	**Frequency of occurrence: n (%)**			
Domain 1: Anxiety and uncertainty about the household food supply	Never	Rarely	Sometimes	Often
Q1: Did you worry that your household would not have enough food?	100 (52.91)	35 (18.52)	39 (20.63)	15 (7.94)
Domain 2: Insufficient quality (including variety and preference of the type of food)				
Q2: Were you or any household member not able to eat the kinds of food you preferred because of lack of resources?	89 (47.09)	30 (15.87)	46 (24.34)	24 (12.70)
Q3: Did you or any household member eat a limited variety of food due to a lack of resources?	86 (45.50)	36 (19.05)	43 (22.75)	24 (12.70)
Q4: Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	111 (58.73)	27 (14.29)	27 (14.29)	24 (12.70)
Domain 3: Insufficient food intake and its physical consequences				
Q5: Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	112 (59.26)	27 (14.29)	36 (19.05)	14 (7.41)
Q6: Did you or any other household member eat fewer meals in a day because there was not enough food?	122 (64.55)	28 (14.81)	27 (14.29)	12 (6.35)
Q7: Was there ever no food at all in your household because there were not enough resources to go around?	145 (76.72)	16 (8.47)	23 (12.17)	5 (2.65)
Q8: Did you or any household member go to sleep at night hungry because there was not enough food?	155 (82.01)	13 (6.88)	13 (6.88)	8 (4.23)
Q9: . Did you or any of your household members go a whole day without eating because there was not enough food?	165 (87.30)	10 (5.29)	9 (4.76)	5 (2.65)
Household Food Insecurity Access-related Domains	No to all items in the domain [n(%)]		Yes to at least one item in the domain [n(%)]	
I. Anxiety and uncertainty about the household food supply	100 (52.91)		89 (47.09)	
II. Insufficient food quality	68 (35.98)		121 (64.02)	
III. Insufficient food intake	101 (53.44)		88 (46.56)	

[a] All questions within the three domains were specified by the exact period of time – 30 days.

Domain II (Q2-Q4): *Insufficient food quality (including variety and preference of the type of food):* Outcomes from the domain demonstrate that 64.0 % of households struggle with food quality; 12.7 % reported that they tackle a problem with insufficient food quality „often". This is partially linked with the findings related to low scores of the HDDS, as the measure of dietary diversity (Figure 11) . The unfavorable situation urges for attention and might be possibly improved through introduction of neglected food groups/ resources to the households (GFSI, 2015; Megersa et al.).

Domain III (Q5-Q9): Insufficient food intake: Results from the domain indicate that 46.6 % of households suffer from deficient food intake. Majority of this inconvenienced group reported household members had to eat smaller meal than they felt they needed because there was not enough food and/or had to eat fewer meals in a day because there was not enough food. In addition to that, there are 12.7 % of respondents whose household member/s had to go at least rarely a whole day without eating because there was not enough food. The overall results on the household access can be compared with the studies using the same methodology approach (De Cock et al., 2013; De Toledo Vianna et al., 2011 and Chatterjee et al, 2011).

6.2.3 Food consumption and the household dietary diversity (HDDS)

The outcomes in Figure 14 are in the accordance with the statement that Indonesia struggle with low dietary diversity on the national level and thus this issue is one out of the major four challenges for weakening the household food insecurity (GFSI, 2015 and Poorrezaeian, 2015). The dominant food group out of the HDDS is represented by carbohydrates, particularly by rice, consumed by 95 % of the households. Rice is the most important staple food here and usually accompanies every meal and it is often the main ingredient for dessert or beverages. In addition, Toba Lake area with constant weather and favorable temperatures throughout the year offers very convenient conditions for rice production (SUDA, 2010) which is however labor intensive and requires high energy intake (Purwestri et al., 2017). Considerable part of the Indonesian diet is also fresh or dried fish consumed by 45 % of the households, notably in area of Toba Lake with the long-term fishing tradition. As a benefit, higher fish consumption of households living around lake is associated with higher household income and food security (Fiorella et al.,

2014). Further results show that the household consumption of milk and milk products is not very common (7 %). In Indonesia, this is an issue of (i) high costs of the milk products and (ii) custom and habit when local people equal the milk and its products to white substances that are unpleasant to consume. Accordingly, the households prefer receiving animal protein rather in the form of eggs (41 %) and meat (28 %). This is complementary finding on the HDDS (Figure 11 in Chapter 6.2.1.) which demonstrates that households in both regencies eat only a third (5.3) out of the 15 food groups available in the region. Considering the fact that rural areas of Indonesia face the problem with (i) low dietary diversity and (ii) protein quality (GFSI, 2015), the other available food groups should be introduced to the households and consumption of milk products should be promoted on the national level.

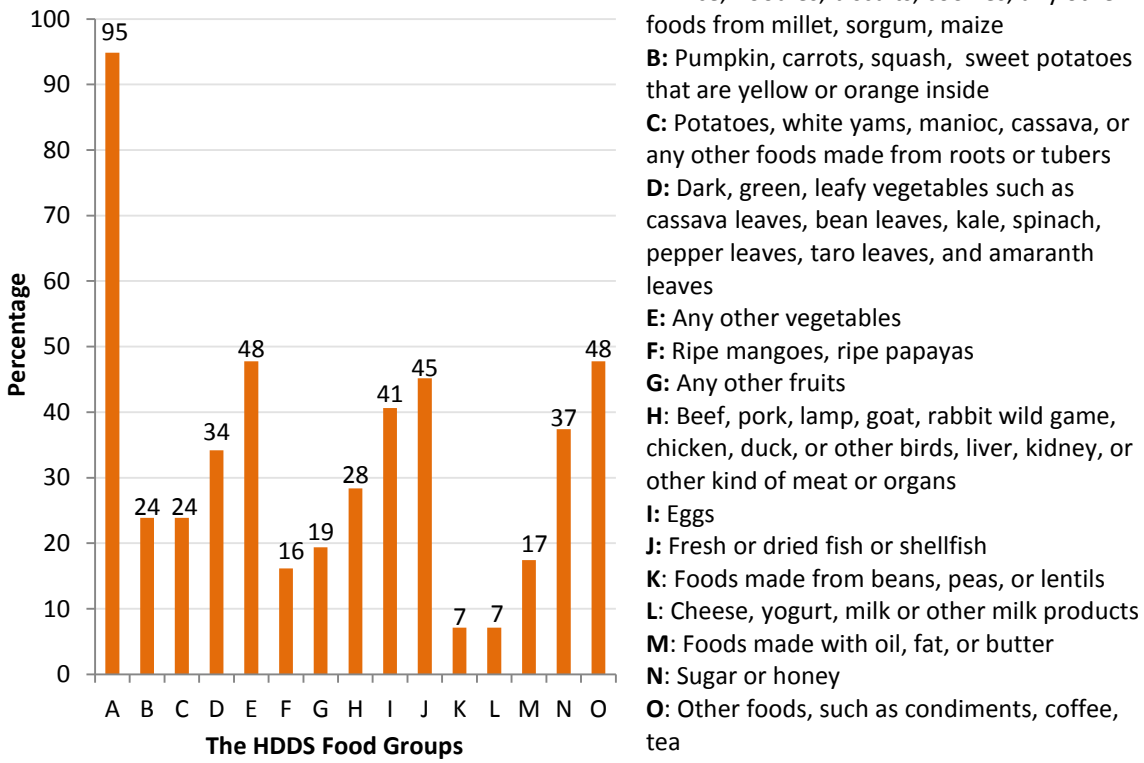

Figure 14 The HDDS food groups consumed by households (N=189)

6.3 Food security analysis in the geographical context

Since district around Lake Toba is characterized by diverse natural, agricultural and also social conditions among its regencies, the differences related to the food security

status between the districts are expected. Table 22 gives results of food security indicators depending on the municipality and regency. The average HDDS in Samosir Regency is 9.03 compared to 4.51 in Tobasa Regency which indicates that Samosir is significantly more affected by household food insecurity. Despite severe food insecurity in Samosir Regency, dietary diversity is slightly higher than in Tobasa Regency, 6.2 compared to 4.9 food groups consumed by the households. These considerable differences between Tobasa and Samosir Regency might be explained by divergent geographic and social conditions. While Tobasa Regency provides extensive agricultural land, greater options for agricultural extension services and knowledge, Samosir regency located on mountainous island provides with very limited access to agricultural land, education and information (Bangkaru, 2001 and SUDA, 2010). In addition, Tobasa Regency as the agricultural education center of North Sumatra Province with several agricultural universities offers many opportunities for local smallholder to enhance their knowledge which results in improving their livelihoods. Such disadvantaged position and conditions make Samosir Regency significantly more vulnerable to food insecurity as it is clearly shown in the study (Table 22 and Table 23).

Table 22 The average values of the HFIAS, HDDS, MAFP across the Districts (N=192)

Regency	Sub-regency	Municipality	HFIAS[a]	HDDS[b]	MAFP[c]
Samosir Regency	Simanindo	Ambarita	6.36	6.55	11.50
		Garoga	9.63	6.00	11.41
		Martoba	11.11	6.05	11.05
Tobasa Regency	Sigumpar	Sigumpar Dangsina	5.70	4.03	11.20
		Dolok Jior	3.96	5.04	11.12
		Nauli	3.35	4.39	11.87
	Laguboti	Pasar Laguboti	4.04	4.32	11.76
		Gasaribu	5.50	6.80	11.40

[a] Household Food Insecurity Access Scale
[b] Household Dietary Diversity Score
[c] Months of Adequate Household Food Provisioning

These findings are supported by the results on the categorical status indicator - the HFIAP (Table 23). Significant differences can be seen between the two regencies: nearly a quarter (24.4 %) of households in Tobasa Regency faces to severe food insecurity while the share of the households with the same food security status approaches 42.7 % in Samosir Regency. Moreover, the share of households considered as food secure is nearly 15 % less in Samosir Regency than in Tobasa Regency. However, values of MAHFP are

comparable in both regencies and indicate that household's ability to address vulnerability in such a way as to ensure availability of food year round is high. Overall results reveal that 20.3 % of households experience moderate food insecurity and 31.3 % severe food insecurity. This confirms the evidence of the Food Security and Vulnerability Atlas which classified North Sumatra Province in Priority group 2 out of 6 groups, based on the severity of the food security situation (FSVA, 2015).

Table 23 The HFIAP categorization according to the districts (in %) (N=192)

Regency	Sub-regency	Municipality	FS[a]	MIFI[b]	MOFI[c]	SFI[d]
Samosir	Simanindo	Ambarita	31.8	22.7	18.2	27.3
		Garoga	18.5	14.8	18.5	48.1
		Martoba	10.5	10.5	26.3	52.6
Total (SR)			20.3	16.0	21.0	42.7
Tobasa Regency	Sigumpar	Sigumpar Dangsina	26.7	26.7	13.3	33.3
		Dolok Jior	26.9	15.4	23.1	34.6
		Nauli	48.0	12.0	24.0	16.0
	Laguboti	Pasar Laguboti	35.0	20.0	20.0	25.0
		Gasaribu	39.1	26.1	21.7	13.0
Total (TSR)			35.1	20.0	20.4	24.4
Total			29.7	18.8	20.3	31.3

[a] Food secure
[b] Mildly food insecure
[c] Moderately food insecure
[d] Severely food insecure

Figure 15, 16 and 17 serve as a graphical display of the significant differences between the two regencies and confirms the more favorable food security situation in Tobasa regency, except results on the HDDS as the measure of the dietary diversity. The results shows that municipalities within Tobasa regency tend to be more food secure, in the term of (i) food access (the HFIAS) and (ii) food stability (the MAHFP) but in the case of the dietary diversity, the municipalities in Samosir regency achieve higher levels of the HDDS which indicates that they the households consume the higher number of unique foods over a given period. However, it seems there is a discrepancy between the specific outcome and the facts related to the agricultural and geographical conditions of the two regencies, as described above (SUDA, 2010) and obviously the deeper agricultural analysis would be needed to identify the source of this finding.

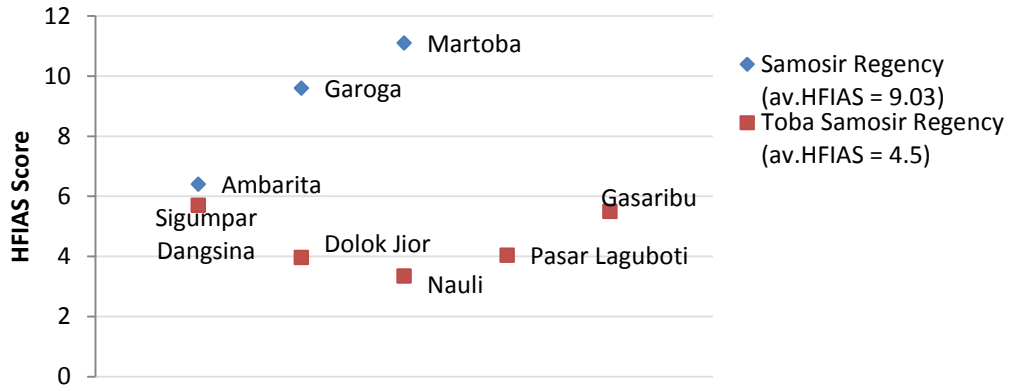

Figure 15 The HFIAS scores

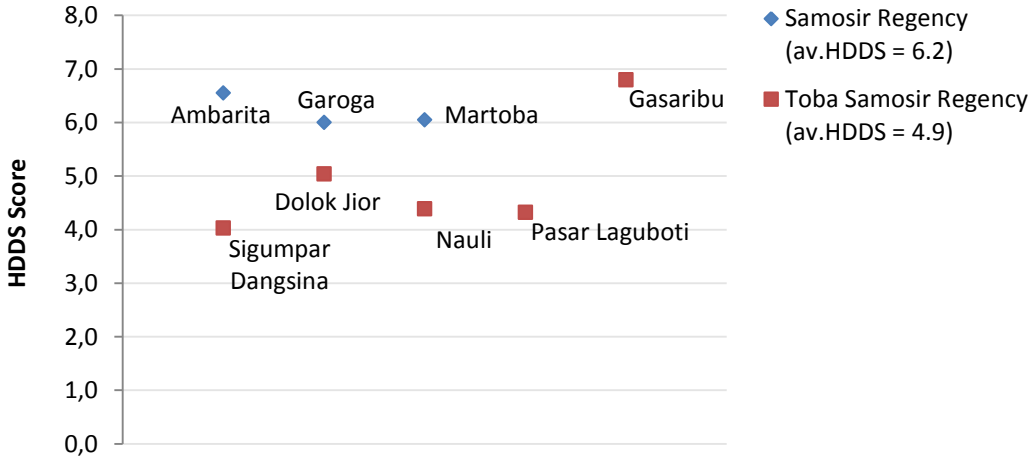

Figure 16 The HDDS scores

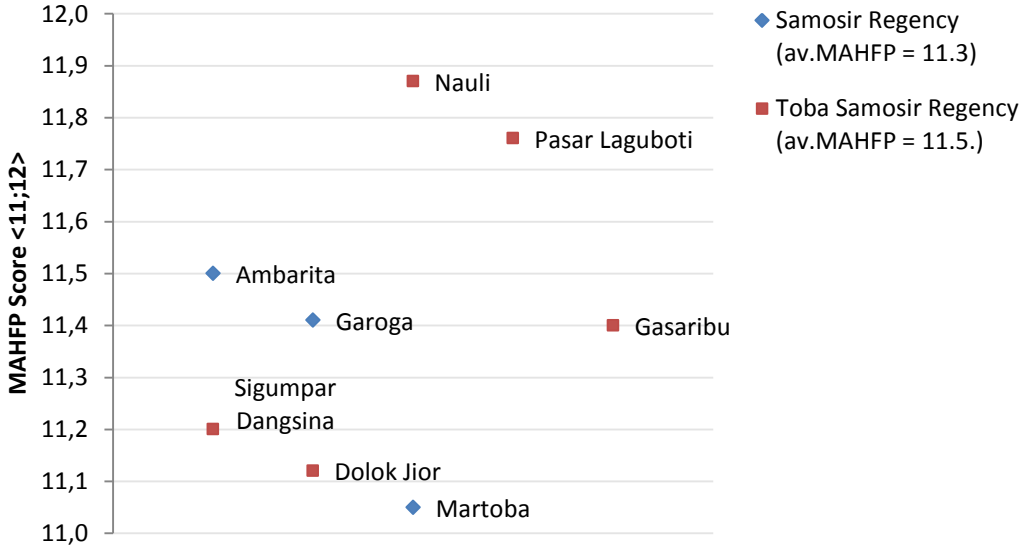

Figure 17 The MAHFP scores

6.3.1 Principal component analysis (PCA) on the food security indicators and study sites

In order to complete the household food security assessment in the geographic context, the Principal component analysis (PCA) was used to support the visualization of the data in Figure 18. The PCA emphasizes variation and bring out strong patterns in the dataset. It reveals in what way the particular municipality is different from another and shows that the variables represented by the (i) HFIAS, (ii) HDDS and (iii) MAHFP do not contribute to these differences in the same way (they are not correlated) and work independently from each other. The analysis also detect other sample patterns, like grouping of (i) Ambarita and Gasaribu both achieving the high levels of the dietary diversity and low levels of the food access, (ii) Nauli and Pasar Laguboti with significantly improved food stability and low scores of the both dietary diversity and food access and (iii) Dolok Jior and Sigumpar Dangsina with unfavorable results related to the MAHFP and the HDDS. The PCA also shows the similar patterns of the municipalities in the particular regency, except Gasaribu in Tobasa which tends to be more similar to municipalities of Samosir regency, particularly in the term of dietary diversity.

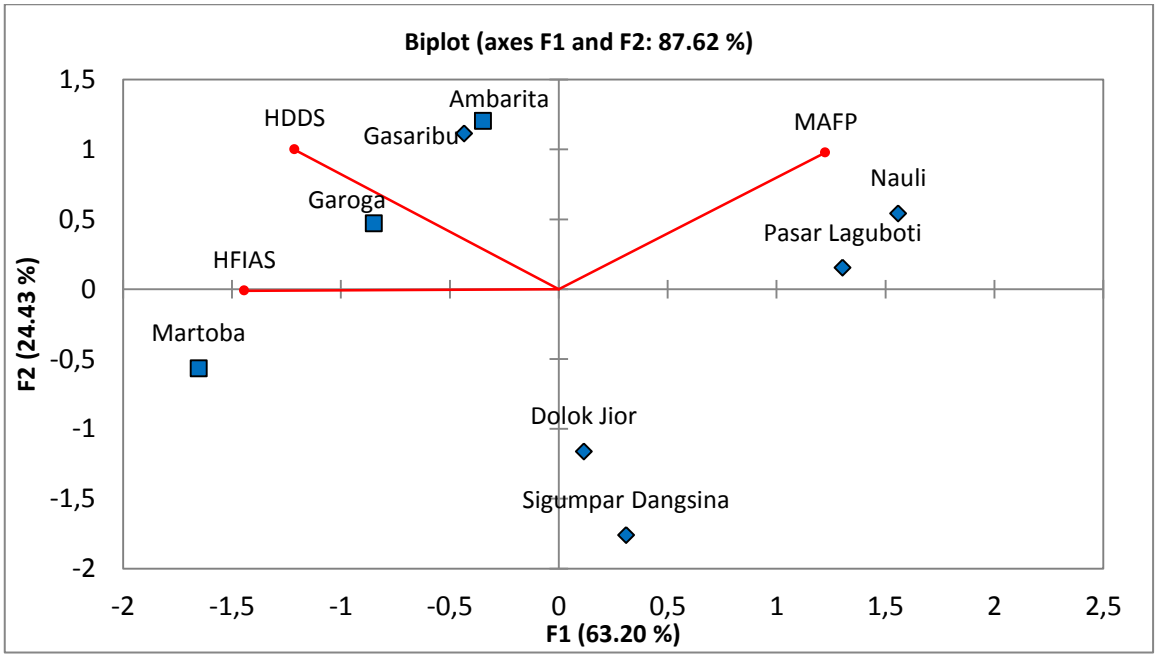

Figure 18 Principal components analysis (PCA) on the food security indicators

6.4 Determinants of the household food insecurity

This chapter provides outcomes on correlations between the HFIAS, the HDDS, MAHFP and the HFIAP, as the complex indicators for measuring food access, dietary diversity and food stability, and possible determinants of the household food insecurity. In accordance with the objectives of the study, the chapter also gives results on the stated hypotheses.

6.4.1 Gender and household food security status

Two-sample t-tests were used for analysing the difference between male-headed and female-headed households in each food security indicator. Table 24 shows that on two out of the three indicators the female-headed households experience more severe status of food insecurity compared to male-headed households. However, differences between male-headed and female-headed household related to the food access (the HFIAS) and the dietary diversity (HDDS) are not statistically significant. In culture of Batak ethnicity, there are no expressive differences in livelihoods of men and women, particularly in gender division of labor which may partially explain low statistical differences between the gender and the HFIAS and the HDDS. Batak women are used to working in the field, carry out most home food processing and have primary responsibility for raising children (Tobing, 1956). The ability to do the labor-intensive work and livelihood strategies adopted by Batak women make their female-headed households conclusively less vulnerable to food insecurity, as confirmed by Bangkaru (2001) . However, this is inconsistent with studies from Guilmoto (2015), Retnaningsih (2013), Sohn (2015) and Swamy (2014) confirming that status of women in Indonesia is significantly disadvantaged, particularly in the terms of their socioeconomic situation which is reflected it their deteriorative nutrition security condition (Vaezghasemi et al., 2014). These statements are also supported by the UNDP's Gender Inequality Index which places Indonesia in the 110^{th} lowest position out of the 186 (UNDP, 2015).

Nevertheless, the results also reveal that the difference between the male-headed and female-headed households, in relation to the food stability, is statistically significant ($\alpha=0.01$). It indicates that female-headed households have disadvantaged food access stability during the year to meet their dietary needs; 10.69 (SD 2.26) months per year

compared to male-headed households' food access stability: 11.47 (SD0.86) months per year. The outcome also imply that female-headed households are more vulnerable to losing access to food as a consequence of sudden shocks (e.g. climatic or economic crisis) or cyclical events (e.g. seasonal food insecurity). The difference might be partially justified by the different on-farm activities adopted by men and women. In North Sumatra, women direct their on-farm activities on growing of traditional crops while men as farmers are more likely to grow cash crops which enable them to generate cash for purchasing of food easily (Bangkaru, 2001 and Sohn, 2015).

Table 24 Food security indicators in relation to the gender of the household head (N=192)

Indicator	**Male**		**Female**		**t-stat**
	Mean	Stdev	Mean	Stdev	
HFIAS[a]	5.96	6.52	7.44	7.50	-0.856
HDDS[b]	5.27	2.58	5.81	2.67	-0.810
MAHFP[c]	11.47	0.86	10.69	2.26	2.856***

[a] Household Food Insecurity Access Scale
[b] Household Dietary Diversity Score
[c] Months of Adequate Household Food Provisioning
*10 % significance level, **5 % significance level, ***1 % significance level

The basic output of the two-sample t-test is the predominant rejection of the hypothesis H1 that female-headed households are more vulnerable to food security and achieve lower levels of food insecurity status. However, the H1 is rejected only in the case of the food access and dietary diversity; represented by the HFIAS and the HDDS but not in the case of the MAHFP, as the measure of the food stability. The outcomes related to MAHFP proved a statistically significant difference between the male-headed and female-headed households ($\alpha=0.01$) and indicate that food access stability of female-headed households is lower. For the confirmation of these findings, the analysis was extended on testing of correlation between the HFIAP categorical indicators and the female-headed and male-headed households. Because of low frequencies, the HFIAP categories were coupled into two groups; (i) food secure and mildly food insecure and (ii) moderately food insecure and severely food insecure. For this analysis, chi-square test in contingency table is used ($\alpha=0.05$). The test confirmed the previous result that level of household food insecurity was not associated with gender, in the term of household food access (*p-value=0.175*) and thus, supported the rejection of the hypothesis H1.

6.4.2 Education levels and household food security status

Table 25 displays the average values of the food security indicators for various education levels of the head of households. In the case of the household food access, the clear interaction between level of food security and education is obvious; lower scores of the HFIAS are associated with higher education levels. This indicates that households headed by educated people achieve improved levels of food security. Since the average values of the HFIAS (scaled on range of 0-27) are: (i) 11.1 (SD 7.7) for primary school and (ii) 0.7 (SD 0.6) for master education, the great importance of education in rural areas positively influencing the household food access may be confirmed. In the case of dietary diversity (the HDDS), several fluctuations may be observed. Based on the results, households headed by people with master degree consume 4.0 (SD 1.7) food groups in average out of 15 possible food groups. While heads of households with educational attainment at vocational school consume in average 7.5 food groups (SD 3.5). This finding may be partially related to increased consumption of wild crops by people with lower educational levels and which results in a greater dietary diversity. According to FSVA (2015), wild foods obtained from hunting and gathering can contribute significantly to food and nutrition security, particularly in remote areas. Gathered wild crops are believed to contribute substantially to calorie intake and hunted rodents, mammals and insects provide important sources of animal protein.

Table 25 The average values of the food security indicators in relation to education (N=192)

Education of Head HH	**HFIAS** [a]		**HDDS** [b]		**MAHFP** [c]	
	Mean	Stdev	Mean	Stdev	Mean	Stdev
Primary school	11.1	7.7	5.0	3.1	11.1	1.0
Junior high school	7.6	6.9	5.7	2.8	11.5	0.6
Senior high school	5.8	6.5	5.0	2.4	11.4	0.9
Vocational school	5.5	3.5	7.5	3.5	11.5	0.7
Associate bachelor	6.3	6.6	5.9	2.2	12.0	0.0
Undergraduate degree	3.2	5.4	5.3	2.1	11.6	1.3
Master degree	0.7	0.6	4.0	1.7	12.0	0.0

[a] Household Food Insecurity Access Scale

[b] Household Dietary Diversity Score

[c] Months of Adequate Household Food Provisioning

The MAHFP, as a measure of the food stability, returns with its tendency to the HFIAS and accordingly supports the acceptance of the hypothesis H2. In detail, households headed

by people with higher educational levels have an improved food provisioning. For comparison, households headed by people with master degree have an adequate access to food (food stability) for 12 (SD 0.0) months per year while those with primary education for 11.1 (SD 1.0) months per year in average.

Chi-square test in contingency table is used to assess the hypothesis H2 (Table 26). In order to ensure the validity of the chi-square test, the HFIAP categories were gathered in two groups and the education levels attained by the heads of households into three groups, according to their severity and sequence. The outcomes of the test accepted the hypotheses H2 that households headed by more educated people tend to be food secure and vice versa (*α=0.05, test criteria 6.79, critical value 5.99*). The overall outcomes highlight the important role of rural education as human capital and support the studies by Akele et al. (2013), Chatterjee et al. (2012) and Tawodzera (2011) that education is expected to have a significant explanatory power in relation to food security in rural areas. Nevertheless, there are also findings by De Cock et al. (2013) and Musemwa et al. (2015) reporting the opposite tendency.

Table 26 Chi-square test on relation between the HFIAP categories and educational levels (N=192)

Education Level Attained		The HFIAP Groups		Row Total
		Group 1: FS [a] + MIFI [b]	Group 2: MOFI [c] + SFI [d]	
Group A	Primary high school Junior high school	22 (25.5) [0.48]	31 (27.5) [0.44]	53 [0.92]
Group B	Senior high school Vocational school	44 (47.1) [0.21]	54 (50.9) [0.19]	98 [0.40]
Group C	Associate bachelor Undergraduate degree Master degree	22 (15.4) [2.84]	10 (16.6) [2.63]	32 [5.47]
Column Total		88 [3.53]	98 [3.27]	**[6.79]****

Note: Observed Frequencies (Expected Frequencies) [Test Criteria]
[a] Food secure
[b] Mildly food insecure
[c] Moderately food insecure
[d] Severely food insecure

6.4.3 Household income in relation to household food security status

For a clearer analysis, dataset was divided into income quintiles; five groups with equal frequency of households, ranked by amount of household total income.

Table 27 Income quintiles (in IDR and USD/ per month)

Income Quintile	Avg. HH Total Income (IDR)	Lower Limit (IDR)	Upper Limit (IDR)	Avg. HH Total Income (USD)	Lower Limit (USD)	Upper Limit (USD)
20% (1)	662,500	75,000	1,000,000	51.3	5.8	77.4
40% (2)	1,314,063	1,000,000	1,600,000	101.7	77.4	123.8
60% (3)	2,007,813	1,650,000	2,500,000	155.4	127.7	193.5
80% (4)	3,368,750	2,500,000	4,500,000	260.7	193.5	348.2
100% (5)	7,400,000	5,000,000	35,000,000	572.7	387.0	2708.6

Note: The exchange rates are in the accordance with the time of the data collection (1 USD = 12,900 IDR)

Table 27 demonstrates a high income inequality in the region when average monthly household income in Quintile 1 is 51.3 USD while in Quintile 5 the households reach 572.7 USD/ month in average. According to Miranti et al. (2014) and WB (2014), Indonesia has one of the fastest rising rates of inequality in the South-east Asia region. Its Gini coefficient increased from 0.32 in 1999 to 0.41 in 2012. For this reason, the WB has been working closely with the Government of Indonesia in analysing the trends and consequences of income inequality.

Studies conducted by Labadarios et al. (2011), Rose and Charlton (2002); Rosen and Shapouri (2001) confirm that economically vulnerable rural households are more likely to be food insecure and that low-income is considered as one of the main determinants driving households into food insecurity (Alderman, 2009). In addition, low-income households have limited access to agricultural inputs which is influencing the quality and volume of their agricultural production, as 82.3 % of households in the study direct their livelihood on on-farm activities. Given the outcomes of the mentioned studies, (Labadarios et al., 2011; Rose and Charlton, 2002; Rosen and Shapouri, 2001) it is expected that low-income rural households in Tobasa Regency and Samosir Regency achieve low levels in all the observed dimensions of food security; food access, dietary diversity and food stability. However, there is also evidence confirming the opposite tendency when households with lower incomes tend to be more food insecure (De Cock et al., 2013; Musemwa et al., 2015). Table 28 shows a clear correlation between food security indicators and household income. The most noticeable differences may be observed in case of the food access, represented by the HFIAS when the higher is the score, the more severe household food insecurity is (scaled on range 0-27).

Table 28 Food security indicators in relation to the income quintiles (N=192)

	Income Quintile 1	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5
HFIAS	12.4 [a]	7.9 [b]	4.4 [b c]	4.2 [b c]	2.4 [c]
	(7.6)	(6.5)	(5.7)	(4.7)	(3.2)
MAHFP	10.9 [b]	11.3 [a b]	11.4 [a b]	11.8 [a]	11.9 [a]
	(1.2)	(0.9)	(1.2)	(0.6)	(0.3)
HDDS	5.2	5.2	5.5	6.0	5.8
	(-3.0)	(2.2)	(2.4)	(2.4)	(3.1)

Note: The same symbols (a b c) indicate no significant difference among means of individual indicators (in row) by Tukey's Honest Significance Difference Test at *α=0.05*

In detail, low-income households (Quintile 1) achieve an average score of 12.4 (SD 7.6) while the score of the high-income households' (Quintile 5) is in average 2.4 (SD 3.2). Table 28 demonstrates the statistically significant differences (*α=0.05)* in the HFIAS (*F=15.29, p < 0,001*) and MAHFP (*F=6.6; p < 0,001*) among particular income quintiles when detailed differences among the means of the individual indicators are displayed by using the symbols. Differences in average means of the HDDS in each Income Quintiles are not found as statistically significant (*α=0.05).* However, overall results accept the hypothesis H3 that income has an important role in the food security condition of the households; low-income households are difficult to access the food. These findings also supported by studies from from Akele et al. (2013), Chatterjee et al. (2012) and Tawodzera (2011).

6.4.4 Livelihood strategies in relation to household food insecurity

In Table 29 differences in the HFIAP categories depending on the basic form of on-farm activity are given. Because of low frequencies, the original four categories are merged into two categories with higher frequencies. The groups depending on particular type of livelihood were divided into four clusters, as described in Table 29. Surprisingly, households driving their livelihoods on neither crop nor livestock production (Cluster 1) attain the highest levels of food security. 61.8 % of these non-agricultural households are classified as food secure or mildly insecure. Then, 57.5 % of households oriented on both crop and livestock production (Cluster 4) have to face more severe levels of food insecurity.

Table 29 The HFIAP categorization in relation to the type of livelihood (N=192)

Livelihood strategy	FS[a] +MIFI[b] %	MOFI[c] + SFI[d] %	n=	u-statistics
Cluster 1: Non-agricultural production	61.8	38.2	34	1.336
Cluster 2: Livestock production	53.3	46.7	15	0.258
Cluster 3: Crop production	51.3	48.7	39	0.160
Cluster 4: Livestock and crop production	42.3	57.7	104	-1.151

[a] Food secure
[b] Mildly food insecure
[c] Moderately food insecure
[d] Severely food insecure

These outcomes are in line with findings of Gillespie and Van Den Bold (2015) and IFPRI (2015) that agricultural households are more vulnerable to food insecurity. Their study confirm that there two groups of rural Indonesians who tend to be more poor and food insecure; (i) laborers working on other peoples' land, (ii) smallholders with very small plats (<0.5 ha). Nevertheless, the two-sample t-test for relative frequencies (Table 29) demonstrates that there is no statistically significant difference ($\alpha=0.05$) among the clusters and particular food security groups. Similarly, Chi-square test in contingency table (Table 30) confirms the previous results ($\alpha=0.05$, *test criteria 12.12, critical value 16.92*).

Table 30 Chi-square test on relation between the HFIAP categories and household livelihood (N=192)

	Food secure	Mildly food insecure	Moderately food insecure	Severly food insecure	Row Total
Non-agricultural production	13 (10.09)	8 (6.38)	5 (6.91)	9 (10.63)	35
	[0.84]	[0.41]	[1.22]	[0.25]	[2.72]
Livestock production	6 (4.45)	2 (2.81)	5 (3.05)	3 (4.69)	16
	[0.54]	[0.23]	[0.30]	[0.61]	[1.68]
Crop production	11 (11.58)	9 (7.31)	3 (7.92)	16 (12.19)	39
	[0.03]	[0.39]	[3.06]	[1.19]	[4.67]
Livestock and crop production	23 (30.88)	17 (19.50)	28 (21.13)	31 (32.50)	102
	[0.49]	[0.32]	[2.24]	[0.01]	[3.05]
Column Total	56 [1.86]	36 [1.36]	41 [6.82]	59 [2.06]	**192 [12.12]****

Note: Observed Frequencies (Expected Frequencies) [Test Criteria]

In order to identify the relations between the particular (i) off-farm activities and (ii) source of income items and the four HFIAP categories, Chi-square test was used for detailed analysis. Given the low frequencies, the tests are possible to use only in the case of seasonal works and fishing, out of the list with off-farm activities (Table 19) and in the case of selling crops, selling animals, fishing, rural temporary works, administrative works

and trading, out of the list with sources of income (Table 20). Chi-square tests reveal following (*critical value 7.81)*:

- Adopting of seasonal works, as off-farm activity, does not influence the household food security status (*α=0.05, test criteria 6.92).*
- Households driving their off-farm activities on fishing, tend to be classified as mildly food insecure (*α=0.05, test criteria 9.18).*
- Food security status of households is not associated neither with selling crops (*α=0.05, test criteria 2.87)* neither with selling animals (*α=0.05, test criteria 2.87),* as possible sources of household incomes.
- Although fishing proved its importance as off-farm activity, its influence on household food security status, as source of income, is not confirmed (*α=0.05, test criteria 0.46).*
- There is no association between households depending on trading, as source of income and their food security status (*α=0.05, test criteria 6.00).*
- Rural temporary works, as the source of income, is associated with the lowest food security status; households depending on rural temporary works tend to be classified as severely food insecure (*α=0.05, test criteria 13.281).*
- Although 31.18 % of households drive their livelihoods on administrative works, it does not its importance as source of income; the HFIAP categories do not depend on administrative works *(α=0.05, test criteria 4.99).*

Given the fact that Tobasa and Samosir are located around Lake Toba, an expansion of the fishing as the new off-farm activity, seems to be very feasible strategy for improving the rural livelihoods and its food security condition. This specific finding is not in line with study by Fiorella et al. (2014) oriented on analysing links between fishing livelihoods and food security around lake. It claims that participating in fishing as a livelihood is not associated with household food security. However higher household fish consumption is significantly associated with higher household income and food security (Fiorella et al., 2014). The basic outcome of the analysis is the acceptance of H4 that the type of livelihood strategy adopted by households is associated with its food security status.

6.4.5 Regression model

In order to predict the correlation among (i) household food access represented by the HFIAS, (ii) diversity of off-farm activities and (iii) total household income, several regression methods and multivariate linear models was prepared and the appropriate one selected. The model interprets the HFIAS as a regression function of constant, average total household cash income and number of off-farm activities. It is expected that the higher is the total household income and number of various off-farm activities, the milder the level of household insecurity is, i.e. the lower is the HFIAS. Therefore, estimated regression model is: $y\hat{}=8.461-0.573\ x1-1.004\ x2$, where y is the HFIAS, x1 is average total household income and x2 is the number of off-farm activities. Estimated regression coefficients confirm that relation between the HFIAS and average total household income is indirect, and the same relation is for the HFIAS and the number of off-farm activities. An increase of the average household total income by 1 million IDR, an equivalent of 76.24 USD, results in the HFIAS decreasing by 0.57 points. Scores of the HFIAS are scaled on a range of 0-27. Similarly, an increase in number of various off-farm activities adopted by households by 1.00 causes a decrease of the HFIAS by 1.004 point.

The quality of the regression model was approved by the F-test (*p-value = 0.000035*). Individual t-tests are statistically significant for constant and b1 and statistically insignificant for b2, i. e. average total household income is a suitable predictor for the HFIAS. The coefficient of determination is rather low, i. e. only lower proportion of variability of observed data was explained by the model. These findings confirm the importance of off-farm activities and higher household incomes for improving food security in rural areas. As McCarthy and Sun (2009) claims, rural people who direct their livelihood on off-farm activities tend to be more educated than those focused on on-farm activities. This repeatedly highlights the important role of education in mitigating household food insecurity.

6.5 Household food security in the context of the Batak traditions

The outcomes of the observations, as a secondary product of the data collection, confirm that culture and traditions have a strong role in daily life of the Indonesians and

thus have a meaningful impact on their livelihoods and food security status. Therefore, the understanding of how traditions influence food security within the Batak community is essential in order to take appropriate measures to ensure food security.

It was observed that maintaining of tradition results in certain agricultural patterns which significantly influence food security status of the rural households. Given the favorable agricultural conditions in the Toba Lake area, the farmers could benefit from planting and harvesting rice, as the most important crop providing high caloric intake, three times a year. Nevertheless, agricultural households do not take this opportunity and harvest rice only once year since it is a long-term tradition. The farmers believe this pattern related to rice production has to be preserved and maintained because it was already proven by their fathers and grandfathers. Therefore, a targeted culture-sensitive awareness campaign might help to educate the farmers and increase the smallhoders‘ rice production and thus improve the food accessibility and stability of the households. Study by Agada and Igbokwe (2016) confirms that culture is a strong determinant in number of meals consumed per day, household food preference, agricultural decision making, division labor and hence food security.

Similarly, further observations revealed that the rural Indonesians do not accept consumption of milk and milk products since this dietary pattern is not anchored in their tradition. In addition to that, the household members find white substances difficult to consume in general and are not aware of beneficial effects coming from consumption of milk product. For this reason, increased coloring and flavoring of the milk products and promotion of its nutrition benefits could possibly result in higher household dietary diversity and improved intake of proteins.

Several studies, focused on investigating the relations between culture and food security, include the gender aspect (Agada and Igbokwe, 2016 and Trefry et al., 2014). For the purpose of this study, role of the gender in the household food security concept is assessed as well, however not in the cultural concept but as a representative of social capital of the household, in accordance with the Sustainable Livelihoods Framework (Figure 4). As stated in the Chapter 6.4.1., the findings confirm that in the term of food accessibility and dietary diversity, female-headed households are not more vulnerable to food insecurity than male-headed household which underlines the strong position of women in the society of Batak Toba people. Considering the cultural aspect, Bangkaru (2001) points out that historical isolation of Bataks has kept their culture more intact and

forms of their social interaction are different from people in other parts of Indonesia. Since the status of the Indonesian women is predominantly disadvantaged, as confirmed in studies by Guilmoto (2015), Retnaningsih (2013), Sohn (2015) and Swamy (2014), this partially rationalizes why social status of Batak women is equal to men.

In conclusion, investigation of the link between culture and household food security is not in the line with objectives of the study, thus these outcomes may be considered as a secondary product of the findings. This remarkable theme deserves a separate study and deep analysis of the Indonesian culture and food patterns. The outcomes of such study would definitely contribute to developing of the appropriate strategies tackling household food insecurity.

6.6 Justification of using the methodology approach for measuring food insecurity

The purpose of the chapter is to demonstrate the relevancy of using the methodology developed by USAID's Food and Nutrition Technical Assistance (FANTA) for measuring food security status of households. Given the multi-dimensional nature of food security, methodology approach is needed to assess ideally each out of the three basic elements of the food security complex including food access, food availability and food utilization (Ganapathy et al., 2005). However, the tools measuring food security, such as food consumption, caloric adequacy or anthropometry method are sometimes technically difficult, costly to collect and invasive (Coates et al., 2003, Deitchler et al., 2010 and Hodinott, 2002). In recent years, methods for food security measurement have been focusing on the recognition of the subjective nature of food security (Maxwell and Slater, 2003) which results in displacement of quantitative approach to qualitative and in principal change in thinking about food security concept and its measuring (Webb et al., 2006).

According to Coates and et al. (2007), the HFIAS is a household-level survey tool that enables researchers to understand food insecurity experienced by household, not by individual. Data obtained can be used collectively to examine community or district. There are two key uses of the HFIAS; (i) comparing change over time which is useful for monitoring of food security interventions and (ii) comparing food access across population/ municipalities (Coates et al., 2003). In order to evaluate the applicability and validity of the FANTA's tool, many studies have been carried out in the field of socio-

economic, agricultural, environmental also medical research; relevant studies are listed in Table 31. In addition, study by Salarkia et al. (2013) focused on assessment of the FANTA‘s Household Food Insecurity Access Scale (HFIAS), as a valid tool for measuring food access, confirms its applicability and reliability and highlights its time-friendly nature and easy administration of the indicators. According to Coates (2004) and Maes et. (2011), the tool developed by USAID can be easily used and interpreted by local personnel if it is properly adapted to local context. Considering (i) these positive reviews and that (ii) the methodology has proved its applicability in many studies, it conclusively demonstrates itself as a relevant approach for measuring household food insecurity in North Sumatra.

Table 31 Research Studies Using the FANTA’s Methodology Approach for Food Security Analysis

Major purpose of the study	FANTA's indicators used	Source
Analyzing link between fishing livelihoods and food security, Kenya	HFIAS	Fiorella et al., 2014
Food insecurity in urban areas of India	HFIAS, HFIAP	Chatterjee et a.l, 2011
Validity of the Household Food Insecurity Access Scale, Iran	HFIAS, HFIAP	Salarkia et al., 2014
Role of livestock diversification in ensuring household food insecurity, Ethiopia	HDDS	Megersa et al., 2013
Harmonizing indicators and the role of household surveys, Global scale	HFIAS, HFIAP, HDDS, MAHFP	Carlettto et al., 2012
Household food insecurity in rural areas, Brazil	HFIAS, HFIAP	De Toledo Vianna et al., 2011
Urban household food insecurity, Zimbabwe	HFIAS, HFIAP, HDDS, MAHFP	Tawodzera, 2001
Household food insecurity and coping strategies, South Africa	HFIAS, HFIAP	Musemwa et al., 2015
Food security in rural areas of South Africa	HFIAS, HFIAP, HDDS, MAHFP	De Cock et al., 2013
Adaption of climate change and the impacts on household food security, South Africa	HFIAS	Shisanya et al., 2016
Monitoring of food security interventions ir rural districts of Rwanda	HFIAS	Nsabuwera et al., 2016
Household food insecurity and dietary diversity in rural Cambodia	HFIAS, HFIAP, HDDS	McDonald et al., 2015
Prevalence of household food insecurity in urban areas of North India	HFIAPS, HFIAP	Chinnakali et al., 2014

6.7 Proposed interventions

Comprehensive analysis of relations between the household assets, livelihood strategies and household food security condition, together with understanding of the cultural context, allows suggesting tailored intervention strategies aimed at preventing food

insecurity. The geographic patterning of food insecurity and alarming rates in rural areas of Toba Lake require attention and actions by all levels in the government. Given the overall findings of the study, the Indonesian Ministry of Agriculture, or specifically the Government of North Sumatra should consider following actions:

I. Introduce more food groups available for the region, particularly milk and milk products should be promoted and its production supported through the government interventions. This would result in higher household dietary diversity and improved intake of proteins.

II. Develop strategies aimed at improving household members' education, particularly in Samosir. Since Samosir regency is located on the island, in the middle of the Toba Lake, it has significantly disadvantaged access to education, specifically to Tobasa regency which is considered as one the main education centers of North Sumatra. These strategies could be implemented in the form of reduced school-fees, more frequent transport connections between the two regencies or alternatively by an enhanced offer of temporary accommodation nearby education institutions in Tobasa.

III. Promote and help to integrate fishing, as one the form of possible off-farm activities, into rural livelihoods. This intervention might include development of extension services on good fishing practices, particularly in Samosir and ensure better access to fishing spots in Toba Lake in Tobasa regency.

IV. Develop policies focused on supporting rural labor market with new employment opportunities of non-temporary character since (i) the higher-income households are significantly less vulnerable to food accessibility and stability (ii) temporary rural works as source of income is a strong determinant of household food insecurity.

V. Institute social safety nets on meso-level (separately in Samosir and Tobasa regency) for protection of female-headed households, suffering from disadvantaged food access stability, from the impact of economic shocks and other household crises.

VI. Facilitate access to land and establish reduced rates of land for female-headed households and encourage their agricultural diversification; to support an increase in production of cash crops; cassava, coffee, cocoa and cloves in particular.

VII. Support enhancement of the research on food security. Since household food insecurity is a multi-dimensional concept with many possible determinants and influencing factors, research from different science disciplines would conclusively complete the current results and recommendations. This could be performed through cultural-anthropological study aimed at deeper understanding the links between the Indonesian traditions and food security. Similarly, a specific agricultural research, e.g. soil analysis or research on fertilization strategies would help decision-makers to develop the most effective interventions.

VIII. Monitor and evaluate the intervention strategies and programs by using USAID's FANTA methodology approach since it proved its validity and appropriateness for the specific conditions in rural areas of North Sumatra.

6.8 Research Limitations

The major limitations revealed within the study are linked to data collection, particularly interviewing respondents. Although both enumerators and respondents were strictly instructed in challenging parts in given questionnaire, there may be several slots for misunderstanding, summarized below. Accordingly, this could result in validity decline of the particular findings.

- Possible overestimating of the HDDS: respondents were asked to exclude the food not prepared directly in home for consumption. The including food purchased and consumed outside the home by household members may result in higher scores of dietary diversity.
- Incorrect understanding of the term "household": for purpose of the research, the term is defined as "people who live together and share food". The swap of the terms "household" and "family" may be confusing since family members do not necessarily live and share food together.
- Possible minor distortions in the MAHFP: outcomes related to household food access stability could be biased when particular respondent was not a household member responsible for food preparation.
- Possible mild distortions in outcomes related to the dietary diversity: based on observations, low-income households consume dog meat due to its easy

availability and associated with low costs. However, there was no single questionnaire reporting dog meat consumption. Obviously, this is not well socially acceptable in the region since it is a matter of poor people. However, rural people do not want to be publicly classified as poor (personal unacceptability). Thus, this can cause minor inaccuracies in results linked to household dietary diversity.

- Although the data collection was based on maximum effort to approach each respondent/ household individually and encouraging to complete the questionnaire, some of the respondents refused to fill specific sections of the form. This results in lower number of total respondents in the particular divisions. Thus, the total number of the respondents (N) is quoted at relevant tables and figures.

7 Conclusion

The principal contribution of the study for practice is found in the utilization of the outcomes in the formulation of intervention strategies tackling household food insecurity in rural areas of Indonesia. Accordingly, the survey will be passed on to head of Department on Food Security Affairs in the Government of North Sumatra province. In spite of the comprehensive analysis of food security on national level, the entire empirical evidence on the household (micro) level has been neglected. For this reason, the study has capacity to bring new insights in problematic of household food insecurity needed for developing tailored interventions and programs focused on improving rural livelihoods. The used methodology approach by USAID's Food and Nutrition Technical Assistance (FANTA) proved its validity and reliability and demonstrated itself as an appropriate tool for household food security analysis in rural areas of Indonesia.

The survey was conducted in two regencies of North Sumatra province, (i) Tobasa and (ii) Samosir and included 192 households with 892 individuals in total. Considering divergent natural, agricultural and social conditions between the districts, the study reveals that households in Samosir regency have to face to significantly more severe levels of food insecurity, in the term of food access and stability. However, rural households of Tobasa suffer from lower dietary diversity; consuming in average only 4.9 food groups out of 15 food groups available in the region. The detailed analysis focused on food access-related domains demonstrates that nearly a half, specifically 47.09 %, of households in both regencies feel anxious and uncertain about the household food supply, including 28.57 % of household who experience the worries related the food supply sometimes or very often. As alarming information may be also considered that there are 12.7 % of households whose member/s have to go at least rarely a whole day without eating because there was not enough food in the household.

Analysis on food consumption and dietary diversity identifies that diet of rural households is represented by (i) carbohydrates; rice in particular, (ii) condiments, (iii) fresh or dried fish and (iv) eggs. Surprisingly, meat (except fish) is consumed by 28 % of the households and milk and its products only by 7 %. Since Indonesia faces problem with low dietary diversity and protein quality in general, this should be an issue of high importance.

Although Indonesian women have to tackle problem with disadvantaged position in society which negatively influences their socioeconomic status, Batak women seem to be nearly equal to their gender opposites. In Tobasa and Samosir regency, there is no statistical difference between male-headed and female-headed households in relation to food access and dietary diversity. However in the terms of food stability, female-headed households are significantly more vulnerable to meet their dietary needs throughout the year. The study also affirms the important role of education, as a part of human capital within Sustainable Livelihood Framework (SLF). Households headed by educated people are generally more food secure, particularly in the term of food stability and food accessibility. Similarly, high-income households attain the higher levels in all the dimensions of food security, except dietary diversity since the results show that amount of household total income is independent on the number of food groups consumed by the households in given period of time.

Dissertation outcomes on relation between the livelihood strategy and household food security status reveal that there is no statistical difference between agricultural and non-agricultural households. In addition, rural households oriented neither on crop production nor on livestock have the highest share (61.8 %) of subjects classified as food secure and mildly food insecure in the group. The detailed analysis of the relation among household livelihood strategies and the HFIAP categories places a great emphasis on fishing as type of livelihood contributing to the improved levels of household food security. Results also show that households depending on rural temporary works as source of income mostly suffer from severe levels of food insecurity. The regression model demonstrates that increase in number of off-farm activities adopted results in improved household access. Similarly, fishing as one of the possible off-farm activities, seems to be an appropriate strategy in preventing household food security, since fishing households tend to be classified as mildly food insecure.

Based on overall findings, the Government of Indonesia is recommended to place principal emphasize on facilitating access to education, development of agriculture extension services, supporting rural labor market, promotion of available food groups, agricultural diversification and establishment of safety nets for female-headed households. Implementation of proposed strategies has a strong potential to improve household food and nutrition security and contribute to sustainability of rural livelihoods in a long term.

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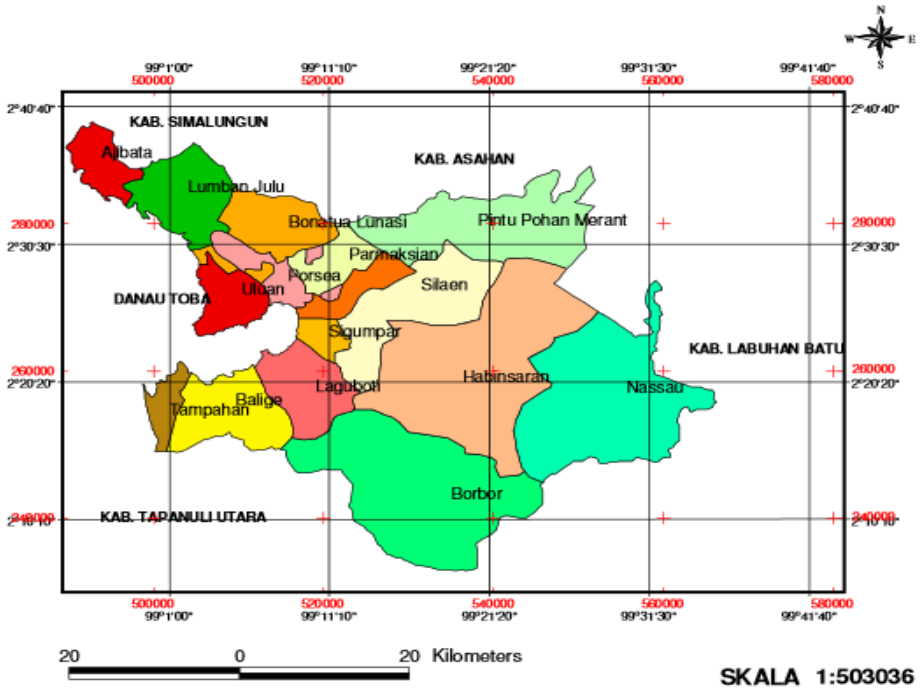
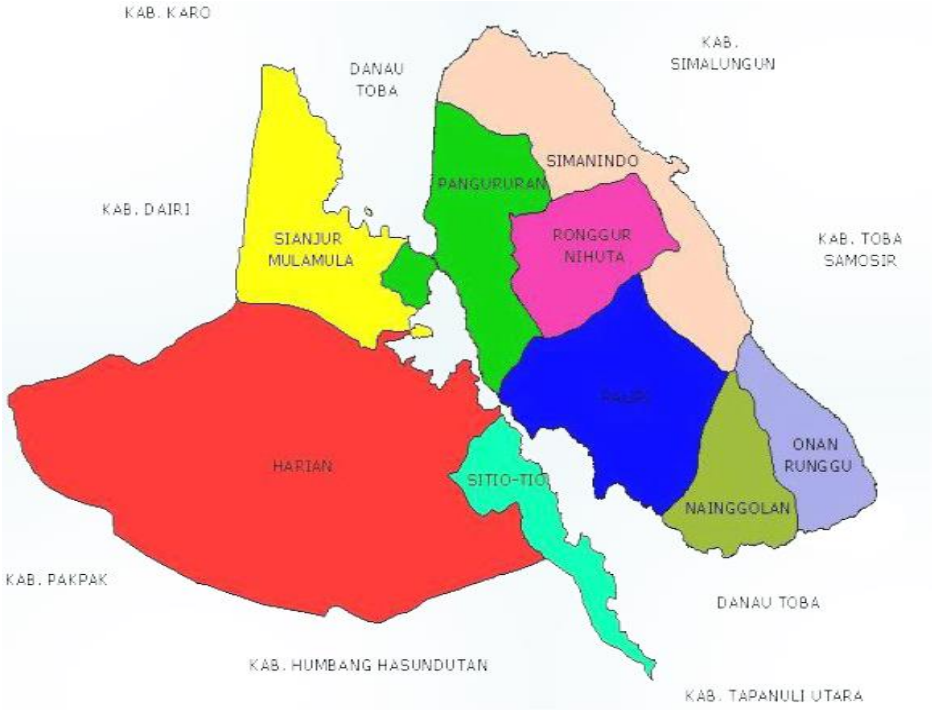
Annexes

Annex 1 Map of Tobasa regency (TSDA, 2013)



Annex 2 Map of Samosir regency (SUDA, 2010)



Annex 3 Questionnaire (in English)

Czech University of Life Sciences Prague
Faculty of Tropical AgriSciences

Dear household members, Horas!

My name is Libuše Valešová from Czech republic, a PhD. candidate from Sustainable rural development in tropics and subtropics. As part of my degree fulfilment, I am conducting a research entitled „Household livelihood strategies in Indonesia: Food security analysis at micro level, North Sumatra. Among the main aims of this research is to examine economic and social aspect of household livelihoods in rural areas and to propose recommendation for improvement of situation in your area.

I would be very grateful if you fill in the full questionnaire because results from this questionnaries and from my research could significantly contribute to the development of region of North Sumatra. Without proper completion this questionnaire would be useless.

Please, note that it is possilbe to choose more than one correct answers.

TERIMA KASIH BANYAK!

Libuše Valešová, MSc.
Department of Economic Development
Faculty of Tropical AgriSciences
Czech University of Life Sciences Prague

A. GENERAL INFORMATION

Name of village:.....

1.

Household member	Sex	Age	Religion	Ethnic group	Educational attainment	Role in the household
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						

2. Who is head of your family/household?.....

3. What skills, capacity, knowledge and experience do household members have (workshops, training, labour capacity)?.....

B. HOUSING AND FACILITIES

1. Type of dwelling:

1. house, 2. hut, 3. tent, 4.others (please, specify).....

2. Type of ownership to this dwelling

1.own house, 2.rented, 3.shared, 4.others.....

3. If rented, what is the monthly rent? (in IDR).....

4. How many rooms does your household have? ……..

5. What is the main source of fuel for cooking food in your household?

1.gasoline (LPG), 2. kerosene, 3. charcoal, 4. wood, 5. cow Dung, 6. agriculture crop residue, 6. others (please, specify)……..

6. How much money your household spends every month for buying this fuel? (in IDR).....

7. What is the main source of lighting for your household?

1.public electricity network, 2. cooperative electricity network, 3. private electricity network, 4. household generátor, 5. kerosene lamp, 6. gas lamps, 7.others (please, specify)…….....

8. What is the main source of drinking water for your household?

1.public network, 2. cooperative network, 3. private network, 4. well with pump, 5. traditional pump, 6. spring, 7. protected tank, 8. unprotected tank, 9. dam, 10. collection of rain water, 11. others (please, specify)…….....

9. How much does your household pay for drinking water every month? (in IDR).....

10. What type of sanitation does your household currently use?

1.toilet inside house, 2. toilet outside house, 3. community toilet, 4. nature, 5. others (please, specify)……

11. Does your household own one or more of the following assets?

1.radio, 2. television, 3. mobile phone, 4. land phone, 5.refrigerator, 6. satelite dish, 7. electric generátor, 8. fan, 9. air conditioner, 10. bycicle, 11. motorcycle, 12. car/ truck, 13. workshop/ factory, 14. shop/ company, 15. swing kit, 16. irrigation equipment, 17. tractors, 18. others (please, specify)…….....

C. LAND AREA AND LAND OWNERSHIP

Please, fill in in the case that your household own a land:

1. What are the terms of access to your land?

1. ownership, 2. rental, 3. share arrangements, 4. open-access, 5. Leasing

2. What is the estimated area of cultivable (arable) land the household owned (in hectars or rente)?.....

3. What is the area of land household rented from others for agriculture (in hectars or rente)?.....

4. What is the area of land the household leases to others (in hectars or rente)?.....

Please, fill in in the case that your household deals with crop production:

D. CROP PRODUCTION

1. Is there any season during the year when you have to hire an extra (seasonal) labourers? 1. yes, 2. no

2. If yes, how many labourers do you hire and for which months?.....

3.Are you or any household member active in any off-farm activities?

1.No off-farm activities, 2.governor officer, 3.renting of land, 4.working in warung/ small shop, 5.restaurant, 6. seasonal works

F. HOUSEHOLD INCOME

1. What have been the THREE major sources of income for your household recently? (Rank the sources by priority from 1 to 3).

1.Sale of agriculture products, 2. Sale of animals, 3. Sale of fish, 4. Rural temporary work, 5. Urban temporary work, 6. Monthly salary, 7. Remittance, 8. Trade, 9. Other (please, specifiy)……

2. Are there any other sources of finance available for your household?

1. no, there are not, 2. bank credit, 3. support of non-governmental organization

3. Do you have any loan? If yes, please, specify what is the interest rate?.....

4. How stable/ unstable your household income has been over previous 12 months?

1.stable, 2. moderately stable (no income for six of the 12 months), 3. Unstable

5. What have beent the THREE major sources of expenditure for your household recently? (Rank the expenditures by priority from 1 to 3)

1.food, 2.crop inputs (seeds, fertilizers), 3.livestock inputs (feed, animals) 4. education, 5.lease, 5.loan (credit), 6.others (please specify).....

6. What is the estimate of your average monthly expenditure (IDR)?.....

7. What is the estimate of your average monthly income (IDR)?.....

8. If you took a loan, what is the loan amount and the repayment time?.....

9. If you took a loan, was it a group loan?.....

10. Do save money with a bank?.....

11. Do you save money with another financial intermediary?.....

12. How much money do you save per month?.....

13. How many times have you lent already?.....

14. What guarantee do you give to the lender?.....

G. HOUSEHOLD FOOD INSECURITY ACCESS SCALE

1. Did you worry that your household would not have enough food? (in past 30 days)

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

2. Were you or any household member not able to eat the kinds of food you preferred because of lack of resources?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

3. Did you or any household member eat a limited variety of food due to a lack of resources?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

4.Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

6. Did you or any other household member eat fewer meals in a day because there was not enough food?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

7. Was there ever no food at all in your household because there were not enough resources to go around?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

8. Did you or any household member go to sleep at night hungry because there was not enough food?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

9. Did you or any of your household members go a whole day without eating because there was not enough food?

1. no, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

10. How much money do you spend on food a day in average? (IDR).....

H. HOUSEHOLD COPING STRATEGY

1. Recently, did your household have to use any of the following strategie to overcome daily food insecurity? If so, how often did your household use each of these strategies?

Type of coping strategies	Daily	Weekly	Monthly	Yearly
Borrowed food, helped by relatives				
Purchased food on credit				
Consumed seed stock held for next season				
Adults ate less food that children could eat more				
Sent children to live with relatives				
Bartered food or non-food items to buy more staple food				
Used up savings				
Reduced expenditure on health and education				
Borrowed money from relatives/ neighbors				
Sold poultry – chicken, ducks, etc.				
Sold articles (utensils, blankets, building materials, jewelery)				
Sold small animals				
Sold big animals (cattle, water bufalo, etc.)				
Stopped smoking cigarettes and other stuff				
Others (please, specify)……				

2. What have been the THREE main sources of accessing food your household recently?

1. own production, 2. sale of livestock, 3. trade/ small business, 4. regular monthly salary, 5. daily (agriculture and non-agriculture labour), 6. remittance, 7. public help, 8. help from relatives

I. HOUSEHOLD DIETARY DIVERSITY SCORE

1. How many times per day does your family actually eat?……

2. When your family eats, do they satisfy their hunger? 1. yes, 2.rather yes, 3.rather no, 4.no

3. Were there months, in the past 12 months, in which you did not have enough food to meet your family´s needs?

1.Yes, 2.No

4.If yes, which were the months in the past 12 months, which you did not have enough food to meet your family´s needs?

1. January, 2. February, 3. March, 4. April, 5. May, 6. June, 7. July, 8. August, 9. September, 10. October, 11. November, 12. December

4. If there is any season during the year when your family does not eat enought to satisfy its hunger, it is because of:

1.unsufficient agriculture production, 2. unavailability to agricultural inputs (seeds, fertilizers, etc.), 3. low family income, 4.unemployment of family members, 5. unsufficient amount of food on market, 6.problems with pests, 7. unavailability to credits or loans

5. Are there any types of foods that you or anyone else in your household ate yesterday during the day and at night?

1. tofu, tempeh, bread, rice, rice noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat?
2. any pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside?
3. any potatoes, yams, cassava, manioc or any other foods made from roots or tubers?
4. any dark, green, leafy vegetables such as cassava leaves, bean leaves, kale, spinach, pepper leaves, taro leaves an amaranth leaves?
5. any other vegetables?
6. Any ripe mangoes, papayas, rambutan, jackfruit?
7. any other fruits?
8. any meat?
9. any eggs?
10. any fresh or dried fish or shelfish
11. any foods made from beans, peas, lentils, or nuts?
12. any cheese, yogurt, milk or other milk products?
13. any foods made with oil, fat, or butter?
14. any sugar or honey?
15. any other foods, such as condiments, coffee, tea?

5. What do you usually eat during the day? (per 1 person)

Meal and its estimated amount:
Breakfast:
Snack:
Lunch:
Snack:
Dinner:

6. Do you sometimes feel lack of energy regarding to unsufficient food intake?

1. never, 2. rarely (once or twice in the past 30 days), 3. sometimes (3-10 times in the past 30 days), 4. often (more than 10 times in the past 30 days)

Annex 4 Questionnaire (in Indonesian)

Czech University of Life Sciences Prague
Faculty of Tropical AgriSciences

Kepada Yth, Bapak/Ibu
di Tempat,

Horas!

Nama saya Libuse Valešová dari Republik Ceko, kandidat doktor (Ph.D) dibidang pembangunan pedesaan berkelanjutan di daerah tropis dan subtropis. Sebagai bagian dari syarat untuk mendapatkan gelar saya, saya melakukan penelitian berjudul "Strategi Penghidupan Rumah Tangga di Indonesia: Analisis Ketahanan pangan di tingkat mikro, Sumatera Utara. Tujuan utama dari penelitian ini adalah untuk menguji aspek ekonomi dan sosial dari kehidupan rumah tangga di daerah pedesaan dan untuk mengusulkan rekomendasi bagi perbaikan situasi di daerah Bapak/Ibu.

Saya akan sangat berterima kasih jika Bapak/Ibu mengisi kuesioner secara lengkap (jujur) karena hasil dari kuesioner ini dan penelitian saya secara signifikan dapat memberikan kontribusi bagi pengembangan wilayah Sumatera Utara. Jika kueisioner ini tidak diisi secara lengkap maka penyelesaian akan sia-sia.

Harap diperhatikan, bahwa ada kemungkinan untuk memilih lebih dari satu jawaban yang benar.

TERIMA KASIH BANYAK!

Libuše Valešová, MSc.
Department of Economic Development
Faculty of Tropical AgriSciences
Czech University of Life Sciences Prague

A. Informasi umum

Nama desa:.....

1.

Anggota rumah tangga	Jenis kelamin	Usia	Agama	Suku	Tingkat Pendidikan	Peran dalam rumah tangga
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						

2. Siapa kepala keluarga?.....

3. Apa keahlian, kemampuan, pengetahuan dan pengalaman yang dimiliki anggota keluarga (lokakarya, pelatihan, prestasi kerja)?.....

B.PERUMAHAN DAN FASILITAS

1. Jenis hunian: 1. rumah 2. pondok, 3. tenda, 4.lainnya (sebutkan)…….....

2. Jenis kepemilikan rumah: 1.milik sendiri, 2.sewa, 3.berbagi dengan orang lain, 4.lainnya.....

3. Jika disewa, berapa sewa sebulan? (dalam Rp)……

4. Berapa jumlah kamar rumah yang Anda miliki? ……

5. Apa sumber bahan bakar utama yang Anda gunakan untuk memasak makanan di rumah Anda?

1.gas (LPG), 2. minyak tanah, 3. arang, 4. kayu, 5. kotaran sapi, 6. sisa bahan pertanian, 6. lainnya (sebutkan)…….....

6. Berapa banya uang yang Anda keluarkan tiap bulan untuk membeli bahan bakar tersebut? (dalam Rupiah).....

7. Apa sumber utama untuk penerangan rumah Anda?

1.jaringan listrik umum, 2.jaringan listrik koperasi, 3. jaringan listrik swasta, 4. generator keluarga, 5. minyak lampu, 6. lampu gas, 7.lainnya (sebutkan)……

8. Apa sumber utama air minum untuk rumah tangga Anda?

1.jaringan umum, 2.jaringan koperasi, 3. jaringan swasta, 4.sumur pompa, 5. pompa tradisional, 6. musim semi, 7. tangki yang terlindungi, 8. tanki tanpa dilindungi, 9. bendungan, 10. tampungan air hujan, 11. lainnya (tolong, sebutkan)…….

9. Berapa yang Anda bayar untuk air minum setiap bulan? (dalam rupiah).....

10. Jenis sanitasi apa yang digunakan di rumah tangga Anda saat ini?.....

1.toilet dalam rumah, 2. tpilet di luar rumah, 3. toilet umum, 4. alam terbuka, 5. lainnya (tolong, sebutkan)…….....

11. Apakah aset rumah tangga Anda satu atau lebih seperti di bawah ini?

1.radio, 2. Televisi, 3. HP, 4. telepone umum, 5.kulkas, 6. parabola, 7. generator listrik, 8. kipas, 9. AC, 10. sepeda, 11. kereta, 12. mobil/truk, 13. bengkel/fabrik, 14. toko/perusahaan, 15. kit ayunan, 16. peralatan irigasi, 17. traktor, 18. lainnya (tolong sebutkan)……

C. LUASAN TANAH DAN KEPEMILIKAN LAHAN

Tolong, isi pertanyaan berikut tentang lahan yang Anda miliki:

1. Apa bentuk akses ke lahan Anda?

1. milik sendiri, 2. sewa, 3. patungan, 4. akses terbuka, 5. menyewakan

2. Berapa luaskah kira-kira tanah yang diolah (garapan) yang Anda miliki (dalam hektar atau rante)?.....

3. Berapa luas tanah yang Anda sewa dari orang lain untuk pertanian (dalam hektar atau rante)?.....

4. Berapa luas lahan Anda yang disewakan kepada orang lain (dalam hektar atau rante)?.....
Tolong isi tabel berikut ini yang berkaitan dengan hal-hal produksi tanaman Anda:

D. TANAMAN PRODUKSI

1. Apakah anda setiap musim selama setahun Anda harus menyewa pekerja tambahan (musiman)? 1. ya, 2. tidak

2. Jika ya, berapa banyak buruh yang Anda pekerjakan dan bulan apa?.....

3. Apakah Anda atau anggota keluarga yang aktif dalam kegiatan di luar pertanian?

1. Tidak ada kegiatan diluar pertanian, 2.PNS, 3.menyewa lahan, 4.kerja di warung/toko, 5.restauran, 6. pekerja musiman. 7. Lainnya (tolong, sebutkan)

F. PENGHASILAN RUMAH TANGGA

1. Apa yang menjadi TIGA sumber pendapatan utama bagi rumah tangga Anda akhir-akhir ini? (Urutkan sumber itu berdasarkan prioritas dari 1 sampai 3).

1. penjualan produk pertanian, 2. penjualan ternak, 3. penjualan ikan, 4. pekerja sementara di desa, 5. pekerja sementara di kota, 6. gaji bulanan, 7. uang kiriman, 8. perdangan, 9. cucian, 10. menyewa sepeda dan sepeda motor, 11. kerajinan tangan, 12. lainnya (tolong, sebutkan)……

2. Apakah ada sumber penghasilan lain untuk rumah tangga Anda?

1. tidak ada, 2. kredit di bank, 3. sumbangan dari organisasi yang bukan milik pemerintah. 4.lainnya (tolong, sebutkan)…

3. Apakah Anda memiliki pinjaman? Jika ya, tolong, sebutkan berapa persen bunganya?.....

4. Seberapa stabil / tidak stabilkah pendapatan rumah tangga Anda dari 12 bulan sebelumnya? 1.stabil 2. cukup stabil (tidak ada penghasilan selama enam bulan dalam 12 bulan), 3.tidak stabil

5. Apa yang menjadi TIGA sumber utama pengeluaran untuk rumah tangga Anda akhir-akhir ini? (Urutkan berdasarkan prioritas pengeluaran dari 1 sampai 3)

1.makanan, 2.pemasukan tanaman (benih, pupuk), 3.pemasukan dari peternakan (pakan, hewan) 4. pendidikan, 5.penyewaan, 5.pinjaman (kredit), 6.lainnya (tolong sebutkan).....

6. Berapa perkiraan pengeluaran rata-rata setiap bulan (Rp)?……

7. Berapa penghasilan rata-rata bulanan Anda (Rp)?.....

8. Jika Anda mengambil pinjaman, berapa jumlah pinjaman Anda dan kapan pembayarannya?.....

9. Jika Anda mengambil pinjaman, apakah itu pinjaman kelompok?.....

10. Apakah Anda menyimpan uang di bank?.....
11. Apakah Anda menyimpan uang dengan perantara keuangan orang lain?.....

12. Berapa banyak uang yang Anda simpan per bulan?.....

13. Berapa kali Anda meminjamkan?.....

14. Apa jaminan yang Anda berikan kepada pemberi pinjaman?.....

G. SKALA AKSES KETAHANAN PANGAN RUMAH TANGGA

1. Apakah Anda khawatir bahwa rumah tangga Anda tidak akan memiliki cukup makanan? (dalam 30 hari yang sudah berlalu)

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

2. Apakah Anda atau anggota keluarga tidak bisa makan jenis makanan yang Anda sukai karena kurangnya sumber daya?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

3. Apakah Anda atau anggota keluarga terbatas memakan jenis makanan karena kurangnya sumber daya?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

4. Apakah Anda atau anggota keluarga harus makan beberapa makanan yang Anda benar-benar tidak ingin makan karena kurangnya sumber daya untuk memperoleh jenis makanan lain?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

5. Apakah Anda atau anggota keluarga harus makan makanan yang lebih sedikit dari yang Anda butuhkan dikarena tidak ada cukup makanan?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

6. Apakah Anda atau anggota rumah tangga lainnya makan makanan lebih sedikit dalam sehari karena tidak ada cukup makanan?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

7. Apakah pernah tidak ada makanan sama sekali di rumah Anda karena tidak ada sumber daya yang cukup disekitar Anda?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

8. Apakah Anda atau anggota keluarga pergi tidur di malam hari dalam keadaan lapar karena tidak ada cukup makanan?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

9. Apakah Anda atau anggota keluarga sepanjang hari tanpa makan karena tidak ada cukup makanan?

1.tidak, 2.jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4.sering (lebih dari 10 kali dalam 30 hari terakhir)

10. Berapa banyak uang yang Anda habiskan untuk makanan setiap? (IDR)/(rupiah) – PER KELUARGA PER HARI.....

H. HOUSEHOLD COPING STRATEGY/STRATEGI MENGATASI RUMAH TANGGA

1. Baru-baru ini, apakah rumah tangga Anda harus menggunakan salah satu dari strategi berikut untuk mengatasi kerawanan pangan sehari-hari? Jika demikian, seberapa sering Anda menggunakan setiap strategi ini?

Jenis strategi mengatasi	HARIAN	MINGGUAN	BULANAN	TAHUNAN
Meminjam makanan, dibantu oleh kerabat				
Membeli makanan secara kredit				
Mengkonsumsi benih yang akan digunakan untuk musim selanjutnya				
Dewasa makan lebih sedikit makanan sedangkan anak-anak bisa makan lebih				
Mengirim anak-anak untuk tinggal dengan kerabat				
Ditukar makanan maupun bukan makanan untuk membeli lebih banyak makanan pokok				
Menghabiskan tabungan				
Mengurangi pengeluaran untuk kesehatan dan pendidikan				
Meminjam uang dari kerabat / tetangga				
Terjual unggas - ayam, bebek, dll				
Barang-barang Terjual (peralatan, selimut, bahan bangunan, perhiasan)				
Hewan-hewan kecil dijual				
Hewan besar dijual (sapi, kerbau, dll)				
Berhenti merokok dan hal-hal lain				
Lainnya (tolong sebutkan)……				

2. Apa TIGA yang menjadi sumber utama penyediaan pangan rumah tangga Anda akhir-akhir ini?

1. produksi sendiri, 2. penjualan ternak, 3. perdangan/usaha kecil, 4. gaji bulanan, 5. harian (kerja dipertanian dan bukan pertanian), 6. uang kiriman, 7. bantuan umum, 8. bantuan kerabat

I. NILAI KERAGAMAN MAKANAN RUMAH TANGGA

1. Berapa kali per hari keluarga Anda benar-benar makan?……

2. Ketika keluarga Anda makan, apakah mereka dapat memuaskan rasa lapar mereka? 1. ya, 2.sedikit ya, 3.sedikit tidak, 4.tidak

3. Apakah ada bulan, dalam 12 bulan terakhir, di mana Anda tidak memiliki cukup makanan untuk memenuhi kebutuhan keluarga Anda? 1.ya, 2.tidak

4. Jika ya, bulan apa dalam 12 bulan terakhir, dimana Anda tidak memiliki cukup makanan untuk memenuhi kebutuhan keluarga Anda?

1. Januari, 2. Februari, 3. Maret, 4.April, 5.Mei, 6. Juni, 7. Juli, 8. Agustus, 9. September, 10. Oktober, 11. Nopember, 12.Desember

5. Jika ada setiap musim selama setahun ketika keluarga Anda tidak cukup makan untuk memuaskan rasa lapar, hal itu disebabkan:

1. produksi pertanian yang tidak mencukupi, 2.ketidaktersediaan input pertanian (bibit, pupuk, dll), 3. pendapatan keluarga yang rendah, 4. anggota keluarga pengangguran, 5. jumlah makanan yang tidak cukup di pasar/pekan, 6. masalah dengan hama, 7. ketidaktersediaan kredit atau pinjaman

6. Apakah ada jenis makanan yang Anda atau orang lain makan kemarin siang hari dan pada malam hari di rumah Anda?

1. tahu, tempe, roti, nasi, bihun, biskuit, atau makanan lain yang terbuat dari millet/jawawut, sorgum, jagung, beras, gandum?
2. setiap labu, wortel, labu, atau ubi jalar yang kuning atau oranye di dalam?
3. setiap kentang, ubi, singkong, ubi kayu atau makanan lain yang terbuat dari akar atau umbi?
4. setiap gelap, sayuran berdaun hijau seperti daun singkong, daun kacang, kangkung, bayam, daun lada, daun talas sebuah daun bayam?
5. setiap sayuran?
6. setiap mangga matang, pepaya, rambutan, nangka?
7. setiap buah lainnya?
8. daging apapun?
9. setiap telur?
10. setiap ikan segar atau kering atau shelfish
11. setiap makanan yang terbuat dari kacang, kacang polong, lentil, atau kacang?
12. setiap keju, yoghurt, susu atau produk susu lainnya?
13. setiap makanan yang dibuat dengan minyak, lemak, atau mentega?
14. gula atau madu?
15. makanan lain, seperti bumbu, kopi, teh?

7. Apa biasanya yang Anda makan di siang hari? (Per 1 orang)

Makanan dan perkiraan jumlahnya:
Sarapan:
Kue:
Makan siang:
Kue:
Makan malam:

8. Apakah Anda kadang-kadang merasa kekurangan energi mengenai tidak tercukupi asupan makanan?
1. tidak pernah, 2. jarang (sekali atau dua kali dalam 30 hari terakhir), 3. kadang-kadang (3-10 kali dalam 30 hari terakhir), 4. sering (lebih dari 10 kali dalam 30 hari terakhir)

Annex 5 Photo Documentation

Picture 1 Data Collection: rural Household Members

Picture 2 Morning Market in Tobasa Regency

Picture 3 Data Collection: author explaining questions in Bahasa